T. Lauder Brunton

Sir T. L. Brunton

MATERIA MEDICA AND THERAPEUTICS.

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DR. PEREIRA'S

ELEMENTS OF MATERIA MEDICA AND THERAPEUTICS:

ABRIDGED AND ADAPTED FOR THE USE OF

MEDICAL AND PHARMACEUTICAL PRACTITIONERS AND STUDENTS,

AND COMPRISING

ALL THE MEDICINES OF THE BRITISH PHARMACOPŒIA, WITH SUCH OTHERS AS ARE FREQUENTLY ORDERED IN PRESCRIPTIONS OR REQUIRED BY THE PHYSICIAN.

EDITED BY

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PREFACE.

THE ABRIDGMENT of the work of the late Dr. PEREIRA on Materia Medica and Therapeutics, edited by Dr. Farre in conjunction with Professor Bentley and the late Mr. Warington, and published in 1865, was limited to a description of such pharmacological remedies as were contained in the first edition of the British Pharmacopœia. Another and much altered edition of the Pharmacopœia having since appeared, and a continued demand existing for a book in which the store of information which PEREIRA's great and celebrated work contains, should be made available, in a somewhat condensed form, for the use of medical and pharmaceutical practitioners and students, the present Editors, in undertaking the task of providing for this demand, have thought it desirable to embrace a wider range of subjects than that comprised in the previously published Abridgment. The work now submitted to the profession is based upon that of which Dr. Farre was the principal editor, but, instead of its treating only of the medicines that are noticed in the Pharmacopœia, it includes such other remedies as medical men are in the habit of using.

The arrangement adopted is similar to, but not precisely the same as, that followed by the original author. Some alteration in this respect seemed desirable, especially in the first part of the book, which treats of chemical elements and definite chemical compounds, organic compounds being now included among these if they be obtained as products of decomposition and not as educts from the vegetable or animal kingdom. Such organic products are described among the compounds of carbon.

In the part of the book which treats of medicines derived from the vegetable kingdom much new matter, not contained in the previous Abridgment, is introduced, in which the wants of the student, the pharmacist, and the medical practitioner, have been consulted.

The Editors, anxious to retain for this reproduction of Dr. Pereira's work the high character which the elements of Materia Medica, as published by the author, acquired and has always maintained, have endeavoured to bring the subjects treated of up to the present state of chemical and pharmacological knowledge. In the part that relates to chemical substances considerable alteration was necessary to reconcile the descriptions to modern chemical theories and to the nomenclature and notation of the present Pharmacopœia. The introduction of new medicines has also involved the insertion of much original matter. It has not been deemed necessary to indicate this where it occurs; but all the matter introduced from the Pharmacopœia is distinguished by its being enclosed within angular braces. Where the instructions of the Pharmacopœia are given in full, such matter is marked thus [§], and where given in abstract, it is marked as follows [§ ⁂]. Short explanatory notes are sometimes introduced among the matter extracted from the Pharmacopœia, and these, when so occurring, are enclosed within curved braces, thus ( ).

March, 1872.

CONTENTS.

ELEMENTS OF MATERIA MEDICA.

Group II.

VEGETABLE MATERIA MEDICA.

Sub-kingdom I.—*CRYPTOGAMIA.*

Class I.—ACOTYLEDONES.

Sub-Kingdom II.—*PHANEROGAMIA.*

Class II.—MONOCOTYLEDONES.

Class III.—*DICOTYLEDONES.*

Division I.—GYMNOSPERMIA.

CONIFERÆ.

Division II.—ANGIOSPERMIA.

Sub-class I.—MONOCHLAMYDEÆ.

Group III.

ANIMAL MATERIA MEDICA.

Sub-Kingdom I.—*INVERTEBRATA.*

Sub-Kingdom II.—*VERTEBRATA.*

[§ WEIGHTS AND MEASURES OF THE BRITISH PHARMACOPŒIA.

WEIGHTS.

1 Grain	gr.		
1 Ounce	oz.		= 437·5 grains
1 Pound	lb.	= 16 ounces	= 7000 "

MEASURES OF CAPACITY.

1 Minim	min.	
1 Fluid drachm	fl. drm.	= 60 minims
1 Fluid ounce	fl. oz.	= 8 fluid drachms
1 Pint	O.	= 20 fluid ounces
1 Gallon	C.	= 8 pints

MEASURES OF LENGTH.

1 line = $\frac{1}{12}$ inch
1 inch = $\frac{1}{39 \cdot 1393}$ seconds pendulum
12 " = 1 foot
36 " = 3 " = 1 yard

Length of pendulum vibrating seconds of mean time in the latitude of London, in a vacuum at the level of the sea . . . . 39·1393 inches

RELATION OF MEASURES TO WEIGHTS.

1 Minim is the measure of			0·91 grains of water
1 Fluid drachm	"		54·68 "
1 Fluid ounce	"	1 ounce or	437·5 "
1 Pint	"	1·25 pounds or	8750·0 "
1 Gallon	"	10 pounds or	70,000·0 "

WEIGHTS AND MEASURES OF THE METRICAL SYSTEM.

WEIGHTS.

1 Milligramme	=	the thousandth part of one grm. or		0·001	grm.
1 Centigramme	=	the hundredth	,, ,,	0·01	,,
1 Decigramme	=	the tenth	,, ,,	0·1	,,
1 Gramme	=	weight of a cubic centimetre of water at 4° C.		1·0	,,
1 Decagramme	=	ten grammes	,, ,,	10·0	,,
1 Hectogramme	=	one hundred grammes	,,	100·0	,,
1 Kilogramme	=	one thousand grammes	,,	1000·0	,,

MEASURES OF CAPACITY.

1 Millitre	=	1	cub. centim. or the mea. of	1	gram.	of water
1 Centilitre	=	10	,,	10	,,	,,
1 Decilitre	=	100	,,	100	,,	,,
1 Litre	=	1000	,,	1000	,,	(1 kilo.)

MEASURES OF LENGTH

1 Millimetre	=	the thousandth part of one metre or	0·001	metre
1 Centimetre	=	the hundredth ,,	0·01	,,
1 Decimetre	=	the tenth part ,,	0·1	,,
1 Metre	=	the ten-millionth part of a quarter of the meridian of the earth.		

RELATION OF THE WEIGHTS OF THE BRITISH PHARMACOPŒIA TO THE METRICAL WEIGHTS.

1 Pound	=	453·5925	grammes
1 Ounce	=	28·3495	,,
1 Grain	=	0·0648	,,

RELATION OF MEASURES OF CAPACITY OF THE BRITISH PHARMACOPŒIA TO THE METRICAL MEASURES.

1 Gallon	=	4·543487	litres		
1 Pint	=	0·567936	,,	or 567·936	cubic centimetres
1 Fluid ounce	=	0·028396	,,	28·396	,,
1 Fluid drachm	=	0·003549	,,	3·549	,,
1 Minim	=	0·000059	,,	0·059	,,

RELATION OF THE METRICAL WEIGHTS TO THE WEIGHTS OF THE BRITISH PHARMACOPŒIA.

1 Milligramme	=	0·015432 grs.
1 Centigramme	=	0·15432 ,,
1 Decigramme	=	1·5432 ,,
1 Gramme	=	15·432 ,,
1 Kilogramme = 2 lbs. 3 oz. 119·8 grs.	or	15432·348 ,,

RELATION OF THE METRICAL MEASURES TO THE MEASURES OF THE BRITISH PHARMACOPŒIA.

1 Millimetre = 0·03937 inches
1 Centimetre = 0·39371 ,,
1 Decimetre = 3·93708 ,,
1 Metre = 39·37079 ,, or 1 yard 3·7 inches
1 Cubic centimetre = 15·432 grain-measures
1 Litre = 1 pint 15 oz. 2 drs. 11 m. or 15432·348 grain-measures.]

The following tables, which have been published in Miller's *Elements of Chemistry*, afford ready means of converting measures of either of the two foregoing systems into those of the other system.

For Conversion of Metrical into English Measures.

A. LENGTH.

Metrical to English. *English to Metrical.*

1. Millimetres to Inches.	2. Metres to feet.	3. Inches to Millimetres.	4. Feet to Metres.
1 = 0·03937	1 = 3·2809	1 = 25·4	1 = 0·3048
2 = 0·07874	2 = 6·5618	2 = 50·8	2 = 0·6096
3 = 0·11811	3 = 9·8427	3 = 76·2	3 = 0·9144
4 = 0·15748	4 = 13·1236	4 = 101·6	4 = 1·2192
5 = 0·19685	5 = 16·4045	5 = 127·0	5 = 1·5240
6 = 0·23622	6 = 19·6854	6 = 152·4	6 = 1·8288
7 = 0·27559	7 = 22·9663	7 = 177·8	7 = 2·1336
8 = 0·31496	8 = 26·2472	8 = 203·2	8 = 2·4384
9 = 0·35433	9 = 29·5281	9 = 228·6	9 = 2·7432
25mm. = nearly 1 inch.		4 inches = rather more than 10cm.	

B. Capacity.

Metrical to English.

1. Cubic Centimetres to cubic Inches.	2. Litres to Fluid Ounces.	3. Litres to Pints.	4. Litres to Gallons.
1 = 0·061024	1 = 35·2754	1 = 1·76377	1 = 0·22047
2 = 0·122048	2 = 70·5508	2 = 3·52754	2 = 0·44094
3 = 0·183072	3 = 105·8262	3 = 5·29131	3 = 0·66141
4 = 0·244096	4 = 141·1016	4 = 7·05508	4 = 0·88188
5 = 0·305120	5 = 176·3770	5 = 8·81885	5 = 1·10235
6 = 0·366144	6 = 211·6524	6 = 10·58262	6 = 1·32282
7 = 0·427168	7 = 246·9278	7 = 12·34639	7 = 1·54330
8 = 0·488192	8 = 282·2032	8 = 14·11016	8 = 1·76377
9 = 0·549216	9 = 317·4786	9 = 15·87393	9 = 1·98424

The capacity of a litre is that of a cube each side of which is a decimetre.

English to Metrical.

1. Cubic Inches to Cubic Centimetres.	2. Fluid Ounces to Cubic Centimetres.	3. Pints to Litres.	4. Gallons to Litres.
1 = 16·387	1 = 28·349	1 = 0·56699	1 = 4·5358
2 = 32·774	2 = 56·699	2 = 1·13398	2 = 9·0717
3 = 49·161	3 = 85·048	3 = 1·70097	3 = 13·6076
4 = 65·548	4 = 113·398	4 = 2·26796	4 = 18·1434
5 = 81·935	5 = 141·747	5 = 2·83495	5 = 22·6793
6 = 98·322	6 = 170·096	6 = 3·40194	6 = 27·2152
7 = 114·709	7 = 198·446	7 = 3·96893	7 = 31·7510
8 = 131·096	8 = 226·796	8 = 4·33592	8 = 36·2869
9 = 147·483	9 = 255·146	9 = 5·10291	9 = 40·8228

C. Weight.

Metrical to English.

1. Grammes to Grains.	2. Kilogrammes to Ounces.	3. Kilogrammes to Pounds.
1 = 15·432348	1 = 35·2739	1 = 2·2046
2 = 30·864696	2 = 70·5478	2 = 4·4092
3 = 46·297044	3 = 105·8217	3 = 6·6138
4 = 61·729392	4 = 141·0956	4 = 8·8184
5 = 77·161740	5 = 176·3695	5 = 11·0230
6 = 92·594088	6 = 211·6434	6 = 13·2276
7 = 108·026436	7 = 246·9173	7 = 15·4322
8 = 123·458784	8 = 282·1912	8 = 17·6368
9 = 138·891132	9 = 317·4651	9 = 19·8414

A milligramme is about $\frac{1}{65}$ grain.

The weight of a gramme is that of a cubic centimetre of distilled water at 4° C. (39° ·2F.)

English to Metrical.

1. Grains to Grammes.	2. Ounces to Grammes.	3. Pounds to Kilogrammes.	4. Hundred Weights to Kilogrammes.
1 = 0·06479	1 = 28·349	1 = 0·45358	1 = 50·80097
2 = 0·12959	2 = 56·699	2 = 0·90717	2 = 101·60194
3 = 0·19439	3 = 85·048	3 = 1·36076	3 = 152·40291
4 = 0·25919	4 = 113·398	4 = 1·81434	4 = 203·20368
5 = 0·32329	5 = 141·747	5 = 2·26793	5 = 254·00485
6 = 0·38879	6 = 170·096	6 = 2·72152	6 = 304·80582
7 = 0·45359	7 = 198·446	7 = 3·17510	7 = 355·60679
8 = 0·51838	8 = 226·796	8 = 3·62869	8 = 406·40736
9 = 0·58319	9 = 255·146	9 = 4·08228	9 = 457·20873

TEMPERATURES AND SPECIFIC GRAVITIES.

The British Pharmacopœia directs that temperature in all cases, excepting where otherwise stated, is to be determined by Fahrenheit's thermometer, and specific gravities are to be taken at the temperature of 60°.

WATER-BATH AND STEAM-BATH.

[§ When a *water-bath* is directed to be used, it is to be understood that this term refers to an apparatus by means of which water or its vapour, at a temperature not exceeding 212°, is applied to the outer surface of a vessel containing the substance to be heated, which substance may thus be subjected to a heat near to, but necessarily below, that of 212°. In the *steam-bath* the vapour of water at a temperature above 212°, but not exceeding 230°, is similarly applied.]

MARKS OF QUOTATION.

All quotations from the British Pharmacopœia, when given in this work, are enclosed in angular braces. Such quotations when given in full are further indicated by this mark § placed within the brace, thus [§], and when given in abstract they are indicated by this mark §$^{*}_{*}$, thus [§$^{*}_{*}$].

ELEMENTS

OF

MATERIA MEDICA.

THE TERM MATERIA MEDICA is used to designate that department of medicine which is devoted to the consideration of pharmacological remedies or substances employed as medicines in the treatment of disease.

The subject of MATERIA MEDICA, or PHARMACOLOGY, comprises *Pharmacognosy*, *Pharmacy*, and *Pharmacodynamics* or *Therapeutics*.

PHARMACOGNOSY (*pharmacognosia*, from φάρμακον, *a medicine*; and γιγνώσκω, *I know*) treats of the origin, properties, varieties, quality, and purity of *unprepared medicines* or *simples*.

PHARMACY (*pharmacia*, from φάρμακον, *a medicine*) treats of the collection, preparation, and preservation of medicines.

PHARMACODYNAMICS (*pharmacodynamica*, from φάρμακον, *a medicine*; and δύναμις, *power*), and—THERAPEUTICS (*therapeia*, *therapeutice*, *therapeutica*, from θεραπεύω, *I cure*), treat of the effects, uses, and administration of medicines in the cure of disease.

The substances used as medicines are derived from the mineral, vegetable, and animal kingdoms. Some of these substances are used in nearly the same state as that in which they are obtained from their natural sources, but in most cases they are submitted to processes by which they are prepared for administration, and they are thus often greatly altered in composition and properties.

Most of the medicines prepared from animal and vegetable substances are mixtures in indefinite proportions of ingredients the chemical nature of which cannot be defined with accuracy. On the other hand, medicines prepared from mineral substances are for the most part of definite and known chemical composition. Definite chemical compounds, which are used in medicine, are also obtained, as educts or products, from some animal and from many vegetable substances.

The medicines to be described in this work will comprise all those of the British Pharmacopœia, together with such others as are frequently ordered in prescriptions, and required for the use of medical practitioners. They are arranged in three groups, as follows:—

1. Medicines derived from the mineral kingdom, and definite chemical compounds, organic as well as inorganic, which are obtained as products of decomposition, and not as educts, from the vegetable and animal kingdoms.

2. Medicines derived from the vegetable kingdom, including bodies of definite chemical composition obtained as educts from vegetable substances.

3. Medicines derived from the animal kingdom, including bodies of definite chemical composition obtained as educts from animal substances.

The substances included in the first group consist partly of simple or elementary and partly of compound bodies. They are arranged according to the nature of their chemical constituents.

The substances included in the second and third groups are all compounds. They are described in connection with the natural sources from which they are derived, these being arranged according to their natural historical relations.

GROUP I.

The matter of which the material world is composed has been resolved by chemists into about 63 simple or elementary substances, of which 13 are non-metallic and 50 are metallic.

Only 33 of these elements, 10 of which are non-metallic and 23 metallic, are mentioned in the British Pharmacopœia, and enter into the composition of the substances used in medicine.

Names, Symbols and Atomic Weights of the Elementary bodies mentioned in the British Pharmacopœia, and contained in the substances used in Medicine.

ELEMENTARY BODIES	SYMBOLS AND ATOMIC WEIGHTS	
	Old System	New System
1. Aluminium	Al = 13·75	**Al** = 27·5
2. Antimony (Stibium)	Sb = 122	**Sb** = 122
3. Arsenic	As = 75	**As** = 75
4. Barium	Ba = 68·5	**Ba** = 137
5. Bismuth	Bi = 210	**Bi** = 210
6. Boron	B = 11	**B** = 11
7. Bromine	Br = 80	**Br** = 80
8. Cadmium	Cd = 56	**Cd** = 112
9. Calcium	Ca = 20	**Ca** = 40
10. Carbon	C = 6	**C** = 12
11. Cerium	Ce = 46	**Ce** = 92
12. Chlorine	Cl = 35·5	**Cl** = 35·5
13. Chromium	Cr = 26·25	**Cr** = 52·5
14. Copper (Cuprum)	Cu = 31·75	**Cu** = 63·5
15. Gold (Aurum)	Au = 196·5	**Au** = 196·5
16. Hydrogen	H = 1	**H** = 1
17. Iodine	I = 127	**I** = 127
18. Iron (Ferrum)	Fe = 28	**Fe** = 56
19. Lead (Plumbum)	Pb = 103·5	**Pb** = 207
20. Lithium	L = 7	**L** = 7
21. Magnesium	Mg = 12	**Mg** = 24
22. Manganese	Mn = 27·5	**Mn** = 55
23. Mercury (Hydrargyrum)	Hg = 100	**Hg** = 200
24. Nitrogen	N = 14	**N** = 14
25. Oxygen	O = 8	**O** = 16
26. Phosphorus	P = 31	**P** = 31
27. Platinum	Pt = 98·5	**Pt** = 197
28. Potassium (Kalium)	K = 39	**K** = 39
29. Silver (Argentum)	Ag = 108	**Ag** = 108
30. Sodium (Natrium)	Na = 23	**Na** = 23
31. Sulphur	S = 16	**S** = 32
32. Tin (Stannum)	Sn = 59	**Sn** = 118
33. Zinc	Zn = 32·5	**Zn** = 65

There are two methods adopted in the British Pharmacopœia for representing the composition of chemical substances by the use of symbols or symbolic formulæ. One of these is the method that has generally prevailed among chemists until lately; the other is of modern introduction, but is now adopted by most chemical teachers and writers in this country. To a certain extent the new symbolic notation involves a new nomenclature, and though this is not adopted nor indicated in the Pharmacopœia, yet, as new names for chemical substances are every day becoming more generally used, they will be introduced here in connection with the new formulæ and as synonyms to the pharmacopœial names.

In order to facilitate the comprehension of the new system, the following brief explanation is given of some of the fundamental doctrines upon which it is based.

Atoms and Symbols.—Each chemical element is represented by a *symbol*, such as **Al** or **Sb**, which also represents the smallest quantity of the element capable of uniting with any other element to form a chemical compound. This quantity is called an *atom*, but the term atom, as thus used, does not necessarily imply all that has been assumed in what is called the atomic theory of the constitution of matter. It is only intended to imply the smallest or chemically-indivisible particle of a body, and this particle may be distinguished as the chemical atom.

The term atom is not generally applied to compounds, but there are some compounds which enter into combination with other bodies in quantities or particles which are believed to be smaller than those capable of existing in a free or separate state ; and the smaller or combined quantity of such a compound is called its atom, while the quantity, as expressed in a formula, representing the compound in the free state, is called a *molecule.*

Molecules and Formulæ.—The term *molecule* is used to represent the smallest quantity of an element or compound capable of maintaining an independent existence, that is, of existing in a separate or free state, uncombined with other elements or compounds. A molecule usually consists of more than one atom. There are some reasons for believing that the smallest quantity of an element capable of thus existing is equal to two atoms. Thus, hydrogen, oxygen, and sulphur, in the free state, are respectively represented as **HH** or $H_2=2$, **OO** or $O_2=32$, and **SS** or $S_2=64$, these quantities representing the molecules or double atoms of the elements.

The smallest quantities or particles of compound bodies are in most cases assumed to be the same, whether they be free or combined with other bodies, and they are then called molecules ; but, as already stated, there are some compounds which enter into combination with other bodies in quantities smaller than those in which they exist in the free state, and in such case the smaller quantity is called an atom and the larger quantity a molecule. Thus, the organic radicle called ethyl, as it enters into combination with other bodies, is represented by the formula $C_2 H_5$, and this is its atom, hydrochloric ether being $C_2 H_5 Cl$; but ethyl in the free state is represented by $C_4 H_{10}$, and this is its molecule.

When two or more symbols are placed together to represent a compound body, as for instance in the case of ethyl or of hydrochloric ether, referred to above, such a group of symbols is called a formula.

Atomic or Proportional Weights.—We have no means of determining the absolute quantities represented by the chemical atoms, but we can determine their relative or proportional quantities, by weight and also by volume. The proportional weights of the atoms are called their *atomic weights*, and as the atom of hydrogen weighs less than that of any other element, this is taken as the standard of comparison or unity. Thus, **H**=1, **O**=16, **S**=32, signifies that the atom of oxygen is sixteen times, and the atom of sulphur thirty-two times as heavy as that of hydrogen. It will be seen by reference to the table at page 3, that the atomic weights of many of the elements are represented in the new system as double those of the old system. This is the case with carbon, oxygen, and sulphur, among the non-metallic elements, and with fifteen of the metallic elements, in the list.

Atomic or Proportional Volumes.—Taking hydrogen as the standard of comparison for the volumes as well as for the weights of the atoms of elementary substances, it is found in most cases that quantities representing the atomic weights of such of the elements as exist in or can be converted into the state of gas or vapour, under similar conditions of temperature and pressure, will each have the same volume. The atomic volumes of the elements in the state of vapour are therefore alike, with only a few exceptions ; and specific gravity being defined as the weight of a unit of volume, it follows that the specific gravities of the elements in the state of gas or vapour, referred to hydrogen as unity, correspond with their atomic weights.

The molecules or double atoms of the elements, and the molecules of all compounds, in the state of gas or vapour, and under similar conditions of temperature and pressure, occupy with only a few exceptions, the space of two atoms of hydrogen ; their specific gravities will therefore be half the weights of the molecules, or in other words, the weight of the molecule of an elementary or compound body, in the state of gas or vapour, is double its specific gravity, referred to hydrogen as unity.

Formerly the terms *atomic weight*, and *equivalent weight* or *chemical equivalent*, were used as synonymous terms; but the term *equivalent* or *equivalence* is now used in a sense quite distinct from that of *atomic weight*. And here again, hydrogen is taken as the standard of comparison for *equivalence*.

We call the atomic weight of **H**=1, and that of **O**=16, but as 16 parts of oxygen combine with 2 parts of hydrogen when the tendency to combination is fully satisfied, we say that the 16 of **O** is *equivalent* to 2 of **H**.

So in like manner the atom of **B** or **Au** is equivalent to 3, the atom of **C** to 4, the atom of **N** or **P** to 5, or sometimes to 3, and the atom of **S** to 6, or sometimes to 2, of hydrogen.

These are sometimes called the atomicities or quantivalence of these several bodies, the quantities represented by their atomic weights, according to the new system, being capable of combining with or replacing respectively either 1, 2, 3, 4, 5 or 6 atoms of hydrogen.

OXYGEN. O=8 or **O**=16.

History.—Oxygen gas was discovered by Dr. Priestley in 1774. In the following year Scheele discovered it without knowing what Priestley had done. Lavoisier named it oxygen, from ὀξύς, *acid*, and γεννάω, *I beget*, or *produce*. It is found in both kingdoms of nature, constituting at least three-fourths of the known terraqueous globe. Thus water contains eight-ninths of its weight of oxygen; and the solid crust of our globe probably consists of at least one-third part, by weight, of this principle. Of the atmosphere, oxygen constitutes nearly twenty-one per cent. by volume, or about twenty-three per cent. by weight. It is also an essential constituent of all living bodies. It is disengaged by plants, and absorbed by animals. The former obtain it by the decomposition of water and carbonic acid; the latter consume it in the oxidisement of hydrogen and carbon, and the consequent formation of water and carbonic acid. Thus the two kingdoms of the organised world bear an important relation to each other. Vegetables may have been the original producers of atmospheric oxygen, as they are now the purifiers of the air. In the sun's rays they absorb carbonic acid, decompose it, retain the carbon, and emit the oxygen.

Preparation.—There are several methods of procuring oxygen gas, but it is most conveniently and very economically obtained from chlorate of potash by heating it either alone or mixed with black oxide of manganese or other metallic oxide, such as oxide of copper. The metallic oxide thus used does not appear to undergo any change in the process, but by its presence it causes the chlorate to yield the oxygen at a lower temperature than would be required if the chlorate were heated alone.

Process.—Mix chlorate of potash in dry crystals, with about one-tenth its weight of black oxide of manganese. Heat the mixture in a flask or retort until gas is given off, which will commence at about 450° F., and when the air that filled the apparatus has been expelled, the gas which is evolved, from the decomposing salt, may be collected. The decomposition is as follows:—$\mathbf{2KClO_3{=}2KCl+3O_2}$. One ounce of chlorate of potash yields nearly two gallons of the gas.

Ozone.—This name is applied to a peculiar modification of oxygen which is obtained under certain circumstances, as for instance, when a succession of electric sparks is passed through air or oxygen gas, or when sticks of phosphorus moistened with water are left in contact with atmospheric air contained in a bottle at a temperature of about 70° F., for one or two hours. Under these circumstances a small portion of the oxygen becomes converted into *ozone*, in which state it has a peculiar odour, somewhat resembling that of chlorine, and it is more active in its tendency to combine with other bodies than ordinary oxygen gas is.

This modification of oxygen appears to be also produced during the oxidation of the vapour of ether and some essential oils, such as oil of turpentine. Thus, if a clean glass rod heated to about 500° F. be introduced into a bottle containing the vapour of ether, oxidation of part of the ether takes place, and ozone is at the same time produced.

Atmospheric air often contains a minute portion of ozone, the presence of which is indicated by means of paper impregnated with starch and iodide of potassium. The ozone by its oxidising power liberates the iodine from its combination with potassium, and the blue iodide of starch is thus formed.

Therapeutics.—Soon after the discovery of oxygen, the most exaggerated notions prevailed as to its remedial powers. Various diseases (scorbutus, for example) were thought to be dependent on a deficiency of it; and it was, in consequence, submitted to a considerable number of trials, with, as it was at first asserted, remarkable success. But Chaptal and Fourcroy declared that it was injurious in phthisis. In England it was tried by Beddoes and Hill. The latter states that he found it beneficial in asthma, debility, ulcers, gangrene, white swelling, and scrofulous diseases of the bones. The beneficial results obtained by the use of acids (especially nitric acid), of the oxides of mercury, chlorate of potash, vegetable food, &c., were referred to the oxygen which these substances contained, and which they were supposed to communicate to the system. These notions are now exploded.

In asphyxia arising from a deficiency of atmospheric air, or from breathing noxious vapours, the inhalation of oxygen gas has been said to be, and probably is, useful. On the same principle, it may be employed during an attack of spasmodic asthma when there is danger of suffocation; but it is at best only a palliative, and has no power of preventing the occurrence of other attacks. Chaussier has recommended its use in children apparently stillborn: I have known it used without benefit. To combat the asphyxia of malignant cholera, inhalations of oxygen were tried in Russia, Poland, Prussia, and France, but without success. On the whole, then, I believe oxygen to be almost useless as a remedy.

Pharmaceutic Uses.—Oxygen gas is not used for any operation described in the Pharmacopœia; it is, however, sometimes administered in solution in water (*oxygen water*), and there are many pharmaceutical processes in which oxygen is transferred from one state of combination to another, as for instance, in the production of phosphoric acid by the action of nitric acid upon phosphorus.

Ozone, sometimes distinguished as active oxygen, is supposed to exert an important influence, through its oxidising power, as a sanitary agent in the atmosphere. It is generally absent or deficient in quantity in the air of densely populated districts, or where there is much decomposing organic matter. It has been used with the view of rendering some medicines more efficacious. Thus, *ozonised cod-liver oil* is prepared by passing ozonised air through the oil. *Ozonic ether*, which has been introduced by Dr. Richardson, is ether to which peroxide of hydrogen has been added as long as anything is taken up by the former.

HYDROGEN. H or **H**=1.

History.—Cavendish, in 1766, may be considered as the real discoverer of hydrogen, though it must have been occasionally procured, and some of its properties known, previously. Lavoisier gave it the name of hydrogen, from ὕδωρ, *water*, and γεννάω, *I beget* or *produce*. It is found in both kingdoms of nature, and next to oxygen may be regarded as the most important constituent of the terraqueous globe; it constitutes 11·1 per cent. by weight of water.

Preparation.—Hydrogen is usually prepared by the action of zinc on diluted sulphuric acid, as directed in the process for *Ferrum redactum*. The reaction may be thus represented,

$$\mathbf{Zn+H_2SO_4=H_2+ZnSO_4}.$$

Properties.—Hydrogen is combustible, burning with a pale flame, does not support combustion, and yields, when exploded with half its volume of oxygen, water only.

Therapeutics.—A *flame of hydrogen* has been employed as a cautery, to form issues. It is not otherwise used therapeutically.

Pharmaceutic Uses.—It is used in its free state in the preparation of *reduced iron*, where it acts as a deoxidising agent.

[§ **Aqua**, *Water*.] HO = 9, or $\mathbf{H_2O}$=18.

[§ Natural water, the purest that can be obtained, cleared, if necessary, by filtration.

Tests.—Free from odour, taste, and visible impurity.]

History.—The ancients regarded water as an elementary substance, and this opinion was held until, in 1783–4, it was shown to be a compound of hydrogen and oxygen. This discovery is generally ascribed to Cavendish, but has been also claimed for Watt and for Lavoisier. The varieties of water in common use are derived from rain-fall, rivers, and springs. When *rain* is collected, before it touches the earth, or from a granitic or siliceous surface, it may be very pure and soft; but when it has run over or through calcareous or clayey soil it becomes impregnated with salts, including those of lime and magnesia, as well as with other soluble substances, which often greatly affect its qualities. The waters of *rivers* and also of *springs* or *wells* derive most of their saline matter from this source, but they are often, especially in populous districts, further polluted by sewage and other impurities which are allowed to pass into them. This is more particularly the case with rivers which receive the town drainage of the districts through which they run. The earthy salts contained in these waters give to them the quality of *hardness*, that is, of curdling soap without producing a lather.

Purification.—Various methods are resorted to for the purpose of purifying common water: those which require to be noticed are *subsidence*, *filtration*, *ebullition*, and *distillation*.

1. *Subsidence.*—By allowing water to remain for some time in perfect repose, various impurities mechanically suspended in it gradually subside; and from these the water is decanted. In this way accumulations of filth are formed in the tanks and cisterns employed for the reception of common river water. This method of purification is sometimes the only one resorted to, and at other times is preliminary to further purifications by the following processes.

2. *Filtration.*—By this process water is rendered clear and transparent. It removes living beings and other suspended impurities, and is also capable of removing certain substances held in solution. The materials employed for the filtration of water are perforated plates of metal or stoneware, unsized or bibulous paper, flannel, cloth, or other tissues, sponge, porous stone (filtering stone), charcoal (animal charcoal is more effective than vegetable), and beds of sand. In the stoneware filtering machines usually sold in the shops, a combination of filtering materials (viz. sponge, sand, and charcoal) is generally employed. Paper is only fitted for operations on the small scale. Two kinds of filter paper are usually kept,—a coarser and a finer kind; the former for the separation of the grosser particles, the latter for the removal of finely-divided matters.

3. *Ebullition* destroys the vitality of both animals and vegetables, expels air or carbonic acid, and causes the precipitation of carbonate of lime.

4. *Distillation.*—When properly conducted this is the most effectual method of purifying water. But distilled water is in general contaminated by traces of organic matter. (See **Aqua Destillata.**)

Therapeutics.—Water is employed both cold and hot, and also in the state of ice and of aqueous vapour.

a. Cold Water.

Internally, a. Cold Drinks. — Hippocrates, Celsus, and other ancient writers, employed cold water in *ardent fever.* In modern times, also, it has been extensively used in the same malady. When exhibited under proper circumstances, cold water operates as a real refrigerant, reducing preternatural heat, lowering the pulse, and disposing to sweating. Besides fever, there are several other affections in which cold water is a useful remedy. For example: to facilitate recovery from *epilepsy*, *hysteria*, and *fainting*; and to alleviate *gastric pain* and *spasm*, and *hiccup.* Large draughts of it have sometimes caused the expulsion of *intestinal worms* (*Tœnia* and *Ascaris vermicularis*).

The copious use of water augments the quantity of liquid thrown out of the system by the cutaneous and pulmonic surfaces, and by the kidneys. If our object be to promote diaphoresis, external warmth should be conjoined with the internal use of diluents; whereas, when we wish to excite the renal vessels, the skin should be kept cool. In inflammatory affections of the urinary passages, we advise the free employment of aqueous fluids, with the view of diluting the urine, and thereby of rendering it less acrid and irritating.

β. Cold Injections.—Cold water is thrown into the *rectum* to check hemorrhage, to expel worms, to allay local pain, to rouse the patient in poisoning by opium, to relieve the pain of hemorrhoids, and to diminish vascular action in enteritis. Dr. A. T. Thomson speaks very favourably of the effects of cold water introduced into the *vagina*, by means of the stomach-pump, in uterine hemorrhage.

Externally, *a*. *The Cold Bath.*—The temperature of this ranges from 33° to about 75° F.: when below 50° F. the bath is considered very cold. Its primary effects constitute the *shock*; its secondary effects, the *reaction* or *glow.* The immediate effects of the cold bath are—a sensation of cold (speedily followed by one of warmth), contraction of the cutaneous vessels, paleness of the skin, diminution of perspiration, and reduction of the volume of the body. Shivering, and as the water rises to the chest, a kind of convulsive sobbing, are also experienced. If the immersion be only temporary, reaction quickly follows. The cutaneous circulation is speedily re-established; a glow is felt, perspiration comes on, the pulse becomes full and frequent, and the body feels invigorated.

The cold bath is employed with the view of obtaining the nervous impression or shock—the refrigeration—or the reaction or glow; but principally for the latter purpose in cases where it is desirable to increase the tone and vigour of the body.

In weakly and debilitated subjects, the reaction or glow is imperfectly effected, and in such the cold bath acts injuriously. Whenever cold bathing is followed for several hours by coldness of surface, blueness of lips, feeble pulse, reduction of strength, and headache, its use should be prohibited. In pregnancy and in diseases of the heart and lungs, it is a dangerous remedy; as also in persons disposed to apoplexy, and who are unaccustomed to cold bathing. It is a common opinion that immersion in cold water is dangerous when the body is heated by exercise or other exertion, and hence it is customary with bathers to wait until they become cool.

β. Cold Affusion (*Perfusio*).—Hippocrates used it, and Celsus recommends it in some affections of the head.

The affusion on the head is thus effected:—The water is to be poured on the head (inclined over a pan or tub), by means of an ewer or pitcher, from a height of one to three feet. If the patient be confined to his couch, the head should be inclined over the side of the bed. In children it is sufficient to squeeze a large sponge, previously soaked in water, at some height above the head, as recommended by Dr. Copland. When the object is to apply affusion to the whole body, the patient is placed in a large tub or pan (e.g. a bathing tub or washing pan), and then an attendant, standing on a chair, may readily effect it. The time that the affusion should be continued varies, according to circumstances, from a quarter of a minute to two or three minutes; but in some cases it has been employed for twenty minutes. After the affusion the body should be carefully wiped dry, the patient wrapped up warm, and placed in bed.

The effects of affusion depend partly on the temperature of the liquid, and partly also on the sudden and violent shock given to the system by the mechanical impulse: hence the reason why the effects vary according to the height from which the water is poured. When water whose temperature is between 32° and 60° F. is used, we denominate the affusion *cold*.

Cold affusion is used with advantage in numerous diseases: as in *syncope*; in *poisoning* by hydrocyanic acid, alcohol, opium, belladonna, &c.; in *asphyxia* caused by the inhalation of carbonic acid, the fumes of burning charcoal, sulphuretted hydrogen, &c.; in *hysteria* and *epilepsy*, and in *spasmodic closure of the glottis*. Cold, in these cases, excites a sudden act of inspiration. 'The influence of cold water dashed on the face in exciting sudden sobbing acts of inspiration is well known.' (M. Hall.) It has also been recommended, and with great show of reason, to dash cold water over the faces of children stillborn, with the view of exciting the respiratory act. Cold affusion may be applied to young children suffering from *convulsive fits*, while the body is placed in the warm bath, attention having been previously paid to the state of the gums and the bowels. It frequently acts as a soporific in *delirium tremens* and the *delirium of fever*, when opium has failed, the patient falling asleep as soon as his head is replaced on the pillow.

Cool and tepid affusion are employed as substitutes for cold affusion where dread is entertained of the effect of the latter. They are safer, though less powerful agents.

γ. *The Shower-bath* (*Impluvium*).—The shower-bath is very similar in its effects to, but milder than affusion, and is frequently employed as a hygienic agent to promote the tone and vigour of the body. In chorea and hysteria it is particularly useful. In insanity it is used with the greatest benefit to allay mental excitement. In violent cases, 'the application of the shower-bath, the patient being up to the middle in warm water, seldom fails to subdue the paroxysms.' (Conolly.) The period during which it should be continued is a circumstance of some moment. Dr. Conolly observes that it 'should be suspended when the patient appears overcome, and instantly renewed when symptoms of violence recur. A strong shower continued even for a minute has sometimes considerable effect;' and it should never be 'many minutes prolonged without careful observation of the patient's state,' as even a fatal result has been known to follow its excessive use. 'After four or five applications of this kind, the patient becomes entirely subdued, and should then be taken out of the bath, rapidly dried, warmly covered up, and put into bed with every possible demonstration of kind attention. Calmness and sleep are the usual results, and more permanent effects frequently follow. A bath of this kind appears to produce a moral as well as a physical impression, being succeeded, in recent cases, by tranquillity for a few days, and in chronic cases by quietness and improved behaviour for many weeks, and sometimes even for months.' An extemporaneous shower-bath, produced by the aid of a cullender, may be used to allay the violent delirium of fever; and is rendered more beneficial if the patient can be persuaded to sit in a semicupium of warm water.

δ. *Washes.*—Cold, cool, or tepid washing or sponging may be used in febrile diseases with great advantage. A little vinegar is frequently mixed with the water, to make the effect more refreshing. Cold washing is also used to lessen the susceptibility of the skin, and diminish the liability to rheumatism and catarrh.

One method of treating burns is by the application of cold water to the injured part. In modern times Sir James Earle was the great advocate for this plan, which proves more successful in scalds and slight burns. The burnt part should be covered with rags, and kept constantly wetted with water, in which ice is placed from time to time; 'care being taken never to remove the rags from the burnt surface.'

If the cold fluid be continually renewed, the practice has been called *irrigation.* It is effected either by allowing cold water to drop on the affected part from a stopcock inserted in the side of a bucket of water, or by conducting a stream of water from a vessel by means of a strip of cloth on the principle of a syphon.

What is called *water-dressing* may be regarded as a modified and improved form of poultice. It consists in the application of two or three layers of soft lint dipped in water and applied to inflamed parts, wounds and ulcers, the whole being covered with oiled silk or Indian rubber, which should project beyond the margin of the lint, to retain the moisture and prevent evaporation. Dr. Macartney considers it to operate differently to a poultice: unlike the latter, he says it prevents or diminishes the secretion of pus, checks the formation of exuberant granulations, and removes all pain. Moreover, the water is not apt to become sour, like a poultice, and does not injure the sound part.

b. Ice and Snow.

The temperature of these agents does not exceed 32° F. They are employed both internally and externally, to obtain sometimes the primary, at other times the secondary, effects of cold.

Externally.—Ice is used to check hemorrhage, more especially when the bleeding vessel cannot be easily got at and tied; as after operations about the rectum, more especially for piles and fistula. Ice has also been applied in prolapsus of the rectum or vagina, when inflammation has come on which threatens to terminate in mortification.

The *ice-cap* (i.e. a bladder containing pounded ice) is applied to the head with great benefit in inflammation of the brain; in fever, where there is great cerebral excitement, with a hot dry skin; and in acute hydrocephalus. In apoplexy, likewise, it might be useful; as also in delirium tremens, and in mania with great mental excitement. In the retention of urine to which old persons are liable, ice-cold water applied to the hypogastrium is sometimes very effective in causing the evacuation of this secretion. Dr. Todd found ice very useful in *tetanus*, when applied to the whole length of the spine. Friction with ice or snow is also used as an application to *frost-bitten parts.* The feet, hands, tip of the nose, and pinnæ of the ears, are the organs most frequently attacked. In order to guard against mortification, and other ill effects arising from too rapid change of temperature, the vital properties must be slowly and gradually recalled. In order to effect this, the frost-bitten part should be rubbed with snow or pounded ice, or bathed in ice-cold water, very gradually raising the temperature of the applications until the part acquires its natural heat.

A mixture of pounded ice and salt is sometimes used, as recommended by Dr. Arnot, in 1849, as a *local anæsthetic*, which has the advantage of destroying the sensation of the part to which it is applied without occasioning loss of consciousness.

Internally.—Ice, or ice-cold water, is swallowed to cause contraction of the gastric vessels, and thereby to check or stop hemorrhage from the mucous membrane of the stomach. It has also been found beneficial in nasal, bronchial, and uterine hemorrhage. In the latter cases, the constriction of the bleeding vessels must be effected through the sympathetic relations which exist between the stomach and other organs. Ice is also employed to relieve cardialgia, vomiting, and spasmodic pain of the stomach. In the latter stage of typhus fever its internal use is sometimes beneficial. It was most acceptable, and afforded great relief in cholera.

c. Warm and Hot Water.

Externally, a. Baths of Tepid, Warm, or Hot Water.—The practice of bathing is of great antiquity. In the writings ascribed to Hippocrates we find baths mentioned, and their effects described. They are also noticed by Celsus, Pliny, and other Roman writers.

The Tepid Bath has a temperature of from 85° to 92° F. It gives rise to a sensation of either heat or cold, according to the temperature of the body at the time of immersion. It cleanses the skin, promotes perspiration, and allays thirst. It is sometimes employed as a preparative to the temperate, cool, or cold bath. When there is a tendency to apoplexy, the simultaneous immersion in the tepid bath, and affusion of cold water over the head, have been recommended.

The Warm Bath has a temperature of from 92° to 98° F. In general it causes a sensation of warmth, which is more obvious when the body has been previously cooled. It renders the pulse fuller and more frequent, accelerates respiration, and augments perspiration. It causes languor, diminution of muscular power, faintness, and a tendency to sleep. As it increases perspiration, it is useful in acute anasarca, in the anasarca of scarlatina, and in chronic renal anasarca, if the patient has sufficient power to bear it. In diabetes with a dry skin it is sometimes useful. As a relaxant, it is employed to assist reduction in dislocations of the larger joints, and in herniæ. In the passage of calculi, whether urinary or biliary, it is used with the greatest advantage: it relaxes the ducts, and thereby alleviates the pain, and facilitates the passage of the concretion. In gastritis, enteritis, cystitis, and nephritis, it proves a valuable and powerful agent. In exanthematous diseases, when the eruption has receded from the skin, in chronic cutaneous diseases, rheumatism, amenorrhœa, and dysmenorrhœa, it is highly serviceable. The *coxæluvium*, or *hip-bath*, is resorted to in inflammatory or spasmodic affections of the abdominal and pelvic viscera, and in amenorrhœa and in dysmenorrhœa. It is also sometimes employed as a substitute for the general bath, where some affection of the lungs, heart, or great vessels, prohibits the use of the latter. The *bidet* is employed in piles, prolapsed rectum, strangury, ischuria, &c. The *pediluvium*, or *foot-bath*, is used as a revulsive or counter-irritant, in slight colds; to promote the menstrual and hemorrhoidal discharges; and for various topical purposes. The *brachiluvium* or *arm-bath*, and *manuluvium* or *hand-bath*, are principally applied in topical affections of the upper extremities.

The Hot Bath has a temperature of from 98° to 112°. It causes a sensation of heat, renders the pulse fuller and stronger, accelerates respiration, occasions intense redness of the skin, and subsequently copious perspiration; gives rise to violent throbbing, and a sensation of distention of the vessels of the head, with a feeling of suffocation and anxiety. Long immersion in it sometimes causes apoplexy. Being a powerful excitant, its use requires caution. It is principally employed in paralysis, rheumatism, and some other chronic diseases, also in collapse, &c.

β. *Warm Fomentations.*—Warm fomentations are employed to lessen inflammation, and to relieve pain, tension, and spasm. In inflammation of the abdominal and pelvic viscera, and in strangury, they are highly serviceable. My friend and colleague, Mr. Luke, has for several years employed, at the London Hospital, warm water as an emollient application to burns and scalds. In almost every instance it soothes and mitigates pain. Mr. Luke thinks that it exerts a beneficial influence in mitigating the consecutive inflammation, rendering the after consequences less severe locally, and the reparative process more speedy, than under other modes of treatment. The water has generally been used in the form of fomentations; repeatedly changing the flannels, and taking care that the surface of the skin was exposed to the air as little as possible.

Internally.—Tepid or warm water is *taken into the stomach* to promote vomiting; to dilute the contents of the stomach in cases of poisoning by acrid substances, to excite diaphoresis, in rheumatism, catarrh, gout, &c.; and to allay troublesome cough, especially when dependent on irritation at the top of the larynx. Warm water is *injected into the rectum* to excite alvine evacuations; to promote the hemorrhoidal flux; to diminish irritation in the large intestine, or in some neighbouring organs, as the uterus, bladder, prostate gland, &c.; and to bring on the menstrual secretion. *Thrown into the vagina*, it is used to allay uterine irritation and pain, and to promote the lochial discharge. *Injected into the bladder*, it is sometimes employed to relieve vesical irritation, to distend the bladder previously to the operation of lithotrity, or when exploring for calculi.

d. Aqueous Vapour.

1. *The Vapour Bath.*—The general effects of the vapour bath are those of a powerful stimulant and sudorific. It softens and relaxes the cutaneous tissue, expands the superficial vessels, accelerates the circulation of blood, augments the frequency of the pulse and respiration, and produces copious perspiration. These effects are succeeded by a feeling of languor and a tendency to sleep. If the whole body be immersed in vapour, which is constantly inhaled, the temperature should be a little less than if the trunk and limbs alone are subjected to its influence; because the inhalation of vapour stops the cooling process of evaporation from the lungs. The following is a comparative view of the heating powers of water and of vapour, distinguishing the latter according as it is or is not breathed :—

	Water	Vapour	
		Not breathed	Breathed
Tepid bath . . .	85° 92°	96°—106°	90°—100°
Warm bath . . .	92 — 98	106 —120	100 —110
Hot bath. . . .	98 —106	120 —160	110 —130

The vapour bath is very useful when our object is to relax the skin, and to produce profuse sweating; as in chronic rheumatism and gout, in slight colds from checked perspiration, and in chronic skin diseases accompanied with a dry state of the cutaneous surface. In old paralytic cases, without signs of vascular excitement of the brain ; in some uterine affections, as chlorosis, amenorrhœa, and irritation of the womb; in dropsy of aged and debilitated subjects ; in old liver complaints ; and in some scrofulous affections, it is occasionally employed with advantage.

Topical or *local vapour baths* are employed in the treatment of local diseases; as affections of the joints. Dr. Macartney recommends the topical use of vapour, as a soothing and anodyne application, in painful wounds, contusions, and fractures.

2. *Inhalation of Warm Vapour.*—The inhalation of warm aqueous vapour proves highly serviceable, as an emollient remedy, in irritation or inflammation of the tonsils, or of the membrane lining the larynx, trachea, or bronchial tubes, as in the sore throat of scarlatina and in croup. It may be employed by Mudge's inhaler, or by inspiring the vapour arising from warm water.

[§ **Aqua Destillata,** *Distilled Water.* HO or $\mathbf{H_2O}$.

Take of water ten gallons, distil from a copper still, connected with a block-tin worm ; reject the first half gallon, and preserve the next eight gallons.]

The first distilled portion is to be rejected, as it may contain carbonic acid, ammonia, and other volatile impurities. The latter portions are not to be distilled, to guard against empyreuma from the charring of organic matters. The still in which the operation is conducted ought not to be employed for any other purpose, otherwise the water is apt to acquire a faint odour, and taste of the last matters subjected to distillation.

[§ *Tests.*—A fluid ounce of it evaporated in a clean glass capsule leaves scarcely a visible residue. It is not affected by sulphuretted hydrogen, oxalate of ammonia, nitrate of silver, chloride of barium, or solution of lime.]

If turbidness, milkiness, or precipitate, be occasioned by any of these, we may infer the existence of some impurity in the water. But water which has been repeatedly distilled gives traces of acid and alkali when examined by the agency of voltaic electricity, which, therefore, is the most delicate test of the purity of water. Distilled water also usually contains traces of organic matter. Nitrate of silver is the most delicate test of its presence. A solution of this salt in pure water, preserved in a well-stoppered bottle, undergoes no change of colour by exposure to light; but if any vegetable or animal matter be present, the liquid acquires a dark or reddish tint.

Properties.—Distilled water has the following properties:—at ordinary temperatures it is a transparent liquid, colourless, tasteless and inodorous, and miscible with alcohol in all proportions, with ether in certain proportions, not miscible with the fixed oils. Water rapidly absorbs some gases, as hydrochloric acid, ammonia, &c. It is neither combustible nor a supporter of combustion. A cubic inch at 62° F., Bar. 30 inches, weighs 252·458 grains, so that this fluid is about 815 times heavier than atmospheric air; but being the standard to which the gravities of solids and liquids are referred, its specific weight is usually said to be 1. An imperial gallon weighs, at 62°, 10 lbs. or 70,000 grs. Water has the greatest density at 39·2° F. At a temperature of 32° it crystallises, and in so doing expands. The sp. gr. of ice is 0·918. The fundamental form of crystallised water (ice) is the rhombohedron. Water evaporates at all temperatures, but when the barometer stands at 30 inches, water boils at 212° and is converted into steam, whose bulk is about 1700 times that of water, and whose sp. gr. is 0·622 (that of atmospheric air being 1).

In its chemical relations water may be regarded as a neutral body. It reacts neither as an acid nor as an alkaline or basic body. It combines with acids, alkalies, and many salts. If a saline compound absorbs water from the atmosphere, it is said to be *deliques-*

cent, as acetate of potash; if under the same circumstances it loses water, as in the case of carbonate of soda, it is termed *efflorescent.*

The quantity of water contained in solid bodies is frequently determined by drying them, and ascertaining the loss which they in consequence suffer. Desiccation may be effected by heat, either alone or aided by a current of artificially dried air; or by a vacuum, either alone or aided by the presence of oil of vitriol. In some cases these methods fail to expel the whole of the water, which can only be got rid of by the substitution of another substance for it. Such water must be regarded as an essential constituent of the substance, and its removal (without substitution) would completely alter the properties of the compound.

Composition.—The composition of water is determined both by analysis and synthesis. If this liquid be submitted to the influence of a galvanic battery, it is decomposed into two gases; namely, one volume of oxygen and two volumes of hydrogen, or by weight, eight parts of oxygen, and one part of hydrogen. These gases, in the proportions just mentioned, may be made to recombine, and form water, by heat, electricity, or spongy platinum.

Uses.—Distilled water is used as the solvent in the following preparations.

Aquæ Medicatæ, *Medicated Waters.*—These are saturated aqueous solutions of essential oils, obtained by submitting fresh or dried vegetables, or their essential oils, to distillation with water, or in one instance, *camphor water*, by solution.

Infusa, *Infusions*, are aqueous solutions of certain constituents of vegetable substances obtained without the aid of ebullition. They are prepared by digesting distilled water (cold or hot) on the substance sliced, bruised, or reduced to coarse powder, usually in a glazed earthenware or porcelain vessel fitted with a cover. Polished metal vessels retain the heat better, but are objectionable on account of their ready corrosion. Cold water is used when the active principle is very volatile, or when it is desirable to avoid the solution of any substance soluble in hot water. Thus, when the object is to extract the bitter principle from calumbo or quassia without taking up the starchy matter, cold water is preferred. In most cases, however, boiling water is used. Infusions are preferred to decoctions when the active principle is either volatilised by a boiling heat, as in the cases of orange-peel and buchu, or readily undergoes some chemical change by ebullition, as in the case of senna.

Decocta, *Decoctions*, are aqueous solutions of certain constituents of organic substances, obtained with the aid of ebullition. In this operation the volatile constituents of vegetables may be dissipated; and hence, when these are the active principles, the process is an objectionable one.

LIQUORES, *Solutions*, consist, generally, of substances dissolved in, or diluted with, water.

MUCILAGINES, *Mucilages*, are amylaceous or gummy substances, either dissolved or suspended in water.

MISTURÆ, *Mixtures*, are mostly aqueous preparations, some of which contain earthy salts, or other ingredients, suspended by means of sugar or gum. They are generally intended to be administered in doses of not less than half a fluid ounce.

SYRUPI, *Syrups*, are infusions or aqueous solutions of organic or inorganic bodies saturated with sugar.

Distilled water is also employed in making extracts and other preparations.

Hydrogenii Peroxidum. *Peroxide of Hydrogen. Oxygenated Water. Hydroxyl.* $HO_2=17$, or $\mathbf{H_2O_2}=34$.

This compound, which was discovered by Thenard in 1818, contains twice as much oxygen, in relation to the hydrogen, as water contains. It may be obtained by decomposing peroxide of barium, diffused in water, with hydrofluosilicic acid, when insoluble silicofluoride of barium is precipitated, and peroxide of hydrogen is left in solution. The solution may be concentrated without heat over oil of vitriol, but in the concentrated state it is very unstable, and decomposes spontaneously at about 68° F. A dilute solution, containing about 10 per cent., has been prepared for use in medicine. It possesses bleaching properties, and has been used for whitening the skin, and for changing the colour of hair. It must not be confounded with oxygen water (see p. 7).

Therapeutics.—It has been employed internally as a disinfectant and slight stimulant; and externally for cleansing ulcers, and promoting granulation of their surfaces.

NITROGENIUM. Nitrogen. N or $\mathbf{N}=14$.

History.—Nitrogen gas was first recognised, in 1772, by Dr. Rutherford, who termed it *mephitic air*. Priestley called it *phlogisticated air*. Lavoisier named it *azote* (from *ἀ*, *not*, and *ζωή*, *life*). Cavendish, finding it to be a constituent of nitric acid, gave it the appellation it now usually bears, *nitrogen* (*νίτρον*, *nitre*, and *γεννάω*, *I beget* or *produce*). It is found in both kingdoms of nature; is a constituent of coal, of nitrates, of ammoniacal salts, and of some mineral waters. It forms about 79 per cent. of the atmosphere. It is a constituent of various organic principles, as the alkaloids, albuminous principles, gelatine, mucus, urea, uric acid, &c.

Preparation.—The readiest method of procuring it is to burn a piece of phosphorus in a confined portion of atmospheric air. The phosphorus combines with the oxygen of the air and forms metaphosphoric acid. The residual gas, after being thoroughly washed, is nearly pure nitrogen.

Properties.—It is a colourless, odourless, tasteless gas; is without action on vegetable colours; and is neither combustible nor a supporter of combustion. It does not precipitate solution of lime. Its sp. gr. is 0·971. It is very slightly absorbed by water. It is usually distinguished by its negative properties, just described.

Nitrogenii Protoxidum. *Protoxide of Nitrogen. Nitrous Oxide.*

$NO=22$ or $\mathbf{N_2O}=44$.

History.—Discovered by Dr. Priestley in 1776. He termed it *dephlogisticated nitrous air.* Sir H. Davy called it *nitrous oxide.* It is commonly called *laughing gas.*

Preparation.—It is obtained by heating nitrate of ammonia, which has been previously deprived of its water of crystallisation, in a glass retort or flask. The salt at temperatures between 340° and 480° F. is resolved into nitrous oxide and water, these being the only products, as shown by the following equation, $\mathbf{NH_4NO_3=N_2O+2H_2O}$.

Physiological Effects.—The pure gas when inhaled without atmospheric air produces anæsthesia, which, however, lasts only for a short time. If the gas be mixed with air, or the lungs be not emptied before inhaling, the effect is generally that of excitement, with a tendency to muscular action and violent laughter. Used in excess it produces asphyxia and death, probably by depriving the blood of its available oxygen.

Therapeutics.—It is extensively used as an anæsthetic in operations of short duration, such as tooth-drawing. For this purpose the pure gas is administered, and admixture of air prevented as much as possible, the lungs being first deprived of air by two or three preliminary respirations with the gas, after which insensibility is usually produced in a few seconds.

Aqua Nitrogenii Protoxidi. *Protoxide of Nitrogen Water, Oxygenous Aërated Water.*

A solution of nitrous oxide in water, condensed under pressure, and containing about five volumes of the gas in one of the solution, has been used as a stimulant.

Acidum Nitricum. *Nitric Acid.*

History.—Nitric acid was known in the seventh century to Geber, who termed it *solutive water.* The nature of its constituents was shown by Cavendish in 1785, and their proportions were subsequently determined by Davy, Gay-Lussac, and Thomson.

Liquid nitric acid is usually obtained by submitting to distillation a nitrate (either of potash or soda) with oil of vitriol. Formerly it was procured by distilling a mixture of nitre and either sulphate of iron or clay, and the product was called *spirit of nitre*. The name *aqua fortis* has also been, and still is frequently, applied to nitric acid when not very concentrated. Anhydrous nitric acid, or, as it is now termed, nitric anhydride, (NO_5 or $\mathbf{N_2O_5}$) is obtained by subjecting nitrate of silver to the action of dry chlorine gas. It is a colourless body, solid and crystalline at common temperatures, but fusing at 86° F., very unstable, decomposing at temperatures above 113°, and sometimes at common temperatures when kept even in sealed tubes. This anhydride does not possess the ordinary properties of an acid, but dissolved in water it forms nitric acid.

[§ **Acidum Nitricum.** *Nitric Acid.*

An acid prepared from nitrate of potash or nitrate of soda by distillation with sulphuric acid and water, and containing 70 per cent. by weight of the nitric acid, HO,NO_5 or $\mathbf{HNO_3}$, corresponding to 60 per cent. of anhydrous nitric acid, NO_5 or $\mathbf{N_2O_5}$.

Characters and Tests.—A colourless liquid, having a specific gravity of 1·42. When exposed to the air it emits an acrid, corrosive vapour. If it be poured over copper filings dense red vapours are immediately formed, but if the acid be mixed with an equal volume of water, and then added to the copper, it gives off a colourless gas, which acquires an orange-red colour as it mixes with the air, and which, if it be introduced into a solution of sulphate of iron, communicates to it a dark purple or brown colour. The boiling point of the acid is 250°. If submitted to distillation the product continues uniform throughout the process. It leaves no residue when evaporated to dryness. Diluted with six times its volume of distilled water it gives no precipitate with cloride of barium or nitrate of silver. 90 grains by weight of it mixed with half an ounce of distilled water require for neutralisation 1,000 grain-measures of the volumetric solution of soda.]

This acid, which is represented by the formula $NO_5,4HO$ or $\mathbf{(HNO_3)_2 3H_2O}$, corresponds with the nitric acid of the London Pharmacopœia. It is weaker by one-fourth (by weight) than the nitric acid of the Edinburgh and Dublin and first British Pharmacopœias.

Preparation.—Nitre (either nitrate of potash or nitrate of soda) is mixed with an equal weight of oil of vitriol in a glass retort, to which a receiver is attached, and heat is gradually applied until acid vapours pass over, which are easily condensed by the application of cold water to the receiver. The reaction which occurs may be thus represented :—

$$\underset{\text{Nitre.}}{\mathbf{KNO_3}} + \underset{\text{Sulphuric Acid.}}{\mathbf{H_2SO_4}} = \underset{\text{Nitric Acid.}}{\mathbf{HNO_3}} + \underset{\text{Bisulphate of Potash.}}{\mathbf{KHSO_4}}$$

But as commercial oil of vitriol always contains a little water, the nitric acid produced by the process will do so also. The specific gravity of the acid thus obtained will be about 1·5, while nitric acid represented by the formula $\mathbf{HNO_3}$ has a sp. gr. of 1·517. The acid produced by the above process is always coloured by the presence of nitrous acid, and this colouration increases as the acid is exposed to the action of light. This liability to change in the nitric acid of sp. gr. 1·5 has been the principal cause of its having been replaced in the Pharmacopœia by a weaker acid, which may be formed by the addition of water to the strong acid until the specific gravity is reduced to 1·42. If after thus diluting it, it be heated to the boiling point, the nitrous gas which caused the colour of the strong acid will be expelled.

It is found in both kingdoms of nature, generally combined with potash, soda, lime, or magnesia, as nitrates. These are found on the surface of the earth in various parts of the world, also in some few mineral waters, and occasionally in well waters as a result of animal decomposition. Nitrates are also frequent constituents of vegetable juices.

Physiological Effects.—In the concentrated form the acid is powerfully escharotic and corrosive, which property it derives in part from its affinity for water, but more especially from the facility with which it gives out oxygen; so that the appearances caused by its action on some of the tissues are different from those produced by sulphuric acid. The permanent yellow stain which it communicates to the cuticle is peculiar to it. Both iodine and bromine stain the skin yellow or brown, but a little caustic potash readily removes the stain when recent; whereas the yellowish stain produced by nitric acid becomes orange on the addition of an alkaline soap. The yellow or citron stain communicated to the lining membrane of the tongue, pharynx, &c., by nitric acid, has been well represented by Dr. Roupell in his work on poisons. A preparation, presenting similar appearances, is preserved in the anatomical museum of the London Hospital. Nitric, like sulphuric acid, also chars the animal tissues; and thus, after the ingestion of it, the stomach is sometimes found blackened, as if sulphuric acid had been swallowed. The symptoms are similar to those produced by sulphuric acid. The yellow, citron, or orange spots sometimes observed on the lips, chin, or face, will, when present, at once indicate the kind of acid swallowed. Sometimes the binoxide of nitrogen is evolved by the mouth. Properly diluted, nitric acid produces effects similar to those of the other mineral acids. It is said, however, to act less evidently as a tonic, and to be more apt to disagree with the stomach, so that it cannot be employed for so long a period.

Therapeutics. Internal.—As nitric acid produces certain effects, in common with other mineral acids, it may be used, in the form of *dilute nitric acid*, as a substitute for the latter in various diseases. Thus, it is administered in conjunction with the bitter infusions in those conditions admitting of, or requiring, the use of tonics. Properly diluted, it is employed as a refrigerant in febrile disorders. In lithiasis, attended with phosphatic deposits in the urine, it has been used instead of the sulphuric or hydrochloric acid. As a lithonlytic injected into the bladder, very dilute nitric acid has been successfully employed by Sir B. Brodie. In some obstinate cutaneous diseases, as impetigo, it is given to the extent of half a drachm daily in barley water. It may be employed, also, to relieve heartburn. In 1793 this acid was used by Mr. Scott, a surgeon at Bombay, as a substitute for mercurial preparations. Mr. Scott first tried it in chronic hepatitis, and with considerable success. He then extended its use to venereal diseases, and obtained the happiest results from it. Subsequently it has been most extensively employed in the last-mentioned diseases ; but the success attending its use has been variable. That it has been and is frequently serviceable, no one can doubt who reads the immense body of evidence offered in its favour by Scott, Kellie, Albers, Prioleau, Rollo, Cruickshank, Beddoes, Ferriar, and others. But on the other hand, it is equally certain that on very many occasions it has been useless. The same remark, indeed, may be made of mercury, or of any other remedy ; but as an anti-venereal medicine it does not admit of comparison with this metal. However, we frequently meet with syphilitic cases in which the employment of mercury is either useless or hurtful. Thus it can rarely be employed with advantage in scrofulous subjects ; or in persons whose idiosyncrasies render them peculiarly susceptible to the influence of this metal ; and in sloughing sores it is inadmissible. Now, these are the cases in which nitric acid may be employed with benefit ; and I believe the best mode of administering it is in conjunction with the compound decoction of sarsaparilla. For further information respecting its employment, I must refer to the works of Holst and Mr. Samuel Cooper.

External.—In the *concentrated* state, nitric acid has been employed as a powerful escharotic, to destroy warts, and as an application to parts bitten by rabid animals or venomous serpents, to phagedenic ulcers, &c. In order to confine the acid to the spot intended to be acted on, the neighbouring parts may be previously smeared with some resinous ointment. In sloughing phagedena, the application of strong nitric acid, as recommended by Mr. Welbank, is attended with the most successful results, as I have on several occasions witnessed. The best mode of applying it is by a piece of lint tied round a small stick or skewer. When the slough is very thick, it is sometimes necessary to remove part of it with a pair of scissors, in order to enable the acid to come in contact with the living surface. Largely *diluted* (as 50 or 60 drops of strong acid to a pint or quart of water), it is recommended by Sir Astley Cooper as a wash for sloughing and other ill-conditioned sores.

Pharmaceutic Uses.—Nitric acid is used as an oxidising agent in the production of diluted phosphoric acid, solution of perchloride of iron, solution of persulphate of iron, and several other preparations. It is also used in the following preparations :—

[§ **Acidum Nitricum Dilutum.** *Diluted Nitric Acid.*

Take of

Nitric Acid	6 fluid ounces.
Distilled Water	a sufficiency.

Dilute the acid with 24 fluid ounces of the water, then add more water, so that at a temperature of 60° it shall measure 31 fluid ounces. Or as follows :—

Take of

Nitric Acid	2,400 grains.
Distilled Water	a sufficiency.

Weigh the acid in a glass flask, the capacity of which, to a mark on the neck, is one pint; then add distilled water until the mixture at 60° temperature, after it has been shaken, measures a pint.

Characters and Tests.—Colourless. Specific gravity, 1·101. 361·3 grains by weight (6 fluid drachms) require for neutralisation 1,000 grain-measures of the volumetric solution of soda, corresponding to 14·95 per cent. of anhydrous nitric acid. Six fluid drachms, therefore, correspond to 54 grains of the anhydrous acid (one equivalent of NO_5, or half an equivalent of $\mathbf{N_2O_5}$).

Dose, 10 to 30 minims.]

[§ **Acidum Nitro-Hydrochloricum Dilutum.** *Diluted Nitro-Hydrochloric Acid.*

Take of

Nitric Acid	3 fluid ounces.
Hydrochloric Acid	4 fluid ounces.
Distilled Water	25 fluid ounces.

Mix the acids, and allow them to remain for twenty-four hours in a bottle, the mouth of which is partially closed; then add the water in successive portions, shaking the bottle after each addition, and preserve the mixture in a stoppered bottle.

Characters and Tests.—Colourless. Specific gravity, 1·074. 352·4 grains by weight (6 fluid drachms) require for neutralisation 920 grain-measures of the volumetric solution of soda.

Dose, 5 to 20 minims.]

In this process, the mixture of nitric and hydrochloric acids yields chloronitric gas ($N_2O_2Cl_4$), or chloronitrous gas ($N_2O_2Cl_2$), and free chlorine, together with water,

$$2HNO_3+6HCl=N_2O_2Cl_4+4H_2O+Cl_2 \text{ or}$$
$$2HNO_3+6HCl=N_2O_2Cl_2+4H_2O+2Cl_2$$

and these products, mixed with water, constitute the diluted nitro-hydrochloric acid.

The diluted acid will not answer to the indicated test of specific gravity unless some precaution be adopted in the process for preventing the loss of gas. This may be done by putting the mixed acids into a large bottle (a Winchester quart), and the water into another similar bottle, then connecting them by inserting into the mouth of each a short bent glass tube through a cork, and joining the tubes by a piece of flexible tubing. By this means the gas evolved from the mixed acids will be conveyed to the bottle containing the water, where its absorption may be effected, and the loss that would otherwise occur prevented. The neutralising power of the acid is not quite so high as the Pharmacopœia represents.

Therapeutics.—It has been employed *internally* in the same cases as nitric acid, more especially in syphilis, diseases of the liver, and some of the exanthemata. *Externally* it has been used as a bath, either local or general, in the proportion of six or eight fluid ounces of the acid to each gallon of water, in syphilis and hepatic affections. Dr. Lendrick has more recently noticed the utility of the general nitro-muriatic bath, at a temperature of 90° or 95°, in syphiloid and mercurial cachexiæ, and liver consumption. In India, the whole body (the head excepted) is immersed; but in this country pediluvia are usually employed, or the body is merely sponged with it.

Administration.—When taken internally, the *dose* is ten or fifteen minims properly diluted, and carefully increased.

Antidote.—Poisoning by this acid is to be treated in the same way as that by sulphuric acid.

Ammonia. *Ammonia.* NH_3 or $\mathbf{NH_3}=17$.

History.—It is probable that Pliny was acquainted with the smell of ammonia, produced by the action of lime on nitrum (sal ammoniac ?). Dr. Black, in 1756, first pointed out the distinction between ammonia and its carbonate. Dr. Priestley was the first to collect it in the gaseous state. Free or combined, it exists in both kingdoms of nature. Hydrochlorate and sulphate of ammonia are met with native, usually in the neighbourhood of volcanoes. Aluminous sulphate of ammonia (or ammonia alum) occurs in Bohemia. Carbonate of ammonia is a constituent of the atmosphere, and is, therefore, found in rain water. Ammonia is found in vegetables in small quantities only, but is developed during the decomposition (spontaneous or artificial) of most vegetable substances, as gluten. It is one of the bases found in the urine of man, where it exists in combination with phosphoric, hydrochloric, and uric acids. Ammonia is also a product of the putrefaction of animal matters.

Preparation.—Ammoniacal gas is obtained by heating a mixture of one part of powdered sal ammoniac and two parts of dry quicklime in a glass retort, the products being ammonia, chloride of calcium, and water. $\mathbf{2NH_4Cl + CaO = CaCl_2 + H_2O + 2NH_3}$.

Properties.—Ammonia is a colourless invisible gas, having a strong and well-known odour. It reddens turmeric paper, and changes the colour of violet juice to green; but by exposure to the air, or by application of heat, both the turmeric paper and violet juice are restored to their original colour. The specific gravity of this gas is 0·59. Ammoniacal gas is not a supporter of combustion, but is slightly combustible in the atmosphere, and, when mixed with air or oxygen, it forms an explosive mixture. Every two volumes of it require one and a half volumes of oxygen for their complete combustion. The results of the explosion are a volume of nitrogen and some water. It forms white fumes when brought into contact with hydrochloric acid gas, or chlorine. Dissolved in water, it communicates a deep blue colour to the salts of copper; throws down with the bichloride of platinum a yellow precipitate; with chloride of mercury a white precipitate; with protonitrate of mercury a black precipitate; and with a concentrated solution of tartaric acid, a crystalline precipitate. It is extremely soluble in water and also in alcohol.

[§ **Liquor Ammoniæ Fortior.** *Strong Solution of Ammonia.*

Ammoniacal gas, NH_3 or $\mathbf{NH_3}$, dissolved in water, and constituting 32·5 per cent. of the solution.]

Preparation.—[§ ⁂ Ammoniacal gas, produced from a mixture of sal ammoniac and slaked lime, is passed into distilled water contained in a Woulf's bottle under some pressure, until the liquid has the strength indicated by the tests.]

[§ *Characters and Tests.*—A colourless liquid, with a characteristic and very pungent odour, and strong alkaline reaction. Specific gravity, 0·891. 52·3 grains by weight require for neutralisation 1,000 grain-measures of the volumetric solution of oxalic acid. One fluid drachm contains 15·83 grains of ammonia, NH_3 or $\mathbf{NH_3}$. When diluted with four times its volume of distilled water, it does not give precipitates with solution of lime, oxalate of ammonia, sulphide of ammonium, or ammonio-sulphate of copper; and when treated with an excess of nitric acid, is not rendered turbid by nitrate of silver, or by chloride of barium.] The last-named six tests show the absence of carbonic acid, lime, metallic impurities, sulphur, chlorine, and sulphuric acid.

Physiological Effects.—The local action of strong solution of ammonia is exceedingly energetic. Applied to the skin it causes pain, redness, vesication, and destruction of the part; thus acting, first as a rubefacient, then as a vesicant, and lastly as a caustic, or corrosive. Its emanations are also irritant: when they come in contact with the conjunctival membrane, a flow of tears is the result; when inhaled, their powerful action on the air-passages is well known. Persons in syncope are observed to be almost immediately raised from a death-like state merely by inhaling the vapour of this solution. In cases of insensibility it must be employed with great caution; for, if used injudiciously, serious or even fatal consequences may be the result. When swallowed it acts as a powerfully corrosive poison. *In small* or *therapeutic* doses, such as we are accustomed to employ in the treatment of diseases, ammonia acts as a diffusible stimulant, excitant, or calefacient. It produces a sensation of warmth in the mouth, throat, and epigastrium, frequently attended with eructations. A temporary excitement of the vascular system succeeds, but this quickly subsides. The heat of the skin is sometimes increased, and there is a tendency to sweating, which, if promoted by the use of warm diluents and clothing, frequently terminates in copious perspiration. But the skin is not the only secreting organ stimulated to increased exertion; we observe the kidneys produce more urine, and frequently the quantity of bronchial mucus is increased. The nervous system is also affected, and the activity of its functions heightened. Ammonia does not render the urine alkaline.

If we compare the effects of ammonia with those of other stimulants, as camphor, wine, and opium, we observe, in the first place, that the influence of ammonia is principally manifested in the ganglionic and true spinal systems, while the other stimulants above mentioned affect the cerebral system. Thus the effects of ammonia are usually exhibited on the circulation, respiration, secretion, and spasmodic actions; but camphor, wine, and opium, though they also affect these functions, yet they principally affect the intellectual functions. Secondly, the effects of ammonia are more transient than those of the other agents just referred to. Thirdly, the vascular excitement caused by wine and opium is attended by diminished mucous secretion, and is allied more to an ordinary febrile attack.

Therapeutics. — Ammonia is adapted for speedily rousing the action of the vascular and respiratory systems, and for the prompt alleviation of spasm. It is more especially fitted for fulfulling these indications when our object is at the same time to promote the action of the skin. It is calculated for states of debility with torpor or inactivity. It is also used as an antacid and local irritant.

(1.) *As a stimulant and sudorific, or expectorant.* — Ammonia is given with manifest advantage in many cases, of which the following are illustrations:—In *continued, especially typhoid, fever*, when its diaphoretic action should be promoted by diluents and warm clothing; in the *exanthemata*, when the eruption has receded from the skin and the extremities are cold: and in *pneumonia*, and some other inflammatory diseases, when the violence of the vascular action has been reduced by proper evacuations, or when the disease has assumed an asthenic character from the commencement. In the *chronic bronchitis* of old persons, when the power to expectorate is deficient, ammonia combined with infusion of senega is a valuable stimulant expectorant.

(2.) *As a nervine stimulant, and anti-spasmodic*, ammonia is frequently employed with the greatest benefit. In *poisoning* by those cerebro-spinants commonly called sedatives—such as digitalis, tobacco, and hydrocyanic acid, it is a most valuable agent. I believe the efficiency of ammonia as an antidote to poisoning by hydrocyanic acid, arises, not from its neutralising the acid, for hydrocyanate of ammonia is also highly poisonous, but from its exerting an influence of an opposite nature to that of the poison. In poisoning by the oil of bitter almonds, or other agents supposed to contain this acid, ammonia is equally serviceable. The antidote should be given by the stomach, if the patient can swallow, and the vapour should be cautiously inhaled. Ammonia is also used to remove the cerebral disorder of intoxication and nervous headache. This remedy has been supposed to possess a specific influence in relieving those disorders of the nervous system accompanied with spasmodic or convulsive symptoms; and hence it is classed among the remedies denominated *anti-spasmodic*.

The vapour of the solution of ammonia may be inhaled when we wish to make a strong impression on the nervous system, as in syncope, or to prevent an attack of epilepsy. To guard against or relieve fainting, ammoniacal inhalations are very powerful and useful. Their instantaneous operation is frequently astonishing. In asphyxia, ammoniacal inhalations have been strongly recommended by Sage. That they may sometimes be of service I can readily believe, but they must be employed with great caution.

(3.) *As a remedy for the bites of poisonous animals*—as serpents and insects—ammonia is frequently employed with the best effects. It was strongly recommended for this purpose by Dr. Meade. There does not appear, however, any ground for the assertion of

Sage that it is a specific. It has been used by Dr. Halford of Australia as an antidote for snake-poisoning by injecting it as *Liquor ammoniæ* into a vein.

(4.) *As an antacid in dyspeptic complaints, accompanied with preternatural acidity of stomach and flatulence*, but without inflammation, a properly diluted solution of ammonia may be employed with a twofold object—that of neutralising the free acid, and of stimulating the stomach. It must be remembered that the healthy secretions of the stomach are of an acid nature, and that the continued use of ammonia, or any other alkali, must ultimately be attended with injurious results, more especially to the digestive functions. While, therefore, the occasional employment of alkalies may be serviceable, their constant or long-continued use must ultimately prove deleterious. Ammonia may, under some circumstances, be employed to neutralise acids introduced into the stomach from without, as in *poisoning by the mineral acids*; though chalk and magnesia would be more appropriate, being less irritant.

(5.) *As a local irritant.*—As a local agent, ammonia has been employed in a variety of diseases—sometimes as a rubefacient or irritant, sometimes as a vesicant, and occasionally as a caustic. Thus it is employed as a rubefacient in rheumatic and neuralgic pains, and as a counter-irritant to relieve internal inflammations. Employed as a vesicant it has two advantages over cantharides—a more speedy operation, and non-affection of the urinary organs. If a piece of lint, soaked in a strong solution of ammonia, is placed on the skin and covered with a watch-glass to prevent evaporation, a blister will rise in a few minutes. As a caustic it may be used with advantage in the bites of serpents and rabid animals.

Administration.—Employed in solution or vapour:—*Dose* of the *strong* solution from three to ten minims well diluted; but the weaker solution is the one usually administered internally.

Antidotes.—The diluted acids, as vinegar, lemon, or orange-juice, &c., are antidotes for ammonia. To abate the inflammatory symptoms caused by the inhalation of its vapour, blood-letting has been found serviceable.

[§ **Liquor Ammoniæ.** *Solution of Ammonia.*

Ammoniacal gas, NH_3 or $\mathbf{NH_3}$, dissolved in water.

Take of

Strong solution of Ammonia	1 pint.
Distilled Water	2 pints.

Mix and preserve in a stoppered bottle.

Tests.—Specific gravity, 0·959. 85 grains by weight require for neutralisation 500 grain-measures of the volumetric solution of oxalic acid, corresponding to 10 per cent. by weight of ammonia, NH_3 or $\mathbf{NH_3}$. One fluid drachm contains 5·2 grains of ammonia.]

Administration.—This solution of ammonia is the one commonly employed for internal use. *Dose*, ten to thirty minims properly diluted. It is also used externally in the form of liniment.

[§ **Linimentum Ammoniæ.** *Liniment of Ammonia.*

Take of

Solution of Ammonia	1 fluid ounce.
Olive Oil	3 fluid ounces.

Mix together with agitation.]

[§ **Ammoniæ Carbonas.** *Carbonate of Ammonia.*

Synonym.—Ammoniæ Sesquicarbonas, *Lond. Dub.*

$$2NH_4O,3CO_2 \text{ or } \mathbf{N_4H_{16}C_3O_8}$$

A volatile and pungent ammoniacal salt, produced by submitting a mixture of sulphate of ammonia or chloride of ammonium and carbonate of lime to sublimation.

Characters and Tests.—In translucent crystalline masses, with a strong ammoniacal odour, and alkaline reaction; soluble in cold water, more sparingly in spirit. It volatilises entirely when heated, and is readily dissolved by acids with effervescence. If diluted nitric acid be added to it in slight excess, and the solution be boiled, it will give no precipitate with chloride of barium or nitrate of silver. 59 grains dissolved in one ounce of distilled water will be neutralised by 1,000 grain-measures of the volumetric solution of oxalic acid.

$$\left.\begin{array}{c}\text{20 grains of}\\ \text{Carbonate of Ammonia}\end{array}\right\}\text{ neutralise }\left\{\begin{array}{l}23\tfrac{1}{2}\text{ grains Citric acid}\\ 25\tfrac{1}{2}\text{ grains Tartaric acid.]}\end{array}\right.$$

Preparation.—Manufacturers prepare it by submitting to sublimation a mixture of sal ammoniac, or impure sulphate of ammonia, and chalk. In a manufactory which I inspected a few years since it was prepared as follows:—The retorts in which the sublimation is effected are of cast iron, and similar in shape and size to those employed in the manufacture of coal gas. Each retort communicates posteriorly with a leaden receiver, with which is connected a second receiver of the same size and shape. The receivers have the form of square prisms placed endways, and are supported in a wooden frame-work. In some manufactories they are cylindrical, and have movable tops and bottoms. The impure carbonate thus obtained is contaminated with carbonaceous matter, which it deposits when dissolved in acids. It is redistilled in iron pots surmounted with leaden heads, and heated by the flue of the retort furnace. A little water is introduced into the pots to render the sesquicarbonate translucent. In some cases the pots are heated by a water bath; a temperature of 150° F. being sufficient for this process. In this way *refined sesquicarbonate of ammonia* is obtained. If sal ammoniac (chloride of ammonium) be employed, the decomposition in this process may be represented thus: $\mathbf{2NH_4Cl+CaCO_3=(NH_4)_2CO_3+CaCl_2}$, but in the act of undergoing vaporisation part of the salt suffers decomposition; ammonia, $\mathbf{NH_3}$, and water, $\mathbf{H_2O}$, are lost, and the compound which condenses presents on an average the composition which is approximately represented by the pharmacopœia formula. It is generally regarded as a mixture of

two molecules of Bicarbonate of Ammonia,	$\mathbf{2[NH_4HCO_3]}$
and one molecule of Carbamate of Ammonia,	$\mathbf{(NH_3)_2CO_2}$
	$\mathbf{N_4H_{16}C_3O_8}$

Sesquicarbonate of ammonia cannot be resublimed, unchanged; hence in the process of refining its constitution is altered, and the proportion of the constituent elements varies according to the manner of conducting the process.

Properties.—When exposed to the air it evolves carbamate of ammonia (NH_3,CO_2 or $\mathbf{(NH_3)_2CO_2}$), leaving a residue of bicarbonate ($NH_4O,2CO_2,HO$ or $\mathbf{HNH_4CO_3}$); so that its vapour has a pungent odour, and strongly reddens turmeric paper. The resulting bicarbonate is opaque, pulverulent, and much less pungent, from which it has been termed *mild carbonate of ammonia.* Carbonate of ammonia is soluble in four times its weight of cold water; but boiling water or alcohol decomposes it, with the evolution of carbonic acid.

Impurities.—The carbonate of ammonia of commerce is sometimes contaminated with empyreumatic oil, and in this state it yields a more or less deeply-coloured, or even blackish, solution when dissolved in dilute acid. The pure salt, on the other hand, yields a colourless solution. If any hyposulphite of ammonia be present, the salt, when neutralised by acetic acid, yields with the nitrate of silver a precipitate which is at first white, but becomes black. The presence of lead (derived from the leaden receivers used in its manufacture) is recognised by dissolving the salt in diluted nitric acid, and testing with sulphuretted hydrogen, which produces a dark or black colour or precipitate, if lead be present.

Physiological Effects.—In small doses it proves antacid, stimulant and sudorific, usually increasing the frequency of the pulse. By repeated use it operates as a resolvent or liquefacient spanæmic, like the other alkalies, though much less intensely so. In doses of thirty grains or more it is apt to occasion vomiting. The effects of an over-dose are abdominal pains, and other symptoms of inflammation, convulsions, and other phenomena indicative of its action on the nervous system.

Therapeutics.—It is used in similar cases to those which are benefited by solution of ammonia, but it is less caustic and also less stimulant. In *epilepsy* I have extensively employed it, and in many cases with obvious benefit. It should be given in large doses in properly diluted solutions : to adults from ten grains to a scruple. It frequently proves successful in hysterical epilepsy, and in that syncopal form of epilepsy, which Sauvages called lipothymia, and which patients describe as ' dying away,' but the connection of which with ordinary epilepsy is shown by its occasional transition into the latter. In *hysteria* also it is one of our most useful and valuable remedies ; given either alone or in combination with a bitter infusion. In *asthenic pneumonia* and in *chronic bronchitis* of old persons it affords the same relief as solution of ammonia ; and in the latter disease, when expectoration is difficult, it is sometimes used as an *emetic.* In *diabetes* this salt has been recommended by Dr. Barlow, and several cases of this disease are said to have been relieved, if not cured by it. I regret that I cannot confirm Dr. Barlow's favourable notice of it. Although in some cases I have seen patients temporarily improve under its use, yet the amendment has been brief, and was probably referable to other circumstances. In some cases it failed to give any relief, even after a very prolonged trial. In some cases of *scrofula* it has been employed with excellent effect. It is best adapted for those cases attended with a languid circulation and a dry state of skin. Combined with citric or tartaric acid it is a useful remedy in febrile cases, where the object is to promote cutaneous circulation and exhalation. Full doses of this salt have been employed in *paralysis*, to occasion vomiting. Mixed with some aromatic oil (as the oil of bergamot or lavender), it is used as a *smelling salt*, against syncope, hysteria, &c. As a topical agent it has been employed in aqueous solution, or made into ointment with lard. Its operation in these cases is that of a topical stimulant and rubefacient. It proves useful in rheumatic pains, sprains, &c.

Administration.—As a stimulant and diaphoretic, it is used in doses of from five to twenty grains. It is usually given in solution, but sometimes in the form of pill. As an emetic, the dose is thirty grains, properly diluted, and repeated if necessary.

[§ Solution of Carbonate of Ammonia. Take of carbonate of ammonia in small pieces half an ounce ; distilled water, ten fluid ounces. Dissolve and filter.]

Pharmaceutic Use.—As a test.

[§ **Spiritus Ammoniæ Aromaticus.** *Aromatic Spirit of Ammonia.*—
Take of

Carbonate of Ammonia	8 ounces.
Strong solution of Ammonia	4 fluid ounces.
Volatile Oil of Nutmeg	4 fluid drachms.
Oil of Lemon	6 fluid drachms.
Rectified Spirit	6 pints
Water	3 pints.

Mix, and distil seven pints.

Test.—Specific gravity, 0·870.

Dose, ½ to 1 fluid drachm.]

Therapeutics.—It is popularly known as *spirit of sal volatile*; it is less powerful than solution of ammonia, but is used in similar cases as an antacid and stimulant.

[§ **Spiritus Ammoniæ Fœtidus.** *Fetid Spirit of Ammonia.*

Take of

Assafœtida	1½ ounce.
Strong solution of Ammonia	2 fluid ounces.
Rectified Spirit	a sufficiency.

Break the assafœtida into small pieces and macerate it, in a closed vessel, in fifteen fluid ounces of the spirit for twenty-four hours, then distil off the spirit, mix the product with the solution of ammonia, and add sufficient rectified spirit to make one pint.

Dose, ½ to 1 fluid drachm.]

Therapeutics.—Used as a stimulant and antispasmodic.

[§ **Ammonii Chloridum.** *Chloride of Ammonium.*

Synonyms.—Ammoniæ Hydrochloras, 1864.
Ammoniæ Murias, Edin., Dubl.
Sal Ammoniac.

NH_4Cl or $\mathbf{NH_4Cl}$.

May be formed by neutralising hydrochloric acid with ammonia and evaporating to dryness. It is usually prepared by sublimation.

Characters and Tests.—In colourless inodorous translucent fibrous masses, tough, and difficult to powder; soluble in water and in rectified spirit. Its aqueous solution when treated with caustic potash evolves ammonia, and when treated with nitrate of silver forms a copious curdy precipitate. When heated it volatilises without decomposition, and leaves no residue.

Dose, 5 to 20 grains.]

Preparation.—In Egypt, sal ammoniac is obtained by sublimation from the soot afforded by the combustion of camel's dung. Some years ago this salt was manufactured in London from the soot of coals. At the latter end of the last century it was made in Paris by the union of ammoniacal vapour (obtained by the decomposition of animal matters, in iron cylinders placed in a furnace) with muriatic acid gas. At Liége it is obtained by sublimation from the soot obtained by burning, in peculiar ovens, a mixture of coals, common salt, animal matter, and clay (L. Gmelin). At the present time sal ammoniac is manufactured in this country from the impure ammoniacal liquors obtained as secondary products in the manufacture of coal gas and animal charcoal. The ammonia contained in these liquors is either at once converted into the hydrochlorate by the addition of hydrochloric acid, the liquors evaporated, and the impure crystals purified by sublimation; or it is first treated with sulphuric acid, and the resulting sulphate is mixed with common salt and sublimed, when sulphate of soda remains behind, and sal ammoniac rises in vapour: thus $(NH_4)_2SO_4+2NaCl=2NH_4Cl+Na_2SO_4$.

Physiological Effects.—In this country it is so rarely employed internally, that we have very slight experience either of its physiological or of its therapeutical effects. But in Germany, where it is supposed to promote the disappearance of indurations and the products and results of chronic inflammation, it is regarded as a powerful alterative, a stimulant to the absorbents, and a promoter of healthy secretion.

Therapeutics.—It is employed in Germany to restore secretions and exhalations which have been arrested by inflammation, and which have not returned when the violence of the inflammation has been subdued; or to improve their quality, as in pulmonary and vesical catarrh, mucous discharges from the urethra and vagina, dysentery, peritonitis, and pleurisy. In these cases it is used as a substitute for mercury. It is also used in chronic inflammation of the lungs, liver, and spleen: enlargement of the mesenteric glands; induration of the prostate, uterus, and ovaries; and chronic ulceration of the uterus. Its solution is employed *locally* in headache, inflammatory affections of the brain, mania, and apoplexy. When used for this purpose, it must be employed as soon as the salt is dissolved. Mr. Walker found that five parts of this salt, with five parts of nitrate of potash, and sixteen parts of water, lowered the thermometer from 15° to 10° F. A *freezing mixture* of this kind placed in a bladder, has been recommended by Sir A. Cooper as an application (*ice-poultice*) to hernial tumours. It may be applied to the head instead of the ice-cap, already noticed.

Administration.—For internal use the dose of it is from five to thirty grains every two or three hours, either in a pulverulent form, combined with sugar or gum, or in solution with some saccharine or mucilaginous substance, to which an aromatic should be added. For an ordinary lotion one ounce may be dissolved in ten ounces of water.

Emplastrum Ammonii Chloridi. *Sal-Ammoniac Plaster.*

Take of

Lead Plaster	½ ounce.
Soap	2 drachms.

Melt them together, and when nearly cold, add:—

Chloride of Ammonium in fine powder . .	½ drachm.

This plaster is stimulant and rubefaciant. Its efficacy depends on the evolution of ammoniacal gas, in consequence of the action of the alkali of the soap upon the sal-ammoniac, hence it requires renewal every twenty-four hours.

Trochisci Ammonii Chloridi. *Sal-Ammoniac Lozenges.*

Lozenges containing two or three grains of chloride of ammonium, are employed in bronchitis.

[§ **Solution of Chloride of Ammonium.**

Take of

Chloride of Ammonium . .	1 ounce.
Distilled Water	10 fluid ounces.

Dissolve and filter.]

Pharmaceutic Use.—As a test.

[§ **Ammonii Bromidum.** *Bromide of Ammonium.*
NH_4Br or $\mathbf{NH_4Br}$.]

This compound can be prepared either by neutralising ammonia with hydrobromic acid, or by first preparing bromide of iron, and then adding to this a solution of ammonia or carbonate of ammonia, as in making the iodide.

[§ *Characters.*—In colourless crystals, which become slightly yellow by exposure to the air, and have a pungent saline taste. May be sublimed unchanged by the application of heat. Readily soluble in water; less soluble in spirit. A solution of the salt in water, mixed with mucilage of starch, and a drop of an aqueous solution of bromine or chlorine, does not exhibit any blue colour.

Dose, 2 to 20 grains.]

The last test indicates freedom from iodide.

Therapeutics.—Effects similar to those of bromide of potassium.

Ammonii Iodidum. *Iodide of Ammonium.* NH_4I or $\mathbf{NH_4I}$.

May be prepared by digesting iron wire in excess, with the requisite quantity of iodine and some water, so as to produce a solution of iodide of iron. This may then be decomposed by adding carbonate of ammonia in solution, as long as a precipitate is formed, filtering and evaporating the filtrate at a very gentle heat, or on a water bath.

The crystals of this salt are similar to those of sal-ammoniac when deposited from solution, are very soluble in water, and when exposed to the air become tinged from oxidation and consequent liberation of a minute quantity of iodine. The salt when thus coloured can be bleached, if desired, by admitting into the bottle a little sulphuretted hydrogen gas.

Dose, 2 to 10 grains.

Therapeutics.—Effects similar to those of iodide of potassium.

[§ **Solution of Sulphide of Ammonium.**

Take of

Solution of Ammonia . . . 5 fluid ounces.

Put three fluid ounces of the ammonia into a bottle, and conduct into this a stream of sulphuretted hydrogen so long as the gas continues to be absorbed; then add the remainder of the ammonia, and transfer the solution to a green glass bottle, furnished with a well-ground stopper.]

In this process hydrosulphuret of ammonia (sulphydrate of ammonium, NH_4S,HS or $\mathbf{HNH_4S}$) is first formed, and this, by the addition of ammonia, is converted into sulphide of ammonium, thus:—

Sulphydrate of Ammonium.		Aqueous Ammonia.		Sulphide of Ammonium.		Water.
$\mathbf{HNH_4S}$	+	$\mathbf{HNH_4O}$	=	$\mathbf{(NH_4)_2S}$	+	$\mathbf{H_2O}$.

Used as a test.

Ammoniæ Nitras. *Nitrate of Ammonia.* NH_4ONO_5 or $\mathbf{NH_4NO_3}$.

This salt is obtained by adding carbonate of ammonia to dilute nitric acid until the solution is neutral, and then evaporating until it crystallises. If the solution be evaporated at a temperature below 100° F., large and beautiful six-sided prisms are obtained, terminated by six-sided pyramids (*prismatic nitrate of ammonia*). These contain four molecules of water, $\mathbf{NH_4NO_3.4H_2O}$. If the solution be boiled down, fibrous crystals are obtained (*fibrous nitrate of ammonia*). When dried at 260° F., the salt is deprived of its water of crystallisation, and converted into *anhydrous nitrate of ammonia*. This last state is that in which it should be used for producing *nitrous oxide*, the purpose to which it is principally applied.

[§ **Ammoniæ Phosphas.** *Phosphate of Ammonia.*
$2NH_4O,HO,PO_5$ or $(NH_4)_2HPO_4$.

Take of

Diluted Phosphoric Acid . .	20 fluid ounces.
Strong solution of Ammonia . . .	a sufficiency.

Add the ammonia to the phosphoric acid until the solution is slightly alkaline, then evaporate the liquid, adding more ammonia from time to time, so as to keep it in slight excess, and when crystals are formed, on the cooling of the solution, dry them quickly on filtering paper placed on a porous tile, and preserve them in a stoppered bottle.

Characters and Tests.—In transparent colourless prisms. Soluble in water, insoluble in rectified spirit. When treated with caustic potash, ammonia is evolved. The aqueous solution gives a yellow precipitate with nitrate of silver. If twenty grains of this salt be dissolved in water, and solution of ammonio-sulphate of magnesia added, a crystalline precipitate falls, which, when well washed upon a filter with solution of ammonia diluted with an equal volume of water, dried, and heated to redness, leaves 16·8 grains.

Dose, 5 to 20 grains.]

This salt, as met with in commerce, is usually made by treating bone ash with sulphuric acid, as in the process described for phosphate of soda, and converting the acid phosphate of lime so produced into phosphate of ammonia by adding carbonate of ammonia, when phosphate and carbonate of lime are precipitated, and phosphate of ammonia is left in solution. As thus produced, however, the phosphate of ammonia is generally mixed with a little sulphate, which may be detected by adding chloride of barium to a solution of the salt previously acidified with nitric acid. If there be sulphate present, a precipitate will be formed, insoluble in diluted nitric acid.

Therapeutics.—Dr. Garrod states that 'it is capable of dissolving a considerable amount of urate of soda, and clinical experience has shown that it is of great value in the treatment of certain urinary diseases when a tendency to uric acid calculi exists, and also in certain conditions of the gouty habit.'

Dose, 5 to 20 grains.

Ammoniæ Sulphas. *Sulphate of Ammonia.*
NH_4O,SO_3 or $(NH_4)_2SO_4$.

Prepared, by the aid of sulphuric acid, from the ammoniacal liquors obtained in the distillation of coal, &c., and purified by crystallisation or sublimation.

[§ **Liquor Ammoniæ Acetatis.** *Solution of Acetate of Ammonia.**

Acetate of Ammonia, $NH_4O,C_4H_3O_3$ or $\mathbf{NH_4C_2H_3O_2}$, dissolved in water.

Take of

Acetic Acid	10 fluid ounces.
Carbonate of Ammonia . .	$3\frac{1}{4}$ ounces, or a sufficiency.
Distilled Water . . .	$2\frac{1}{2}$ pints.

Reduce the carbonate of ammonia to powder, and add it gradually to the acetic acid, until a neutral solution is formed, then add the water.

Dose, 2 to 6 fluid drachms.]

Synonyms.—Spiritus Mindereri, Mindererus's Spirit.

Liquor Ammoniæ Acetatis Concentratus. *Concentrated Solution of Acetate of Ammonia.*

Take of

Strong solution of Ammonia .	$3\frac{1}{2}$ fluid ounces, or a sufficiency.
Acetic Acid	10 fluid ounces, or a sufficiency.

Mix gradually, and if the product is not neutral to test papers, make it so by the addition of the proper quantity of either liquid.

Dose, a fluid drachm or more.

This concentrated solution was the Liquor Ammoniæ Acetatis of the British Pharmacopœia of 1864. It is sometimes supplied by wholesale houses, for convenience in carriage, with instructions to dilute it with five times its volume of water, to bring it to the strength of the preparation now ordered in the Pharmacopœia; but from this it differs in its being entirely free from carbonic acid, some of which gas is retained in the solution when made with carbonate of ammonia. The concentrated solution may be used with advantage in lotions containing acetate or subacetate of lead, as the presence of carbonic acid in such cases is undesirable. The neutral condition of the acetate of ammonia can also be more easily ascertained in the concentrated solution than in the other, and this is sometimes considered an advantage; but, on the other hand, the presence of carbonic acid in the weaker solution made with carbonate of ammonia renders this solution more agreeable to the palate.

Characters and Tests.—A transparent colourless liquid, with a saline taste. Treated with caustic potash, it gives off an ammoniacal, and with sulphuric acid an acetous, odour. The concentrated solution, diluted with four or five volumes of distilled water, and the

* This nearly corresponds with Liquor Ammoniæ Acetatis, London and Edinburgh; it is about $\frac{1}{3}$ stronger than the Dublin, and only $\frac{1}{5}$ the strength of Liquor Ammoniæ Acetatis, 1864.

weaker solution after being boiled, is neutral to test paper, and gives no precipitate with chloride of barium, nitrate of silver, or sulphuretted hydrogen.

Therapeutics. Internal Use.—It is employed in febrile and inflammatory diseases, and forms a constituent of the ordinary saline draught. It is given in conjunction with nitrate of potash, or tartar emetic, and sometimes with camphor and opium. When administered as a diaphoretic, its operation should be promoted by the use of tepid diluents and external warmth. Used thus, it is of the greatest value as a remedy in Morbus Brightii. Its diuretic effect is assisted by keeping the skin cool, and conjoining the spirit of nitrous ether.

External Use.—Diluted with water it is sometimes employed as a discutient wash to inflamed and bruised parts. Fifteen minims mixed with an ounce of rose-water, may be employed as a collyrium in chronic ophthalmia. It has also been employed with benefit in porrigo and other cutaneous diseases, and for inflamed nipples.

[§ **Ammoniæ Benzoas.** *Benzoate of Ammonia.*

$NH_4O,C_{14}H_5O_3$ or $\mathbf{NH_4C_7H_5O_2}$.

Take of

Solution of Ammonia	.	3 fluid ounces, or a sufficiency.
Benzoic Acid .	. .	2 ounces.
Distilled Water	. .	4 fluid ounces.

Dissolve the benzoic acid in three fluid ounces of solution of ammonia previously mixed with the water; evaporate at a gentle heat, keeping ammonia in slight excess; and set aside, that crystals may form.

Characters and Tests.—In colourless laminar crystals, soluble in water and in alcohol. It gives a bulky yellow precipitate with persalts of iron. Its aqueous solution, when heated with caustic potash evolves ammonia, and if it be not too dilute, when acidulated with hydrochloric acid it gives a deposit of benzoic acid. When heated it sublimes without any residue.]

Physiological Effects.—Benzoate of ammonia, being more soluble in water than benzoic acid, is more readily absorbed, and is converted in the body into hippuric acid, which is found in the urine. It is slightly stimulant to the urinary organs, and is one of the most effectual means of rendering the urine acid, which it will sometimes do even when the urine is alkaline in consequence of disease of the spine.

Therapeutics.—Employed in chronic inflammation of the bladder, and when the urine is alkaline, or phosphates are deposited.

Dose, 10 to 20 grains.

[§ **Liquor Ammoniæ Citratis.** *Solution of Citrate of Ammonia.*

Citrate of Ammonia, $3NH_4O,C_{12}H_5O_{11}$ or $3\mathbf{NH_4.C_6H_5O_7}$, dissolved in water. Take of

Citric Acid	3 ounces.
Strong solution of Ammonia . .	$2\frac{3}{4}$ fluid ounces or a sufficiency.
Distilled Water	1 pint.

Dissolve the citric acid in the water, and add the solution of ammonia until the liquid is neutral to test papers.

Dose, 2 to 6 fluid drachms.]

Therapeutics.—Effects similar to those of acetate of ammonia.

Ammoniæ Oxalas. [§ *Oxalate of Ammonia.*

$$2NH_4O,C_4O_6+2HO \text{ or } (\mathbf{NH_4})_2\mathbf{C_2O_4.H_2O}.$$

Take of

Purified Oxalic Acid . . .	1 ounce.
Boiling Distilled Water . . .	8 fluid ounces.
Carbonate of Ammonia . . .	a sufficiency.

Dissolve the oxalic acid in the water, neutralise the solution at a boiling temperature, filter it while still hot, and set it by, that crystals may form as it cools.]

[§ **Solution of Oxalate of Ammonia.**

Take of

Oxalate of Ammonia	$\frac{1}{2}$ ounce.
Warm Distilled Water	1 pint.

Dissolve and filter.

Use.—Employed as a test for lime.]

CHLORUM. Chlorine. Cl or **Cl**=35·5.

History.—Discovered by Scheele in 1774, and called by him *dephlogisticated muriatic acid.* Berthollet, in 1785, named it *oxygenated muriatic acid.* Sir H. Davy called it *chlorine* (from χλωρός, *green*) on account of its colour. It is found in both kingdoms of nature.

In the inorganic kingdom it exists principally in combination with sodium, either dissolved in the water of the ocean or forming deposits of rock salt. Chlorine occurs also in combination with magnesium, calcium, lead, silver, &c. In the organic kingdom it is found, in combination, in both animals and vegetables. Hydrochloric acid, in the free state, exists, according to Dr. Prout, in the stomach of animals during the process of digestion.

Preparation.—There are two principal methods of procuring chlorine gas:—

(1.) *By adding sulphuric acid slightly diluted with water to a mixture of common salt and black oxide of manganese.*—To 8 parts of common salt and 4 of manganese, mixed together, and put into a retort, add 5 parts of sulphuric acid mixed with an equal weight of water, and apply a gentle heat. The gas, which is copiously evolved, may be purified by passing it through a small quantity of water in a wash-bottle. The decomposition may be represented as follows:—

Black Oxide of Manganese.		Common Salt.		Sulphuric Acid.		Sulphate of Manganese.		Bisulphate of Soda.		Water.		Chlorine.
MnO_2	$+$	$2NaCl$	$+$	$3H_2SO_4$	$=$	$MnSO_4$	$+$	$2NaHSO_4$	$+$	$2H_2O$	$+$	Cl_2

(2.) *By heating a mixture of hydrochloric acid and black oxide of manganese.*—To 3 ounces of black oxide of manganese add 8 or 10 fluid ounces of hydrochloric acid in a retort, and apply a gentle heat to the mixture. This quantity will yield 3 or 4 gallons of the gas. The following reaction occurs:—

Black Oxide of Manganese.		Hydrochloric Acid.		Chloride of Manganese.		Water.		Chlorine.
MnO_2	$+$	$4HCl$	$=$	$MnCl_2$	$+$	$2H_2O$	$+$	Cl_2

Properties.—Chlorine, at ordinary temperature and pressure, is a gaseous substance, having a yellowish-green colour, a pungent suffocating odour, and an astringent taste. Its sp. gr. is 2·47. It is not combustible, but is a supporter of combustion. Phosphorus and powdered antimony take fire spontaneously when introduced into it, and a taper burns in it, with the evolution of a red light and much smoke. When water is present it destroys vegetable colours, organic odours, and infectious matters. Hence its use as a bleaching agent, a deodoriser, and a disinfectant. Chlorine combines with water to form a solid crystalline *hydrate*, 10HO,Cl or $10H_2O,Cl_2$. This is pale yellow and transparent. When chlorine gas is prepared over water nearly at the freezing point (32° F.), bubbles of gas, in their passage through the water, sometimes become enveloped with a crystalline coating of the hydrate of chlorine. At the temperature of 60° F., and when the mercury in the barometer is standing at 30 inches, water takes up about twice its bulk of chlorine gas.

Therapeutics.—*As a fumigating agent, disinfectant*, and *antiseptic*, chlorine, I believe, stands unrivalled. For destroying miasmata, noxious effluvia, and putrid odours, it is the most powerful agent known; and is, therefore, well adapted for disinfecting prisons, ships, hospitals, dissecting rooms, and all other places, the air of which requires purification. The ingredients for producing the gas should be contained in saucers placed in the higher parts of the room, as the gas which is developed will descend by its density, and soon become mixed with the surrounding air. The following is the method adopted by Faraday at the General Penitentiary at Millbank.

One part of common salt was intimately mixed with one part of the black oxide of manganese, then placed in a shallow earthen pan, and two parts of oil of vitriol, previously diluted with two parts (by measure) of water, poured over it, and the whole stirred with a stick. Chlorine continued to be liberated from this mixture for four days. The disinfecting power of chlorine is supposed to depend on its affinity for hydrogen, by which it effects the decomposition of water or aqueous vapour, with the hydrogen of which it unites, while the nascent oxygen oxidises the organic matter: or it may act merely by abstracting hydrogen from the putrid miasmata.

As an antidote in poisoning by hydrocyanic acid, sulphuretted hydrogen, or hydrosulphuret of ammonia, chlorine gas is a very valuable agent. I believe, however, that chloride of lime will be found a more convenient, safe, and opportune substance. The beneficial influence of chlorine in the treatment of animals asphyxiated by sulphuretted hydrogen, doubtless arises, in part at least, from its chemical properties; for when mixed with sulphuretted hydrogen it forms chloride of sulphur and hydrochloric acid. The best method of applying the remedy is to diffuse a little chlorine in the air, and then to effect artificial respiration.

[§ **Liquor Chlori.** *Solution of Chlorine.*

Chlorine gas dissolved in water.

Take of

Hydrochloric Acid	6 fluid ounces.
Black Oxide of Manganese, in fine powder	1 ounce.
Distilled Water	34 fluid ounces.

Introduce the oxide of manganese into a gas bottle, and, having poured upon it the hydrochloric acid diluted with two ounces of the water, apply a gentle heat, and, by suitable tubes, cause the gas, as it is developed, to pass through two ounces of the water placed in an intermediate small phial, and thence to the bottom of a three-pint bottle containing the remainder of the water, the mouth of which is loosely plugged with tow. As soon as the chlorine ceases to be developed, let the bottle be disconnected from the apparatus in which the gas has been generated, corked loosely, and shaken till the chlorine is absorbed. Lastly, introduce the solution into a green glass bottle furnished with a well-fitting stopper, and keep it in a cool and dark place.

Characters and Tests.—A yellowish-green liquid, smelling strongly of chlorine, and immediately discharging the colour of a dilute solution of sulphate of indigo.

Specific gravity, 1·003. Evaporated, it leaves no residue. When 20 grains of iodide of potassium, dissolved in an ounce of distilled water, are added to 439 grains by weight (1 fluid ounce) of this preparation, the mixed solution acquires a deep red colour, which requires for its discharge 750 grain-measures of the volumetric solution of hyposulphite of soda, corresponding to 2·66 grains of chlorine.

Dose, 10 to 20 minims.]

The tests prove, first, freedom from saline impurity; and, secondly, the quantity of chlorine present in solution, the chlorine replacing the iodine of the iodide of potassium, and the free iodine reacting upon the hyposulphite of soda to form iodide of sodium and tetrathionate of soda; thus, $\mathbf{Cl_2} + \mathbf{2KI} = \mathbf{2KCl} + \mathbf{I_2}$; then $2(\mathbf{Na_2H_2S_2O_4}) + \mathbf{I_2} = \mathbf{2NaI} + \mathbf{Na_2S_4O_6} + \mathbf{2H_2O}$.

Therapeutics.—It has been used diluted with six volumes of water as a gargle in *putrid sore throat*, as a local bath in *liver diseases*, and as a deodorising application to *cancerous and other ulcers attended with a fetid discharge*; in the latter case I have repeatedly employed it with advantage, though I give the preference to the solution of chlorinated soda. Internally it has been administered in *typhus*, in *scarlet fever*, and in *malignant sore throat*.

Antidote.—White of egg in milk, or even flour, chlorine forming, with albumen, caseine, or gluten, a harmless compound.

Acidum Hydrochloricum. *Hydrochloric Acid.*

History.—Watery hydrochloric acid was probably known to Geber, in the eighth century. The present mode of obtaining it was contrived by Glauber. Priestley, in 1774, first obtained gaseous hydrochloric acid. Scheele may be regarded as the first person who entertained a correct notion of the composition of this acid, and to Sir H. Davy we are principally indebted for the establishment of Scheele's opinion. The solution is commonly known as *Spirit of Salt.*

[§ **Acidum Hydrochloricum.** *Hydrochloric Acid.*

Synonym.—Acidum Muriaticum purum, *Ed.*, *Dub.*

Hydrochloric Acid gas, HCl or **HCl**, dissolved in water, and forming 31·8 per cent. by weight of the solution.

It may be prepared by the following process:—

Take of

Chloride of Sodium, dried . . .	48 ounces.
Sulphuric Acid	44 fluid ounces.
Water	36 fluid ounces.
Distilled Water	50 fluid ounces.

Pour the sulphuric acid slowly into thirty-two ounces of the water, and when the mixture has cooled add it to the chloride of sodium previously introduced into a flask having the capacity of at least one gallon. Connect the flask by corks and a bent glass tube with a three-necked bottle, furnished with a safety tube, and containing the remaining four ounces of the water ; then, applying heat to the flask, conduct the disengaged gas through the wash-bottle into a second bottle containing the distilled water, by means of a bent tube dipping about half an inch below its surface ; and let the process be continued, until the product measures sixty-eight ounces, or the liquid has acquired a specific gravity of 1·16. The bottle containing the distilled water must be kept cool during the whole operation.]

In the above operation, the proportions of acid and salt are, according to the formula, $\mathbf{NaCl+H_2SO_4=NaHSO_4+HCl}$. These proportions are employed for two reasons: 1st, a much lower heat is required: and, 2ndly, the resulting salt, bisulphate of soda, is easily got out without risking the flask, which is not the case when double the amount of salt is used, and neutral sulphate is left. The addition of the water facilitates the operation, and renders the resulting mass more soluble and manageable.

[§ *Characters and Tests.*—A colourless and strongly acid liquid, emitting white vapours having a pungent odour. Specific gravity 1·16. When evaporated to dryness it leaves no residue. It gives with nitrate of silver a curdy white precipitate soluble in excess of ammonia, insoluble in nitric acid. 114·8 grains mixed with half an ounce of distilled water require for neutralisation 1,000 grain-measures of the volumetric solution of soda. When diluted with four times its volume of distilled water, it gives no precipitate with solution of chloride of barium, or sulphuretted hydrogen, and does not tarnish or alter the colour of bright copper foil when boiled with it. If a fluid drachm of it mixed with half an ounce of distilled water be put into a small flask with a few pieces of granulated zinc, and while the effervescence continues a slip of bibulous paper wetted with solution of sub-acetate of lead be suspended in the upper part of the flask above the liquid for about five minutes, the paper will not become discoloured.]

The tests prove absence of fixed impurity, of sulphuric acid, free chlorine, lead, arsenic, and sulphurous acid.

Properties.—Pure liquid hydrochloric acid, possesses the usual characteristics of a strong acid; is decomposed by some metals (e.g. zinc and iron), hydrogen being evolved, and a metallic chloride formed. When it acts on a metallic oxide, water and a metallic chloride are produced. It is without action on gold leaf, and does not decolorise sulphate of indigo. A rod dipped in a solution of caustic ammonia produces white fumes when brought near strong liquid hydrochloric acid.

Commercial hydrochloric acid is frequently more or less impure, being contaminated with iron, sulphuric and sulphurous acids, chlorine, arsenic, chloride of ammonium, &c.

Therapeutics, Internal Use.—Hydrochloric acid has been employed in the so-called putrid and petechial fevers, malignant scarlatina, and ulcerated sore throat. It is usually administered in these cases in conjunction with the vegetable tonics; as cinchona or quassia. It is frequently employed to counteract phosphatic deposits in the urine. After a copious evacuation, it is, according to Dr. Paris, the most efficacious remedy for preventing the generation of worms; for which purpose a strong infusion of quassia is the best vehicle. It has been employed with benefit in some forms of dyspepsia. Two facts give a remarkable interest to the employment of this acid in dyspeptic complaints—namely, that it is a constituent of the healthy gastric juice; and secondly, when mixed with mucus, it has a solvent or digestive power in the case of various articles of food. Lastly, hydrochloric acid has been used in scrofulous and venereal affections, in hepatic disorders, &c. It is administered in the form of the dilute acid.

External Use.—In the concentrated form it is employed as a caustic to destroy warts, and as an application in sloughing phagedena, though for the latter purpose it is inferior to nitric acid. Van Swieten employed it in cancrum oris; and more recently Bretonneau has spoken in the highest terms of its efficacy in angina membranacea, commonly termed diphtheria. It is applied to the throat by a sponge. Properly diluted, it forms a serviceable gargle in ulceration of the mouth and throat. The objection to its use as a gargle is its powerful action on the teeth: to obviate this as much as possible, the mouth is to be carefully rinsed each time after using the gargle. It is sometimes applied to ulcers of the throat by means of a sponge.

Antidotes.—In a case of poisoning by hydrochloric acid, the antidotes are chalk, whiting, magnesia or its carbonate, and soap; and in the absence of those, oil, the bicarbonated alkalies, milk, white of egg, or demulcents of any kind. Of course the gastro-enteritis is to be combated in the usual way.

[§ **Acidum Hydrochloricum dilutum.** *Diluted Hydrochloric Acid.*

Synonym.—Acidum Muriaticum Dilutum, Edin.

Take of

Hydrochloric Acid	8 fluid ounces.
Distilled Water	a sufficiency.

Dilute the acid with 16 ounces of the water, then add more water, so that at a temperature of 60° it shall measure 26½ fluid ounces.

Or as follows:—

Take of

Hydrochloric Acid	3,060 grains.
Distilled Water	a sufficiency.

Weigh the acid in a glass flask, the capacity of which to a mark on the neck is one pint, then add distilled water until the mixture at 60° temperature after it has been shaken, measures a pint.

Tests.—Specific gravity 1·052. 345 grains by weight (6 fluid drachms) require for neutralisation 1,000 grain-measures of the volumetric solution of soda, corresponding to 10·58 per cent. of real acid. Six fluid drachms contain one equivalent or 36·5 grains of hydrochloric acid, HCl or **HCl**.

Dose, 10 to 30 minims.]

[§ BROMUM. Bromine. Br, or **Br** = 80.

A liquid non-metallic element, obtained from sea-water and from some saline springs.]

History.—Bromine (from βρῶμος, a stench) was discovered by M. Balard in 1826. It exists in sea-water and many mineral waters, especially brine springs, in combination with either sodium, magnesium, or calcium. The saline springs near Kreuznach in Germany, are especially rich in it. Bromine has also been found in the sea-plants of the Mediterranean, and in the mother-waters of Kelp.

Preparation.—When the mother-liquor of sea-water, or bittern, has been deprived, as much as possible, of its other salts by crystallisation, chlorine is developed in it, either by binoxide of manganese and hydrochloric acid; or, when the quantity of metallic chloride is sufficient, by binoxide of manganese and sulphuric acid. This decomposes the bromide of magnesium contained in the liquor, and sets free bromine, which distils over; $\mathbf{MgBr_2 + Cl_2 = MgCl_2 + Br_2}$. The bromine thus obtained requires to be subsequently purified.

[§ *Characters and Tests.*—A dark brownish-red, very volatile, liquid, with a strong and disagreeable odour. Its specific gravity is 2·966. At the common temperature of the air it gives off red vapours, and at a temperature of 117° it boils. Agitated with solution of soda in such proportion that the fluid remains very slightly alkaline, it forms a colourless liquid, which, if coloured by the further addition of a small quantity of the bromine, does not become blue on the subsequent addition of a cold solution of starch.] This last test shows the absence of iodine. When exposed to a cold of −4° F., it is a yellowish-brown, brittle, crystalline solid.

Physiological Effects.—The constitutional effects resulting from the continued use of bromine have not been well determined; they are probably intermediate between chlorine and iodine, but, according to Dr. Glover, more nearly related to the former than the latter. In small doses it acts as a tonic, diuretic, and resolvent. It is rarely used in the uncombined state, but a solution of one part in forty of water may be given in doses of five or six drops, properly diluted. The aqueous solution may also be applied externally, or an ointment consisting of ten or fifteen grains of bromine to an ounce of lard.

[§ Solution of Bromine.

Take of

Bromine	10 minims.
Distilled Water . . .	5 fluid ounces.

Place the bromine in a bottle furnished with a well-fitting stopper, pour on the water, and shake several times. Keep it excluded from the light.]

Used for detecting iodine in bromide of potassium.

IODUM. Iodine. I or **I**=127.

History.—Iodine (from Ἰώδης, violet) was discovered in 1811 by M. Courtois, a saltpetre manufacturer at Paris. It is found in a few minerals, but rarely; sea-water likewise contains it, probably in the state of iodide of sodium or magnesium; it is also found in many mineral waters and brine springs. A very considerable number of vegetables, particularly those belonging to the family Algæ, yield it.

According to Mr. Whitelaw, a Glasgow manufacturer, the following algæ yield iodine in the ratios indicated by the numbers given:—

Laminaria digitata, 100; *L. bulbosa*, 65; *L. saccharina*, 35; *Fucus serratus*, 20; *F. bulbosus*, 15.

The quantities of chloride of potassium in those algæ follow nearly the same ratio. Professor Graham states that, according to Mr. Whitelaw, the long elastic stems of the *Rhodomenia palmata* afford most of the iodine contained in kelp.

Iodine of Commerce.

Preparation.—The kelp is broken into pieces and lixiviated in water, to which it yields about half its weight of salts. The solution is concentrated by evaporation, and thereby deposits soda salts (common salt, carbonate and sulphate of soda), and on cooling also lets fall crystals of chloride of potassium. The mother liquor (called *iodine ley*) is dense, dark-coloured, and contains the iodine, in the form, it is believed, of iodide of sodium. Sulphuric acid is added, to render the liquid sour, by which carbonic acid, sulphuretted hydrogen, and sulphurous acid gases are evolved, and sulphur is deposited. The acid ley is then introduced into a leaden still, and heated to 140° F., when black oxide of manganese is added. A leaden head having two stoppers is then adapted and luted with pipe-clay, and to the neck of the head is fitted a series of spherical glass condensers, each having two mouths opposite to each other, and inserted the one into the other. Iodine is evolved, and is collected in the condensers. The process is watched by occasionally removing the stopper, and additions of sulphuric acid or manganese are made if deemed necessary.

An improvement upon the ordinary process of making *kelp* has been patented and worked by Mr. E. C. C. Stanford. It consists in submitting the dry weed to distillation in iron retorts, and operating upon the residue for the extraction of the iodine. The advantages are, that the very considerable loss which is always sustained in burning the *vraik* is avoided, and in addition several other products are obtained of commercial value.

The following is the mutual reaction of sulphuric acid, black oxide of manganese, and iodide of sodium :—

$$2NaI + MnO_2 + 2H_2SO_4 = Na_2SO_4 + MnSO_4 + 2H_2O + I_2.$$

Impurities.—The iodine of commerce is always contaminated with variable proportions of *water*. An ounce, if very moist, may contain a drachm, or perhaps even a drachm and a half, of water. This fraud is detected by compressing the iodine between folds of blotting-paper. In this moist state it is unfit for making pharmaceutical preparations of fixed and uniform strength.

Various substances, such as *coal*, *plumbago*, *black oxide of manganese*, *sand*, and *charcoal*, are also said to have been employed for the purpose of adulterating iodine; but in no samples of iodine which I have examined have I ever found any of these substances. Dr. Herzog mentions, as accidental adulterations, water, chloride of iodine, clay, and iodide of cyanogen,—the latter formed by the decomposition of marine animals in the kelp-coal. Sulphide of antimony, galena, and acid tartrate of potash, are quoted by him as intentional adulterations, in addition to those above mentioned.

[§ **Iodum.** *Iodine.*

A non-metallic element, obtained principally from the ashes of sea-weeds.]

Pure iodine for pharmaceutical and chemical purposes is best obtained by triturating commercial iodine with about a tenth of its weight of iodide of potassium, and resubliming at a gentle heat.

[§ *Characters and Tests.*—Laminar crystals of a peculiar odour, dark colour, and metallic lustre, which, when heated, yield a beautiful violet-coloured vapour; very sparingly soluble in water, but freely dissolved by alcohol, by ether, and by a solution of iodide of potassium. The aqueous solution strikes a deep blue colour with starch. It sublimes without leaving any residue, and the portion that first comes over does not include any slender colourless prisms (iodide of cyanogen **CyI**), emitting a pungent odour. 12·7 grains, dissolved in an ounce of water containing 15 grains of iodide of potassium, require for complete discoloration 1,000 grain-measures of the volumetric solution of hyposulphite of soda.]

It fuses at about 245° F., and at 347° is volatilised, though the vapour rises along with that of water at 212°. Iodine vapour has a great specific gravity — namely, 8·716, according to Dumas. Iodine requires 7,000 times its weight of water to dissolve it. In the free state it is distinguished from most other bodies by its forming the blue compound with starch. So delicate is this test, that, according to Stromeyer, water which does not contain more than one four-hundred-and-fifty-thousandth part of its weight of iodine acquires a perceptibly blue tinge on the addition of starch. This blue colour is destroyed by heat; and, therefore, in testing for iodine, the liquids employed should be cold; an excess of alkali also destroys it by forming two salts, an iodate and an iodide, but by supersaturating with acid the colour is restored. The action of iodine on starch is also impeded by some organic constituents of plants.

Physiological Effects.—That iodine becomes absorbed, when employed either externally or internally, we have indisputable evidence by its detection, not only in the blood, but in the secretions, the urine, sweat, saliva, and milk. In all cases it is found in the state of iodine. It may be readily detected in the urine of patients who have been using iodine, by adding a cold solution of starch and a few drops of nitric acid, when the blue iodide of starch is produced. The *local* action of iodine is that of an irritant. Applied to the skin, it stains the cuticle orange-yellow, causes itching, redness, and desquamation. If the vapour of it, mixed with air, be inhaled, it excites cough and heat in the air-passages. The *general* effects of iodine are these:—In *small medicinal doses*, its action is *alterative*, as we sometimes obtain the palliation, or even the removal of disease, as scrofulous diseases, and visceral and glandular enlargements, without any perceptible alteration in the functions of the body. By some unexplained influence, it sometimes not only puts a stop to the further progress of disease, but apparently restores the part to its healthy state. It is usually given with the view of exciting the action of the absorbents; but its influence is not limited to this set of vessels. It exercises a controlling and modifying influence over the blood vessels of the affected part, and is in the true sense of the word an *alterative*. Sometimes it increases the appetite, from which circumstance it has been denominated a *tonic*. But in irritable subjects, and those disposed to dyspepsia, it occasions nausea, sickness, heat of stomach, and loss of appetite, especially after its use has been continued for some days, and the bowels are oftentimes slightly relaxed. Rapid emaciation is said to have been occasionally produced by iodine; but Lugol asserts that, instead of producing emaciation, it encourages growth and increase of size. Lugol, however, while he employed iodine largely, gave it cautiously and in small doses; and by simply altering the morbid actions which interfere with the healthy nutrition of the body, may have improved its condition, while in other hands the production by iodine of either local or general irritation may have impaired it. Two most remarkable effects which have been produced by iodine are, *absorption of the mammæ and wasting of the testicles.* With regard to wasting of the testicles, I suspect it to be very rare. I have seen iodine administered in some hundreds of cases, and never met with one in which atrophy either of the breast or testicle occurred. Majendie also never saw these effects, though they are said to be common in Switzerland. 'Iodine,' says Lugol, 'is a powerful *diuretic.* All the patients using it have informed me that they pass urine copiously.' Coindet, however, expressly says that it does not increase the quantity of urine. In some cases in which I carefully watched its results, I did not find any diuretic effect. It frequently acts as an *emmenagogue.* In some instances the continued use of iodine has given rise to a disordered state of system, which has been denominated *Iodism.* The symptoms (termed by Dr. Coindet *iodic*) are violent vomiting and purging, with fever, great thirst, palpitation, rapid and extreme emaciation, cramps, and small and frequent pulse, occasionally with dry cough, and terminating in death. This condition, however, must be a very rare occurrence; for it is now hardly ever met with, notwithstanding the frequency and freedom with which iodine is employed. The daily experience of almost every practitioner proves that the dangers resulting from the use of iodine have been much exaggerated, and we can hardly help suspecting that many symptoms which have been ascribed to the injurious operation of this remedy ought to have been referred to other causes; occasionally perhaps, they depended on gastro-enteritis. In some cases the remarkable activity of iodine may have arisen from some idiosyncrasy on the part of the patient. M. Velpeau stated, at the Académie Impériale de Médecine of Paris, that he had treated 15,000 persons with iodine externally or internally, but had never seen anything exactly resembling constitutional *iodism.* He had seen irritation of the throat and digestive organs, mouth and nose, and ptyalism, but never rapid emaciation, wasting of the breasts or testicles, or bulimia; in short, symptoms of poisoning, such as M. Rilliet has described at Geneva. The difference, he thinks, may depend on the doses employed, or on the quality of the iodised preparations. *In very large doses*, iodine has acted as an irritant poison, causing inflammation of the bowels, and death.

Therapeutics.—As a remedial agent iodine is principally valuable for its resolvent influence in chronic visceral and glandular enlargements, indurations, thickening of membranes (as of the periosteum), and in tumors. In comparing its therapeutical power with that of mercury, we observe in the first place, that it is not adapted for febrile and acute inflammatory complaints, in several of which mercury proves a most valuable agent. Indeed, the existence of inflammatory fever is a contra-indication for the employment of iodine. Secondly, iodine is especially adapted for scrofulous, mercury for syphilitic, maladies; and it is well known that in the former class of diseases mercurials are for the most part injurious. Thirdly, the influence of iodine over the secreting organs is much less constant and powerful than that of mercury; so that in retention or suppression of the secretions mercury is for the most part greatly superior to iodine. Fourthly, iodine evinces a specific influence over the diseases of certain organs (e.g. the thyroid body), which mercury does not. These are some only of the peculiarities which distinguish the therapeutical action of iodine from that of mercury.

a. In *bronchocele.*—Of all the remedies yet proposed for bronchocele, this has been by far the most successful. Indeed, judging only from the numerous cases cured by it, and which have been published, we should almost infer it to be a sovereign remedy. I much regret, however, that my own experience does not accord with this inference. I have repeatedly seen iodine, given in conjunction with iodide of potassium, and used both externally and internally, fail in curing bronchocele; and I know others whose experience has been similar. Dr. Copland thinks that where it fails it has been given in 'too large and irritating doses, or in an improper form; and without due attention having been paid to certain morbid and constitutional relations of the disease during the treatment.' But, in two or three of the instances before mentioned, I believe the failure did not arise from any of the circumstances alluded to by Dr. Copland, and I am disposed to refer it to some peculiar condition of the tumor, or of the constitution. Sometimes the thyroid gland is enlarged, but has a healthy structure. In others, the tumefaction of the gland is only temporary, and may arise from increased vascularity and effusion of serum. A third class of bronchoceles consists of an enlargement of the thyroid gland from the development of certain fluid or solid substances in its interior, and which may be contained in cells, or be infiltrated through its substance. Now it is impossible that all these different conditions can be cured with equal facility by iodine: those having solid deposits are, of course, most difficult to get rid of. If the swelling be tender to the touch, and have other marks of inflammation, the usual local antiphlogistic measures should precede the employment of iodine.

β. In *scrofula.*—Dr. Coindet was, I believe, the first to direct public attention to this remedy in the disease in question. Three memoirs on the effects of iodine in scrofula have been subsequently published by Lugol, physician to the Hôpital St.-Louis, serving to confirm the opinions already entertained of its efficacy. From the first memoir it appears that in seventeen months 109 scrofulous patients were treated by iodine only; and that of these 36 were completely cured, and 30 relieved; in 4 cases the treatment was ineffectual, and 39 cases were under treatment at the time of the report. In his illustrative cases we find glandular swellings, scrofulous ophthalmia, abscesses, ulcers, and diseases of the bones, were beneficially treated by it. Lugol employs iodine internally and externally. His local external treatment consists in employing ointments or solutions of iodine, cataplasms, and local baths. His external general treatment consists in the employment of ioduretted baths. In the treatment of cutaneous scrofula I have seen the most beneficial results from the application of the tincture of iodine by means of a camel's-hair pencil. It dries up the discharge and promotes cicatrisation. The successful results obtained by Lugol in the treatment of this disease cannot, I think, in many instances, be referred to iodine solely. Many of the patients were kept several months (some as much as a year) under treatment in the hospital, where every attention was paid to the improvement of their general health by warm clothing, good diet, the use of vapour- and sulphur-baths, &c.; means which, of themselves, are sufficient to ameliorate, if not cure, many of the scrofulous conditions before alluded to. Whether it be to the absence of these supplementary means of diet and regimen, or to some other cause, I know not; but most practitioners will, I think, admit, that they cannot obtain, by the use of iodine, the same successful results which Lugol is said to have met with, though in a large number of cases this agent has been found a most useful remedy.

γ. *In chronic diseases of various organs, especially those accompanied with induration and enlargement*, iodine has been eminently successful when employed as a resolvent. In chronic inflammation, induration, and enlargement of the *liver*, after antiphlogistic measures have been adopted, the two most important and probable means of relief are iodine and mercury, which may be used either separately or conjointly. If the disease admits of a cure, these are the agents most likely to effect it. Several cases of enlarged *spleens* relieved, or cured, by iodine, have been published. In chronic diseases of the *uterus*, accompanied with induration and enlargement, iodine has been most successfully employed by Dr. Thetford and by Dr. Ashwell. Besides the internal use of iodine, this substance was employed in the form of ointment (composed of iodine gr. 15, iodide of potassium oz. $\frac{1}{4}$, spermaceti oint. oz. $1\frac{1}{2}$), of which a portion (about the size of a nutmeg) was introduced into the vagina, and rubbed into the affected cervix for ten or twelve minutes every night. It may be applied by the finger, or by a camel's-hair pencil, or sponge mounted on a slender piece of cane. The average time in which resolution of the induration is accomplished varies, according to Dr. Ashwell, from eight to sixteen weeks. 'In hard tumors of the walls or cavity of the uterus, resolution, or disappearance, is scarcely to be expected;' but 'hard tumors of the cervix, and indurated puckerings of the edges of the os (conditions which most frequently terminate in ulceration), may be melted down and cured by the iodine.' In *ovarian* tumors, iodine has been found serviceable. In the chronic *mammary* tumor, described by Sir A. Cooper, I have seen it give great relief, alleviating pain, and keeping the disease in check. In indurated enlargements of the *parotid, prostate, and lymphatic glands*, several successful cases of its use have been published.

δ. As an *emmenagogue*, iodine has been recommended by Coindet, Majendie, and others.

ε. *Chronic diseases of the Nervous System*, such as *paralysis and chorea*, have been successfully treated by iodine, by Dr. Manson.

ζ. In some forms of *the venereal disease*, iodine has been found a most serviceable remedy. De Salle cured chronic venereal affections of the *testicles* with it.

η. In checking or controlling *the ulcerative process*, iodine is, according to Mr. Key, one of the most powerful remedies we possess. 'The most active phagedenic ulcers, that threaten the destruction of parts, are often found to yield in a surprising manner to the influence of this medicine, and to put on a healthy granulating appearance.'

θ. *As an injection for the cure of hydrocele*, Velpeau has employed a mixture of the tincture of iodine with water, in the proportion of from one to two drachms of the tincture to an ounce of water: of this mixture from one to four ounces are to be injected and immediately withdrawn.

ι. *Inhalation* of *iodine vapour* has been used in phthisis. I have repeatedly tried it in this complaint, but never with the least benefit.

κ. As *a topical remedy* iodine is exceedingly valuable in several classes of diseases. The part affected is painted with the tincture or liniment, by means of a camel's-hair pencil. In some few cases only, where the skin is very delicate, it will be necessary to dilute the tincture. When it is required to remove the stain which its use gives rise to, a poultice or gruel should be applied. In *lupus* it proves highly beneficial. My attention was first drawn to its efficacy in this disease by my colleague Mr. Luke. Under its employment the process of ulceration is generally stopped, and cicatrisation takes place. The tincture should be applied, not only to the ulcerated portion, but to the parts around. In *eczema* it also is an excellent application. In *cutaneous scrofula*, likewise, as I have already remarked. In several other cutaneous diseases, such as *lichen*, *prurigo*, *pityriasis*, *psoriasis*, *impetigo*, *porrigo*, *ecthyma*, and *scabies*, Dr. Kennedy has found its use beneficial. According to the testimony of Dr. Davies and an anonymous writer, it is a valuable application to *chilblains*. In the treatment of *diseases of the joints* it is used with great advantage. In *erysipelas* I have seen it highly beneficial. In *phlegmonous inflammation*, *sloughing of the cellular membrane*, *inflammation of the absorbents*, *gout*, *carbuncle*, *whitlow*, *lacerated*, *contused*, and *punctured wounds*, and *burns*, and *scalds*, it is most highly spoken of by Dr. Davies. In *acute rheumatism* and *gout* the application of iodine to the affected parts gives unquestionable relief. Either tincture or liniment of iodine should be applied to the affected joints, and repeated daily until the cuticle begins to peel off. According to my experience, no remedy gives so much relief as this: I have rarely found it fail. It deserves, however, especial notice, that the skin of different invalids is most unequally susceptible of its influence: in some few it excites so much pain that a second application of it is with difficulty permitted, and it occasionally causes an herpetic eruption. In others, however, it produces scarcely any painful effects. In *diseases of the lungs and bronchial tubes* simulating phthisis, and also in incipient protracted phthisis, it may be applied to the outside of the thorax with great benefit. It is usually a much less painful application than emetic tartar or croton oil, though, as I believe, equally effective. Another and most effectual method of employing iodine externally, is to apply the ointment to the cutis vera, the epidermis being previously removed by a blister. But the method more usually followed is to rub the ointment into the affected part, without the epidermis being previously removed. Its topical uses are, therefore, nearly as extensive as those of nitrate of silver. Moreover, it is used very much in the same classes of cases, and with the same views.

Administration.—Iodine is rarely administered alone, but generally in conjunction with iodide of potassium. The tincture is a good form for internal use. For inhalation, a few drops of the tincture may be added to hot water, and the vapour inhaled in the ordinary way. A little tincture of conium is sometimes added, to prevent irritation. In the administration of iodine, care should be taken to avoid gastric irritation. On this account we should avoid giving it on an empty stomach. Exhibited immediately after a meal, its topical action is considerably diminished. This is especially the case when amylaceous substances (as potatoes, bread-pudding, sago, tapioca, and arrowroot) have been taken, as the iodine forms with them an iodide of starch.

[§ **Liquor Iodi.** *Solution of Iodine.*

Take of

Iodine	20 grains.
Iodide of Potassium	30 grains.
Distilled Water	1 fluid ounce.

Dissolve.]

[§ **Tinctura Iodi.** *Tincture of Iodine.*

Take of

Iodine	$\frac{1}{2}$ ounce.
Iodide of Potassium	$\frac{1}{4}$ ounce.
Rectified Spirit	1 pint.

Dissolve the iodine and the iodide of potassium in the spirit.]

The proportion of iodide of potassium is only one-fourth as much as in the London tincture. It is chiefly useful in facilitating the solution of the iodine.

The tincture is intended both for internal and external use. *Dose* for internal use, min. 5 to 20 (= about gr. $\frac{1}{8}$ to gr. $\frac{1}{2}$ of iodine) in water.

[§ **Linimentum Iodi.** *Liniment of Iodine.*

Take of

Iodine	$1\frac{1}{4}$ ounce.
Iodide of Potassium	$\frac{1}{2}$ ounce.
Camphor	$\frac{1}{4}$ ounce.
Rectified Spirit	10 fluid ounces.

Dissolve the iodine, iodide of potassium and camphor in the spirit. This is half the strength of Lin. Iodi 1864. The camphor is now introduced.]

This liniment contains five times as much iodine as the tincture, and is only intended for external use. It should not be applied to tender skins.

[**Unguentum Iodi.** *Ointment of Iodine.*

Synonym.—Unguentum Iodi Compositum 1864.

Take of

Iodine	32 grains.
Iodide of Potassium	32 grains.
Proof Spirit	1 fluid drachm.
Prepared Lard	2 ounces.

Rub the iodine and the iodide of potassium well together, with the spirit, in a glass or porcelain mortar, add the lard gradually, and mix thoroughly.]

The proportion of iodide of potassium is less by one-half than in the London ointment.

[§ **Vapor Iodi.** *Inhalation of Iodine.*

Take of

Tincture of Iodine	1 fluid drachm.
Water	1 fluid ounce.

Mix in a suitable apparatus, and having applied a gentle heat, let the vapour that arises be inhaled.]

[§ **Volumetric Solution of Iodine.** (Appendix III.)

Take of

Pure Iodine, in powder	127 grains.
Iodide of Potassium	180 grains.
Distilled Water	a sufficiency.

Mix the iodide of potassium and iodine in a bottle with eighteen ounces of the water; agitate until both are dissolved, and when the solution is complete, add as much more distilled water as will make the total bulk exactly one pint.

Put the iodide of potassium and the iodine into the 10,000 grain flask, fill the flask to about two-thirds its bulk with distilled water, gently agitate until solution is complete, and then dilute the solution with more water until it has the exact volume of 10,000 grain-measures; 1,000 grain-measures of this solution contain $\frac{1}{10}$th of an equivalent in grains (12·7) of iodine, and therefore correspond to 1·7 grain of sulphuretted hydrogen, 3·2 grains of sulphurous and 4·95 grains of arsenious acid.

Grammes and cubic centimètres may be employed instead of grains and grain-measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. 100 cubic centimètres contain 1·27 gramme of iodine and correspond to 0·17 gramme of sulphuretted hydrogen, 0·32 gramme of sulphurous, and 0·495 gramme of arsenious acid.

This solution is used for testing the following substances. It is dropped from the burette into the liquid to be tested until free iodine begins to appear in the solution.

	British Weights and Measures.				Metrical Weights and Measures.		
	Grs. wt. of Substance	=	Gr.-meas. of Vol. Sol.	or	Grms. wt. of Substance	=	C.C. of Vol. Sol.
Acid. Arsenios. .	4·0	=	808	or	0·40	=	80·8
Acid. Sulphuros. .	34·7	=	1000	or	3·47	=	100·0
Liq. Arsenicalis .	441·5	=	808	or	44·15	=	80·8
Liq. Arsenici Hydrochloricus	441·5	=	810	or	44·15	=	81·0

SULPHUR. Sulphur or Brimstone.

$S=16$ or $\mathbf{S}=32$.

History.—Sulphur (from *Sal*, and πῦρ fire) has been known from the most remote periods of antiquity. The word brimstone (*brynston* as written by Piers Ploughman) signifies *brennestone* or *burnstone.*

It is found in both kingdoms of nature. *Native sulphur* is found either imbedded in rocks or produced by sublimation (*volcanic sulphur.*) Sulphur is also found in the mineral kingdom in a state of combination, as in the various forms of pyrites. It is also a constituent of various animal and vegetable substances, such as albumen, &c.

Preparation.—Sulphur is procured in two ways; by the purification of native sulphur, or by the decomposition of the native sulphides. The sulphur of British commerce is almost exclusively obtained in the first way. It is brought principally from Sicily. Crude or rough sulphur comes over in irregular blocks or masses, whose colour is somewhat paler than that of refined sulphur. Fine Sicilian sulphur contains not more than 3 per cent. of foreign matter, chiefly earthy, but not at all arsenical. Vauquelin distilled 200 grains of rough sulphur, and obtained a residuum of 0·82, composed of silica, carbonate of lime, iron, bituminous charcoal, alumina, and magnesia; but the proportion of earthy matter is generally more considerable. Sulphur obtained from pyrites usually contains orpiment ($\mathbf{As_2S_3}$).

Refining.—There are three modes of refining sulphur: viz. first, fusion and decantation; secondly, distillation; thirdly, sublimation. Formerly sulphur was refined by fusing it in an iron caldron, allowing the earthy impurities to subside, and ladling out the supernatant liquid sulphur. At present, sulphur is refined by distillation and sublimation: by distillation, *massive sulphur* is obtained: by sublimation, *flowers of sulphur.*

[§ Sulphur Sublimatum. *Sublimed Sulphur.*

Sulphur, prepared from crude or rough sulphur by sublimation.

Characters and Tests.—A slightly gritty powder of a fine greenish-yellow colour, without taste, and without odour unless heated; burning in open vessels with a blue flame and the evolution of sulphurous acid. Entirely volatilised by heat; does not redden moistened litmus paper. Solution of ammonia, agitated with it and filtered, does not on evaporation leave any residue.

Dose, 20 grains to 1 drachm.]

The tests indicate the absence of earthy matters, of adhering acid, and of sulphide of arsenic. Pure sulphur is also entirely soluble in boiling oil of turpentine.

Physiological Effects.—Sulphur taken into the stomach is, for the most part, evacuated by the bowels; but a portion becomes absorbed and may be detected in the secretions; in the urine it is found as sulphate and sulphide (Wöhler). It is probable, therefore, that by the mutual action of sulphur and the soda of the bile, sulphide of sodium and sulphate of soda are formed, and that these are subsequently absorbed.

In *small* and *repeated doses*, sulphur acts as a gentle stimulant to the secreting organs, especially to the skin and the mucous membranes, particularly the bronchial membrane. It promotes the capillary circulation of these parts, and increases their secretions. Sundelin says it operates specifically on the mucous membrane of the rectum, and thereby promotes critical hemorrhoidal secretions. That it becomes absorbed is shown by the odour of sulphuretted hydrogen which it communicates to the sweat, urine, and milk, and by silver articles becoming blackened in the pockets of patients who are under the influence of it.

In *larger doses* sulphur acts as a mild purgative, without exciting the pulse or occasioning griping. As the stools are usually solid, Dr. Paris concludes that the action of sulphur on the bowels is confined to the muscular coat.

Therapeutics.—Sulphur is employed both internally and externally.

Internally.—It is given for various purposes. *In diseases of the rectum*, as stricture, hemorrhoids, and prolapsus, it is a valuable agent as a mild purgative: I have frequently employed it in these cases as a substitute for castor oil. In order to promote its purgative effect, it is sometimes necessary to conjoin magnesia or the bitartrate of potash, as in *confection of sulphur. In chronic cutaneous diseases*, more especially prurigo, impetigo, and scabies, the internal use of sulphur is attended with great benefit. *In pulmonary affections*, as chronic catarrhs and asthma, it is sometimes useful. *In rheumatic and gouty affections* also. After an attack of acute rheumatism, when the joints are left in a swollen and painful state, I have seen sulphur prove highly useful. It is popularly taken with ardent spirit (gin) in this complaint. Dr. Graves and Dr. Brown-Séquard have derived advantage from it in *paralysis* from softening.

Externally.—Sulphur is a most valuable remedy in various skin diseases, more especially *scabies*. It is supposed by some that its curative power depends on its poisonous influence over the so-called *itch insect*, *Sarcoptes hominis* of Raspail, the *Acarus scabiei* of other writers, or rather on the poisonous influence of the sulphuretted hydrogen formed in the cells of the cuticle after the use of the sulphur ointment, for Küchenmeister found that the itch insect can live some days in sulphur. But some doubts have been entertained whether this animal be the cause, effect, or mere accompaniment of itch. Rayer observes, that it is indubitable that the number of these insects bears no proportion to that of the vesicles. 'It is, further,' he observes, 'rare to discover these insects on the abdomen and on groins, where the eruption of scabies is nevertheless very common and very apparent; moreover, scabies is known to continue when no more acari are to be discovered. Sulphur is also a most valuable application in various other skin diseases, as porrigo, impetigo, &c.

Administration.—It is usually given with syrup or treacle, or suspended in milk. The dose of it, as a purgative, is from sixty grains to a quarter of an ounce. As an alterative or sudorific, the dose is about twenty or thirty grains.

[§ **Confectio Sulphuris.** *Confection of Sulphur.*

Take of

Sublimed Sulphur	4 ounces.
Acid Tartrate of Potash, in powder . .	1 ounce.
Syrup of Orange-peel	4 fluid ounces.

Rub them well together.

Dose, 60 to 120 grains.]

Laxative or mildly purgative.

[§ **Unguentum Sulphuris.** *Ointment of Sulphur.*

Take of

Sublimed Sulphur	1 ounce.
Prepared Lard	4 ounces.

Mix thoroughly.]

Chiefly employed in scabies. Mr. Erasmus Wilson recommends it to be diligently rubbed in before the fire night and morning for two days, the patient to wear a flannel shirt, and to take a warm wash bath on the third day, when the cure is generally completed. Sometimes three days' rubbing is required.

[§ ⁂ **Sulphur Precipitatum.** *Precipitated Sulphur.*

Prepared by boiling 5 ounces of sulphur and 3 ounces of slaked lime, with a pint and a half of water, filtering the solution, diluting it with 2 pints more of water, and when it has cooled adding hydrochloric acid in excess. The precipitate thus formed, *precipitated sulphur*, is to be washed with distilled water and dried.]

The reactions in this process may be represented as follows: in boiling the sulphur and lime with water, pentasulphide of calcium and hyposulphite of lime are formed,

$$3CaH_2O_2 + 6S_2 = 2CaS_5 + CaS_2H_2O_4 + 2H_2O$$

Then, on the addition of hydrochloric acid to the two salts contained in the solution, there are produced, chloride of calcium and water which remain in solution, and sulphur which is precipitated,

$$2CaS_5 + CaS_2H_2O_4 + 6HCl = 3CaCl_2 + 4H_2O + 6S_2.$$

The reaction is usually more complex than the above equation represents, and sulphuretted hydrogen is generally evolved. This result will occur when the proportion of pentasulphide in relation to the hyposulphite is greater than is above represented.

The sulphide with hydrochloric acid gives sulphuretted hydrogen and sulphur,

$$CaS_5 + 2HCl = CaCl_2 + H_2S + S_4.$$

The presence of a definite proportion of hyposulphite prevents the formation of sulphuretted hydrogen, as shown in the first equation above given.

[§ *Characters and Tests.*—A greyish-yellow soft powder, free from grittiness, and from the smell of sulphuretted hydrogen. When heated in an open vessel, it burns with a blue flame and the evolution of sulphurous acid. Entirely volatilised by heat. Under the microscope it is seen to consist of opaque globules without any admixture of crystalline matter. Otherwise it corresponds with sublimed sulphur.

Dose, 20 grains to 1 drachm.]

The *Lac Sulphuris, Milk of Sulphur*, of commerce frequently contains a large quantity of sulphate of lime, sulphuric acid being substituted for hydrochloric acid in precipitating it, as ordered in the London Pharmacopœia of 1721.

[§ **Acidum Sulphuricum.** *Sulphuric Acid.*

An acid produced by the combustion of sulphur and the oxidation of the resulting sulphurous acid by means of nitrous vapours. It contains 96·8 per cent. by weight of the sulphuric acid HO,SO_3 or $\mathbf{H_2SO_4}$, and corresponds to 79 per cent. of anhydrous sulphuric acid, SO_3 or $\mathbf{SO_3}$.

Characters and Tests.—A colourless liquid of oily appearance, intensely acid and corrosive. Specific gravity 1·843. It evolves much heat on the addition of water, and when thus diluted gives a copious precipitate with chloride of barium. 50·6 grains by weight, mixed with an ounce of distilled water, require for neutralisation 1,000 grain-measures of the volumetric solution of soda. Evaporated in a platinum dish, it leaves little or no residue. When a solution of sulphate of iron is carefully poured over its surface there is no purple colour developed where the two liquids unite. Diluted with six times its volume of distilled water it gives no precipitate with sulphuretted hydrogen.]

The acid thus described in the Pharmacopœia is the *oil of vitriol* of commerce, but the tests to which it is required to answer ensure the absence of impurities frequently contained in commercial sulphuric acid. The specific gravity and neutralising power indicate the strength most commonly attained in the process of manufacture and most compatible with the purity of the product. The test with sulphate of iron indicates the absence of nitric or nitrous acid, and that with sulphuretted hydrogen shows the absence of arsenic and other metallic impurities.

Physiological Effects.—The concentrated sulphuric acid is a powerful corrosive or escharotic. It abstracts and unites with water and bases contained in the tissues and secretions, coagulates albuminous liquors, combines with albumen, fibrine, and mucus, and darkens the colouring matter of the blood. If its action be carried further it dissolves and decomposes the organic constituents of the tissues, charring or carbonising them.

The parts to which the acid is applied become, in the first place, white by the formation of sulphate of albumen. By the more prolonged action of the poison, they assume a brownish or blackish appearance. Black spots are frequently observed in the stomachs of those who have swallowed the acid; and in the surrounding parts the blood is usually coagulated in the blood-vessels. Such are the topical chemical effects of this acid.

When strong sulphuric acid has been swallowed, the symptoms of poisoning are the following:—Alteration, or even destruction, of the soft parts about the mouth; burning pain in the throat, stomach, and bowels; frequently alteration of the voice, from the swelling and disorganisation of the parts about the larynx; breath fetid, from the decomposed tissues; constant and abundant vomiting of matters which may be bloody or otherwise, but which effervesce by falling on a marble hearth; bowels variously affected, sometimes constipated, though usually purged, the stools being bloody. The constitutional symptoms are principally those arising from depression of the vascular system: thus the pulse is frequent and irregular, feeble, often imperceptible; extremities cold; great feebleness, or even fainting, with cold sweats. One remarkable characteristic is, that the mental faculties are usually unaffected, even up to a few minutes before death.

Diluted sulphuric acid is a thirst-quenching, refrigerant spanæmic. It sharpens the appetite, checks profuse sweating, and not unfrequently reduces the frequency and volume of the pulse. Under its use, the milk of nurses frequently acquires a griping quality.

After the use of the acid for a few days, especially if it be exhibited in full doses, patients frequently complain of abdominal pain and griping. If its use be persevered in, these effects augment, heat and pain in the throat and stomach are experienced, the digestive functions are disturbed, and sometimes purging with febrile symptoms occurs.

Therapeutics.—As a local agent, sulphuric acid is employed as a caustic, irritant, or astringent. As a caustic it has no advantage over many other agents, except that which arises from its liquid form, which would be an advantage in applying it to wounds caused by rabid animals or poisonous serpents, since the liquidity of the acid enables it to penetrate into all parts of the bites. In entropium this acid has been employed as a caustic to destroy a portion of the skin, so that by the subsequent cicatrisation the lid may be turned outwards. This plan of treatment has been practised successfully by several eminent oculists, among whom I may name Mr. Guthrie and Mr. Lawrence. So also in ectropium, Mr. Guthrie has applied the acid to the inner side of the averted lid with advantage. When the liquid form is inconvenient, it has been made into a paste with an equal quantity of charcoal.

Dilute sulphuric acid may be administered in *febrile diseases*, as a refrigerant, to diminish thirst and preternatural heat; though, in most of these cases, the vegetable acids are to be preferred. In the latter stage of fever, considerable benefit is sometimes gained by the use of a vegetable bitter (as calumba or cinchona), in combination with the diluted sulphuric acid. To assist the appetite and promote digestion, it is administered to patients recovering from fever. *To check profuse sweating* in pulmonary and other affections, whether phthisical or not, it is sometimes a valuable agent. No other remedy is so efficacious in relieving colliquative sweatings as this. In *hemorrhages*, as those from the nose, lungs, stomach, and uterus, it is commonly administered as an astringent, but it is obvious that it can only act as such when it can come in contact with the bleeding surface, as where it is administered in hemorrhage from the stomach. In hemorrhage from the nose, lungs, and uterus, its efficacy is therefore doubtful. So also in purpura hæmorrhagica it is given with the same intention; but, though I have several times employed it, I have not observed any evident benefit derived therefrom. In *skin diseases*, especially lichen, prurigo, and chronic nettle-rash, it is sometimes highly serviceable. No remedy is so successful in relieving the distressing itching, formication, and tingling of the skin, as diluted sulphuric acid taken internally. In those forms of *dyspepsia* connected with an alkaline condition of the stomach, as in pyrosis, the sulphuric has been found to succeed better than hydrochloric acid. Dilute sulphuric acid in full doses of half a fluid drachm to one fluid drachm, and repeated at short intervals of half an hour or an hour, with or without a few drops of tincture of opium, has been strongly recommended by several practitioners in the treatment of *cholera.* Probably no single mode of treating this formidable disease has been found so generally useful. It was largely used at St. Bartholomew's Hospital, for patients suffering from the premonitory symptoms of cholera (diarrhœa, &c.), and almost always with success; but it was also used in advanced cases, and cases of collapse, with marked advantage. In obstinate *diarrhœa* and chronic *dysentery* it is frequently used; and the diarrhœa of phthisis and of typhoid fever, arising from ulceration of the bowels, is often more effectually checked by this means than by chalk and astringents.

In *lead colic* it was employed by M. Gendrin at Paris. The internal treatment consists in administering sulphuric acid largely diluted. Forty drops of diluted sulphuric acid, or four drops of the strong acid, are mixed with a pint of water, and two or three pints are given daily. The abdominal pains generally cease after the second day, and with the pains the constipation ceases also. Sulphur baths are used at the same time. Out of a large number of cases witnessed by Dr. H. Bennett, all with one or two exceptions got well in from three to six days. The sulphuric acid drink not only cures but prevents lead colic. The Manager of the British Lead Works at Birmingham states (*Lancet*, Dec. 17, 1842) that, after the employment of the sulphuric acid drink for fifteen months, there did not occur a single case of colic, though it was previously of constant occurrence amongst his men.

[§ **Acidum Sulphuricum Dilutum.** *Diluted Sulphuric Acid.*

Take of

Sulphuric Acid	7 fluid ounces.
Distilled Water	a sufficiency.

Dilute the acid with 77 fluid ounces of the water, and when the mixture has cooled to 60° add more water, so that it shall measure $83\frac{1}{2}$ fluid ounces. Or as follows:—

Take of

Sulphuric Acid	1,350 grains.
Distilled Water	a sufficiency.

Weigh the acid in a glass flask, the capacity of which, to a mark on the neck, is one pint; then gradually add distilled water until the mixture, after it has been shaken and cooled to 60°, measures a pint.

Tests.—Specific gravity 1·094. 359 grains by weight (6 fluid drachms) of it require for neutralisation 1,000 grain-measures of the volumetric solution of soda, corresponding to 11·14 per cent. of anhydrous sulphuric acid. Six fluid drachms therefore correspond to 40 grains of the anhydrous acid (one equivalent of SO_3 or half an equivalent of $\mathbf{SO_3}$)

Dose, 5 to 30 minims.]

[§ **Acidum Sulphuricum Aromaticum.** *Aromatic Sulphuric Acid.*

Take of

Sulphuric Acid . . .	3 fluid oz. or 2,419 grains by weight.
Rectified Spirit	2 pints.
Cinnamon Bark, in coarse powder .	2 ounces.
Ginger, in coarse powder . . .	$1\frac{1}{4}$ ounce.

Mix the sulphuric acid gradually with the spirit, add the cinnamon and ginger, macerate for seven days, agitating frequently, then filter.

Tests.—Specific gravity 0·927. 304·2 grains by weight (6 fluid drachms) require for neutralisation 830 grain-measures of the volumetric solution of soda, corresponding to 10·91 per cent. of anhydrous sulphuric acid. Six fluid drachms, therefore, correspond to 33·2 grains of anhydrous acid.

Dose, 5 to 30 minims.]

[§ **Acidum Sulphurosum.** *Sulphurous Acid.*

Sulphurous acid gas, SO_2 or $\mathbf{SO_2}$, dissolved in water, and constituting 9·2 per cent. by weight of the solution.]

[§ ⁂ It is produced by passing sulphurous acid gas, resulting from the decomposition of sulphuric acid heated in a glass flask in contact with charcoal, through cold distilled water, until the solution is saturated.]

In this process the charcoal takes oxygen from the sulphuric acid, and a mixture of two volumes of sulphurous acid and one of carbonic acid is evolved. The former dissolves in the water through which it is made to pass, the latter escapes into the air.

$$\mathbf{2H_2SO_4 + C = 2H_2O + 2SO_2 + CO_2.}$$

[§ *Characters and Tests.*—A colourless liquid with a pungent sulphurous odour. Specific gravity 1·03. It gives no precipitate, or but a very slight one, with chloride of barium, but a copious one if solution of chlorine be also added (*a*). 34·7 grains by weight of it mixed with an ounce of distilled water and a little mucilage of starch do not acquire a permanent blue colour with the volumetric solution of iodine until 1,000 grain-measures of the latter have been added (*b*). When evaporated it leaves no residue.

Dose, $\frac{1}{2}$ to 1 fluid drachm.]

In applying the tests, the following reactions occur:—

(*a*). Chloride of barium gives no precipitate with sulphurous acid, but the addition of chlorine in the presence of water converts the sulphurous into sulphuric acid ($\mathbf{SO_2 + 2H_2O + Cl_2 = H_2SO_4 + 2HCl}$), and a precipitate of sulphate of baryta will then be formed.

(*b*). The addition of iodine does not cause a permanent blue colour (iodide of starch) to be produced until all the sulphurous acid has been converted into sulphuric acid by the mutual reaction of iodine, water, and sulphurous acid ($SO_2+2H_2O+I_2=H_2SO_4+2HI$). If the acid be of the proper strength, 34·7 grains of it will require 1,000 grain-measures of the volumetric solution of iodine to produce this change, and there will be no free iodine to act upon the starch until the change has been completed. If the blue compound were produced at an earlier period, it would indicate a deficiency in the strength of the acid.

Therapeutics.—The gaseous acid has been used as a remedy for the cure of *itch.* Baths, or fumigations of sulphurous acid gas, are commonly termed *sulphur baths*, and may be had at most of the bathing establishments of the principal towns of this country. At the Hôpital St.-Louis, in Paris, a very complete apparatus for the application of this remedy in diseases of the skin has been erected by D'Arcet. It is a kind of box, inclosing the whole body, with the exception of the head. The sulphur is placed on a heated plate in the lower part of the box. From 10 to 20 baths, or even more, are requisite for the cure of itch. 'Sulphurous fumigations,' says Rayer, 'which are employed in some hospitals, are not attended with expense, leave no unpleasant smell, and do not soil the linen; but the long continuance of the treatment necessary to relieve the disease more than counterbalances these generally insignificant recommendations.' There are various other diseases of the skin in which baths of sulphurous acid have been found more or less successful, such as chronic eczema, lepra, psoriasis, impetigo, and pityriasis. Both the gaseous and liquid acids are destructive to vegetation; hence, perhaps, their utility in the treatment of skin diseases, connected with vegetable growths, as porrigo and pityriasis. Sulphur vapour baths are also used to detect the presence of lead on the skin of persons suffering from any of the forms of lead poisoning; but they are less convenient and less frequently used than baths of sulphurated potash, which are also called sulphur baths. The liquid acid may be applied, as suggested by Dr. Garrod, mixed with an equal bulk of glycerine.

Acidum Hydrosulphuricum. *Hydrosulphuric Acid.* *Sulphuretted Hydrogen.*

History.—Discovered by Scheele in 1777, though Meyer and Ruellius had previously observed it. It is an ingredient in sulphurous waters, its origin in these cases being probably referable to the action of water or watery acids on metallic sulphides. In marshes and stagnant waters, and in common waters which have been bottled, it is frequently produced by decomposition of sulphates (especially gypsum) effected by putrescent organic matter. Many sulphuretted organic matters evolve it during their decomposition, as eggs, night-soil, &c.

Properties.—It is a colourless, transparent gas, having the odour of rotten eggs, and a sp. gr. of 1·17. It reddens litmus, and burns in the air with a bluish flame, the deposition of sulphur on the sides of the glass vessel in which it is burned, (the supply of oxygen being insufficient for its complete combustion,) and the production of sulphurous acid gas. It blackens white lead and solutions of the salts of lead, copper, and bismuth. When mixed with 20,000 volumes of air, hydrogen, or carburetted hydrogen, its presence may be detected by the discolouration it effects in white lead mixed with water and spread on a card.

The respiration of the undiluted gas proves fatal to animals. On man it acts, when inspired, most injuriously. In the undiluted state it would probably prove fatal. When moderately diluted, its respiration causes immediate insensibility, with depression of all the powers of life. Still more diluted, it causes convulsions; and when air is but slightly contaminated with it, it causes nausea or sickness, debility, and headache. Various ill, or even fatal, effects produced by emanations from decomposing organic matters, and which have been loosely ascribed to sulphuretted hydrogen, may be in part owing to other gaseous substances at present undistinguished by their chemical, or, in some cases, even by their sensible properties. Parent-Duchâtelet says that workmen can breathe with impunity an atmosphere containing $\frac{1}{100}$th of sulphuretted hydrogen: he himself has respired, without serious symptoms, air containing $\frac{1}{33}$rd of it.

Preparation.—[§ SULPHURETTED HYDROGEN. HS or $\mathbf{H_2S}$.

Take of

Sulphide of Iron	$\frac{1}{2}$ ounce.
Water	4 fluid ounces.
Sulphuric Acid	a sufficiency.

Place the sulphide of iron and the water in a gas-bottle closed with a cork perforated by two holes, through one of which passes air-tight a funnel tube of sufficient length to dip into the water, and through the other a tube for giving exit to the gas. Through the former pour from time to time a little of the acid, so as to develop the sulphuretted hydrogen as it may be required.]

It is used in pharmacy as a test.

Sulphuris Chloridum. *Chloride of Sulphur.* S_2Cl or $\mathbf{S_2Cl_2}$.

Synonyms.—Hypochloride of sulphur. Subchloride of sulphur.

Obtained by transmitting dry chlorine gas over flowers of sulphur till they are for the most part dissolved. The decanted fluid may be distilled by a gentle heat from the excess of dissolved sulphur. This gives the compound pure, in the form of a yellow oily liquid, of exceedingly pungent odour and taste, and decomposed when dropped into water. The preparation usually employed in medicine consists of flowers of sulphur impregnated with a small and variable quantity of the oily subchloride.

[§ **Sulphuris Iodidum.** *Iodide of Sulphur.* S_2I or $\mathbf{S_2I_2}$.

Take of

Iodine	4 ounces.
Sublimed Sulphur	1 ounce.

Rub them together in a wedgwood mortar until they are thoroughly mixed. Put the mixture into a flask, close the orifice loosely, and apply a gentle heat, so that the colour of the mass shall become gradually darkened. When the colour has become uniformly dark throughout, increase the heat so as to produce liquefaction. Then incline the flask in different directions, in order to return into the liquid any portion of the iodine which may have been condensed on the inner surface of the vessel. Lastly, withdraw the heat, and when the liquid has congealed, remove the mass by breaking the flask, reduce it to pieces, and keep these in a well-stoppered bottle.

Characters.—A greyish-black solid substance, with a radiated crystalline appearance. It resembles iodine in smell and in the property of staining the cuticle when applied to it. Soluble in about sixty parts of glycerine; insoluble in water, but decomposed when boiled with it. If 100 grains be thoroughly boiled with water, the iodine will pass off in vapour and about 20 grains of sulphur will remain.]

[§ **Unguentum Sulphuris Iodidi.** *Ointment of Iodide of Sulphur.*

Take of

Iodide of Sulphur	30 grains.
Prepared Lard	1 ounce.

Triturate the iodide of sulphur in a porcelain mortar, and gradually add the lard, rubbing them together until the ointment is perfectly smooth and free from grittiness.]

Therapeutics.—Chloride of sulphur and iodide of sulphur are used in the form of ointment in skin affections. They may be applied with advantage, Nelligan says, in lupus, lepra, and in chronic lichenoid eruptions.

[§ PHOSPHORUS. Phosphorus. P or **P**=31.

A non-metallic element obtained from bones.]

History.—This substance was discovered in 1669 by Brandt, an alchymist at Hamburgh; and received its name from being luminous in the dark (φῶς light, and φέρω I carry). Phosphorus is found in the mineral kingdom pretty plentifully, chiefly as phosphate of lime, which is also an important constituent of the organic exuviæ entombed in the fossiliferous rocks. Phosphorus likewise exists in considerable quantities in bones, urine, &c., in the form of phosphate of lime and phosphate of ammonia and magnesia. It is usually prepared from bone ash. This substance is treated with sulphuric acid, whereby carbonic acid is expelled, and sulphate and a soluble superphosphate of lime are formed. The filtered liquid is mixed with charcoal, dried, and distilled in earthen retorts. The phosphorus, accompanied by various permanently gaseous products, passes over and is condensed in water.

[§ *Characters and Tests.*—A semitransparent, colourless, wax-like solid, which emits white vapours when exposed to the air. Specific gravity 1·77. It is soft and flexible at common temperatures, melts at 110°, ignites in the air at a temperature a little above its melting point, burning with a luminous flame and producing dense white fumes. Insoluble in water, but soluble in ether and in boiling oil of turpentine.]

It is also readily soluble in benzol and bisulphide of carbon.

Preservation.—In consequence of its strong affinity for oxygen it should be kept under water in well-closed bottles.

Granulation.—Phosphorus may be granulated by melting it under spirit of wine and shaking it in a closed vessel until it is cold.

Impurities.—Commercial phosphorus sometimes contains sulphur or arsenic, or both, as well as other impurities which are probably derived from the sulphuric acid employed in decomposing the bone ash. When this acid has been prepared from arsenical pyrites it contains arsenious acid, which becomes reduced in the process for making phosphorus. By evaporating a solution of such phosphorus in dilute nitric acid, a blackish arsenical deposit is obtained: the phosphorous acid contained in the solution deoxidizes the arsenic.

Red or Amorphous Phosphorus.—This substance, one of the allotropic forms of phosphorus, is manufactured extensively for the preparation of lucifer matches and for other purposes as a chemical agent. It is obtained by submitting ordinary phosphorus to the action of a temperature of about 450° or a little above, for some hours in an apparatus from which air is excluded. The red phosphorus thus produced is purified from any unaltered common phosphorus by digesting it in bisulphide of carbon or in solution of caustic soda, which dissolves the latter.

This remarkable substance differs in many of its properties from ordinary transparent phosphorus. It is insoluble in bisulphide of carbon and benzol; does not fume when exposed to the air, and absorbs oxygen very slowly. It is inflammable only at a temperature much higher than that required by the ordinary kind. It is, however, usually damp from the presence of a small quantity of phosphorous acid produced by oxidation. Red phosphorus is also stated to be destitute of poisonous qualities.

It may be employed in nearly all those operations in which phosphorus is required; in some cases with decided advantage, as it does not give rise to such violent action as is sometimes occasioned by the common kind. It can also be handled much more conveniently.

Physiological Effects.—Phosphorus is thrown out of the system as phosphorous acid, and perhaps also as phosphoric acid and phosphuretted hydrogen.

Therapeutics.—In this country phosphorus is rarely employed. It has been strongly recommended in cases attended with great prostration of the vital powers, as in the latter stages of typhus fever, dropsies, &c.; in some chronic diseases of the nervous system (as epilepsy, paralysis, melancholy, mania, amaurosis, &c.) occurring in debilitated subjects. In some of the exanthemata, as measles, it has been administered to promote the re-appearance of the eruption, when this, from some cause, has receded from the skin.

Administration.—Phosphorus cannot be given with safety in the solid form. It may be administered dissolved in ether, or, still better, in oil. *Dose*, gr. $\frac{1}{20}$.

According to Méhu, sweet oil of almonds, which has been gradually heated to 480° F., and maintained at that temperature for ten or fifteen minutes, then cooled and filtered, is the best menstruum for phosphorus, which dissolves in it with facility, and remains unaltered in the solution. Méhu recommends 1 part of phosphorus to be dissolved in 80 parts of the oil at 180° Fahr., and 20 parts of ether to be afterwards added. This may be administered in capsules, each containing 5 grains of the solution or one-twentieth of a grain of phosphorus.

Antidotes.—In poisoning by phosphorus, large quantities of mild demulcent liquids are to be exhibited, so as to envelope the phosphorus and exclude it from the air contained in the alimentary canal. Magnesia should be given, in order to neutralise the phosphorous and phosphoric acids which may be formed. Parts burned with phosphorus are to be washed with a weak alkaline solution, to remove any adherent acid which might serve to keep up irritation.

Phosphoric Acid. $3HO,PO_5$ or $\mathbf{H_3PO_4}$.

History.—Phosphoric acid was first distinguished by Marggraf in 1740. The acid here described is designated *common, tribasic*, or *ortho*-phosphoric acid, to distinguish it from other acids of phosphorus. It occurs both in the inorganised and organised kingdoms. All the phosphoric salts of the mineral kingdom are those of common or tribasic phosphoric acid.

[§ **Acidum Phosphoricum Dilutum.** *Diluted Phosphoric Acid.*

Phosphoric Acid, $3HO,PO_5$ or $\mathbf{H_3PO_4}$ dissolved in water, and corresponding to 10 per cent. by weight of anhydrous phosphoric acid PO_5 or $\mathbf{P_2O_5}$.

Take of

Phosphorus	413 grains.
Nitric Acid	6 fluid ounces.
Distilled Water	a sufficiency.

Place the nitric acid diluted with eight ounces of the water in a tubulated retort connected with a Liebig's condenser, and having added the phosphorus apply a gentle heat, so as slowly to distil five fluid ounces of liquid. Return this to the retort, and continue the distillation, occasionally returning the distillate, until the phosphorus has entirely disappeared. Transfer the contents of the retort to a porcelain dish of hard well-enamelled ware, and evaporate the liquid, until it is reduced to four fluid ounces; then transferring it to a platinum vessel, continue the evaporation until it is reduced to about two fluid ounces and orange-coloured vapours are no longer formed. Mix it now with distilled water until, when cold, it measures one pint.]

By the mutual action of phosphorus and dilute nitric acid, phosphorous acid ($\mathbf{H_3PO_3}$), as well as phosphoric acid, is produced, while nitric oxide is evolved. The formation of phosphorous as well as phosphoric acid may be accounted for by the equations subjoined :—

$$\mathbf{P + HNO_3 + H_2O = \overset{\text{Phosphorous Acid.}}{H_3PO_3} + NO}$$

$$\mathbf{3P + 5HNO_3 + 2H_2O = \overset{\text{Phosphoric Acid.}}{3H_3PO_4} + 5NO}$$

By concentrating the solution of phosphorous and phosphoric acid, the phosphorous acid is converted into phosphoric acid by the free nitric acid present. The excess of nitric acid is driven off by evaporation.

[§ *Characters and Tests.*—A colourless liquid with a sour taste, and strongly acid reaction. Specific gravity 1·08. With ammonio-nitrate of silver it gives a canary-yellow precipitate (Ag_3PO_4) soluble in ammonia, and in dilute nitric acid. Evaporated it leaves a residue, which melts at a low red heat, and upon cooling exhibits a glassy appearance.

(By the action of heat it is converted first into pyrophosphoric, and then into metaphosphoric acid.)

It is not precipitated by sulphuretted hydrogen, chloride of barium, nitrate of silver acidulated with nitric acid, or by the solution of albumen. When mixed with an equal volume of pure sulphuric acid, and then introduced into the solution of sulphate of iron, it does not communicate to it a dark colour. Mixed with an equal volume of solution of perchloride of mercury and heated, no precipitate is formed. 355 grains poured upon 180 grains of oxide of lead in fine powder, leave after evaporation a residue (principally phosphate of lead), which after it has been heated to dull redness weighs 215·5 grains. Six fluid drachms therefore correspond to 35·5 grains of anhydrous phosphoric acid.]

The non-precipitation by sulphuretted hydrogen shows the absence of arsenic and other metallic impurities, by chloride of barium the absence of sulphuric acid, by nitrate of silver of hydrochloric, by albumen of the metaphosphoric acid HPO_3. The noncoloration of the sulphate of iron indicates the absence of nitric acid. Freedom from phosphorous acid is proved by its want of power to precipitate metallic mercury from the perchloride. $HgCl_2 + H_2O + H_3PO_3 = Hg + 2HCl + H_3PO_4$. The increase in weight of the oxide of lead implies the presence of $13\frac{3}{4}$ per cent. by weight of tribasic, or 10 of anhydrous acid.

[§ This acid is stronger than the acid bearing the same name in the London Pharmacopœia in the proportion of 10 to 8·7.]

Therapeutics.—Phosphoric acid has been employed in the same cases in which sulphuric and other mineral acids have been used, and under the same regulations. It may be employed for a longer period, without disturbing the digestive functions, than the other agents of this class. Thus its power of dissolving phosphate of lime has led to its employment in those forms of lithiasis attended with phosphatic deposits in the urine. Dr. Paris found it to assuage the thirst so commonly present in diabetes, more effectually than any other acidulated drink.

Administration.—Internally the dilute phosphoric acid should be given in doses of from twenty minims to a fluid drachm, properly diluted.

BORON. Boron. B or **B**=11.

Acidum Boracicum. *Boracic Acid.* $BO_3,3HO$ or H_3BO_3.

Synonyms.—Sal Sedativum Hombergi. Homberg's Sedative Salt.

History.—Beecher was the first discoverer of boracic acid, though the credit of the discovery has usually been given to Homberg, who, in 1702, obtained it in small shining plates, which have been called *sedative* or *narcotic salt* (*sal sedativum Hombergi*). In 1776 it was discovered in the lagoons of Tuscany by Hoefer and Mascagni, and more recently by Mr. Smithson Tennant, Dr. Holland, and Mr. Lucas in the crater of Vulcano, one of the Lipari Islands. It is peculiar to the inorganised kingdom, and is found both free and combined. Free Boracic acid is obtained from the *lagoons* of Tuscany, which are spread over a surface of about thirty miles. In combination with soda (forming *tincal*) it is found on the borders of lakes in Thibet and elsewhere, resulting from the spontaneous evaporation of the waters of the lakes. It is also found combined with magnesia as *boracite.*

Preparation.—Boracic acid may be prepared from the impure native acid obtained from the lagoons of Tuscany, by dissolving in water or in spirit, and crystallising the acid from its solution.

Properties.—It occurs in the form of white, transparent, pearly, hexagonal scales, which are odourless, have a weak, scarcely acid taste, and communicate a wine-red tint to litmus. A hot aqueous solution of the acid renders turmeric paper brown, like the alkalies. The colour of rhubarb paper is unchanged by it. At 60° the crystallised acid requires 25 times its weight of water to dissolve it, but only 3 times at 212°. When its concentrated solution is boiled a portion of the acid is volatilised along with the water. When sufficiently heated, it evolves its water of crystallisation, melts, forming a transparent liquid, and on cooling becomes a brittle glass (*vitrified boracic acid*). A red hot platinum wire dipped into a pulverised mixture of equal parts of a boracic salt and bisulphate of potash gives a green tint to the flame of the blow-pipe.

[§ *Tests.*—Soluble in alcohol. The solution burns with a green flame.]

Uses.—It is considered to be inert, or nearly so. It is, therefore, not employed directly in medicine, but is used in the manufacture of borax, and the solution of it is used as a test.

[§ Solution of Boracic Acid.

Take of

Boracic Acid	50 grains.
Rectified Spirit	1 fluid ounce.

Dissolve and filter.]

Used as a test for rhubarb, which is not turned brown by it, as is the case with turmeric, which is sometimes added to rhubarb to improve its colour.

CARBONIUM. Carbon. C=6 or C=12.

History.—The term *carbon* (from *carbo*, *ōnis*, coal) was first employed by Morveau, Lavoisier, and Berthollet, to designate the pure matter of charcoal. It is found in both kingdoms of nature; and is an essential constituent of all organised beings, both vegetable and animal.

[§ Carbo Ligni. *Wood Charcoal.*

Wood charred by exposure to a red heat without access of air.]

Preparation.—Ordinary wood charcoal is prepared on the large scale, for the purposes of fuel, by burning billet-wood (oak, beech, hazel, and sometimes willow), piled in a conical heap, covered with turf and sand, to prevent the access of atmospheric air, a few holes being left near the bottom and one at the top, to occasion a draught. The heap is then set fire to, and when the flame has pervaded the whole mass, the holes are closed. When cooled, the billets are found converted into charcoal.

[§ *Characters.*—In black brittle porous masses, without taste or smell, very light, and retaining the shape and texture of the wood from which it was obtained. When burned at a high temperature with free access of air, it leaves not more than 2 per cent. of ash.]

Properties.—Wood charcoal is easily pulverised, especially when hot. Its specific gravity varies according to the substance from which it has been obtained. A remarkable property possessed by it is that of abstracting certain substances (such as sulphuretted hydrogen, organic colouring principles, various odorous matters, &c.) from liquids in which they are dissolved, or through which they are diffused. Another curious quality is that of condensing within its pores a certain quantity of any gas with which it may be placed in contact. Thus one volume of box-wood charcoal absorbs 1·75 volume only of hydrogen gas, but 90 volumes of ammoniacal gas. The use of charcoal for respirators, disinfecting purposes, &c., depends upon this property of absorbing various gases, which appear also in some cases to undergo slow combustion in its pores, similar to that observed with spongy platinum. Some of the properties now mentioned (as that of decolorising) are possessed, in a more eminent degree, by animal charcoal. By combustion in oxygen gas, wood charcoal yields carbonic acid gas—a property by which it is shown to consist of carbon.

Therapeutics.—In this country, charcoal is used as a therapeutic agent, principally as a disinfectant and antiseptic, to absorb the fetid odour evolved by gangrenous and phagedenic ulcers. For this purpose it may be used in the form of powder or of poultice. Its disinfecting and antiseptic powers, however, are much inferior to those of chlorine, or of chlorinated lime and soda. As a *tooth-powder* it is a valuable agent, freeing the teeth from the foreign matters which cover them, and at the same time counteracting the unpleasant smell of the breath arising from decayed teeth or disordered stomach: but it is apt to lodge in the space between the gum and tooth, forming an unsightly livid circle.

Internally, charcoal has been exhibited in various affections of the alimentary canal, such as dyspepsia, cardialgia, diarrhœa, cholera, and dysentery. The beneficial effects said to have been produced in these cases can only be referred to the action of charcoal on the secretions of the bowels; an explanation apparently supported by Dr. Chapman's statement, that in dysentery, when the stools are highly acrid and offensive, charcoal entirely divests them of the bad smell and acrimony. It has also been used in various other diseases, but experience has not confirmed its efficacy.

The *Dose* of charcoal, as ordered by different writers, varies from ten grains to a tablespoonful or more.

Pharmaceutic Uses.—Wood charcoal is used as a deoxidising agent, in the preparation of sulphurous acid, and of bromide and iodide of potassium.

[§ **Cataplasma Carbonis.** *Charcoal Poultice.*

Take of

Wood Charcoal in powder	$\frac{1}{2}$ ounce.
Bread	2 ounces.
Linseed Meal	$1\frac{1}{2}$ ounce.
Boiling Water	10 fluid ounces.

Macerate the bread in the water a short time near the fire, then mix, and add the linseed meal gradually, stirring the ingredients, that a soft poultice may be formed. Mix with this half the charcoal, and sprinkle the remainder on the surface of the poultice.]

[§ **Carbo Animalis.** *Animal Charcoal. Bone Black.*

The residue of bones which have been exposed to a red heat without the access of air. Consists principally of charcoal, and phosphate and carbonate of lime.]

Properties.—In its general properties animal charcoal agrees with charcoal procured from wood. It is denser and less combustible than wood charcoal, but greatly exceeds the latter in its power of destroying colour and odour. It yields, when burnt in oxygen gas or atmospheric air, carbonic acid, like other forms of carbon, but leaves a much larger amount of ash.

Composition.—Animal charcoal, prepared by calcining the bones of the ox, sheep and horse, consists of the following ingredients, according to Dumas:—

Phosphate of Lime, Carbonate of Lime	88·0
Charcoal	10·0
Carburet of Iron	2·0
Sulphide of Calcium or Iron	traces
Common Bone Black	100·0

The proportion of charcoal here stated is certainly small. Dr. Christison states that he has found, in the animal black of this country, usually about 20 per cent. of charcoal. When bone black is calcined in the open air, the carbon is burnt off, and a whitish residue is obtained, called *bone ash.*

For the ordinary purposes of the arts, as sugar-refining, crude animal charcoal answers very well, because the earthy salts in no way affect the process. But in various pharmaceutical operations the presence of phosphate and carbonate of lime would preclude its use, on account of the free acid in the liquids to be decolorised. Hence the necessity for the purification of animal charcoal.

[§ **Carbo Animalis Purificatus.** *Purified Animal Charcoal.*

Animal charcoal, from which the earthy salts have been almost wholly removed.

Take of

Bone Black in powder	16 ounces.
Hydrochloric Acid	10 fluid ounces.
Distilled Water	a sufficiency.

Mix the hydrochloric acid with a pint of the water, and add the bone black, stirring occasionally. Digest at a moderate heat for two days, agitating from time to time; collect the undissolved charcoal on a calico filter, and wash with distilled water till what passes through gives scarcely any precipitate with nitrate of silver. Dry the charcoal, and then heat it to redness in a covered crucible.]

In this process the hydrochloric acid dissolves the phosphate of lime, and decomposes the carbonate of lime and sulphide of calcium, evolving carbonic acid and sulphuretted hydrogen gases, and forming chloride of calcium, which remains in solution.

[§ *Characters.*—A black pulverulent substance; inodorous and almost tasteless. Tincture of litmus, diluted with twenty times its bulk of water, agitated with it and thrown upon a filter, passes through colourless. When burned at a high temperature, with a little red oxide of mercury and free access of air, it leaves only a slight residue.]

Therapeutics.—Dr. Garrod has proposed purified animal charcoal as a general antidote in cases of poisoning; but I agree with Dr. Taylor in regarding the experiments adduced in favour of it as inconclusive. Like many other agents, it is certainly capable of acting mechanically, and of thereby impeding the action of poisons, but beyond this there is no evidence of its antidotal power.

Pharmaceutic Uses.—The principal use of animal charcoal is as a decolorising agent in various pharmaceutical processes, as in the preparation of hydrochlorate of morphia, veratria, santonin, &c. The property possessed by minute particles of charcoal, of abstracting colouring matter from liquids, depends, probably, on some chemical affinities existing between carbon and colouring matter. It has been stated that charcoal which has been once used cannot have its decolorising property restored by a fresh ignition, unless it be mixed with some inorganic substance. This, however, is an error. The animal charcoal which has been used in sugar-refining is returned to the maker to be freshly ignited, and is then employed again, and this process of re-igniting is repeated many times, without any loss of decolorising power. The effect of animal charcoal in removing substances from their solutions is not limited to colouring matters. Warington has shown that it also deprives liquids of their bitter principles, alkaloids, resins, tannin, and even some metallic salts. It is obvious, therefore, that it cannot be employed to decolorise poisonous liquids, since it deprives the solution of more or less of its deleterious ingredient, as well as of its colouring matter. Moreover, it is clear that manufacturers who employ animal charcoal to decolorise their solutions must lose part of their product, and hence, in the preparation of hydrochlorate of morphia, &c., a loss must be sustained by the employment of charcoal as a decoloriser. By macerating the charcoal in appropriate solvents, the whole or greater part of the absorbed alkaloids, &c. may, in most cases, be recovered unchanged.

Acidum Carbonicum. *Carbonic Acid. Carbonic Anhydride.*

CO_2 or $\mathbf{CO_2}$.

History.—Although the ancients were acquainted with the poisonous properties of carbonic acid gas, Dr. Black, in 1757, was the first who explained its nature.

Preparation.—Carbonic acid gas may be procured in various ways, but for ordinary purposes is usually obtained by the action of a mineral acid on carbonate of lime. Soda-water makers and the preparers of the alkaline bicarbonates obtain it by the action of sulphuric acid on common whiting.

$$CaCO_3 + H_2SO_4 = CaSO_4 + H_2O + CO_2.$$

Sometimes hydrochloric is substituted for sulphuric acid, and marble for chalk or whiting, as in the processes of the Pharmacopœia for the bicarbonates of potash and soda.

$$CaCO_3 + 2HCl = CaCl_2 + H_2O + CO_2.$$

For therapeutic purposes it is frequently liberated from the bicarbonate of potash or soda by the action of citric or tartaric acid.

Properties.—At ordinary temperatures and pressures, carbonic acid is gaseous. It is invisible, irrespirable, has a faint odour, and a sharp taste. Its specific gravity is 1·529. It is neither combustible nor a supporter of combustion, except in the case of potassium, which, when heated in this gas, takes fire, the products of the combustion being carbon and carbonate of potash. It extinguishes most burning bodies when introduced into it in the ignited condition. It reddens litmus feebly, is readily absorbed by a solution of caustic potash, and forms, with a solution of lime or of baryta, a white precipitate, soluble in acetic acid, or in excess of carbonic acid. The *carbonates* effervesce on the addition of hydrochloric acid. The evolved gas is known to be carbonic acid by the characters before stated.

At the ordinary temperature and pressure of the atmosphere, one volume of water absorbs one volume of carbonic acid gas, and acquires a sp. gr. of 1·0018. By doubling the pressure, the quantity of gas absorbed by the water is doubled, and so on for other degrees of pressure. In the United States' Pharmacopœia five volumes of gas are directed to be condensed in one volume of water. Mr. Webb tells me that a pressure of eleven atmospheres is used in the preparation of his soda water. The *Bottle Soda Water* of the shops is, in general, carbonic acid water only. Some manufacturers introduce a small portion of soda. Carbonic acid water is a brisk sparkling liquid. It has a pungent acidulous taste; reddens litmus; and causes, with lime water, a white precipitate (*carbonate of lime*), which is re-dissolved by an excess of carbonic acid water.

Physiological Effects.—Taken into the stomach, dissolved in water, or in the form of effervescing draughts, it allays thirst, and diminishes preternatural heat, thus acting like other dilute acids. If it be evolved in the stomach it distends this viscus, excites eructations, and checks both nausea and vomiting. It appears to promote the secretions of the alimentary tube, to assist the digestive process, to allay irritation, and to act as a refreshing and exhilarating substance. When drunk quickly, and in large quantity, water impregnated with this gas has been known to excite giddiness and intoxication ; and it is probable that champagne is indebted to this substance for part of its intoxicating powers.

Therapeutics.—Carbonic acid is a most valuable remedy for checking vomiting, and diminishing irritable conditions of the stomach. In fever it is an excellent refrigerant; being especially serviceable in those cases which are accompanied with gastric irritation. In that form of lithiasis attended with a white or phosphatic deposit in the urine, carbonic acid water may be taken with advantage; but in this case the common effervescing draught (made of a vegetable acid and a carbonated alkali) must not be substituted for it, on account of the alkaline property communicated by the latter to the urine. It is, however, by no means correct to ascribe a mischievous action to remedies which render the urine alkaline in all cases of phosphatic diathesis. The greatest benefit is occasionally derived from them where the phosphatic deposit occurs in consequence of disease of the lining mucous urinary surfaces, which secrete alkaline fluid and so render the urine alkaline.

Administration.—Carbonic acid may be administered under the form of *carbonic acid water* or the *effervescing draught.* The best mode of exhibiting it is, I believe, in the form of an effervescing draught, composed of citric acid and bicarbonate of potash.

Antidotes.—In accidents arising from the inhalation of carbonic acid gas, proceed as follows:—Remove the patient immediately into the open air, and place him on his back, with his head somewhat elevated. Produce artificial respiration by pressing down the ribs, forcing up the diaphragm, and then suddenly removing the pressure. Dash cold water over the body, and abstract a small quantity of blood either by venesection or cupping. Apply bottles of hot water to the feet. Stimulants of various kinds may be employed, either internally by the stomach, or in the form of frictions, or inhalations of ammonia, or air impregnated with chlorine gas.

Carbonii Bisulphidum. *Bisulphide of Carbon.*

CS_2 or $\mathbf{CS_2}$.

Synonyms.—Sulphuret or *Bisulphuret of Carbon. Carbon Disulphide. Sulphocarbonic Acid.*—It is obtained by passing the vapour of sulphur over red-hot charcoal and condensing the vapour of the sulphide in an ice-cold receiver. The product requires to be rectified by re-distillation.

Bisulphide of carbon is a highly refractive, limpid, colourless liquid, whose odour when pure resembles that of chloroform. As usually met with in commerce, however, the smell resembles that of decomposing vegetable matter. It is heavier than water, having a specific gravity of 1·272. It boils at 106°. It is insoluble in water, but is soluble in alcohol, ether, the volatile and fixed oils. It dissolves sulphur, iodine, phosphorus, camphor, caoutchouc, and some resins. A very minute quantity of iodine dissolved in it yields an amethystine or bluish-red solution.

Therapeutics.—As a topical remedy it has been used as a cooling agent, by evaporation, and as a stimulant and resolvent. Internally, it has been employed as a stimulant, analeptic or restorative, as a sudorific, emmenagogue, ecbolic and anæsthetic.

It may be administered internally in doses varying from two to six or more drops taken on sugar, or dissolved in four times its volume of ether or alcohol, or mixed with milk or mucilaginous decoctions. Externally it is employed in the form of embrocation or liniment, composed of one part of bisulphide and two parts of almond or olive oil or of alcohol.

[§ **Glycerinum.** *Glycerine.*

A sweet principle, $C_6H_8O_6$ or $\mathbf{C_3H_8O_3}$, obtained from fats, and fixed oils, and containing a small percentage of water.]

History.—Glycerine was discovered in 1779 by Scheele, who obtained it in the preparation of lead plaster. Chevreul afterwards showed that it is a constant product of the saponification of fats. It does not generally exist in natural fats and fixed oils, but is produced when these are treated with an alkali or other metallic oxide in the presence of water, or at an elevated temperature by the action of water alone. It is now generally represented as a triatomic alcohol, bearing the same relation to the fats, stearine, oleine, &c., that alcohol bears to the compound ethers.

[§ *Characters.*—A clear colourless fluid, oily to the touch, without odour, of a sweet taste; freely soluble in water and in alcohol. When decomposed by heat, it evolves intensely irritating vapours. Specific gravity 1·25.]

Glycerine, as found in commerce, is frequently contaminated with small quantities of various saline matters, particularly chloride of calcium; when this is the case, it is obviously unfit for use when nitrate of silver is prescribed with it. Good glycerine should leave no residue when heated strongly in a capsule.

Uses.—Glycerine is a valuable external application, used either alone or in conjunction with other substances. It forms an excellent remedy for dry, rough, or chapped skin, and is a good vehicle for carbolic, gallic, and tannic acids, and borax, as ordered in the Pharmacopœia. When used alone, it probably owes its efficacy to its physical properties, by which it excludes air from contact with the surfaces to which it is applied, while it softens the skin, and prevents it from becoming dry. It is a good solvent of many substances, such as gallic and arsenious acids, which are but slightly soluble in water.

Alcohol.

A volatile and inflammable liquid, produced by fermentation from sugar, and constituting the intoxicating ingredient in alcoholic beverages. In its purified state it is used as a vehicle for many medicines.

Preparation.—The preparation of alcohol may be divided into three stages: the production of a fermented vinous liquor; the preparation from this of an ardent spirit by distillation; and lastly, rectification or purification.

1. *Vinous Fermentation.*—To produce a vinous liquid, it is necessary that there be present sugar (or some substance capable of forming sugar, as starch), a certain quantity of water, a proper temperature, and a ferment, usually yeast. Both grape and cane sugar yield alcohol by fermentation. It is highly probable, however, that cane sugar, before it undergoes vinous fermentation, is converted into grape sugar by contact with the ferment; and that, consequently, it is grape sugar alone which yields alcohol and carbonic acid. $C_6H_{12}O_6=2CO_2+2C_2H_6O$. It must not be forgotten, however, that there are other substances produced in appreciable quantity; and that in reality carbonic acid and alcohol are only the leading results of an extremely complicated reaction. Vinous fermentation, then, is the metamorphosis of sugar into alcohol and carbonic acid by means of ferment.

[§ Vinum Xericum. *Sherry.*

A Spanish wine.

Characters.—Pale yellowish-brown, containing about 17 or 18 per cent. of alcohol.]

Manufacture of Wine.—The expressed juice of the grape, called *must*, readily undergoes the vinous fermentation when subjected to a temperature of between 60° and 80° Fahr. It becomes thick, muddy, and warm, and evolves carbonic acid gas. After a few days this process ceases; the thick part subsides, the liquid becomes clear, and is then found to have lost its sweet taste, and to have become vinous. The wine is now drawn off into casks, where it undergoes further changes. It is then racked off into other casks, where it is subjected to the operation of *sulphuring* (i.e. exposed to sulphurous acid, either by burning sulphur matches in the cask, or by the addition of wine impregnated with this acid), to render the glutinous matter incapable of re-exciting fermentation. After this the wine is usually clarified, or *fined* (i.e. deprived of those matters which render the wine turbid, and dispose it to undergo deteriorating changes). Isinglass or white of egg (i.e. gelatin or albumen) is commonly employed for this purpose. The first forms with the tannic acid, the second with the alcohol, reticulated coagula, which envelope and carry down the solid particles that endanger the safety of the wine.

Physiological Effects.—Wine taken in moderate quantities, acts as a stimulant to the nervous and vascular systems and the secreting organs. It quickens the action of the heart and arteries, diffuses an agreeable warmth over the body, promotes the different secretions, communicates a feeling of increased muscular power, excites the mental faculties, and banishes unpleasant ideas. Intoxication, in its various forms (see **Alcohol**, *Physiological Effects*, p. 84), is the effect of excessive quantities of wine. It is remarkable, that though the effects of wine depend mainly on the alcohol contained in this liquor, yet they differ in several circumstances from those of the latter. Wine possesses a tonic influence not observed after the use of ardent spirits. The stimulant effect communicated by wine is slower in its production and subsidence than that developed by spirit; and the intoxicating influence of wine is not equal to that of a mixture of ardent spirit and water of corresponding strength. The habitual use of spirit has also a greater tendency to induce disease of the liver.

Therapeutics.—Wine is used as a stimulant to the nervous system and to the heart, when depressed or exhausted; and to enable the enfeebled stomach to digest. At the present time it is generally given both in *typhus* and *typhoid fever*, though some physicians, as Dr. Gairdner, think that it is not nearly so well borne in the latter disease as in the former, and that patients are often injured by it. Certainly it may be given, as Dr. Tweedie observes, when the pulse is soft and compressible, and the skin cool and damp, and there is a feeling of exhaustion. Nor do sensorial disturbance, low muttering delirium, subsultus tendinum, and a dry black tongue contraindicate it. On the contrary, these *typhoid* symptoms, whether occurring in continued fever or in other febrile diseases, denoting as they do great nervous exhaustion, not only justify but demand its use; and its beneficial effects are often seen in the diminution of the delirium and the greater disposition to sleep, in the decrease of frequency of the pulse, and in the improved condition of the tongue. In scarlatina, idiopathic erysipelas, diphtheria, influenza, anæmia, and pyæmia, and in the second and third stages of consumption, in extensive ulceration, copious suppuration, gangrene of the extremities, and after extensive injuries, severe operations, or profuse hemorrhages, when the powers of life appear to be failing, wine is administered often with the best effects. In chronic inflammation, it must be given more cautiously, but in chronic bronchitis and the asthenic pneumonia of the old and feeble, it is frequently, perhaps generally, beneficial. When there is no local pain or acute inflammation the pulse will generally afford sufficient indication of the fitness of the remedy, especially if the patient is raised from the horizontal to the sitting posture ; but if wine causes a dryness of the tongue, thirst, restlessness, or a quicker pulse, it should be discontinued. Even in *acute rheumatic carditis*, when the heart is disabled by inflammation, and the pulse is irregular and feeble, I do not hesitate to give wine rather freely. In convalescence from debilitating diseases there is little difference of opinion respecting its use.

[§ **Vinum Aurantii.** *Orange Wine.*

Wine made in Britain, by the fermentation of a saccharine solution to which the fresh peel of the bitter orange has been added.

Characters and Tests.—A vinous liquid, having a golden sherry colour, and a taste and aroma, derived from the bitter orange peel. It contains about 12 per cent. of alcohol, and is but slightly acid to test paper.]

2. *Production of Alcohol.*—By the distillation of a vinous liquid we obtain *ardent spirit.* Fermented infusions of barley (raw grain and malt), prepared by the distillers of this country for the production of ardent spirit, are technically denominated *washes.* The liquid obtained by vinous fermentation consists of *water*, *alcohol*, *colouring* and *extractive matters*, *œnanthic ether*, *volatile oil* (e.g. amylic alcohol, called fusel oil, or oil of grain, &c.), *various acids* and *salts.* When the liquid is a fermented infusion of grain (*wash*), the spirit is denominated *corn spirit.*

3. *Rectification.*—By repeated distillations, and by the use of pearlash (carbonate of potash), which, by its powerful affinity for water, checks the rise of this fluid in distillation, is procured the liquid called *rectified spirit.*

[§ **Spiritus Vini Gallici.** *Spirit of French Wine.*

Synonym.—Brandy.

Spirit distilled from French wine. It has a peculiar flavour, and a light sherry colour derived from the cask in which it has been kept.] According to Brande, the average quantity of alcohol, sp. gr. 825 in brandy, is about 55 per cent. by measure.

[§ **Mistura Spiritus Vini Gallici.** *Mixture of Spirit of French Wine.*

Take of

Spirit of French Wine . . .	4 fluid ounces.
Cinnamon Water	4 fluid ounces.
The yolks of two Eggs.	
Refined Sugar	$\frac{1}{2}$ ounce.

Rub the yolks and sugar together, then add the cinnamon water and spirit.

Dose, 1 to 2 fluid ounces.]

[§ **Spiritus Rectificatus.** *Rectified Spirit.*

Alcohol, $C_4H_6O_2$ or $\mathbf{C_2H_6O}$, with 16 per cent. of water; obtained by the distillation of fermented saccharine fluids.

Characters and Tests.—Colourless, transparent, very mobile and inflammable, of a peculiar pleasant odour, and a strong spirituous burning taste. Burns with a blue flame without smoke. Specific gravity 0·838. Remains clear when diluted with distilled water. Odour and taste purely alcoholic. Four fluid ounces with thirty grain-measures of the volumetric solution of nitrate of silver exposed for twenty-four hours to bright light, and then decanted from the black powder which has formed, undergoes no further change when again exposed to light with more of the test.]

Pure spirit of wine has no reducing action upon nitrate of silver, but it ordinarily contains traces of fusel oil (amylic alcohol), and sometimes of aldehyde, which decompose nitrate of silver when exposed to bright light, the former producing a red colour followed by a reddish-black precipitate, the latter a black precipitate. This test is used, therefore, to show that the spirit does not contain an excessive quantity of any of these impurities. The presence of such foreign matters may also be detected by allowing a small portion of the spirit to evaporate at ordinary temperatures, when their peculiar odour will be perceived in the part *last* passing into vapour. Rectified spirit should be neutral to test-papers; it contains 84 per cent. by weight, or 89 by volume, of alcohol.

[§ **Spiritus Tenuior.** *Proof Spirit.*

Take of

Rectified Spirit	5 pints.
Distilled Water	3 pints.

Mix.

Test.—Specific gravity 0·920.]

Proof spirit contains 49 per cent. by weight, or 58 by volume, of alcohol.

[§ **Alcohol.** *Absolute Alcohol.* $C_4H_6O_2$ or $\mathbf{C_2H_6O}$.

Take of

Rectified Spirit	1 pint.
Carbonate of Potash	$1\frac{1}{2}$ ounce.
Slaked Lime	10 ounces.

Put the carbonate of potash and spirit into a stoppered bottle, and allow them to remain in contact for two days, frequently shaking the bottle. Expose the slaked lime to a red heat in a covered crucible for half an hour, then remove it from the fire, and when it has cooled immediately put the lime into a flask or retort, and add to it the spirit from which the denser aqueous solution of carbonate of potash, which will have formed a distinct stratum at the bottom of the bottle, has been carefully and completely separated. Attach a condenser to the apparatus, and allow it to remain without any external application of heat for twenty-four hours; then applying a gentle heat let the spirit distil, until that which has passed over shall measure $1\frac{1}{2}$ fluid ounce; reject this, and continue the distillation into a fresh receiver until nothing more passes at a temperature of 200°.

Characters and Tests.—Colourless and free from empyreumatic odour. Specific gravity 0·795. It is entirely volatile by heat, is not rendered turbid when mixed with water, and does not cause anhydrous sulphate of copper to assume a blue colour when left in contact with it.]

Properties.—Alcohol is a limpid, colourless, inflammable liquid, having a peculiar and penetrating odour, and a burning taste. It boils at 172° Fahr. It has a strong affinity for water: hence it abstracts this fluid from the atmosphere, and precipitates from their watery solutions those salts (e.g. sulphate of potash) which are not soluble in spirit: while on the other hand, water precipitates from their alcoholic solution those substances (e.g. resin and oil) which are not soluble in water. By the mixture of alcohol and water heat is evolved, while air bubbles are so copiously developed, that for a few moments the liquid appears turbid. When cold, the resulting compound is found to possess a greater density than the mean of its constituents; but as the condensation varies with the proportions of alcohol and water employed, the specific gravity of the resulting compound can be ascertained by experiment only. Its attraction for water, and its power of coagulating albuminous substances, are properties which probably assist in rendering it an antiseptic. Alcohol and rectified spirit of wine give greater firmness to, and whiten the animal tissues. Alcohol combines with certain salts (as the chlorides and nitrates) to form definite compounds, termed alcoholates, in which the alcohol appears to act as a substitute for water of crystallisation.

Physiological Effects.—The effects of alcoholic liquors vary with the strength of the liquid, the substances with which the alcohol is combined, the quantity taken, and the constitution of the patient. *The local effects of alcohol* or *rectified spirit* are those of a powerfully irritant and caustic poison. To whatever part of the body this agent is applied it causes contraction and condensation of the tissue and gives rise to pain, heat, redness, and other symptoms of inflammation. These effects depend partially or wholly on the chemical influence of alcohol over the constituents of the tissues; for the affinity of this liquid for water causes it to abstract the latter from the soft living parts with which alcohol is placed in contact: and when these are of an albuminous or fibrinous nature, it coagulates the liquid albumen or fibrin, and increases the density and firmness of the solid albumen or fibrin. The irritation and inflammation set up in parts to which alcohol is applied, depend in part on the resistance which the living tissue makes to the chemical influence of the poison: in other words, it is the reaction of the vital powers brought about by the chemical action of the alcohol. But, besides the local influence of this liquid, dependent on its affinity, we can hardly refuse to admit a dynamical action, in virtue of which it sets up local irritation and inflammation, independent of its chemical agency. *The remote effects of ardent spirits* may be conveniently considered in the order of their intensity; and for this purpose we may divide them into three degrees or stages. *First* or *mildest degree. Excitement.*—This is characterised by excitement of the vascular and nervous systems. The pulse is increased in frequency, the face flushed, the eyes animated and perhaps red, the intellectual functions are powerfully excited, the individual is more disposed to joy and pleasure; cares disappear; the ideas flow more easily, and are more brilliant. *Second degree. Intoxication* or *drunkenness.*—The essential character of this stage is a disordered condition of the intellectual functions and volition: manifested by delirium, varying in its characters in different individuals, and by an incapability of governing the action of the voluntary muscles. This state is accompanied with excitement of the vascular system and frequently with nausea and vomiting: it is followed by an almost irresistible desire for sleep, which usually continues for several hours, and is attended with copious perspiration. When the patient awakes he complains of headache, loathing of food, great thirst, and lassitude: the tongue is furred, and the mouth clammy. *Third degree. Coma* or *true apoplexy.*—This condition is usually observed when excessive quantities of spirit have been swallowed in a short time. The pulse is generally slow, the pupils are usually dilated, and the breathing is for the most part slow; but exceptions exist to all these statements. In some cases actual apoplexy (with or without sanguineous extravasation) is brought on. The immediate cause of death appears to be either paralysis of the muscles of respiration, or closure of the glottis.

The effects of spirit agree, in a considerable number of circumstances, with those of wine, but present some peculiarities. Spirit more speedily induces excitement, which, however, is of shorter duration, being more rapidly followed by collapse, relaxation, or debility. Death is by no means an unfrequent consequence of deep intoxication from spirit. The effects of opium are readily distinguished from those of spirit when insensibility has not come on. The sleep which both these agents commonly induce is not usually preceded, in the case of opium, by delirium, thickness of voice, and peculiar difficulty of articulation. When delirium is produced by this drug (opium), it is rather of the ecstatic kind. 'There is more poetry in its visions—more mental aggrandisement—more range of imagination.' But when insensibility is present, the diagnosis is not always easy. The odour of the breath is in these cases an important diagnosis. Moreover the pupil is usually (though not invariably) dilated by spirit, whereas it is contracted by opium.

Modus operandi.—That alcohol becomes absorbed is proved by the fact that it has been found in the blood, in the urine, the breath, the bile, the fluid of the serous membranes, the brain, and the liver.

Therapeutics.—Spirit is used both internally and externally :—

Internally.—Rectified spirit is rarely administered internally; for when ardent spirit is indicated, brandy, gin, or whisky, is generally employed. I may observe, however, that brandy is the ardent spirit usually administered for medicinal purposes; and, unless otherwise stated, is the spirit referred to in the following observations. As a *stomachic stimulant*, spirit is employed to relieve spasmodic pains and flatulency, to check vomiting (especially sea-sickness), and to give temporary relief in some cases of indigestion, attended with pain after taking food. As a *stimulant and restorative*, it is given with considerable advantage in the latter stages of fever. As a *powerful excitant*, it is used to support the vital powers, to prevent fainting during a tedious operation, to relieve syncope and languor, and to assist the restoration of patients from a state of suspended animation. In *delirium tremens* it is not always advisable to leave off the employment of spirituous liquors at once, since the sudden withdrawal of the long-accustomed stimulus may be attended with fatal consequences. In such cases it is advisable to allow, temporarily, to the patient the moderate use of the particular kind of spirit which he has been in the habit of employing. In *poisoning by digitalis and tobacco*, spirit and ammonia are used to rouse the action of the heart. In *mild cases of diarrhœa*, attended with griping pain, but unaccompanied by any inflammatory symptoms, a small quantity of spirit and water, taken warm, with nutmeg, is often a most efficacious remedy.

Externally.—Rectified spirit is used externally for several purposes, of which the following are the principal :—*As a styptic*, to restrain hemorrhage from weak and relaxed parts. It proves efficacious in two ways: it coagulates the blood by its chemical influence on the liquid albumen and fibrin, and it causes the contraction of the mouths of the bleeding vessels by its stimulant and astringent qualities. Sponge or soft linen, soaked in spirit and water has been applied to the mouth of the uterus in uterine hemorrhage. *Spirit is employed to harden the cuticle over tender and delicate parts.* Thus, brandy is sometimes applied to the nipples several weeks before delivery, in order to prevent the production of sore nipple from suckling in individuals predisposed to it. Spirit is also applied to the feet, when the skin is readily blistered by walking. The efficacy of spirit in hardening the cuticle depends, in part, on its chemical influence. Spirit gargles have been found serviceable in checking the tendency to inflammation and swelling of the tonsils. *As a stimulant application*, warm rectified spirit has been applied to burned or scalded parts, on the principles laid down for the treatment of these cases by Dr. Kentish. Properly diluted, spirit has been employed as a wash *in various skin diseases* and *in ulcers of bedridden persons. Frictions with rectified spirit* have been used in the abdominal region, to promote labour pains : on the chest to excite the action of the heart in fainting or suspended animation ; on the hypogastric region, to stimulate the bladder, when retention of urine depends on inertia, or a paralytic condition of this viscus ; on various parts of the body, to relieve the pain arising from bruises or to stimulate paralysed parts. Diluted spirit has been used *as an injection for the radical cure of hydrocele.* A mixture of wine and water, however, is commonly employed in this country. *Spirit has been used to form cold lotions.* As the efficacy of it depends on its evaporation, it should be applied by means of a single layer of linen, and not by a compress. Evaporating lotions are applied—to the head in cephalalgia, in phrenitis, in fever, and in poisoning by opium ; to fractures of the extremities ; also to parts affected with erysipelatous inflammation.

Pharmaceutic Uses of Alcohol, and of *Rectified and Proof Spirit.*—Alcohol is not employed in the preparation of any officinal substances, but it is a valuable agent in chemical analysis, and is used in determining the purity of some medicinal substances. Rectified and proof spirits are extensively employed in officinal pharmacy : as in the formation of *tinctures*, *spirits*, *ethers*, and *resinous extracts*, and in the manufacture of the *vegetable alkaloids.* Spirit is also used in various preparations to assist in preserving them (e.g. the liquid extracts), or to precipitate albuminous matter, as in syrup of poppies.

Tinctures,—Are solutions of vegetable, animal, or mineral substances, in spirit. They are in most cases preparations of substances whose active principles are imperfectly or not at all soluble in water, or whose aqueous solutions readily undergo decomposition. Some are prepared by *solution* merely, as the *tincture of iodine* ; some by mixture, as the *tincture of perchloride of iron*; but the greater part of them are prepared (1) by *maceration*, or (2) by *percolation*, or (3) by *maceration and percolation* united in one process.

1. *Maceration.*—In this process the solid ingredients, which are generally cut into small pieces, or bruised, or reduced to coarse powder, are put, together with the spirit, into a suitable vessel, the mouth of which is to be closed, and being shaken together frequently, they are allowed to stand for a sufficient time to admit of the extraction of the required soluble matter by the liquid solvent. This is generally effected in seven days, at the expiration of which time the tincture is strained off, the dregs pressed, and the whole of the liquid product filtered for use.

2. *Percolation.*—This process contemplates the use of the solid ingredients in a more finely divided state than that in which they are generally prepared for maceration. They are closely packed, so as to form a filter-bed, in a vessel of a conical or cylindrical form, called a percolator, having a perforated bottom and fitted to a receiver; and the spirit being poured over the surface of the solid ingredients in the percolator is allowed slowly to percolate through, extracting the soluble matter as it passes. It is found necessary to vary the degree of comminution of the solid ingredients, in this process, according to their nature and also according to the quantity operated upon; otherwise the liquid might cease to pass or might pass too slowly, if the powders be too fine or the filter-bed too closely compacted. Some art, acquired from practical experience, is involved in the successful application of percolation, as a general process, for the preparation of tinctures; but the difficulties sometimes experienced in operating by percolation are obviated in the process of the British Pharmacopœia, which consists of,—

3. *Maceration and percolation, united in one process.*—The ingredients are used in the finest state of comminution suitable for maceration, and they are macerated in the usual way for forty-eight hours with three-fourths of the quantity of spirit intended to be employed. At the expiration of this time they are turned into a percolator, and the tincture having filtered off, the undissolved ingredients will be found to have formed a compact bed at the bottom of the percolator suitable for the second stage of the process, in which the remaining one-fourth of the spirit, being carefully introduced into the percolator without disturbing the filter-bed, is allowed to percolate through. The solid residue is then pressed, the liquors united, and the whole made up to a definite quantity.

A suitable apparatus for conducting this process, with slight modifications, not affecting the principle but rendering it much more easy of application, will be found in the 'Pharmaceutical Journal' for May 1864 (vol. v., 2nd series, p. 542).

[§ **Æther.** *Ether.*

Synonym.—Æther Sulphuricus, *Edin. Dubl.* A volatile liquid prepared from alcohol, and containing not less than 92 per cent. by volume of pure ether, C_4H_5O or $\mathbf{C_4H_{10}O}$.]

History.—This liquid is said to have been known to Raymond Lully, who lived in the thirteenth century. In 1540 Valerius Cordus described the method of making it.

Preparation.—[§ Take of

Rectified Spirit	50 fluid ounces.
Sulphuric Acid	10 fluid ounces.
Chloride of Calcium . . .	10 ounces.
Slaked Lime	½ ounce.
Distilled Water	13 fluid ounces.

Mix the sulphuric acid and twelve ounces of the spirit in a glass matrass capable of containing at least two pints, and, without allowing the mixture to cool, connect the matrass by means of a bent glass tube with a Liebig's condenser, and distil with a heat sufficient to maintain the liquid in brisk ebullition. As soon as the ethereal fluid begins to pass over, supply fresh spirit through a tube into the matrass in a continuous stream, and in such quantity as to equal the volume of the fluid which distils over. For this purpose use a tube furnished with a stopcock to regulate the supply, connecting one end of the tube with a vessel containing the spirit raised above the level of the matrass, and passing the other end through a cork fitted into the matrass. When the whole of the spirit has been added, and forty-two fluid ounces have distilled over, the process may be stopped. Dissolve the chloride of calcium in the water, add the lime, and agitate the mixture in a bottle with the impure ether. Leave the mixture at rest for ten minutes, pour off the light supernatant fluid, and distil it with a gentle heat until a glass bead of specific gravity 0·735 placed in the receiver begins to float. The ether and spirit retained by the chloride of calcium and by the residue of each distillation may be recovered by distillation and used in a subsequent operation.]

Theory of Etherification.—That the sole or efficient cause of the conversion of alcohol into ether is not the mere abstraction of water by the affinity of the sulphuric acid for that liquid, is proved by various circumstances, of which the following are some. (1) Water passes over during the whole process along with the ether; the acid ought to combine with this in preference to dehydrating the alcohol. (2) Ether is not produced by the action of anhydrous sulphuric acid upon alcohol. (3) When the oil of vitriol is mixed with rectified spirit the saturating power of the acid is diminished. The following is the explanation of the successive changes which is generally received by modern chemists. When alcohol is mixed with oil of vitriol a new compound is known to be formed, which is usually designated sulphovinic or sulphethylic acid. It is a monobasic acid, and corresponds in constitution to the so-called bisulphates of potash and soda.

$$C_2H_5HO + H_2SO_4 = C_2H_5HSO_4 + H_2O.$$

When the spirit is supplied to this compound heated previously to ebullition, the alcohol decomposes it, producing ether and sulphuric acid. The former distils over with the water which had been previously formed; the latter remains in the retort in a condition to act upon a fresh quantity of alcohol, and so set up again the same series of changes, as shown by the formulæ made use of above.

$$C_2H_5HSO_4 + C_2H_5HO = (C_2H_5)_2O + H_2SO_4.$$

Ether is regarded as the oxide of a peculiar radicle ethyl ($Et = C_2H_5$), of which alcohol is the hydrate, and sulphovinic acid the acid sulphate.

The *rectification* of ether is intended to free it from alcohol, water, sulphurous acid, and ethereal oil.

[§ *Characters and Tests.*—A colourless very volatile and inflammable liquid, emitting a strong and characteristic odour, and boiling below 105°. Specific gravity 0·735. 50 measures agitated with an equal volume of water are reduced to 45, by an absorption of 10 per cent. It evaporates without residue.]

[§ **Æther Purus.** *Pure Ether.* Ether C_4H_5O, or $C_4H_{10}O$, free from Alcohol and Water.

Take of

Ether	2 pints.
Distilled Water	2 pints.
Lime, recently burned	¼ ounce.
Chloride of Calcium	4 ounces.

Put the ether with one pint of the water into a bottle and shake them together; allow them to remain at rest for a few minutes, and when the two liquids have separated, decant off the supernatant ether; mix this with the remainder of the water, and again after separation, decant as before. Put now the washed ether, together with the lime and chloride of calcium into a retort to which a receiver is closely attached, let them stand together for twenty-four hours, then distil with the aid of a gentle heat.]

By agitation with water the alcohol contained in ordinary ether is removed, and at the same time a portion of water absorbed; the latter is held back by the lime and chloride of calcium, and anhydrous ether distilled off.

[§. *Test.*—Specific gravity not exceeding 0·720.]

Properties.—Pure and recently-prepared ether possesses neither acid nor alkaline properties; but, by exposure to air and light, it absorbs oxygen, by which acetic acid and water are produced. The acetic acid is not immediately observed, because it combines with some undecomposed ether to form acetic ether. Ether is very combustible; it burns in atmospheric air with a yellowish-white flame, and forms carbonic acid and water. Its vapour, mixed with oxygen or atmospheric air, forms a violently explosive mixture. One volume of ether vapour consumes, in burning, six volumes of oxygen gas: the products are, four volumes of carbonic acid, and five volumes of aqueous vapour. By the slow combustion of ether vapour, by means of a coil of platinum wire, acetic, formic, and aldehydic acids are produced. Ether is soluble in 10 parts of water. Alcohol dissolves ether in all proportions. Ether extracts corrosive sublimate, perchloride of gold, bichloride of platinum, and perchloride of iron, from their watery solutions. It readily dissolves bromine and iodine; but the solutions, by keeping, undergo decomposition. It sparingly dissolves sulphur and phosphorus, and the ethereal solution of phosphorus is luminous in the dark, when poured on hot water. It dissolves the volatile oils, most of the fatty and resinous substances, some of the vegetable alkaloids, urea, osmazome, gun cotton (forming *collodion*), and caoutchouc. It is recommended by M. Stas as the best solvent for the separation of the alkaloids, morphia, strychnia, &c., in medico-legal analysis.

Therapeutics. Internal Use.—Ether is principally valuable as a speedy and powerful agent in spasmodic and painful affections which are not dependent on local vascular excitement, but are accompanied by a pale cold skin, and a small feeble pulse. If administered during a paroxysm of spasmodic asthma, it generally gives relief, but has no tendency to prevent the recurrence of attacks. In cramp of the stomach, singultus, and flatulent colic, its happy effects are well established. It is sometimes highly advantageous in a paroxysm of angina pectoris. During the passage of urinary or biliary calculi, it may be used as a substitute for, or in combination with, opium, to overcome the spasm of the ducts or tubes through which the calculus is passing. In the latter stages of continued fever, ether is sometimes employed to relieve the subsultus tendinum and hiccup. Desbois de Rochefort administered it in intermittent fevers. He gave it about half an hour before the expected paroxysm; it acted as a mild diaphoretic, and prevented the recurrence of the attack. Headache of the kind popularly called nervous, that is, unconnected with vascular excitement, is sometimes speedily relieved by ether. I have found it beneficial principally in females of delicate habits. In such it occasionally gives immediate relief, even when the throbbing of the temporal arteries and suffusion of the eyes (symptoms which usually contraindicate the employment of ether) would seem to show the existence of excitement of the cerebral vessels. In flatulence of the stomach it may be taken in combination with some aromatic water. Against sea-sickness it should be swallowed in a glass of white wine. In faintness and lowness of spirits, it is a popular remedy. In poisoning by hemlock and fungi, it has been employed. In asphyxia it has been used with benefit.

External Use.—The principal external use of ether is to produce cold by its speedy evaporation. Thus, in strangulated hernia, it may be dropped on the tumour and allowed to evaporate freely. By this means a considerable degree of cold is produced, and, in consequence, the bulk of the part diminished, whereby the reduction of the hernia is facilitated. Dropped on the forehead, or applied by means of a piece of thin muslin, ether diminishes vascular excitement, by the cold produced from its evaporation, and is exceedingly efficacious in headache and inflammatory conditions of the brain. In burns and scalds it may also be employed as a refrigerant. If its evaporation be stopped or checked, as by covering it with a compress, it acts as a local irritant, causing rubefaction, and, by long-continued application, vesication. It is used with friction as a local stimulant.

Local anæsthesia is frequently produced by means of ether applied in the form of spray, as recommended by Dr. Richardson. It thus produces insensibility through the intense cold caused by its rapid evaporation. It has been successfully used in this way in performing minor operations, such as the opening of abscesses, removal of small tumours, extraction of teeth, &c.

Ether Vapour.—The inhalation of the vapour of ether, as an anæsthetic, to be used in surgical operations, was introduced in 1846, by Drs. Warren and Morton of Boston, in the United States of America. Its employment in this way, by producing the effect called *etherization*, afterwards extended throughout the whole civilised world, but it has more recently been almost entirely superseded by other agents, and especially chloroform. It has been inhaled in cases of insanity attended with much excitement. The effect has been only a temporary diminution of the excitement. In twelve cases, chiefly recent and characterised by considerable excitement, it thus produced temporary relief. In one instance it disposed the patient to take food which she had resisted before. It thus prevented the necessity of using the feeding-tube. In another case with suicidal and homicidal disposition accompanied by great restlessness, it was given every night at bedtime for about three weeks, with the effect of always procuring a quiet night. In 1847 it was administered to sixteen patients in the Utica Asylum. A few were highly excited by it; several seemed intoxicated, and said that they felt as if drunk; one rested remarkably well the next night; two experienced no effect of any kind from it; some were decidedly improved by it, becoming more active, cheerful, and sociable. Dr. Willis has found it of great service in spasmodic diseases of the respiratory organs, and especially valuable in cutting short the severe paroxysms of *hooping-cough.* It has also been employed successfully in cases of *strangulated hernia* for the reduction of the hernia.

Administration.—Liquid ether is given internally in the form of spirit of ether.

[§ SPIRITUS ÆTHERIS. *Spirit of Ether.*

Take of

Ether	10 fluid ounces.
Rectified Spirit	1 pint.

Mix.

Test.—Specific gravity 0·809.]

Administration.—Miscible with water in all proportions.

Dose, 30 to 90 minims.

Oleum Æthereum. *Ethereal Oil.*

This liquid is commonly termed *heavy oil of wine,* or simply *oil of wine.*

It is obtained in the later stages of the process for preparing ether. By washing it with solution of potash, as directed in the London Pharmacopœia, it is partially decomposed with production of a hydrocarbon, known as *light oil of wine* or *etherol,* which is isomeric with olefiant gas. Heavy oil of wine is believed to be a mixture of ethylic sulphate $(C_2H_5)_2SO_4$) with several oily hydrocarbons.

Properties.—Ethereal oil is an oily liquid, having usually a yellowish tint, an aromatic odour, and bitter taste. It is insoluble in water, in which it sinks, but dissolves readily in alcohol and ether.

Treated with potash it yields sulphovinate of potash among the products of its decomposition.

Medical Use.—It is said to act on the nervous system in a somewhat analogous way to ether. It is used as an ingredient in Hoffman's anodyne.

Spiritus Ætheris Compositus. *Lond.* *Compound Spirit of Ether.* *Hoffman's* Anodyne.

Take of

Ether	8 fluid ounces.
Rectified Spirit	16 fluid ounces.
Ethereal Oil	3 fluid drachms.

Mix.

Dose, f℥ss to f℥ij, used as an adjunct to laudanum, to prevent the nausea which the latter sometimes excites.

Æther Aceticus. *Acetic Ether.*

Prepared by submitting to distillation a mixture of 10 parts of crystallised acetate of soda, 15 parts of oil of vitriol, and 6 parts of rectified spirit.

The product is shaken up with a little slaked lime and rectified from chloride of calcium ; a quantity of acetic ether equal in weight to the alcohol is obtained.

Properties.—Colourless, and has an agreeable ethereal fruity odour. Its sp. gr. at 60° is ·89. It boils at 165°. Soluble in 7 parts of water, and in alcohol and ether in every proportion.

Physiological Effects and Uses.—It is similar in its operation to the other ethers, but is milder, more agreeable, and more diaphoretic.

[§ **Spiritus Ætheris Nitrosi.** *Spirit of Nitrous Ether.*

Synonym.—Spiritus Ætheris Nitrici, *Lond. Ed.*

A spirituous solution, containing nitrous ether (nitrite of ethyl), $C_4H_5ONO_3$ or $\mathbf{C_2H_5NO_2}$.

Take of

Nitric Acid	3 fluid ounces.
Sulphuric Acid	2 fluid ounces.
Copper in fine wire (about No. 25) .	2 ounces.
Rectified Spirit	a sufficiency.

To one pint of the spirit add gradually the sulphuric acid, stirring them together; then add, in the same way, two and a half fluid ounces of the nitric acid. Put the mixture into a retort or other suitable apparatus into which the copper has been introduced, and to which a thermometer is fitted. Attach now an efficient condenser, and applying a gentle heat, let the spirit distil at a temperature commencing at 170° and rising to 175° but not exceeding 180°, until twelve ounces have passed over and been collected in a bottle kept cool, if necessary, with ice-cold water ; then withdraw the heat, and having allowed the contents of the retort to cool, introduce the remaining half-ounce of nitric acid, and resume the distillation as before, until the distilled product has been increased to 15 fluid ounces. Mix this with two pints of the rectified spirit or as much as will make the product correspond to the tests of specific gravity and percentage of ether separated by chloride of calcium. Preserve it in well-closed vessels.]

When nitric acid and rectified spirit are together submitted to distillation, if the proportion of spirit to acid is large, the first part of the process consists in the simple distillation of alcohol; when the mixture left in the retort consists of about four volumes of spirit to one of nitric acid, the ether accompanied by aldehyde begins to make its appearance abundantly.

$$\underset{\text{Alcohol}}{2C_2H_6O} + \underset{\text{Nitric acid}}{HNO_3} = \underset{\text{Nitrite of ethyl}}{C_2H_5NO_2} + \underset{\text{Aldehyde}}{C_2H_4O} + \underset{\text{Water}}{2H_2O}$$

As the distillation proceeds, other products, the result of secondary decomposition, pass over, and the reaction becomes very complicated and frequently violent, the temperature at the same time rising.

The product obtained by the distillation in this way of a simple mixture of nitric acid and spirit varies considerably, not only in the amount of nitrous ether contained in it, but also in the amount and nature of other compounds which pass over in the process, and the production of which appears to depend on the proportion of nitric acid present and the temperature at which the reaction takes place. These results are to a great extent influenced by the quantity of ingredients operated upon at once, and therefore sweet spirit of nitre made in that way has always been a variable and unsatisfactory preparation, sometimes very deficient in nitrous ether, and at other times highly charged with aldehyde and other compounds, the presence of which is objectionable.

In the Pharmacopœia process the reaction is more uniform, and it is easily controlled throughout the entire operation. The copper appears to start the action, probably by deoxidising some of the nitric acid, but the portion of it thus acted upon is finally found in the state of sulphate of copper; and to the extent to which this action occurs the production of aldehyde is diminished.

$$C_2H_5HO + HNO_3 + Cu + H_2SO_4 = C_2H_5NO_2 + CuSO_4 + 2H_2O$$

There is a simultaneous reaction in which aldehyde is formed to a certain extent, but the quantity thus produced is less than by the other process, and the product is much more uniform and suitable for use in medicine.

[§ *Characters and Tests.*—Transparent and nearly colourless, with a very slight tinge of yellow, mobile, inflammable, of a peculiar penetrating apple-like odour, and sweetish cooling sharp taste. Specific gravity 0·845. It effervesces feebly or not at all when shaken with a little bicarbonate of soda. When agitated with the solution of sulphate of iron and a few drops of sulphuric acid it becomes deep olive-brown or black (owing to the formation and solution of nitric oxide). If it is agitated with twice its volume of saturated solution of chloride of calcium in a closed tube, 2 per cent. of its original volume will separate in the form of nitrous ether, and rise to the surface of the mixture.]

The non-occurrence of effervescence shows the absence of free acid ; the separation of 2 per cent. of nitrous ether indicates the presence of about 10 per cent. of nitrous ether, 8 per cent. remaining dissolved in the mixture.

Therapeutics.—Spirit of nitrous ether is employed as a diuretic in mild dropsical complaints, as in the anasarca which follows scarlatina. It is given in conjunction with squill, acetate or nitrate of potash, or digitalis. As a refrigerant and diaphoretic, it is used in febrile complaints in combination with the acetate of ammonia and tartarated antimony. As a carminative it is frequently useful in relieving flatulence and allaying nausea. On account of its volatility it may be applied to produce cold by its evaporation. Spirit dealers employ it as a flavouring ingredient.

Administration.—The usual dose of this liquid in febrile cases is f ʒss. to f ʒij. When we wish it to act as a diuretic, it should be given in large doses, as two or three tea-spoonfuls.

Spiritus Pyroxylicus Rectificatus. *Rectified Pyroxylic Spirit.*

Methylic alcohol C_2H_3O,HO or CH_3HO with about 10 per cent. of water; a product of the destructive distillation of wood.

Preparation.—The first runnings of the acid liquor derived from the destructive distillation of wood are redistilled once or twice, and the product is sold under the name of *pyroligneous ether* or *wood naptha.* This is an impure liquor, containing, besides hydrate of methyl, acetone, and other inflammable liquors. It is purified by introducing it into a retort with excess of chloride of calcium, and distilling the mixture by a water-bath, as long as volatile matter passes off. A quantity of water, equal to the spirit employed, is then added, and the distillation continued. The product is now pure or rectified pyroxylic spirit, carrying along with it a little water, which is removed by a second distillation with quicklime.

Characters.—Colourless, mobile and inflammable, burning with a pale blue flame, having a spirituous odour and a warm ethereal taste, with a peculiar after-taste.

Properties.—It is more inflammable than rectified oil of turpentine. It boils at from 140° to 150° F. It dissolves many resins, mixes with most essential oils, and forms crystalline compounds with baryta, lime, and chloride of calcium.

Tests.—Specific gravity 0·841 to 0·846. Without action on litmus paper, free from smoky taste. Is not rendered turbid by mixture with water.

Therapeutics.—It is regarded as a sedative, and has been occasionally used in doses of 20 minims or more in phthisis and bronchitis, &c., to diminish expectoration, and to check cough. It is also said to be useful in relieving sickness.

[§ **Alcohol Amylicum.** *Amylic Alcohol.*

Synonym.—Fousel oil.

Amylic Alcohol $C_{10}H_{12}O_2$ or $\mathbf{C_5H_{12}O}$ with a small proportion of other spirituous substances. An oily liquid, contained in the crude spirit produced by the fermentation of saccharine solutions with yeast, and separated in the rectification or distillation of such crude spirit.

Characters and Tests.—A colourless liquid, with a penetrating and oppressive odour, and a burning taste. When pure, its specific gravity is ·818, and its boiling point 270°. Sparingly soluble in water, but soluble in all proportions in alcohol, ether, and essential oils. Exposed to the air in contact with platinum black it is slowly oxidised, yielding valerianic acid.]

Amylic alcohol is prepared by fractionising the *oil of grain* obtainable from any distillery; the first portions that come over consist of water and several ethers of acetic and other acids of the same series. Amylic alcohol, tolerably pure, comes last.

[§ **Chloroformum.** *Chloroform.* C_2HCl_3 or $\mathbf{CHCl_3}$.]

History.—This liquid was for a long time known in an impure state and regarded as a chloride of carbon. Dumas, in 1834, was the first to make a correct analysis of the pure compound. It is occasionally termed chloride of *formyl*, a radical, however, which is not known in other forms of combination.

Preparation.—[§ Take of

Chlorinated Lime	10 pounds.
Rectified Spirit	30 fluid ounces.
Slaked Lime	a sufficiency.
Water	3 gallons.
Sulphuric Acid	a sufficiency.
Chloride of Calcium, in small fragments	2 ounces.
Distilled Water	9 fluid ounces.

Place the water and the spirit in a capacious still, and raise the mixture to the temperature of 100°. Add the chlorinated lime and five pounds of the slaked lime, mixing thoroughly. Connect the still with a condensing worm encompassed by cold water, and terminating in a narrow-necked receiver; and apply heat so as to cause distillation, taking care to withdraw the fire the moment that the process is well established. When the distilled product measures fifty ounces, the receiver is to be withdrawn. Pour its contents into a gallon bottle half filled with water, mix well by shaking, and set at rest for a few minutes, when the mixture will separate into two strata of different densities. Let the lower stratum, which constitutes crude chloroform, be washed by agitating it in a bottle with three ounces of the distilled water. Allow the chloroform to subside, withdraw the water, and repeat the washing with the rest of the distilled water, in successive quantities of three ounces at a time. Agitate the washed chloroform for five minutes in a bottle with an equal volume of sulphuric acid, allow the mixture to settle, and transfer the upper stratum of liquid to a flask containing the chloride of calcium mixed with half an ounce of slaked lime, which should be perfectly dry. Mix well by agitation. After the lapse of an hour connect the flask with a Liebig's condenser, and distil over the pure chloroform by means of a water bath. Preserve the product in a cool place, in a bottle furnished with an accurately ground stopper. The lighter liquid which floats on the crude chloroform after its agitation with water, and the washings with distilled water, should be preserved, and employed in a subsequent operation.]

The production of chloroform from alcohol is to be attributed to the oxidising and chlorinating action of the chloride of lime; of this action chloral is believed to be the result,

$$2C_2H_6O + O_2 + 6Cl_2 = 2C_2HCl_3O + 6HCl + 2H_2O.$$

This compound, chloral or tri*chloral*dehyde, is however decomposed as soon as formed by the hydrate of lime present;

$$2C_2HCl_3O + Ca2HO = Ca2CHO_2 + 2CHCl_3.$$

so that, finally, chloroform and formate of lime are added to the products of the reaction. Small quantities of other compounds are, however, formed in actual practice, and some alcohol distils over unchanged; these are removed by washing with water, treating with sulphuric acid, and re-distilling. It is important that the sulphuric acid used for purifying the chloroform should be free from nitric or nitrous acid, otherwise the chloroform will be liable to undergo decomposition when it has been kept for some time, and especially if exposed to the light.

[§ *Characters and Tests.*—A limpid colourless liquid, of an agreeable ethereal odour, and sweet taste. Dissolves in alcohol and ether in all proportions; and slightly in water, communicating to it a sweetish taste. Burns, though not readily, with a green and smoky flame. Specific gravity 1·49. It is not coloured by agitation with sulphuric acid, leaves no residue and no unpleasant odour after evaporation (showing its freedom from chlorinated oily impurities).]

Chloroform sinks readily in water. Its specific gravity varies from 1·48 to 1·496 or even to 1·5. Its boiling-point is 140°, and the density of its vapour is 4·2. It is exceedingly volatile, and produces, by rapid evaporation, great cold when placed on the skin, with a slightly tingling sensation. Its vapour has a sweet taste. Chloroform is readily dissolved by oil of turpentine and bisulphide of carbon; it dissolves volatile oils, resins, camphor, and alkaloids, and separates the latter as well as iodine and bromine, when pure, from their watery solutions. When pure, it is quite neutral. It may be distilled with potash, sulphuric acid, and other acids, without change. Heated with strong nitric or sulphuric acid, it undergoes no perceptible change. When kept for some time under sulphuric acid it evolves vapours of hydrochloric acid. When kept under water, it remains unchanged. It does not decompose iodic acid or iodide of potassium.

Adulterations and Impurities.—It should sink readily in water in rounded globules, without imparting any opalescence to the liquid. This appearance would indicate the presence of alcohol. If alcohol be present, even in small quantity, it will be indicated by a thin opaque film around the globule. Another test for the presence of alcohol is the specific gravity, which will not only detect the adulteration with alcohol, but to a certain extent indicate the proportion. The proportion of alcohol in chloroform may also be determined by agitating it with an equal measure of distilled water in a graduated tube, and noticing the loss. The chloroform not being perceptibly soluble in water, should not undergo any change in volume. This test is similar to the washing of ether. Alcohol may be present in chloroform as a result of its passing over during distillation; or it may be sometimes present as an adulteration. If any traces of sulphuric acid remain in it, as a result of its use in rectifying it, this impurity may be discovered by adding a salt of baryta to water with which it has been agitated. Chloroform sometimes presents a pink colour, which, according to the observation of the author, depends on the presence of manganese, either as an impurity in the chloride of lime, or as a result of the rectification of the products of distillation by peroxide of manganese, as recommended by Gregory.

Physiological Effects.—In the liquid state.—In moderate medicinal doses chloroform is stimulant and antispasmodic. In larger doses it is narcotic, impairing sensorial power, and producing drowsiness. In very large or poisonous doses it appears to produce such effects as might be mistaken for poisoning by alcohol. A man swallowed four ounces of chloroform. After taking this large dose he was able to walk for a considerable distance, but he subsequently fell into a state of coma. The pupils were dilated, the breathing stertorous, the skin cold, the pulse imperceptible, and there were general convulsions. He recovered in about five days.

In the state of vapour.—After the first two or three full inspirations, there is a feeling of warmth and excitation extending from the chest to the extremities. This is followed by whirring or whizzing noises in the ears, a sensation of vibratory thrilling and benumbing throughout the body. There is excitement of the brain, with exhilaration, and phenomena similar to those produced by the protoxide of nitrogen. There is loss of sensation and motion, and at last of consciousness. Sleep, more or less profound, is induced, during which the mind is either passive, for nothing is remembered, or it continues active as in dreams. Dr. I. C. Atkinson records, as the result of observation on himself, that the senses are successively obliterated during the inhalation of chloroform. 'The sense of hearing, under a moderate inhalation of chloroform, conveys correct modulations of sound to the brain; for if there be a musical turn of mind, a whole tune, after a prompter has led the way, is pleasingly sung or whistled through, no error in time being perceptible. During the gradual obscuration of the senses the mind is only conscious of the retention, to the latest, of the faculty of hearing, the senses being *obliterated one after another*, but not *simultaneously*.' Among the unpleasant secondary results of its administration may be mentioned vomiting, headache, and severe collapse; but such cases may be regarded as exceptional.

Poisonous Effects.—In cases in which chloroform vapour has proved fatal, the symptoms and appearances have been pretty uniform. The patient passes rapidly into a state of insensibility, with stertorous breathing. The face is pale, sometimes livid, the lips congested, the breathing slow and laborious, the surface cold, the pulse sinks, and soon becomes imperceptible at the wrist. There is complete and universal relaxation of the muscular system, including the sphincters, with entire loss of sensibility. The pupils are dilated. Death has been observed to take place with great rapidity —not more than one or two minutes having elapsed. In one instance, in which thirty drops had been inhaled, the patient died in a minute; in another, so small a quantity as fifteen or twenty drops proved speedily fatal. These and other facts show that the fatality is not so much dependent on the dose administered as on the mode in which the vapour is inhaled, and the condition of the patient at the time.

Modus Operandi.—There is no doubt that chloroform enters into the blood, and affects its colour and liquidity. The amount of carbonic acid excreted by the lungs under the influence of chloroform has been found to be diminished, showing, as in the case of alcohol and ether, that the processes of oxidation going on in the body are lessened. This does not arise from the appropriation of the oxygen in the blood by chloroform, but probably as Dr. Snow has suggested, from an arrest of oxidation, which appears to be a property of chloroform as well as of the vapours of other volatile narcotic liquids. This experimentalist has observed that the venous blood in patients under the influence of chloroform is less dark in colour than in the normal state, indicating, in his opinion, that those changes in the blood which take place in the systemic capillary circulation are diminished. The observations made by Dr. Snow with respect to the action of chloroform on the lower animals, as well as the facts he has collected with regard to the deaths which have taken place in the human subject while chloroform was being inhaled, have led him to adopt the following conclusions:—'1st. Chloroform vapour, if it be inhaled in large proportion with atmospheric air, destroys life by paralysing the heart. 2nd. In smaller proportions, but long continued, it produces death apparently by the brain, and by interfering with the respiratory function. In such cases the heart is found to beat after respiration has ceased. 3rd. Chloroform vapour, if it be blown upon the heart, paralyses it immediately.' Dr. Snow refers the cause of sudden death from chloroform to paralysis of the heart, owing to the vapour having been inhaled in too concentrated a form. It is to be observed, however, that this is the mode in which some have advised its administration; and the results of their practice are not in accordance with this view of its operation. In Dr. Black's opinion, when the vapour is administered in a highly concentrated form, it is irrespirable, owing to its pungency; and spasm of the glottis, leading to asphyxia, is induced. Dr. Black thinks that the safety of chloroform vapour 'is in its inhalation: the chief danger consists not in its impregnating the blood too strongly, but in its non-inhalation. Any concentration of the vapour which can be breathed is safe; any condition of dilution which forces the patient to cough, or to hold his breath, is dangerous; and if persevered in for even half a minute, may be fatal. When deeply narcotised, the patient can inhale the chloroform in its highest concentration; but if this be forced upon him at the commencement, he will immediately experience choking or suffocation.' Death from chloroform cannot, however, be referred in all cases to asphyxia, as this theory would imply. Admitting that a patient can inhale the concentrated vapour when deeply narcotised, it is clear that a persistence in its administration under these circumstances would destroy life by a directly poisonous action. In a fatal case communicated to us by a friend, the heart suddenly ceased to beat *four minutes after the vapour had been withdrawn.* The digital arteries, which had been divided in the operation, suddenly ceased to let blood. The man was dead. This appears to corroborate Dr. Snow's view of the cause of death. Dr. J. Chapman, dissenting from both the above-mentioned opinions, considers that death from chloroform may always be referred to mechanical obstruction of the right side of the heart as its proximate cause. After quoting the results of Dr. Snow's experiments on animals, in which the heart generally continued to beat after respiration had ceased, and the conclusion of the Paris commission, that in all animals killed by chloroform, the action of the heart survives the respiration, he argues that these results are not a little remarkable if death is caused by paralysis of the heart. In confirmation of his own opinion he relates the following experiment:—I caused a cat to inhale chloroform until respiration and the action of the heart had entirely ceased; in fact, until the animal was quite dead. The chest was then opened. The heart lay perfectly still, the right auricle and ventricle being immensely distended by blood. The pericardium having been removed, and the heart observed to be still perfectly motionless, its distension was relieved by division of the pulmonary artery (the aorta was divided at the same time), when instantly the heart resumed its rhythmical contractions. The auricles and ventricles continued to contract alternately for more than half an hour after the vessels had been divided.

Morbid appearances.—Congestion of the vessels of the brain and its membranes has been met with, but not uniformly; the lungs congested, or in an apoplectic condition; the heart flaccid, and the cavities frequently empty, or containing but little blood; the blood generally dark in colour, and very fluid. Dr. Snow, however, records the examination of thirty-four persons who died from chloroform. In the majority of these, the pulmonary artery and right side of the heart were distended with blood. The same distended condition of the right ventricle was observed in the animals which were the subject of Dr. Snow's experiments.

Therapeutics.—Of liquid chloroform.—Dr. Hartshorne, of the Pennsylvania Hospital, made many trials of chloroform in large doses in water. In a case of painful *neuralgia* of the head, the patient took seventy-five drops at night, slept better than she had done for weeks even after inhaling chloroform or ether, was unusually comfortable the next day, and continued to improve under its use. It is stated to have answered admirably as a substitute for Dover's powder in a case of *rheumatism*, and to have afforded prompt relief in a case of *flatulent colic.* M. Aran, physician to the Hospital St. Antoine, Paris, has obtained the most satisfactory results from the internal administration, and external application of chloroform in *lead colic.* The doses have been from twenty to fifty drops, given at short intervals. The medicine has also been administered in the same doses by enema. Dr. Strother administered one hundred drops to a *cholera* patient with the effect of relieving the cramps, the vomiting, and all the other alarming symptoms for several hours, during which time other remedies were applied, and the patient recovered. It was given to a patient labouring under *traumatic tetanus* by Dr. Brickell, of New Orleans, in doses of a hundred drops, but without any very decided advantage. Dr. Warriner states that it produced immediate relief in a case of sick headache, and in a case of *dysmenorrhœa* depending on uterine neuralgia. Chloroform was used by M. Guillot as an antispasmodic in cases of *asthma*, in 1844; and Dr. Formby employed it in cases of *hysteria*, at a still earlier period. According to Dr. Christison, it is serviceable for arresting chronic vomiting depending on nervous causes, such as that which occurs in pregnancy. In *otalgia*, in the case of an adult who suffered from severe pain in the ear which had resisted leeches and morphia, Professor Malmsten, of Stockholm, employed chloroform, twelve drops being dropped into the affected ear. In a few minutes the pain subsided.

Of Chloroform vapour.—*Surgical Operations.*—The uses of chloroform vapour in surgery, introduced by Dr. Simpson of Edinburgh in 1847, may be summed up, in the language of its discoverer, in a few words:—To relax the muscles in reducing dislocations, &c.; to avert the sufferings attendant on deep probings and other painful but necessary modes of diagnostic examination and dressing; but, principally, to annul the pain of protracted operations by the caustic, ligature, or knife. *Tetanus and Hydrophobia.*—Chloroform vapour has been used in cases of traumatic tetanus with temporary relief. Dr. Farre administered it during thirty-six consecutive hours to a man suffering from idiopathic tetanus, and during that time prevented the occurrence of the tetanic spasms, and was enabled to give food by the bowel; but the spasms returned on its discontinuance, and death was only retarded. It has also been found to alleviate the sufferings in hydrophobia; but there is no evidence that it has saved life in these diseases. *Vesical Calculus.*—In a case of lithotrity, in which there was such excessive irritability of the bladder that a tablespoonful of water could not be introduced, chloroform vapour produced such a beneficial effect, that while the patient was under its influence four ounces of warm water were injected, the stone was then broken, the bladder washed out, and the patient recovered without any untoward symptom. *Ophthalmic Surgery.*—Chloroform has been found particularly advantageous in operations for congenital cataract, or other surgical operations where it is important to secure steadiness of the eyeball. *Hernia.*—Strangulated hernia is very frequently reduced, and the surgical operation for its relief is often avoided by the use of chloroform. *Obstetric Practice.*—Chloroform vapour has been most extensively used in midwifery for diminishing or annulling the pains attendant on labour. Its great advantages in this branch of practice have been set forth by Dr. Simpson, Dr. Murphy, and others. Dr. Ramsbotham and Dr. Robert Lee are, however, opposed to its use under any circumstances. *In Medicine.*—The vapour has been used in medical practice chiefly as an antispasmodic, and in many instances with great benefit; in other cases it has been employed as a diffusible stimulant, sedative, or narcotic. *Hooping Cough.*—Chloroform has been found useful in abating the severity of the paroxysms, and apparently in shortening the duration of the disease. It has, in these cases, been inhaled from a few drops to half a drachm, sprinkled on the hand or on a folded handkerchief, and its vapour largely diluted with the air. *Neuralgia.*—Chloroform vapour has also been advantageously employed in neuralgia, in spasmodic asthma, in spasmodic croup, in puerperal convulsions, and various other spasmodic affections. In neuralgic affections of the sciatic nerve, chloroform has been used topically by Dr. Shipman with complete success in two cases. *Convulsions in Infants.*—M. Marotte relates the case of an infant, eleven months old, suffering from convulsions, with spasm of the glottis, during dentition. Chloroform vapour was cautiously administered at intervals, with success. In convulsions depending on cerebral congestion, Professor Malmsten, of Stockholm, has found the inhalation of chloroform beneficial in arresting these convulsions when ordinary remedies had failed. Twenty drops were placed on a folded handkerchief, and held at a distance of an inch and a half from the child's nose. In a very short time the convulsions had ceased. On a slight recurrence the handkerchief was again used with permanent benefit. Dr. West has also found the inhalation of chloroform to cut short fits of convulsions—thereby saving the strength and sometimes even the life of the patient—leaving, however, the cause of the convulsions untouched. *Chorea.*—The sleep produced by chloroform has been found to exert a certain influence over this malady. *Insanity.*—In cases of insanity attended with maniacal excitement, it has allayed the violence of the paroxysms; but, as under ether vapour, the relief has been only temporary.

Administration and Dose.—The dose of the *liquid* may be from five to twenty minims or more. The physicians of the United States have been in the habit of prescribing it in much larger doses. When given alone, the liquid chloroform may be mixed with water and a little mucilage; but the alcoholic solution has been generally employed, under the name of chloric ether.

Different opinions exist, not only as to the best mode of administering chloroform vapour, but as to its operation on the system. Dr. Simpson, whose opinions are entitled to respect as the discoverer of the anæsthetic properties of the liquid, as well as from the large experience he has had in administering it to persons presenting every conceivable variety of temperament, age, and state of health, contends—'1. That chloroform vapour must always be exhibited as rapidly and in as full strength as possible, if you desire to have its first or exhilarating stage practically done away with, and excluded; and you effect this by giving the vapour so powerfully and speedily as to apathise the patient at once. If you act otherwise, and give it in small or slow doses, you excite and rouse the patient in the same way as if nitrous-oxide gas were exhibited. 2. In order that the patient be thus brought as speedily as possible under its full influence, the vapour should be allowed to pass into the air-tubes by both the mouth and nostrils—and hence all compression of the nostrils, &c. is to be avoided. 3. The vapour of chloroform is about four times heavier than atmospheric air. And hence, if the patient is placed on his back during its exhibition, it will, by its mere gravitation, force itself in larger quantities into the air passages than if he were erect or seated. As to the best instrument for exhibiting the chloroform with these indications, the simple handkerchief is far preferable to every means yet adopted. It is infinitely preferable to any instrument yet seen, some of which merely exhibit it by the mouth and not by the nostrils, in small and imperfect, instead of full and complete doses; and with instruments so constructed, there is no doubt whatever that failures and exciting effects would ever and anon occur. Besides, inhaling instruments frighten patients, whilst the handkerchief does not; and mental excitement of all kinds, from whispering and talking around the patient, is to be strictly avoided, if possible. As to the quantity required to be applied to the handkerchief, it has been stated, that the average dose of a fluid drachm was generally sufficient to affect an adult; but I have latterly seldom measured the quantity used. We must judge by its *effects*, more than by its quantity. The operator gathering his handkerchief into a cup-like shape in his hand, should wet freely the bottom of the cup (so to speak), and if the patient is not affected in a minute or so, he should add a little more. It evaporates rapidly; and you must not wet your handkerchief, and then delay for a minute or more in applying it. It must be applied immediately. Not unfrequently, when the patient is just becoming insensible, he will withdraw his face or forcibly push aside the handkerchief. If you *then* fail to reapply it to his face and keep it there, you will be liable to leave him merely excited. But probably two or three inhalations more will *now* render him quite insensible. The simplest test of its full and perfect effect is some noise or stertor in the respiration. Cease it as soon as this has fully set in. But reapply it, of course, from time to time, if it is wished to keep up its effects.' A committee appointed by the American Medical Association to report on the administration of this vapour, consider:—1. That the recumbent position is the most favourable for the inhalation of chloroform, and in obstetrical practice it should be administered in no other. 2. No inhaling apparatus should be employed. A common pocket handkerchief folded in the form of a compress or sponge, applied so as to cover both the nostrils and mouth, is the best vehicle. With this there is no danger of the exclusion of atmospheric air, an accident to which we may be exposed in a greater or less degree with ordinary inhalers. The handkerchief or sponge is at the same time much less formidable in appearance, and much more readily applied. 3. Upon the handkerchief or sponge may be poured a drachm of chloroform if the full anæsthetic effect be desired, or one-half or one-third of this quantity if a less decided result only is sought for; the effect, however, to be the guide, rather than the quantity used, as very different quantities are required in different cases. 4. The inhalation should never be continued after the full anæsthetic effect has been produced, which can generally be recognised at once by the sonorous or stertorous sleep. Nor should it ever be given after the pulse begins to fail in frequency and force. It is advisable that the pulse should never be allowed to fall between 60 and 65 per minute; when it reaches this point the sponge should be removed and atmospheric air alone be inhaled until the pulse recovers its tone. It is also to be borne in mind that the depressing stage of chloroform continues to *increase* for several seconds after it has been withdrawn; differing in this respect from ether, which does not appear to be cumulative in its operation, for under the influence of ether the patient never becomes more depressed than at the moment of ceasing the inhalation. Dr. Snow, who has had considerable experience in administering chloroform vapour in this metropolis in surgical and obstetric practice, prefers the use of an inhaler so constructed as to allow the vapour to pass both by the nose and the mouth into the lungs, the patient being made to breathe through a mask. By the aid of this instrument the amount of vapour inhaled, and its degree of admixture with air, can be easily controlled. According to Dr. Snow, 'atmospheric air, loaded with from 4 to 5, or even 6 per cent. of chloroform vapour, may be safely administered, and will produce insensibility in the average time of from three to four minutes. The proportion of from 8 to 10 per cent. of chloroform vapour in atmospheric air constitutes a dangerous mixture.' Mr. Clover, who has had great experience, uses an apparatus in which air is charged with a definite proportion of chloroform vapour, this being varied at pleasure. It consists of a bag charged with the mixed air and vapour, which hangs at the back of the administrator, a face piece with valves to prevent the expired air being breathed a second time, and a tube connecting them. The bag is charged by means of a bellows which holds a thousand cubic inches of air. This quantity, in passing to the bag, is forced through a vessel in which the chloroform is vaporised, and to each bellowsful of air 33 minims of chloroform are supplied. This will give a mixture containing 4 per cent. of chloroform vapour, but by regulating the size of an opening in the face piece, additional air may be admitted, so as to reduce the strength to 3, 2, or 1 per cent. As a test for the degree of insensibility required for a surgical operation, Dr. Snow advises that the eyelid be raised, and its free border gently touched. If no winking takes place, the operation may be commenced. Others recommend the simple test of pinching, or advise waiting for a complete relaxation of the limbs. It has been found serviceable in cases of great depression to administer a glass of wine or brandy and water before giving the chloroform; and all agree that no food should be taken during one or two hours previous to the inhalation. A mixture of ether and chloroform is used by the order of the Government throughout Austria. No death has occurred from its use in Vienna, and it was used with good effect in our civil hospitals in the East. One part of chloroform to six parts of ether in cold weather, and eight parts of ether in warm weather, is the proportion recommended, but the mixture must be made at the time it is wanted for use.

Antidotes.—In cases of poisoning by the vapour of chloroform, the following points of treatment should be attended to. When the pulse and respiration are suspended, the patient, if not so already, should be placed in a horizontal posture, cold air should be fanned across the face, and cold water should be applied to the head. There should be a free passage of air to the mouth and nostrils, inflation of the lungs with air or oxygen gas by any of the usual methods adopted in asphyxia, and there should be at the same time forced movements of the chest to imitate respiration. Heat and frictions may be applied to the chest and abdomen, and stimulants to the nostrils.

[§ LINIMENTUM CHLOROFORMI. *Liniment of Chloroform.*

Take of

Chloroform	2 fluid ounces.
Liniment of Camphor . . .	2 fluid ounces.

Mix.]

Useful in neuralgia and other painful affections.

[§ SPIRITUS CHLOROFORMI. *Spirit of Chloroform.*

Take of

Chloroform	1 fluid ounce.
Rectified Spirit	19 fluid ounces.

Dissolve.

Test.—Specific gravity 0·871.]

This is intended to represent chloric ether. Spirit of chloroform of this strength may be added to aqueous preparations without any separation of the chloroform. It has a fragrant odour, and a hot, sweet, fragrant taste. It is neutral to test paper. When a few drops are applied to the skin it is more irritating, and evaporates much more slowly, than a similar quantity of chloroform. Unlike chloroform, it may be readily ignited: it burns with a strong yellow flame, somewhat resembling that of ether, but depositing more carbon on cold substances placed within it. It produces an intense green colour with bichromate of potash and sulphuric acid.

Therapeutics.—It has been used with advantage as a substitute for the ethers, and is found to possess equal efficacy as a stimulant and antispasmodic. Its flavour is preferred by most persons to that of the ethereal preparations, and it may be advantageously prescribed when objection is made to the latter form of stimulant.

The *dose* for an adult is from 20 to 40 minims, two or three times a day.

[§ **Tinctura Chloroformi Composita.** *Compound Tincture of Chloroform.*

Take of

Chloroform	2 fluid ounces.
Rectified Spirit	8 fluid ounces.
Compound Tincture of Cardamoms .	10 fluid ounces.

Mix.

Dose, 20 to 60 minims.]

Hydrate of Chloral.

$C_4Cl_3HO_22HO$ or $\mathbf{C_2Cl_3HO.H_2O}$.

This remarkable substance, which, until within the last few months, was prepared only as a chemical curiosity, is now an article of ordinary commerce. It is prepared by passing chlorine gas, dried by allowing it to bubble through oil of vitriol, into absolute alcohol for some hours, or so long as it is absorbed. The alcohol is at first kept cool, but afterwards the temperature is gradually raised until the liquid boils. Large quantities of hydrochloric acid gas are evolved. The impure product is mixed with thrice its volume of sulphuric acid, and after standing, the upper stratum of oily liquid is drawn off and rectified from a small quantity of sulphuric acid. The distillate thus obtained is chloral; to prepare the hydrate it is mixed with a small quantity of water; on cooling it crystallises. The decomposition which occurs in the production of chloral is usually represented in the following manner:—

$$\underset{\text{Alcohol.}}{C_2H_6O} + \underset{\text{Chlorine.}}{Cl_2} = \underset{\text{Aldehyde.}}{C_2H_4O} + 2HCl.$$

The hydrogen of the aldehyde then immediately is three-fourths replaced by chlorine :—

$$\underset{\text{Aldehyde.}}{C_2H_4O} + \underset{\text{Chlorine.}}{3Cl_2} = \underset{\text{Chloral.}}{C_2HCl_3O} + 3HCl.$$

Chloral itself is a liquid having the specific gravity 1·502, and boiling at 201° F. It possesses a pungent and peculiar odour and taste.

The hydrate appears to assume two forms, either that of needles, or, by dissolving these in water and evaporating *in vacuo*, in rhomboidal plates. A syrup of the hydrate is now prepared, and seems to be a convenient form for administration.

Therapeutics.—Introduced as a therapeutic agent by Dr. Liebriech of Berlin, and used with great success as a hypnotic. In doses of thirty grains or more, dissolved in water, and administered either by the mouth or subcutaneously, it speedily produces sleep which generally continues for several hours. In smaller doses it has been found beneficial in slight attacks of delirium tremens.

Bichloride of Methylene.

Synonym.—Chloride of Mono-chlor-methyl.

$$C_2H_2Cl_2 \text{ or } \mathbf{CH_2Cl_2}.$$

Prepared with considerable difficulty by submitting chloroform to the action of nascent hydrogen, evolved from an acid by the action of metallic zinc.

$$\mathbf{CHCl_3 + H_2 = CH_2Cl + HCl.}$$

The compound sold under this name is chiefly chloroform containing a small quantity of the methylene chloride.

Bichloride of methylene is obtained among the products of the action of chlorine upon marsh-gas or chloride of methyl; but it cannot be prepared by this process in sufficient quantity nor in a state of purity, suitable for medicinal purposes.

It has been used in the same way as chloroform as an anæsthetic agent.

Iodoformum. *Iodoform.* C_2HI_3 or $\mathbf{CHI_3}$.

This compound may be prepared by adding an alcoholic solution of potash to a similar solution of iodine, until the liquid is no longer brown but yellow, taking care not to add excess. The liquid is then evaporated to dryness, and the residue treated with water, which leaves the iodoform. The following is the symbolic representation of the principal features of the reaction :—

$$\mathbf{C_2H_5HO + 6KHO + 8I = CHI_3 + 5KI + KCHO_2 + 5H_2O.}$$

The iodide of potassium, and formiate of potash, are removed by the water. The reaction, however, is really more complex than the foregoing equation indicates.

Iodoform has been used with advantage in syphilis, scrofula, goître, and glandular affections generally, in the place of other compounds of iodine. It is administered internally in doses of one grain, and externally dissolved in alcohol, ether, or oil.

[§ **Acetum.** *Vinegar.*

Synonym.—Acetum (*Britannicum*) *Lond.*—An acid liquid prepared from malt and unmalted grain by the acetous fermentation.]

History.—Vinegar must have been known from the most remote periods of antiquity. Moses mentions it. Hippocrates employed it medicinally.

All liquids which are susceptible of vinous fermentation may be made to yield vinegar. A solution of saccharine matter (or some substance capable of producing sugar) is the essential ingredient. It is converted by fermentation, first into alcohol, and subsequently into acetic acid. The liquids employed in the manufacture of vinegar vary according to circumstances. In this country the vinegar of commerce is obtained from an infusion of malt, or of a mixture of malt and raw barley. In wine countries it is procured from inferior wines. Dilute spirit, beer, a solution of sugar and other liquids, are also susceptible of the acetous fermentation. In France, wine vinegar is prepared in casks, which are placed in a stoved chamber, heated to between 68° and 77° Fahr. Each vat communicates with the air by two apertures. Every eight or ten days the liquor in the vats must be changed. Either red or white wine may be used, but the latter is generally employed. Wine vinegar is of two kinds, white and red, according as it is prepared from white or red wine. White wine vinegar is usually preferred, as it keeps better. That which is made at Orleans is regarded as the best.

Theory of Acetification.—During the acetous fermentation the alcohol, previously produced by vinous fermentation, is converted into acetic acid and water by the absorption of atmospheric oxygen.

$$C_2H_6O + O_2 = C_2H_4O_2 + H_2O.$$

[§ *Characters and Tests.* A liquid of a brown colour and peculiar odour. Specific gravity 1·017 to 1·019. 445·4 grains by weight (1 fluid ounce) of it require at least 402 grain-measures of the volumetric solution of soda for their neutralisation, corresponding to 4·6 per cent. of anhydrous acetic acid. If ten minims of solution of chloride of barium be added to a fluid ounce of the vinegar, and the precipitate, if any, be separated by filtration, a further addition of the test will give no precipitate (showing that it contains no more than the lawful $\frac{1}{1000}$th of sulphuric acid). Sulphuretted hydrogen causes no change of colour (metallic impurities absent).]

The presence of nitric acid in vinegar may be recognised by boiling this liquid with diluted sulphate of indigo. The colour is discharged. Or it may be detected by saturating the suspected acid with potash or soda, and evaporating to dryness: the residue deflagrates, when thrown on red-hot coals, if nitric acid be present.

Therapeutics.—Taken internally, vinegar is used for various purposes: the most important of these are, to allay febrile heat by its refrigerant qualities; to diminish inordinate vascular action; to relieve certain affections of the brain supposed to depend on, or be connected with, venous congestion; and to act by its chemical properties of an acid. Thus, in *fevers* whether simple or eruptive, but especially in those varieties commonly denominated putrid and bilious, vinegar (more or less diluted with water) is a most refreshing drink, allaying thirst, and diminishing excessive heat. In *hemorrhages*, as from the nose, lungs, stomach, or uterus, it is particularly beneficial by its refrigerant, sedative, and astringent qualities. It diminishes excessive vascular action, and promotes contraction of the bleeding vessels. As a local astringent, it is injected into the nose in epistaxis, and is used as a wash in profuse hemorrhoidal discharges. The benefit obtained by the application of vinegar and water to the abdomen, vulva, and thighs, in uterine hemorrhages, arises principally from the cold produced. In *consumption*, vinegar, diluted with water, is sometimes serviceable as a palliative, by its refrigerant qualities: it relieves the hectic symptoms, diminishes or puts a stop to the night sweats, checks bronchial hemorrhage, and prevents diarrhœa. In *mania*, it has been recommended as a means of allaying cerebral excitement. In *poisoning by opium*, it is used as a counter-poison; but as acetic acid forms very soluble, and, therefore, powerful compounds with morphia, it ought not to be exhibited until the contents of the stomach have been evacuated. In poisoning by the alkalies and their carbonates, and by lime, vinegar is the safest and most efficacious acidulous substance that can be administered. In diseases attended with *phosphatic deposits* in the urine, it may be advantageously used either as a medicine or condiment. *Enemas containing vinegar* have been employed for the purpose of provoking alvine evacuations in obstinate constipation and strangulated hernia; of expelling the small round-worm (*Ascaris vermicularis*); of checking uterine and intestinal hemorrhage; and of relieving inflammation or congestive conditions of the brain. Sponging the face, trunk, or extremities with cold or tepid vinegar and water, usually proves refreshing and grateful in febrile disorders with a hot skin. It diminishes preternatural heat, promotes the cutaneous functions, and operates as a beneficial stimulant to the nervous system. Fomentations containing vinegar are used in bruises and sprains.

Administration.—Vinegar is given in doses of from one to four fluid drachms. A refrigerant drink in fevers is made by adding one or two ounces of vinegar to a quart of water. A vinegar wash is prepared by mixing three fluid ounces of vinegar with five of water.

[§ **Acidum Aceticum.** *Acetic Acid.*

An acid liquid prepared from wood by destructive distillation, and subsequent purification. 100 parts by weight contain 33 parts of the acetic acid $HO,C_4H_3O_3$ or $\mathbf{HC_2H_3O_2}$, corresponding to 28 per cent. of anhydrous acetic acid $C_4H_3O_3$ or $\mathbf{C_4H_6O_3}$.

This acid corresponds in strength with the 'Acetic Acid of commerce,' or 'Purified Pyroligneous Acid' of the Dublin Pharmacopœia. It is rather weaker than the acid described under the same name in the London Pharmacopœia, and only about one-third the strength of that ordered in the Edinburgh Pharmacopœia.]

Preparation.—By the destructive distillation of the hard woods (oak, beech, hornbeam, ash, and birch) in iron cylinders, an impure acid, called Pyroligneous Acid, is obtained. This is mixed with cream of lime, and the mixture evaporated to dryness in shallow wrought-iron pans, when it forms a black or greyish-coloured granular mass, called pyrolignite of lime. If this be submitted to distillation with sulphuric acid, it yields an impure acetic acid, which is used in the manufacture of crude acetate of lead, and for making carbonate of lead by the Dutch process. If pyrolignite of lime be mixed with a solution of sulphate of soda, double decomposition is effected, and sulphate of lime and acetate of soda are the products. The latter is repeatedly crystallised until it is colourless, and is then in a fit state for the manufacture of pure acetic acid. In some manufactories the acid liquor, after the separation of the greater part of the tar, by subsidence, is at once neutralised by carbonate of soda, and the crude acetate of soda is obtained by crystallisation, and subsequently purified. The acetate of soda being treated with sulphuric acid and distilled, yields acetic acid, $\mathbf{2NaC_2H_3O_2 + H_2SO_4 = 2HC_2H_3O_2 + Na_2SO_4}$. The distillation of acetic acid is usually effected in glass or earthenware stills. On the large scale silver condensers are sometimes used.

[§ *Characters and Tests.*—A colourless liquid with a strong acid reaction, and pungent odour. Specific gravity 1·044. 182 grains by weight require for neutralisation 1,000 grain-measures of the volumetric solution of soda. It leaves no residue when evaporated; gives no precipitate with sulphuretted hydrogen, chloride of barium, or nitrate of silver (showing its freedom from metallic impurities, sulphuric, and hydrochloric acids). If a fluid drachm of it, mixed with half an ounce of distilled water and half a drachm of pure hydrochloric acid, be put into a small flask with a few pieces of granulated zinc, and while the effervescence continues a slip of bibulous paper wetted with solution of subacetate of lead be suspended in the upper part of the flask above the liquid for about five minutes, the paper will not become discoloured.] This last test indicates freedom from sulphurous acid.

Therapeutics.—See **Acidum Aceticum Glaciale.**

[§ **Acidum Aceticum Dilutum.** *Diluted Acetic Acid.*

Take of

Acetic Acid	1 pint.
Distilled Water	7 pints.

Mix.

Tests.—Specific gravity, 1·006. 440 grains by weight (1 fluid ounce) require for neutralisation 313 grain-measures of the volumetric solution of soda, corresponding to 3·63 per cent. of anhydrous acetic acid. One fluid ounce therefore corresponds to 16 grains of anhydrous acid.]

[§ **Acidum Aceticum Glaciale.** *Glacial Acetic Acid.*

Synonym.—Acidum Aceticum, *Edin.*

Concentrated acetic acid, corresponding to at least 84 per cent. of anhydrous acid, $C_4H_3O_3$ or $\mathbf{C_4H_6O_3}$.]

Preparation.—Take of

Acetate of Soda	20 ounces.
Sulphuric Acid	8 fluid ounces.

Dry the acetate of soda thoroughly by heating it carefully till it undergoes the *igneous* fusion. Place this in a stoppered retort, pour on it the acid, and as soon as necessary assist the distillation with a gentle heat. If the distillate is found to contain an appreciable quantity of sulphurous acid, it must be rectified from a little bichromate of potash. Glacial acetic acid is sometimes made without distilling.

The action of sulphuric acid upon acetate of soda not unfrequently gives rise to the formation of a little sulphurous acid, which is indicated by its reducing action upon iodate of potash, iodine being liberated, which colours the starch blue ($\mathbf{6HIO_3+15SO_2+12H_2O=15H_2SO_4+3I_2}$). By treatment with bichromate of potash, this sulphurous acid is converted into sulphuric, which remains behind on redistillation. The distilled acid obtained by this process requires to be congealed by ice, and the part that remains liquid drained off. The solid portion is the monohydrated acid.

[§ *Characters and Tests.*—It crystallises when cooled to 34° and remains crystalline till the temperature rises to above 48°. Specific gravity 1·065 to 1·066, and this is increased by adding 10 per cent. of water. At the mean temperature of the air it is a colourless liquid, with a pungent acetous odour. 60 grains by weight mixed with a fluid ounce of distilled water require for neutralisation at least 990 grain-measures of the volumetric solution of soda. If a fluid drachm of it, mixed with half an ounce of distilled water and half a drachm of pure hydrochloric acid, be put into a small flask with a few pieces of granulated zinc, and while the effervescence continues a slip of bibulous paper wetted with solution of subacetate of lead be suspended in the upper part of the flask above the liquid for about five minutes, the paper will not become discoloured.]

This last test indicates the absence of sulphurous acid. The blackening of the paper would be produced by sulphuretted hydrogen resulting from the reduction of the sulphurous acid; $\mathbf{SO_2 + 3H_2 = 2H_2O + H_2S}$.

Properties.—Glacial acetic acid is the strongest acetic acid procurable. The crystals are brilliant, broad flat plates, of a pearly lustre. Free acetic acid is known by its peculiar odour and by its volatility. Its vapour reddens litmus, and fumes with ammonia. It does not occasion any precipitate with solutions of lime, of the salts of baryta, or of nitrate of silver. It forms with potash a very deliquescent salt. Glacial acetic acid does not cause effervescence when marble is dropped into it, unless water be added. The neutral acetates are all soluble, save those of molybdenum and tungsten. The acetates of silver and protoxide of mercury are slightly soluble. The acetates are known by the acetic odour which they emit, on the addition of sulphuric acid and the application of heat, and by the white lamellar and pearly precipitates which many of them produce with nitrate of silver and protonitrate of mercury. They redden solutions of the persalts of iron (forming *peracetate of iron*). All the acetates are decomposed by heat, and give results which vary somewhat according to the nature of the base. Some of the acetates, as those of potash, lead, and copper, evolve, when heated, an inflammable fluid, called *acetone* or *pyro-acetic spirit*, whose composition is $C_6H_6O_2$ or $\mathbf{C_3H_6O}$.

Therapeutics.—Strong acetic acid is a valuable remedy for the cure of the different forms of porrigo, popularly called ring-worm or scalled head. Its application, which may be effected by means of a piece of lint wrapped around a wooden stick, causes acute but temporary pain, redness of the skin, and whitening of the abraded spots. One or two applications are usually sufficient to effect a cure. It is also employed as a caustic to destroy corns and warts. It has been proposed as a speedy means of exciting rubefaction and vesication, and, for this purpose, blotting-paper or cambric, moistened with the acid, has been applied to the neck in cases of croup. In *scurvy*, acetic acid has been found serviceable. As a stimulant, disinfectant, and antiseptic, diluted acetic acid is used in gangrenous and other ill-conditioned ulcers. In ulceration of the throat, in scarlatina, and in cynanche, gargles containing acetic acid are sometimes used with good effect. Acetic collyria are useful, as mild astringents, in chronic ophthalmia, and for removing lime-dust adhering to any part of the globe or lid of the eye. It may also be employed for the other purposes for which vinegar is used. (See **Acetum**, *Therapeutics*, p. 111.)

Antidotes.—In poisoning by strong acetic acid, the treatment is the same as that for poisoning by other acids.

Acidum Lacticum. *Lactic Acid.* $C_6H_6O_6$ or $\mathbf{C_3H_6O_3}$.

History.—Lactic acid was discovered by Scheele. It exists in sour milk, and is found in the healthy gastric juice, and other animal secretions.

Preparation.—Take of

Sugar	8 parts.
Cheese	1 part.
Chalk	a sufficient quantity.
Water	50 parts.

Set aside the mixture in a warm place, temperature from 70° to 80° F., for about a fortnight, stirring occasionally, and adding chalk to neutralise the acid as it is formed. As soon as a considerable crop of crystals is found to have been deposited, pour off the mother liquor and recrystallise from boiling water. The lactate of lime so obtained may be made to yield the acid by decomposing with a precisely equivalent quantity of sulphuric or oxalic acid.

When pure, lactic acid constitutes a syrupy liquid, which may be concentrated till of specific gravity 1·215. It is miscible with alcohol, ether, and water; it cannot be distilled in the ordinary manner without undergoing partial decomposition. It dissolves zinc and iron with effervescence, producing solutions of the lactates of those metals.

Therapeutics.—Lactic acid has been used as a remedy in some forms of dyspepsia, its employment having been suggested on theoretical grounds. It is used with medicinal pepsin for increasing its solvent power.

It is also used in medicine in combination with iron or other base, to which the action of the compound is principally to be ascribed.

Acidum Oxalicum. *Oxalic Acid.*

History.—This acid was discovered by Scheele, though the credit of its discovery was for a long time given to Bergmann. It is found in combination with bases in many plants. Oxalate of lime is found in rhubarb, bistort, and many lichens; oxalate of potash in wood sorrel and rhubarb; oxalate of soda in salsola.

Preparation.—Oxalic acid is formed either—1, by the action of nitric acid on sugar or potato starch; or, 2, by the action of caustic potash and soda upon sawdust.

1. Treacle is usually employed in this country as a substitute for solid sugar. The process is generally conducted in open earthenware jars, heated by a warm-water-bath. One part of sugar, or, better still, of potato starch, is heated with 5 parts of nitric acid of sp. gr. 1·42, diluted with 10 parts of water, as long as gaseous products are evolved; by evaporation the acid is obtained in crystals, which may be purified by a second crystallisation, after being well dried on paper or porous earthenware. From 12 parts of potato starch, 5 of the acid are obtained. The mother liquor may be treated with an additional quantity of acid, and again concentrated, when a second crop of crystals will be obtained: this is repeated until the solution is quite exhausted. 1 atom of sugar, ($C_6H_{12}O_6$), 3 atoms of water ($3H_2O$), and 9 atoms of oxygen (O_9) derived from the nitric acid, furnish the elements of 3 atoms of oxalic acid ($3H_2C_2O_4,2H_2O$). But the reaction which takes place appears to be more complex than this, as carbonic acid is found among the gaseous products, and saccharic acid, in variable quantities, is found with the oxalic acid in solution. The nitrous vapours which result from the decomposition of the nitric acid, if conveyed into a suitable condenser containing air and aqueous vapour, will yield nitric and nitrous acids, which may be made available in renewing the process.

2. A concentrated solution (sp. gr. 1·35) of mixed caustic soda and potash, in the proportions of 2 atoms of the former to 1 of the latter, is added to sawdust, so as to form a stiff paste, which is placed in a thick layer on an iron plate, and gradually heated until the temperature is raised to about 400° F., or from that to 480°, at which it is kept for a couple of hours; it is afterwards exposed to a lower heat for some hours, when it becomes dry, and is found to contain from 28 to 30 per cent. of oxalic acid. The dry mass is treated with water at 60° F., which dissolves all but the oxalate of soda. This is converted into oxalate of lime by boiling it with milk of lime. The oxalate of lime in its turn is decomposed with sulphuric acid, yielding sulphate of lime and oxalic acid, which is obtained from the solution in crystals.

Impurity.—The crystals of oxalic acid of commerce are sometimes contaminated with nitric acid. In this state they have usually a faint odour, and stain the cork of the bottle in which they are kept, yellow. If they be exposed to a warm atmosphere, the nitric acid escapes along with the water of crystallisation, and may be detected by boiling the crystals with a weak solution of sulphate of indigo, the colour of which is discharged by the nitric acid.

Properties.—Soluble in from 8 to 11 parts of water at 60° F., in their own weight of boiling water, and in 4 parts of alcohol at 60° F. Exposed to warm air, gradually heated to 212° F., the crystals effloresce, evolve 28 per cent. of water, and become a pulverulent residue consisting of $\mathbf{H_2C_2O_4}$. If this dry residue be heated to 320° F., it slowly sublimes unchanged, but if the acid in its original state be suddenly heated to the same temperature, it melts in its water of crystallisation and is decomposed, yielding formic and carbonic acids. If the oxalic acid be dissolved in glycerine and the mixture heated in a retort to about 302° F., *formic acid* distils over, while carbonic acid gas escapes. This is the best process for obtaining formic acid. By the action of oil of vitriol, aided by heat, oxalic acid is resolved into water, which is retained by the sulphuric acid, and carbonic acid and carbonic oxide, which escape in the gaseous state.

With solution of lime, of sulphate of lime, or of chloride of calcium, oxalic acid yields a white precipitate (*oxalate of lime*), insoluble, or nearly so, in excess of oxalic acid, insoluble also in acetic acid, but readily soluble in nitric acid, and slightly so in hydrochloric acid. If the precipitate be collected, dried, and calcined, it yields quicklime. With sulphate of copper, oxalic acid yields a bluish white precipitate (*oxalate of copper*). It reduces the terchloride of gold, and deoxidises iodic acid on boiling.

Physiological Effects.—In doses of 60 grains, or more, oxalic acid acts as a powerful corrosive poison, usually producing death within an hour, and causing great pain in the region of the stomach, attended with vomiting. In small doses of a grain or two, largely diluted, it has been used as an antiphlogistic and anodyne remedy in inflammation of the mucous membranes. It is not, at present, used as a remedial agent; at least, in this country. It is a valuable test for lime, and for estimating the strength of alkalies, for which purposes it is introduced in the Pharmacopœia.

[§ Oxalic Acid, Purified.

$$2HO,C_4O_6+4HO \text{ or } \mathbf{H_2C_2O_42H_2O}.$$

Take of oxalic acid of commerce, one pound; boiling distilled water, thirty fluid ounces. Dissolve, filter the solution, and set it aside to crystallise. Pour off the liquor, and dry the crystals by exposure to the air on filtering paper placed on porous bricks.

Test.—It is entirely dissipated by a heat below 350°.]

[§ Volumetric Solution of Oxalic Acid.

Crystallised Oxalic Acid, $2HO,C_4H_6+4HO=126$ or $H_2C_2O_4,2H_2O=126$.

Take of

Purified Oxalic Acid in crystals, quite dry, but not effloresced	630 grains.
Distilled Water	a sufficiency.

Put the oxalic acid into the 10,000 grain flask, fill the flask to about two-thirds of its bulk with water, allow the acid to dissolve, and then dilute the solution with more water until it has the exact volume of 10,000 grain-measures. 1,000 grain-measures of this solution contain half an equivalent in grains (63 grains) of oxalic acid, and are therefore capable of neutralising one equivalent in grains of an alkali or alkaline carbonate.

Grammes and cubic centimètres may be employed instead of grains and grain-measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. 100 cubic centimètres contain $\frac{1}{20}$th of an equivalent in grammes (6·3 grammes) of oxalic acid, and will neutralise $\frac{1}{10}$th of an equivalent in grammes of an alkali.]

Acidum Hydrocyanicum. *Hydrocyanic Acid.* HC_2N or **HCN**.

History.—Hydrocyanic acid (prussic acid) was first produced by Scheele from Prussian blue in 1782. Its composition was determined by Berthollet in 1787. It is a product peculiar to the organised kingdom. It may be readily procured from many *vegetables*, more especially those belonging to the sub-orders *Amygdaleæ* and *Pomeæ*: as from bitter almonds, apple-pips, the kernels of peaches, apricots, cherries, plums, and damsons; the flowers of the peach, cherry-laurel, and bird-cherry; the bark of the latter, and the root of the mountain ash. In some vegetables hydrocyanic acid does not exist ready formed, but is a product of the process by which it is obtained. This has been fully proved in the case of the bitter almond, and is inferred in other instances.

[§ Acidum Hydrocyanicum Dilutum. *Diluted Hydrocyanic Acid.*

Hydrocyanic acid HC_2N or **HCN** dissolved in water, and constituting 2 per cent. of the solution.

Take of

Yellow Prussiate of Potash	$2\frac{1}{4}$ ounces.
Sulphuric Acid	1 fluid ounce.
Distilled Water	30 fluid ounces or a sufficiency.

Dissolve the prussiate of potash in ten ounces of the water, then add the sulphuric acid previously diluted with four ounces of the water and cooled. Put the solution into a flask or other suitable apparatus of glass or earthenware, to which are attached a condenser and a receiver arranged for distillation; and having put eight ounces of distilled water into the receiver and provided efficient means for keeping the condenser and receiver cold, apply heat to the flask, until by slow distillation the liquid in the receiver is increased to seventeen fluid ounces. Add to this three ounces of the water, or as much as may be sufficient to bring the acid to the required strength, so that one hundred grains (or 110 minims) of it, precipitated with a solution of nitrate of silver, shall yield ten grains of dry cyanide of silver.]

Ferrocyanide of potassium may be regarded as a compound of cyanide of potassium and cyanide of iron. By the action of sulphuric acid and water, one half of the cyanogen is eliminated in the form of hydrocyanic acid, the other half remains combined with the iron and one fourth of the potassium as an insoluble yellow salt (FeK_2FeCy_6), which, however, rapidly decomposes into Prussian blue. The remainder of the potassium forms bisulphate of potash, so that the whole decomposition may be represented thus:—

$$2K_4FeCy + 6H_2SO_4 = FeK_2FeCy_6 + 6KHSO_4 + 6HCy.$$

The bisulphate and the yellow salt remain in the retort, while the hydrocyanic acid, with some water, distils over.

[§ *Characters and Tests.*—A colourless liquid with a peculiar odour. Specific gravity 0·997. It only slightly and transiently reddens litmus. A fluid drachm of it evaporated in a platinum dish leaves no fixed residue. Treated with a minute quantity of a mixed solution of sulphate and persulphate of iron, and afterwards with potash, and finally acidulated with hydrochloric acid, it forms Prussian blue. It gives no precipitate with chloride of barium, but with nitrate of silver it causes a white precipitate ($AgCN$), entirely soluble in boiling concentrated nitric acid; 270 grains of it rendered alkaline by the addition of solution of soda, require 1,000 grain-measures of the volumetric solution of nitrate of silver to be added before a permanent precipitate begins to form, which corresponds to 2 per cent. of the real acid.] Thus:—

$$2NaCy + AgNO_3 = AgCyNaCy + NaNO_3.$$

The instant this double compound ceases to be formed, cyanide of silver is precipitated.

The formation of Prussian blue is thus accounted for. When potash is added to hydrocyanic acid, water and cyanide of potassium are generated. By the reaction of this salt on a protosalt of iron ferrocyanide of potassium is produced. This gives, with the persulphate, Prussian blue. The acid added removes the surplus oxide of iron.

This acid contains rather more than half as much anhydrous acid as acidum hydrocyanicum, Edin.

Physiological Effects. In small or medicinal doses.—Small doses of hydrocyanic acid sometimes relieve certain morbid conditions (as of the stomach), without producing any remarkable alteration in the condition of the general system. If the dose be cautiously increased, and its operation carefully watched, the following effects are usually observed:—a bitter but peculiar taste; increased secretion of saliva; irritation in the throat; frequently nausea; disordered and laborious respiration; pain in the head, giddiness, obscured vision, and sleepiness.

In poisonous doses.—Immediately after swallowing the acid a remarkably bitter taste, sometimes described as hot, is experienced; this is soon followed by a sensation of faintness and giddiness, with salivation, and is succeeded by tetanic convulsions and insensibility; the respiration is difficult and spasmodic; the odour of hydrocyanic acid may be recognised in the breath; the pupils are usually dilated, though sometimes contracted; the pulse is small or imperceptible. When recovery takes place it is usually very rapid, and the whole period of suffering seldom exceeds half an hour. However, exceptions to this exist, in which the symptoms have been prolonged for several hours. Very strong acid, in large doses, begins to operate very speedily, especially if its vapour be inhaled, and death occurs very rapidly. The diluted acid, on the other hand, sometimes does not produce any obvious effect for several minutes, and death may not occur for nearly half an hour.

Local action.—Dr. Christison says that Robiquet's fingers became affected with numbness, which lasted several days, in consequence of their exposure for some time to the vapour of this acid. This effect would appear to depend on the local action of the poison on the nerves,—a mode of action which we are constrained likewise to admit in the case of some other narcotics. The alleviation of gastrodynia by hydrocyanic acid depends probably on this benumbing effect. Some of the local effects produced by hydrocyanic acid are those of an irritant: such are, the acrid impression made by the vapour on the nose and mouth, the ptyalism, the vomiting and purging, and the redness of the mucous membrane of the stomach.

Absorption.—That hydrocyanic acid becomes absorbed is proved by its having been detected in the blood of animals poisoned with it, and by the odour of it exhaled by the breath and from various parts of the body.

Organs affected.—The parts specifically affected by this acid are the brain and true spinal system. The pain in the head, the insensibility, and the coma, are evidence of the cerebral affection; while the tetanic convulsions depend on the disorder of the true spinal system.

Cause of death.—In most cases the immediate cause of death is obstruction of respiration. In some instances it is stoppage of the heart's action. There are cases, however, in which the death is too immediate to be produced by obstructed respiration, while, on opening the chest, the heart is found still beating. This I have observed in experiments on rabbits with strong hydrocyanic acid.

Therapeutics.—In this country, the reputation of hydrocyanic acid as a medicinal agent is chiefly founded on its effects in alleviating certain painful (neuralgic) and spasmodic stomach complaints. Every practitioner is familiar with a stomach complaint, usually termed *gastrodynia*, in which pain of a spasmodic character is the leading symptom. It is not unfrequently accompanied by vomiting and præcordial tenderness, which, however, cannot be regarded as indicative of inflammation, for various reasons; one of which is the alleviation of it often obtained by the use of stimulants and antispasmodics. What may be the precise pathological condition of this malady I know not, but I conceive the affection to be, essentially, a disordered condition of the nerves supplying the stomach, or of the nervous centres from whence those nerves are derived; in other words, it is a gastric neuralgia. It is frequently, but not invariably, accompanied by the irritation of stomach alluded to by Dr. Barlow. But be the proximate cause of the disease what it may, the beneficial effects of the hydrocyanic acid, in some instances of it, are most astonishing; while in others it totally fails. In all the cases in which I have tried it, I have obtained either perfect success or complete failure. I have met with no cases of partial relief. It not only allays pain, but relieves vomiting; and in the latter cases, frequently when all other remedies fail. Dr. Elliotson mentions the following as the stomach affections relieved by it:—1st, those in which pain at the stomach was the leading symptom; 2ndly, those in which the gastrodynia was accompanied by a discharge of fluid, constituting what is called pyrosis, or the water-brash; 3rdly, when the excessive irritability of the stomach produces vomiting; and, 4thly, those disorders of the stomach which, in some of their symptoms, resemble affections of the heart. The late Dr. Prout found it useful in gastrodynia connected with colica pictonum. I have also found it useful in a painful affection of the bowels analogous to that of the stomach, and which, therefore might with propriety be termed *enterodynia*. I have seen hydrocyanic acid used with great success to allay vomiting and purging in severe forms of the ordinary English cholera, when opium has completely failed. In Asiatic or malignant cholera it has occasionally appeared to be serviceable. I have found it successful in checking the diarrhœa of phthisical subjects, when logwood, chalk, and opium had failed. In allaying cough, especially the kind called spasmodic, I have on several occasions found it useful, but it has so frequently disappointed my expectations that I now rarely employ it in any pulmonary diseases. Dr. Roe ascribes to this acid the power of curing simple hooping-cough. He gives it with ipecacuan and tartarated antimony. I have not found this practice so successful as Dr. Roe's reports would lead us to expect.

The *local* employment of the acid has not been attended with very great success. In chronic skin diseases, especially impetigo, prurigo, and psoriasis, the acid has been employed to allay pain and irritation. On several occasions I have tried hydrocyanic washes in prurigo, but without obtaining any relief.

Administration.—It may be given internally in doses of from three to seven minims. As a wash, two fluid drachms of the diluted acid may be employed, mixed with half a pint of distilled or rose water; as a lotion, in skin diseases, frequently about half an ounce of rectified spirit is added; and Dr. A. Thomson recommends, in addition to this, sixteen grains of acetate of lead. The external use of this acid, in all cases (more especially if there be sores), requires great caution.

Antidotes.—The most important agents in the treatment of poisoning by hydrocyanic acid, as well as by the substances which contain it (as cherry-laurel water), are *chlorine*, *ammonia*, *oxide of iron*, *cold affusion*, and *artificial respiration.*

Chlorine is the most powerful of these. It has been strongly recommended by Buchner and Orfila. If solution of chlorine be at hand, this should be given in doses of one or two teaspoonfuls, properly diluted with water. In the absence of this, weak solutions of chlorinated lime, or chlorinated soda, may be administered. The patient should be allowed to inhale, very cautiously, air impregnated with chlorine gas (developed by the action of dilute hydrochloric acid on solution of chlorinated lime).

Ammonia.—The 'spirit of sal ammoniac' was proposed by Mead as an antidote for laurel water; and its value has been admitted by Buchner, Orfila, and Herbst; but it is certainly inferior to chlorine, and, therefore, should be used only in the absence of this. If the patient should be able to swallow, solution of ammonia, diluted with eight or ten parts of water, should be exhibited, and the vapour of ammonia or its carbonate inhaled; the latter practice is most important, and should not be omitted. Orfila says that ammonia is of no use when introduced into the stomach, but that the inhalation of the vapour will sometimes preserve life. Great caution is requisite in the employment of it.

Oxide of iron.—Messrs. T. and H. Smith, of Edinburgh, have recommended, as an antidote, a mixture of the proto- and per-salts of iron, swallowed after a solution of carbonate of potash. The mixed oxides thus produced, on coming into contact with hydrocyanic acid, yield sulphate of potash and Prussian blue. The antidote may be prepared by adding 10 grains of sulphate of iron, and a drachm of tincture of perchloride of iron to a fluid ounce of water contained in one vial; and 20 grains of carbonate of potash to an ounce of water in another vial. The patient is made to swallow the solution of carbonate of potash, and immediately afterwards the ferruginous solution. This quantity will render insoluble nearly 2 grains of hydrocyanic acid.

Cold Affusion has been strongly recommended by Herbst, and is admitted by Orfila to be a valuable remedy. Herbst says that its efficacy is almost certain when it is employed before the convulsive stage of poisoning is over, and that it is often successful even in the stage of insensibility and paralysis. Dr. Taylor also speaks favourably of it.

Artificial Respiration ought never to be omitted. Of its efficacy I am convinced from repeated experiments on animals. To produce respiration, make powerful pressure with both hands on the anterior surface of the chest, the diaphragm being at the same time pushed upward by an assistant. Inspiration is effected by the removal of the pressure, and the consequent resiliency of the ribs.

[§ **Vapor Acidi Hydrocyanici.** *Inhalation of Hydrocyanic Acid.*

Take of

Diluted Hydrocyanic Acid . .	10 to 15 minims.
Water (cold)	1 fluid drachm.

Mix in a suitable apparatus, and let the vapour that arises be inhaled.]

[§ **Benzol.** $C_{12}H_6$ or $\mathbf{C_6H_6}$.

A colourless volatile liquid, obtained from coal-tar. Specific gravity, 0·85.]

This liquid is obtained for commercial purposes, by submitting the more volatile portions of coal naphtha to fractional distillation. The purified naphtha may be made to yield pure benzol by submitting it to cold; benzol is solid, and resembles camphor at temperatures below 32°. The liquid found in commerce is contaminated with homologous hydrocarbons, which boil at higher temperatures.

Pure benzol is a colourless, limpid liquid, of peculiar odour; boiling at 177°, and possessing at 60° a specific gravity ·85. It is a powerful solvent of grease and oily matters generally, as well as of caoutchouc. Benzol, when treated with concentrated nitric acid, yields a nitro-substitution derivative, $\mathbf{C_6H_5NO_2}$, which, contains an atom of $\mathbf{NO_2}$ in place of an atom of the hydrogen of the benzol from which it is obtained. This body, nitrobenzol, is known commonly as *oil of mirbane*, and is extensively employed as a substitute for essential oil of almonds in scenting soap. It is a yellow liquid, oily, boiling at a high temperature, possessing a powerfully sweet taste, and in odour resembling oil of bitter almonds. Nitrobenzol is said by some authorities to be poisonous, although this has been denied by others.

Benzol is not much used medicinally, but extensively, on account of its solvent power, for the removal of grease stains, &c. Its vapour when inhaled acts as an anæsthetic. Large doses taken by the stomach produce narcotic effects, intermediate between those of alcohol and opium. Applied to the skin it has been used very successfully for the destruction of parasites, and it is well suited for this purpose, as it does not affect the skin injuriously. A mixture of 10 parts of benzol, 5 of soap, and 85 of water, may be used for destroying parasites on domestic animals, as well as for some parasitic diseases of man.

[§ **Acidum Carbolicum.** *Carbolic Acid.*

$HO,C_{12}H_5O$ or $\mathbf{HC_6H_5O}$.

Synonym.—Phenic acid.

An acid obtained from coal-tar oil by fractional distillation and subsequent purification.]

This acid, sometimes called Phenol, Hydrate of Phenyl, or Phenic Alcohol, is obtained by treating the heavier coal-tar oils, boiling between 300° and 450° by a solution of soda or by milk of lime. The compounds so produced are decomposed by a mineral acid, and the oily liquid so obtained rectified.

[§ *Characters and Tests.*—In colourless acicular crystals, which at a temperature of 95° become an oily liquid, having a strong odour and taste, resembling those of creasote, which it also resembles in many of its characters and properties. Its specific gravity is 1·065; boiling point 370°. The crystals readily absorb moisture on exposure to the air, and they are thus liquefied; the acid, however, is but slightly soluble in water, but it is freely soluble in alcohol, ether, and glycerine. It does not redden blue litmus paper. A slip of deal dipped into it and afterwards into hydrochloric acid, and then allowed to dry in the air, acquires a greenish-blue colour. It coagulates albumen. It does not affect the plane of polarisation of a ray of polarised light.]

Oil of vitriol dissolves carbolic acid, when pure, without change of colour. Concentrated nitric acid acts violently upon it, giving rise to a yellow crystalline derivative, known as picric, carbazotic, or trinitrophenic acid. It has the composition of carbolic acid in which three atoms of hydrogen have been replaced by peroxide of nitrogen, $C_6\left\{\begin{matrix} H_3 \\ 3NO_2 \end{matrix}\right\}O$; it is much used as a yellow dye.

Carbolic acid and creasote in many respects closely resemble each other. By some persons they have been represented as identical, and on the strength of this carbolic acid has been substituted for creasote in commerce. They have, however, been proved to be distinct bodies, and may be distinguished by their action on a ray of polarised light, creasote turning the plane of polarisation to the right, while carbolic acid produces no such effect.

Therapeutics.—Carbolic acid is used for the same purposes, and in the same way, as creasote. Its use in medicine, however, has principally been as an external application, to correct the fœtor of gangrenous and other offensive sores, and to destroy septic germs which are supposed to be the frequent cause of unhealthy discharges. Mixed by the aid of heat with twice its weight of shellac and thinly spread on calico, it is applied to wounds either directly or over other dressings. Dissolved to saturation in water, it may be used as a wash, or in a more concentrated state, dissolved in glycerine, as ordered in the Pharmacopœia.

Dose, 1 to 3 grains.

[§ **Glycerinum Acidi Carbolici.** *Glycerine of Carbolic Acid.*

Take of

Carbolic Acid	1 ounce.
Glycerine	4 fluid ounces.

Rub them together in a mortar until the acid is dissolved.]

Acidum Sulphocarbolicum. *Sulphocarbolic Acid.*

$HC_6H_5SO_4$.

Synonyms.—Sulphophenic or phenyl-sulphuric acid.

This acid is produced by the action of strong sulphuric acid on carbolic acid, aided by the application of heat. In combination with bases it has been introduced in medicine.

Sodæ Sulphocarbolas. *Sulphocarbolate of Soda.*

$NaC_6H_5SO_4 . H_2O$.

Two volumes of pure carbolic acid are mixed with one volume of oil of vitriol in a flask, and the mixture heated to 280° or 290° for about five minutes. After cooling, the liquid is diluted and saturated with carbonate of soda, evaporated, and crystallised.

Colourless rhombic prisms, odourless, and permanent in the air.

Zinci Sulphocarbolas. *Sulphocarbolate of Zinc.*

$Zn2C_6H_5SO_4. H_2O.$

The acid prepared as in the preceding compound is saturated, with the aid of a gentle heat, with oxide of zinc. The solution is then filtered and allowed to crystallise. The crystals should be dried by exposure to the air.

The sulphocarbolates are said to possess the medicinal properties, while they are free from the strong odour, of carbolic acid. Their therapeutical effects, however, are not fully established.

[§ **Creasotum.** *Creasote.*

A product of the distillation of wood tar.]

History.—This substance was discovered a few years since by Reichenbach, who termed it *creasote*, (κρέας flesh, and σώζω, I preserve), on account of its antiseptic properties.

Preparation.—Creasote is an artificial product. It is prepared from the oil which is obtained by the distillation of wood tar. Those portions of the oil which are heavier than water are freed from adhering acetic acid by carbonate of potash, and are afterwards distilled. A little phosphoric acid is mixed with the product, to neutralise ammonia, and another distillation resorted to. It is next mixed with a strong solution of potash, which combines with creasote, allows any eupion which may be present to collect on its surface, and, by digestion, decomposes other organic matter. The alkaline solution is then neutralised by sulphuric acid, and the oil which separates is collected and distilled. For the complete purification of the creasote, the treatment with potash, followed by neutralisation and distillation, requires to be frequently repeated.

[§ *Characters and Tests.*—A liquid, colourless, or with a yellowish tinge, a strong empyreumatic odour, and sparingly dissolved by water, but freely by alcohol, ether, and glacial acetic acid. Specific gravity 1·071. It coagulates albumen. A slip of deal dipped into it, and afterwards into hydrochloric acid, acquires, on exposure for a short time to the air, a greenish-blue colour. Dropped on white filtering paper and exposed to a heat of 212°, it leaves no translucent stain. It turns the plane of polarisation of a ray of polarised light to the right. It is not solidified by the cold produced by a mixture of hydrochloric acid and sulphate of soda.] Carbolic acid is solid at this temperature.

Properties.—Pure creasote is transparent; has a high refractive power, and an oleaginous consistence. Its odour is that of peat smoke, strong, peculiar, and persistent; its taste burning and caustic. It boils at 426° F., and is fluid at 16·6° F. It is combustible, burning with a sooty flame. It is soluble in caustic potash, and dissolves resins, camphor, fats, and essential oils; and has no acid or alkaline reaction on test-paper.

Impurity.—Creasote is stated to have been mixed with rectified oil of tar, capnomor, and a substance like almond oil. These are readily detected by treating the suspected liquid with acetic acid or solution of potash, in which pure creasote is completely soluble, but not so the adulterated.

With a neutral solution of perchloride of iron, wood creasote, dissolved in alcohol, gives a *green* coloration, whilst an alcoholic solution of coal oil is coloured *brown*. With aqueous solutions, on the contrary, creasote does not change colour, whilst coal-tar creasote furnishes a blue. Creasote from coal forms with collodion a kind of jelly, whilst wood creasote does not gelatinise.

Physiological Effects.—Creasote operates locally as an irritant and caustic. In a concentrated state it is an irritant poison. Applied to the skin it causes heat, redness, and the destruction of the cuticle, which comes away in furfuraceous scales. On the tongue it produces a painful sensation. Placed in contact with a suppurating surface it whitens the part like nitrate of silver. The caustic effect of creasote depends on its union with albumen. Small doses, as one or two minims, produce in most individuals no other unpleasant effect than some sensation of heat in the pharynx, œsophagus, and stomach. Larger doses give rise to nausea, vomiting, vertigo, headache, and heat of head. When given in moderate doses it does not affect the bowels; but when the dose has been considerably augmented, diarrhœa, or even dysentery has been produced—a dose of 120 minims proved fatal in thirty-six hours. The influence of creasote on the urinary organs is sometimes very marked. In some cases it is recognised in the urine by its odour, showing that it has been absorbed, and the urine sometimes acquires a blackish colour from its use. It has been observed to act as a diuretic, and even to cause strangury; so that in its influence over the urinary organs it bears some resemblance to turpentine.

Therapeutics.—As an *internal* remedy creasote has been principally celebrated in this country as a medicine possessing extraordinary powers of arresting vomiting. It has, however, been somewhat overrated. It is decidedly injurious in inflammatory conditions and structural diseases of the stomach; it is most successful in hysterical cases, and sometimes succeeds in pregnancy. It sometimes relieves the chronic vomiting connected with granular disease of the kidneys (Christison), though it frequently fails. In gastrodynia or flatulence it occasionally succeeds, but is admissible in those cases only in which local stimulants are usually found beneficial. Where both hydrocyanic acid and creasote have been separately tried without success, Dr. Elliotson advises their union. Creasote has been found to diminish both the quantity and saccharine quality of the urine in diabetes; I have tried it in this disease without obtaining benefit. Mr. Spinks and Mr. Kesteven have published cases which show the successful employment of creasote in common diarrhœa. The dose given to adults was from two to five drops every three, four, or six, hours, combined with spirit of ammonia. It was seldom found by these gentlemen that the medicine required repetition beyond the second dose. It is particularly serviceable in such cases, on account of its control over the nausea or vomiting which frequently attends diarrhœa.

As an *external* agent, creasote may frequently be employed with great advantage. It has been successfully employed to relieve toothache. After carefully clearing out the cavity of the tooth, a drop of creasote, or an alcoholic solution of it, may be introduced by means of a camel's hair pencil, and the cavity filled with cotton soaked in the liquid. As a local application to chronic skin diseases (porrigo, impetigo, eczema) it is of considerable value. When a caustic application is required, it may be applied undiluted; but for other purposes it is used either in the form of ointment, or dissolved in water as a wash. Creasote may be beneficially applied to foul and indolent ulcers. It serves the double purpose of stimulating the living surface (and thereby of changing the quality of actions going on in the part), and also of preventing the putrefaction of the secreted matters. In hemorrhages creasote acts as a most efficient styptic, partly in consequence of its power of coagulating albuminous liquids, and thereby of causing the formation of a clot, and partly by causing contraction of the bleeding vessels. It has also been employed to check caries, to restrain excessive suppuration, to repress fungous granulations in burns and scalds, and to remove condylomatous and other excrescences. The inhalation of creasote vapour is occasionally useful in relieving excessive bronchial secretion. Dr. Elliotson cured two cases of glanders in the human subject by injecting an aqueous solution of creasote up the affected nostril.

Administration.—Creasote may be given at the commencement of its use in doses of one or two drops, diffused through an ounce of some aromatic water by the aid of mucilage: the dose should be gradually increased. As a caustic, undiluted creasote is applied by means of a camel's hair pencil. Lotions, gargles, or injections of creasote are prepared by dissolving from two to six drops in an ounce of water. A solution of this kind is sometimes mixed with poultices. The inhalation of creasote vapour may be effected by diffusing a few drops of creasote through water or a mucilaginous liquid, and breathing this by means of the ordinary inhaling bottle.

[§ **Mistura Creasoti.** *Creasote Mixture.*

Take of

Creasote	16 minims.
Glacial Acetic Acid	16 minims.
Spirit of Juniper	$\frac{1}{2}$ fluid drachm.
Syrup	1 fluid ounce.
Distilled Water	15 fluid ounces.

Mix the creasote with the acetic acid, gradually add the water, and lastly the syrup and spirit of juniper.]

[§ **Unguentum Creasoti.** *Ointment of Creasote.*

Take of

Creasote	1 fluid drachm.
Simple Ointment	1 ounce.

Mix thoroughly.]

[§ **Vapor Creasoti.** *Inhalation of Creasote.*

Take of

Creasote	12 minims.
Boiling Water	8 fluid ounces.

Mix the creasote and water in an apparatus so arranged that air may be made to pass through the solution, and may afterwards be inhaled.]

POTASSIUM. K or **K** = 39.

History.—Discovered by Davy on October 6, 1807. In combination potassium is found in both kingdoms of nature; in the mineral kingdom in the form of sulphate, nitrate, chloride, silicate, and, perhaps, iodide and carbonate. In organised beings, potassium is met with in the condition of phosphate, sulphate, nitrate, carbonate, and as salts of various organic acids. It is more abundant in vegetables than in animals.

Preparation.—Procured for commercial purposes by reducing at a high temperature carbonate of potash by carbon. It is a bluish-white metal of great lustre. Its specific gravity is ·86507. Its consistence is that of wax. It rapidly attracts oxygen from the air and from moisture, and takes fire when thrown on water or ice, burning with a violet flame. It is usually preserved in Persian naphtha.

[§ **Potassa Caustica.** *Caustic Potash.*

Synonyms. — *Potassæ hydras*, Lond. *Potassa*, Edin.] *Potassa fusa. Hydrate of potassium. Potassic hydrate.*

[§ Hydrate of potash, KO,HO or **KHO**, containing some impurities.]

History.—We learn from Pliny, that soap was made in his time from tallow and wood-ashes; and we may therefore conclude that some method of preparing caustic alkaline solutions was known to the Greeks and Romans. Black, in 1756, first distinguished chemically the caustic alkalies from the carbonates.

Preparation.—[§ Take of

Solution of Potash . . . . . 2 pints.

Boil down rapidly in a silver or clean iron vessel, until there remains a fluid of oily consistence, a drop of which, when removed on a warm glass-rod, solidifies on cooling. Pour this into proper moulds, and when it has solidified, and while it is still warm, put it into stoppered bottles.

Characters and Tests.—In hard white pencils, very deliquescent, powerfully alkaline and corrosive. A watery solution, acidulated by nitric acid, gives a yellow precipitate with perchloride of platinum ($2KCl,PtCl_4$); and only scanty white precipitates with nitrate of silver and chloride of barium (traces of chlorides and sulphates). Fifty-six grains dissolved in water leave only a trace of sediment, and require for neutralisation at least 900 grain-measures of the volumetric solution of oxalic acid.] Pure hydrate of potash is white, and dissolves both in water and alcohol. Its solubility in alcohol enables us to separate it from the carbonate and bicarbonate of potash, both of which are insoluble in this liquid. When purified by solution in alcohol, and subsequent evaporation of the latter, it constitutes the *potasse à l'alcool* of French writers. It has a strong affinity both for water and carbonic acid gas, which it rapidly attracts from the atmosphere, and in consequence becomes liquid. At a low red heat it fuses, and at higher temperatures is volatilised.

Caustic potash is distinguished from the neutral compounds of potassium by communicating a green colour to the infusion of red cabbage or syrup of violets; by reddening turmeric and restoring the blue colour of litmus reddened by an acid; by not effervescing on the addition of an acid; by yielding a brownish-black precipitate (Ag_2O) with nitrate of silver; by its soapy feel; by its solubility in alcohol; and by dissolving recently precipitated hydrate of alumina.

The solid caustic potash of the shops, commonly called *potassa fusa*, is sometimes more or less coloured, and not completely soluble in water and alcohol, in consequence of the presence of foreign matters. These impurities consist chiefly of peroxide of iron, oxide of manganese, carbonate of potash, silica with sulphates and chlorides. It also frequently contains oxide of lead. (See **Liq. Potassæ.**)

Therapeutics.—Caustic potash is sometimes used *as an escharotic*, though its employment is not free from objection; for its great deliquescence occasions some difficulty in localising its action. It may be employed for the production of an issue, and is used thus:—Apply to the part one or two layers of adhesive plaster, in the middle of which is an aperture of the exact size of the intended issue. Then moisten the potash and rub it on the part until discoloration is observed. Wash and apply a linseed-meal poultice, and when the eschar is detached, insert the pea. Issues, however, are more speedily and more conveniently made by the lancet than by caustic. In bites by poisonous animals, as venomous serpents, mad dogs, &c., this caustic may be used with advantage. There are many other cases in which this substance is employed as a caustic: for example, to destroy warts and fungoid growths of various kinds, to destroy varicose veins, and to open abscesses; but for the latter purpose the lancet is generally to be preferred. Its deliquescence may be remedied by the addition of an equal weight of lime, as in the *Potassa cum calce* (Vienna paste), which, when required for use, is made into a paste with spirit of wine.

Potassa cum Calce. *Potash with Lime.* Sometimes called by continental writers *Pasta escharotica Londinensis*, and by English writers *Vienna paste.* A compound of potash and lime was used by the Greeks, under the name of πρωτόστακτον.

Preparation.—Lond., Dubl. Hydrate of potash and lime, of each an ounce, to be rubbed together, and kept in a well-stoppered vessel.

Used as described above, under caustic potash.

[§ **Liquor Potassæ.** *Solution of Potash.*

Take of

Carbonate of Potash	1 pound.
Slaked Lime	12 ounces.
Distilled Water	1 gallon.

Dissolve the carbonate of potash in the water; and, having heated the solution to the boiling-point in a clean iron vessel, gradually mix with it the slaked lime; and continue the ebullition for ten minutes, with constant stirring. Then remove the vessel from the fire; and when, by the subsidence of the insoluble matter, the supernatant liquor has become perfectly clear, transfer it by means of a siphon to a green-glass bottle, furnished with an air-tight stopper, and add distilled water, if necessary, to make it correspond to the tests of specific gravity and neutralising power.]

In this process double decomposition ensues between the carbonate of potash and the lime, resulting in the formation of carbonate of lime and hydrate of potash; the latter remains in solution in the water.

$$K_2CO_3 + Ca2HO = 2KHO + CaCO_3.$$

The liquid should be decanted or drawn off by a siphon, if practicable, as filters are liable to be acted on and partially dissolved by it. Cotton and linen are, however, much less acted on than woollen cloth or paper containing wool.

[§ *Tests.*—Specific gravity 1·058. 462·9 grains by weight (1 fluid ounce), require for neutralisation 482 grain-measures of the volumetric solution of oxalic acid, corresponding to 5·84 per cent. by weight of hydrate of potash, KO,HO or **KHO**. It does not effervesce when added to an excess of diluted hydrochloric acid. Mixed with an equal volume of distilled water it gives no precipitate with solution of lime (absence of carbonate), or oxalate of ammonia (indicating that there is no lime in solution). When it is treated with an excess of diluted nitric acid and evaporated to dryness, the residue forms with water a nearly clear solution (turbidity would point to silica), which may be slightly precipitated by chloride of barium (sulphate), and nitrate of silver (chloride), but is unaffected, or but very slightly affected, by ammonia (indicating only minute quantities of alumina). One fluid ounce contains 27 grains of hydrate of potash.]

Properties.—Liquor potassæ has a soapy feel when rubbed between the fingers, from its property of dissolving the cuticle, and exhibits a powerful alkaline reaction with test-papers. It strongly attracts carbonic acid from the atmosphere, and therefore should be kept in closed vessels. It corrodes flint-glass, and dissolves from it the lead which forms one of its constituents; hence it should be preserved in green-glass bottles. Metallic contamination of this kind is readily detected by adding to the liquor potassæ a drop of solution of sulphide of ammonium; pure solution of potash ought not, under those circumstances, to change colour.

Dose, 15 to 60 minims.

Physiological Effects.—Potash, and its basis potassium, are essential constituents of the human body. They preponderate in the juice of flesh and in the milk. It is obvious, therefore, that they are necessary ingredients of our food; and that, if they be deficient or absent, nutrition will be imperfect. It follows, also, that for the cure of disorders resulting from the use of food deficient in potash, among which Dr. Garrod places scurvy, the administration of this alkali or its salts, and food containing them, is requisite. The local action of potash is exceedingly energetic. It neutralises any free acid in the part to which it is applied; decomposes whatever ammoniacal salts may be present, causing the evolution of ammoniacal gas; and dissolves fibrin, albumen, gelatin, and mucus. Hence, rubbed between the fingers, it corrodes and destroys the epidermis, and thereby gives rise to a soapy feel. As, then, potash forms soluble compounds with substances which enter largely into the composition of the organised tissues, we can readily explain Orfila's observation, that alkalies are of all corrosive poisons those which most frequently perforate the stomach. Nevertheless, Drs. Rees and Taylor assert, in opposition to this statement, that in the few cases that have occurred of poisoning by potash, the stomach has *not* been found perforated. When solution of potash is taken in small doses, and properly diluted, it destroys the acidity of the contents of the stomach, which is essential to the digestion of the albuminous substances. Hence the continued use of it is liable to prove injurious, by altering the chemical properties of the healthy ventricular secretion. Like other alkalies, it may perhaps aid the digestion and absorption of fatty substances. In somewhat larger doses, it acts as a slight irritant, augments the secretions of the alimentary canal, becomes absorbed, and communicates an alkaline quality to the urine. Moreover, the modification thus produced in the quality of the renal secretion is accompanied by an increase in the quantity. By continued use, potash acts as a resolvent, and impoverisher of the blood. The energetic action of solution of potash arises from its causticity, for it is a weak solution, containing only 5·8 per cent. of potash, while carbonate of potash contains 55 per cent.; hence the effect of this carbonate on the urine is much greater.

Therapeutics.—1. As an *antacid*, we resort to the solution of potash in various affections of the digestive organs which are attended with an inordinate acidity of stomach, known by acid eructations, cardialgia, and other dyspeptic symptoms. It must, however, be evident, that the neutralisation of the acid is merely palliative. But the continued employment of alkalies frequently diminishes, temporarily, the tendency to acid secretion. Commonly, it is found that the cases calling for their employment are those benefited by tonics, and hence they are usually given in some tonic infusion; as the infusion of calumbo, or of gentian, or of quassia. Their beneficial effects are frequently manifested in those forms of dyspepsia which result from the use of spirituous liquors. It is also used *to render the urine alkaline, or to diminish its acidity*, in preternatural acidity of urine, especially in lithic acid deposits. But in general, I believe the carbonate or vegetable salts of the alkalies are preferable, in these cases, to the caustic alkalies; as they, especially the latter, are far more effective in rendering the urine alkaline, and are less injurious to the digestive organs. Solution of potash is well known only to render the urine alkaline after long use. Dr. Farre has given it in 2-drachm doses, three times a day for six weeks, or longer, without producing this effect. The alkalies act as solvents for lithic acid, as the alkaline lithates are more soluble than the free acid. They also probably prevent the formation of this acid, or neutralise the free acid in the urine, which is the immediate cause of the precipitation of the lithic acid. As a lithonlytic, caustic potash has been exhibited both by the mouth and by injection into the bladder. In *irritable conditions of the urinary organs*, a combination of solution of potash and opium will be frequently found most beneficial, notwithstanding that alkalies are classed among the incompatibles of the latter substance. This combination I have also frequently found useful in allaying *uterine irritation.* In *rheumatism* and *gout*, especially when attended with lithic acid deposits in the urine, it may be advantageously administered.

2. As a *resolvent* and alterative in *induration and enlargement of the lymphatic and secreting glands*—for example, in bronchocele, mammary tumours, affections of the testicle, diseases of the mesenteric glands, induration of the liver and salivary glands, &c.—solution of potash has been used with benefit. Dr. Seymour recommends it in malignant disease of the ovaries, in as large doses as the stomach will bear. I have seen it remarkably beneficial in excessive enlargement of the lenticular or glandular papillæ at the base of the tongue. In *syphilis* and *scrofula*, it has been employed with advantage. Some of the most obstinate and troublesome forms of the venereal disease frequently occur in scrofulous subjects, in whom mercury is not only useless, but absolutely prejudicial. In cases of this kind, solution of potash, taken in the compound decoction of sarsaparilla, is often very serviceable. In scrofula, the long-continued use of potash has been attended with remarkably beneficial effects. Potash was most extensively employed by Mr. Brandish, during many years, in the treatment of scrofula and other chronic diseases, and, according to his report, with singular success. It is, however, more successful in young than in old persons, and in those of fair and light complexion than in the dark and the swarthy. In *chronic skin diseases*, especially psoriasis, pityriasis, lepra, acne, and lichen, the long-continued employment of potash is sometimes attended with relief. In acne punctata, a weak alkaline solution (as half a drachm of solution of potash in a pint of soft water) is often employed, with the aid of a coarse towel and friction, to remove the thick sebaceous secretion from the follicles.

3. As a *diuretic in dropsy*, solution of potash is often employed,

especially when this disease arises from glandular enlargements, or other causes likely to be relieved by alkaline remedies. Dr. Farre has seen ovarian dropsy disappear entirely under its use in full and long-continued doses, the urine continuing acid all the time.

4. As an *expectorant* in *chronic bronchitis* with a very rough and viscid secretion, solution of potash is used to diminish the viscidity of the mucus.

Dose, 20 minims to 2 fl. dr. in table-beer, milk, or with syrup of orange peel.

[§ **Potassæ Carbonas.** *Carbonate of Potash.*

KO,CO_2 or $\mathbf{K_2CO_3}$ with about 16 per cent. of water of crystallisation.

Obtained from commercial pearlash, the product of lixiviation of wood-ashes, by treating the pearlash with its own weight of distilled water, and evaporating the solution so formed to dryness, while it is kept briskly agitated.]

Synonyms.—Salt of tartar; carbonate of potassium; potassium or potassic carbonate.

History.—It is probable that the ancient Greeks, Romans, and Egyptians were acquainted with this salt, but for a long period it was confounded with carbonate of soda. It is stated to have been found in the waters of Wuissokon, and in the chalybeate of Twer. It is formed during the combustion of inland plants, by the decomposition of the vegetable salts of potash (acetate, malate, tartrate, and oxalate) which they contain. Hence it is procured in great abundance from wood-ashes.

Preparation.—*a. Of potashes and pearlashes.* These are obtained from *wood-ashes*, which are procured by burning wood piled in heaps on the ground, sheltered from the wind, or in pits. The soluble constituents of the ashes are *carbonate, sulphate, phosphate, silicate, and chloride of potassium, and chloride of sodium.* The insoluble constituents are *carbonate and phosphate of lime, alumina, silica, the oxides of iron and manganese, and a dark carbonaceous matter.* In America the ashes are lixiviated in barrels with lime, and the solution evaporated in large iron pots or kettles, until the mass has become of a black colour and of the consistence of brown sugar. In this state it is called, by the American manufacturers, *black salts.* The dark colour is said by Dumas to be owing to *ulmate of potash.* To convert this substance into the *potashes* of commerce, it is heated for several hours, until the fusion is complete, and the liquid becomes quiescent. It is then transferred by large iron ladles into iron pots, where it congeals in cakes. Its colour varies somewhat, but it is usually reddish, in consequence of the presence of peroxide of iron.

To make the substance called *pearlash*, the mass called *black salts*, instead of being fused, is transferred from the kettles to a large oven-shaped furnace, constructed so that the flame is made to play over the alkaline mass, which in the meantime is stirred by means of an iron rod. The ignition is in this way continued until the combustible impurities are burnt out, and the mass, from being black becomes dirty bluish-white, having somewhat of a pearly lustre, whence the name *pearlash.* The colouring matter is probably in this case manganate of potash.

β. *Of Refined Potashes. Carbonate of Potash B. P.*—This is obtained from commercial pearlash, by treating it with its own weight of distilled water, and with brisk agitation, evaporating to dryness the solution drained from the undissolved matters.

By employing in this way a quantity of water insufficient for the complete solution of the salt, the impurities, being less soluble than the carbonate, are to a considerable extent excluded.

γ. *Of pure Carbonate of Potash.*—Pure carbonate of potash may be most readily obtained by heating the bicarbonate of potash to a low red heat; the salt loses carbonic acid and water, and is converted into the carbonate. When the acid tartrate is ignited, various volatile substances are evolved, and the residue in the crucible is a mixture of charcoal and carbonate of potash, and is denominated *black flux.* If made with crude tartar, which contains nitrogen, it is contaminated with cyanide of potassium. By roasting, the charcoal is burnt off, and nearly pure carbonate of potash is obtained from the residue by lixiviation. The carbonate thus produced is called *salt of tartar*; it is comparatively pure. By deflagrating a mixture of equal parts of acid tartrate of potash and nitrate of potash, we obtain carbonate of potash contaminated with hyponitrite and even with some undecomposed nitrate of potash. The residue is called *white flux.* The high price of pearlash has occasionally led to the manufacture of carbonate of potash from *sal enixum* (bisulphate of potash), by heating it in a reverberatory furnace with charcoal. This yields a sulphide of potassium, in consequence of the carbon deoxidising the bisulphate. By roasting, this sulphide is decomposed, and converted into carbonate of potash, the sulphur being dissipated. Mr. Spence, of Manchester, has improved upon the process of procuring carbonate of potash, by passing carbonic acid into solutions of sulphide of barium and sulphate of potash at the ordinary temperature, having previously raised the temperature of the gas to 200° Fahr. By this means the decomposition is effectually accomplished. The sulphate of baryta deposited may be reconverted into sulphide of barium with carbonaceous matter in the usual way.

The carbonate of potash of the Pharmacopœia is obtained as described under β, and should answer to the following

[§ *Characters and Tests.*—A white crystalline powder, alkaline and caustic to the taste, very deliquescent, readily soluble in water but insoluble in spirit, effervescing with diluted hydrochloric acid, and forming a solution with which perchloride of platinum gives a yellow precipitate. ($2KCl,PtCl_4$.) Loses about 16 per cent. of its weight when exposed to a red heat. When supersaturated with nitric acid and evaporated to dryness, the residue is almost entirely soluble in water, only a little silica remaining undissolved, and the solution is precipitated only faintly by chloride of barium and nitrate of silver. Eighty-three grains require for neutralisation at least 980 grain-measures of the volumetric solution of oxalic acid.

20 grains Carbonate of Potash } neutralise { 17 grains Citric Acid or 18 grains Tartaric Acid.]

If, before saturation with nitric acid, nitrate of silver gives with the solution a brown precipitate (oxide of silver), this would indicate the presence of free alkali. Other impurities mentioned by L. Gmelin are phosphate of potash, nitrate or nitrite of potash, cyanide of potassium, soda, and carbonate of lime. To detect the phosphate, dissolve in acetic acid and add a drop of solution of perchloride of iron : a yellowish-white cloud of ferric phosphate will be formed. If nitrate or nitrite be present, dissolve in oil of vitriol and add a solution of sulphate of iron, when a purple or brown coloration will be perceived at the junction of the two strata of liquid. Cyanide of potassium is detected by adding a solution of the mixed sulphates of iron, and then hydrochloric acid,—Prussian blue is formed. To detect soda, saturate with acetic acid, evaporate to dryness, dissolve the residue in spirit of wine, and precipitate the potash by perchloride of platinum ; add sulphuric acid to the filtered liquor and evaporate, and ignite the residue: then treat with water, evaporate the solution thus obtained, and by cooling easily-recognised crystals of sulphate of soda are obtained. The soda may be more readily detected by converting it to common salt by hydrochloric acid, and noticing the intense yellow colour given by it to the flame of alcohol. Some carbonate of lime is held in solution by carbonate of potash, but by long standing it is deposited. To detect it, saturate with acetic acid, and then add oxalic acid ; a white precipitate of oxalate of lime is obtained.

The liquid formed by allowing the salt to deliquesce constitutes the *oleum tartari per deliquium* of ancient pharmacy. Pure carbonate of potash may, though with some difficulty, be crystallised from its aqueous solution ; the crystals are rhombic octahedra.

Physiological Effects.—Its effects are in *quality* precisely those of caustic potash already described, but their *intensity* is much less, on account of the presence of carbonic acid, which diminishes the alkaline properties of the base. When it is taken into the stomach in large quantities, it acts as a powerfully caustic poison, sometimes inducing death in twelve hours, and producing symptoms of irritation somewhat resembling those caused by the mineral acids ; at other times, however, the patient recovers from the immediate effects of the alkali, but, in consequence of the altered condition of the alimentary canal, the assimilative process cannot be carried on; and after dragging on a miserable existence for a few weeks, the unfortunate sufferer dies of absolute starvation. And lastly, in some cases, the caustic operation of the poison is principally confined to the œsophagus, causing stricture and death.

Therapeutics.—This salt is employed, in medicine, in most of the cases already mentioned when describing the uses of caustic potash. For example: as an antacid in dyspeptic affections; in that form of lithiasis which is accompanied with an increased secretion of lithic acid, or the lithates; in gout, &c. and as a diuretic.

Administration.—Dose, from 10 to 30 gr. in water or other liquid.

Antidotes.—When swallowed as a poison, the antidotes are oils or acids.

[§ **Potassæ Bicarbonas.** *Bicarbonate of Potash.*
$KO,HO,2CO_2$ or $\mathbf{KHCO_3}$.]

Synonyms.—Acid carbonate of potassium; hydrogen potassium carbonate.

History.—This salt, formerly called *carbonate of potash* or *aërated kali*, was first prepared by Cartheuser, in 1757.

Preparation.—[§⁂ Take of

Carbonate of Potash . .	1 pound.
Distilled Water . .	2 pints.
Hydrochloric Acid . .	1½ pint.
Water	3 pints.
White Marble, in fragments	1 pound or a sufficiency.

Dissolve the carbonate of potash in the distilled water, and filter the solution into a three-pint bottle. Introduce the marble into any suitable apparatus, so that, by the action of the hydrochloric acid diluted with the water, carbonic acid may be generated from it, and passed under slight pressure into the solution of carbonate of potash. The apparatus employed should be so arranged as to work automatically, keeping excess of carbonic acid gas constantly in contact with the solution. At the end of about a week crystals of bicarbonate will have formed: these are to be washed with a little cold distilled water, drained, and dried. The mother liquor, filtered if necessary, and concentrated to one-half at a temperature of 110°, will yield more crystals.]

By the addition of water and carbonic acid gas, one molecule of carbonate of potash is made to furnish two molecules of the bicarbonate; thus:—

$$\mathbf{K_2CO_3 + H_2O + CO_2 = 2KHCO_3}.$$

[§ *Characters and Tests.*—Colourless right-rhombic prisms, not deliquescent, of a saline feebly alkaline taste, not corrosive. Diluted hydrochloric acid causes strong effervescence, forming a solution with which perchloride of platinum gives a yellow precipitate. Fifty grains exposed to a low red heat leave thirty-four and a half grains of a white residue, which require for exact saturation 500 grain-measures of the volumetric solution of oxalic acid.

20 grains Bicarbonate of Potash neutralise 14 grains Citric Acid, or 15 grains Tartaric Acid.]

It is soluble in four times its weight of water at 60° F., but is insoluble in alcohol. When exposed to the air, it undergoes no change. At a red heat, it gives out carbonic acid and water, and becomes the carbonate. From the carbonate of potash it is best distinguished by a solution of corrosive sublimate, which causes only a slight white precipitate or opalescence with it; whereas with the carbonate it causes a copious brick-red precipitate. This test, however, will not, under all circumstances, detect the carbonate; as when the quantity is very small, or when chloride of sodium is present. Sulphate of magnesia, which precipitates the carbonate, gives no precipitate with the bicarbonate until the mixture has been boiled. Neither this nor any other test will prove the total absence of carbonate.

Physiological Effects.—The effects of this salt are similar to those of carbonate of potash, except that its local action is much less energetic, in consequence of the additional atom of carbonic acid. Hence it is an exceedingly eligible preparation in cases where we want its constitutional, and not its local, action. The neutral salts of potash, combined with vegetable acids, undergo oxidation in the blood, and are transformed into bicarbonates.

Therapeutics.—It may be employed for the same purposes as caustic potash, except that of acting as an escharotic. Thus it is used as an antacid, to modify the quality of urine, in glandular diseases, and affections of the urinary organs. But its most frequent use is that for making effervescing draughts, with either citric or tartaric acid. Where there is great irritability of stomach, I believe the effervescing draught, made with bicarbonate of potash and citric acid, to be more efficacious than that made with bicarbonate of soda and tartaric acid. The citrate of potash which is formed promotes slightly the secretions of the alimentary canal, the cutaneous transpiration, and the renal secretion; and, like other vegetable salts of potash, renders the urine alkaline.

Administration.—Dose, 10 to 30 grains or more.

[§ LIQUOR POTASSÆ EFFERVESCENS. *Effervescing Solution of Potash.*

Synonyms.—Aqua potassæ effervescens. Potash water.

Take of

Bicarbonate of Potash	30 grains.
Water	1 pint.

Dissolve the bicarbonate of potash in the water and filter the solution; then pass into it as much pure washed carbonic acid gas, obtained by the action of sulphuric acid on chalk, as can be introduced with a pressure of seven atmospheres. Keep the solution in bottles securely closed, to prevent the escape of the compressed gas.

Characters and Tests.—Effervesces strongly when the containing vessel is opened, carbonic acid gas escaping. The liquid is clear and sparkling, and has an agreeable acidulous taste. Ten fluid ounces, after being boiled for five minutes, require for neutralisation 150 grain-measures of the volumetric solution of oxalic acid. Five fluid ounces evaporated to one-fifth and twelve grains of tartaric acid added yield a crystalline precipitate, which, when dried, weighs not less than twelve grains.]

[§ **Potassa Sulphurata.** *Sulphurated Potash.*

Synonyms.—Potassii sulphuretum, *Lond.*, *Ed.* Hepar sulphuris, *Dub.*]

History.—First prepared by Albertus Magnus.

Preparation.—[§ Take of

Carbonate of Potash, in powder . .	10 ounces.
Sublimed Sulphur	5 ounces.

Mix the carbonate of potash and the sulphur in a warm mortar, and, having introduced them into a Cornish or Hessian crucible, let this be heated, first gradually, until effervescence has ceased, and finally to dull redness, so as to produce perfect fusion. Let the liquid contents of the crucible be then poured out on a clean flagstone, and covered quickly with an inverted porcelain basin so as to exclude the air as completely as possible while solidification is taking place. The solid product thus obtained should, when cold, be broken into fragments, and immediately enclosed in a green-glass bottle, furnished with an air-tight stopper.]

When sulphur and carbonate of potash are fused together, water and carbonic acid are evolved. A portion of the carbonate of potash remains undecomposed. Assuming that a sulphide of potassium and sulphate of potash are produced, the following equation represents the changes:—

$$5S_2 + 4K_2CO_3 = K_2SO_4 + 3K_2S_3 + 4CO_2.$$

The reaction, however, is never so neat; sulphite, hypo-sulphite, and other compounds being simultaneously formed.

[§ *Characters and Tests.*—Solid greenish fragments, liver-brown when recently broken, alkaline, and acrid to the taste, readily forming with water a yellow solution, which has the odour of sulphuretted hydrogen, and evolves it freely when excess of hydrochloric acid is dropped into it, sulphur being at the same time deposited. The acid fluid, when boiled and filtered, is precipitated yellow by perchloride of platinum, and white by chloride of barium. About three-fourths of its weight are dissolved by rectified spirit] (showing a due proportion of sulphide of potassium, which is soluble in spirit, the sulphate and carbonate of potash being insoluble.)

Properties.—Exposed to the air it undergoes decomposition, from the action of aqueous vapour and oxygen. It becomes green and moist, and ultimately whitish. This change depends on the absorption of oxygen, in consequence of which part of the sulphur is deposited, while a portion of the sulphide of potassium is converted into hyposulphite, afterwards into sulphite, and ultimately into sulphate of potash. Sulphide of potassium is soluble in water, and the solution has a strong alkaline reaction.

Physiological Effects.—In *small doses* (as from four to ten grains) it acts as a general stimulant; increasing the frequency of the pulse, augmenting the heat of the body, promoting the different secretions, more especially those of the mucous membranes, and sometimes exciting local irritation, marked by pain, vomiting, and purging. In *large doses* it is an energetic narcotico-acrid poison. Its local action is that of a powerful irritant; hence the acrid taste, burning pain, and constriction in the throat, gullet, and stomach, with vomiting and purging. But the nervous system is also affected; as is proved by the faintness, the almost imperceptible pulse, the convulsions, and (in some cases) sopor. These symptoms are analogous to those caused by sulphuretted hydrogen, which, in fact, is copiously developed in the stomach. It probably acts chemically on the blood, like sulphuretted hydrogen.

Therapeutics.—Internally, it has been administered in very obstinate skin diseases, such as lepra and psoriasis, which have resisted all the ordinary means of cure. It has also been employed as a resolvent in glandular enlargements. Externally it is applied in the form of lotions, baths, or ointment, in chronic skin diseases, such as eczema, scabies, lepra, and pityriasis, and in lead poisoning.

Administration.—Internally it may be administered in the *dose* of three or four grains gradually increased. It may be given either in solution, or in the form of a pill made with soap. For external use it is employed in solution in water, either as a bath or wash, or in the form of ointment. *Lotions* are sometimes made by dissolving an ounce of the sulphurated potash in two or three quarts of water. The *ointment* is composed of thirty grains of sulphurated potash to one ounce of lard. The *sulphur bath* is made by dissolving four ounces in thirty gallons of water.

Antidotes.—In the event of poisoning by this substance, the antidote is a solution of chlorinated soda or of chlorinated lime.

Potassæ Bisulphas. *Bisulphate of Potash.*
$KO,HO,2SO_3$ or $\mathbf{KHSO_4}$.

Synonyms.—Acid sulphate of potash or of potassium. Potassium hydrogen sulphate. Hydro-potassic sulphate. Sal enixum.

Preparation.—By adding a little sulphuric acid to the residue left after the distillation of nitric acid, boiling down, and setting aside the solution that crystals may be formed.

Characters.—Crystallises from a strongly acid solution in rhomboidal tables which fuse at a heat below redness. It has a very acid taste, reacts strongly as an acid on vegetable colours, and decomposes the carbonates with effervescence. It is very soluble in water, but is partially decomposed by that liquid and the solution deposits neutral sulphate of potash. By a red heat it is decomposed, and is then converted into the neutral sulphate.

[§ **Potassæ Sulphas.** *Sulphate of Potash.*
KO,SO_3 or $\mathbf{K_2SO_4}$.]

Synonyms.—Sulphate of potassium. Potassium or dipotassic sulphate. Sal polychrest. Sal de duobus.

History.—The mode of preparing sulphate of potash was taught by Oswald Croll in 1643.

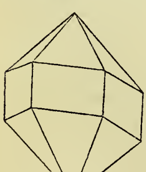
Preparation.—It is prepared from the residuum of the distillation of nitric acid, by dissolving it in water and neutralising exactly by the addition of carbonate of potash or of lime. The solution is then filtered, evaporated, and crystallised.

The residue left after the action of sulphuric acid on nitre consists chiefly of acid sulphate of potash; when carbonate of potash is employed to neutralise, the following change occurs:—

$$\mathbf{2KHSO_4 + K_2CO_3 = 2K_2SO_4 + H_2O + CO_2}.$$

The carbonic acid escapes with effervescence, and the liquid then contains neutral sulphate of potash.

The addition of the lime removes the excess of acid forming sulphate of lime, which is removed by filtration.



[§ *Characters and Tests.* — In colourless, hard, six-sided prisms, terminated by six-sided pyramids; decrepitates strongly when heated; sparingly soluble in water; insoluble in alcohol. The aqueous solution is neutral to test-paper, gives no precipitate with oxalate of ammonia, but acidulated with hydrochloric acid, it is precipitated white by chloride of barium, and yellow by perchloride of platinum.]

Properties.—Crystals of sulphate of potash are inodorous, have a saline bitter taste, and are unchanged by exposure to the air. At 60° F. they require sixteen times their weight of water to dissolve them; they are insoluble in alcohol. A solution of them is decomposed by tartaric acid, which forms crystals of acid tartrate of potash.

The crystals contain no water of crystallisation.

Sulphate of potash is useful, on account of its hardness and dryness, for triturating with and dividing powders, as in *Pulv. Ipecac. Co.* and *Pil. Coloc. Co.*

Physiological Effects.—Sulphate of potash, when given in moderate doses, usually operates as a mild purgative, without occasioning heat, pain, or any other symptoms of irritation. In doses of from fifteen to thirty grains, I have used it in hundreds of cases, in combination with a third part of powdered rhubarb, without having ever witnessed any injurious effects therefrom. I have also given it, but more rarely, in doses of a drachm, also combined with rhubarb, and without any ill consequences. Many of the patients to whom I have administered it were labouring under mild diarrhœa. In all cases it has appeared to act as a mild and safe purgative. The objections to its employment are its slight solubility, and that when given in large doses to children it is apt to produce vomiting. Recently evidence has been adduced of its poisonous and even fatal effects when administered in large doses. In some of these cases one or two ounces were taken. The symptoms were scarcely those of inflammation, but rather resembling those of cholera—abdominal pain, vomiting, purging, cramps of the extremities, and great exhaustion. The immediate cause of death was not obvious, but on the whole I am disposed to attribute it to the absorption of the salt.

Therapeutics.—Sulphate of potash has been found serviceable as a mild *laxative* in disordered conditions of the alimentary canal, as at the commencement of mild diarrhœa, in dyspepsia, hepatic disorders, and hemorrhoidal affections. It is best given in these cases in combination with rhubarb. Thus from five to ten grains of rhubarb with from fifteen grains to a drachm of this salt will be usually found to act mildly and efficiently. As a *lactifuge*, or repressor of the milk, it has been much used by some of the French accoucheurs of the last century. Levret also considered it a valuable purgative in the disorders of childbed, especially puerperal fever. It has been esteemed an excellent *aperient* for children. Its powder, on account of its hardness and solubility, is an excellent dentifrice; the only objection to its use is its taste.

Dose.—It is given in doses of from 15 to 60 grains.

Potassii Chloridum. *Chloride of Potassium.* KCl or **KCl.**

This salt is obtained from kelp, and also from sea-water. It has been found in large quantities, forming part of an immense saline deposit overlying the rock-salt in the salt mines of Stassfurth in Saxony. This deposit, which has been named *carnallite*, is a double chloride of potassium and magnesium ($\mathbf{KCl.MgCl_2 6H_2O}$). Chloride of potassium is also obtained as a secondary product in various chemical processes. It is found in cubical crystals on the surface of many vegetable extracts.

Its medicinal properties resemble those of common salt. It was employed in medicine in the seventeenth century.

Liquor Potassæ Chloratæ. *Solution of Chlorinated Potash.*

A watery solution of hypochlorite and chloride of potassium (prepared by passing chlorine gas into carbonate) constitutes the Eau de Javelle or chlorinated solution of potash. [See **Liq. Sodæ Chloratæ.**]

[§ **Potassæ Chloras.** *Chlorate of Potash.* KO,ClO_5 or $\mathbf{KClO_3}$.]

History.—First obtained in 1786 by Mr. Higgins, who mistook it for nitre.

Synonyms.—Chlorate of potassium; potassium or potassic chlorate; formerly oxymuriate or hyperoxymuriate of potash.

Preparation.—[§ Take of

Carbonate of Potash . . .	20 ounces.
Slaked Lime	53 ounces.
Distilled Water	a sufficiency.
Black Oxide of Manganese . .	80 ounces.
Hydrochloric Acid	24 pints.

Mix the lime with the carbonate of potash, and triturate them with a few ounces of the water so as to make the mixture slightly moist. Place the oxide of manganese in a large retort or flask, and, having poured upon it the hydrochloric acid, diluted with six pints of water, apply a gentle sand heat, and conduct the chlorine as it comes over, first through a bottle containing six ounces of water, and then into a large carboy containing the mixture of carbonate of potash and slaked lime. When the whole of the chlorine has come over, remove the contents of the carboy, and boil them for twenty minutes with seven pints of the water; filter and evaporate till a film forms on the surface, and set aside to cool and crystallise. The crystals thus obtained are to be purified by dissolving them in three times their weight of boiling distilled water and again allowing the solution to crystallise.]

According to the less modern processes for the preparation of this salt, in which chlorine gas was passed into a solution of carbonate or of hydrate of potash, five-sixths of the potash is converted into chloride of potassium, a comparatively worthless compound. The process of the present Pharmacopœia resembles that which is adopted by manufacturers, chloride of *calcium* instead of potassium being among the results of the reaction. The chlorine, on passing into the mixture of carbonate of potash and lime, effects a reaction, which closely resembles that which is brought about when iodine is added to solution of potash. (See **Iodide of Potassium.**)

$$K_2CO_3 + 6Ca2HO + 6Cl_2 = 2KClO_3 + 5CaCl_2 + CaCo_3 + 6H_2O$$

Here under the influence of the chlorine, the carbonate of potash is decomposed by a portion of the lime, whilst a *chloride* of one metal and a *chlorate* of the other are produced.

The water dissolves out the chlorate of potash and chloride of calcium, the residue consisting of the excess of lime and carbonate of lime. On cooling the chlorate crystallises, and is very easily freed from chloride of calcium, in consequence of their great difference of solubility.

At the termination of the process, the mass and its solution acquire a more or less decided pink colour. This, which is a pretty good rough indication that the action of the chlorine has been continued sufficiently long, is probably due to the formation of traces of permanganate from minute quantities of manganese mechanically carried over with the chlorine.

[§ *Characters and Tests.*—In colourless rhomboidal crystalline plates, with a cool saline taste, sparingly soluble in cold water. It explodes when triturated with sulphur. Its solution is not affected by nitrate of silver, or oxalate of ammonia (showing its freedom from chloride of potassium and from lime). By heat it fuses, gives off oxygen gas, and leaves a white residue, readily forming with water a neutral solution, which is precipitated white by nitrate of silver (**AgCl**), and yellow by perchloride of platinum ($2KClPtCl_4$)].

Properties.—100 parts of water at 32° F. dissolve 3·5 parts of chlorate; at 59° F. 6 parts; at 120 F. 19 parts. When thrown on a red-hot coal it deflagrates—a property, however, common to several other salts. Sulphuric acid gives it an orange colour, evolves peroxide of chlorine (Cl_2O_4), known by its greenish-yellow colour, and explosion when heated. Mixed with hydrochloric acid, and then with water, it evolves chlorine, dissolves gold, and forms a bleaching liquid.

100 parts yield by heat 39·2 parts by weight of oxygen, and leave a residue, **KCl**, which should weigh 60·8.

Physiological Effects.—It becomes absorbed into the blood, and is eliminated by the kidneys. It appears to act as a refrigerant and diuretic, like nitrate of potash. Wöhler and Stehberger recognised it in the urine of patients to whom it had been exhibited; so that it does not appear to undergo any chemical change in its passage through the system. This fact is fatal to the hypothesis of the chemico-physiologists, who fancied that it gave oxygen to the system.

Therapeutics.—Chlorate of potash was originally used as a medicine for supplying oxygen to the system, where a deficiency of that principle was supposed to exist. More recently, it has been used by Dr. Stevens and others as a remedy for fever, cholera, and other malignant diseases, which, he supposes, depend on a deficiency of the saline matters in the blood; but as it has been usually employed in conjunction with common salt and carbonate of soda, it is impossible to declare what share the chlorate had in producing the beneficial effects said to have been obtained by what is called the *saline* treatment of these diseases. Dr. Farre says it forms a very useful drink in fever, both relieving thirst and cleaning the tongue. It is chiefly, however, employed in scarlatina, cynanche maligna, stomatitis, and cancrum oris. Cotton wool impregnated with a concentrated solution has been employed as a moxa.

Administration.—The usual dose of it is from ten to fifteen grains to half a drachm. As a fever drink sixty grains may be dissolved in a pint of water, and drunk in the course of twenty-four hours.

[§ **Potassii Iodidum.** *Iodide of Potassium.* KI or **KI**.]

Synonyms.—Hydriodate of potash. Potassium or potassic iodide.

Natural History.—Iodide of potassium is by some said to exist in sea-water and marine organisms, but the fact is not certainly established.

Preparation.—[§ Take of

Solution of Potash . . .	1 gallon.
Iodine	29 ounces, or a sufficiency.
Wood Charcoal, in fine powder	3 ounces.

Put the solution of potash into a glass or porcelain vessel, and add the iodine in small quantities at a time with constant agitation, until the solution acquires a permanent brown tint. Evaporate the whole to dryness in a porcelain dish, pulverise the residue, and mix this intimately with the charcoal. Throw the mixture, in small quantities at a time, into a red-hot iron crucible, and, when the whole has been brought to a state of fusion, remove the crucible from the fire and pour out its contents. When the fused mass has cooled, dissolve it in two pints of boiling distilled water, filter through paper, wash the filter with a little boiling distilled water, unite the liquids, and evaporate the whole till a film forms on the surface. Set it aside to cool and crystallise. Drain the crystals, and dry them quickly with a gentle heat. More crystals may be obtained by evaporating the mother liquor and cooling. The salt should be kept in a stoppered bottle.]

In this process iodide of potassium and iodate of potash are first produced, $3I_2 + 6KHO = 5KI + KIO_3 + 3H_2O$. When the dried salt is fused with charcoal, the iodate is decomposed, the whole being then converted into iodide, carbonic oxide escaping,

$$KIO_3 + 3C = KI + 3CO.$$

[§ *Characters and Tests.*—In colourless, generally opaque, cubic crystals, readily soluble in water, and in a less degree in spirit. It commonly has a feeble alkaline reaction; its solution mixed with mucilage of starch gives a blue colour on the addition of a minute quantity of solution of chlorine. It gives a crystalline precipitate with tartaric acid (showing that it contains iodine and potassium). The addition of tartaric acid and mucilage of starch to its watery solution does not develop a blue colour. Solution of nitrate of silver added in excess forms a yellowish-white precipitate (**AgI**), which, when agitated with ammonia, yields by subsidence a clear liquid in which excess of nitric acid causes no turbidity. Its aqueous solution is only faintly precipitated by the addition of saccharated solution of lime.]

The tests show the absence of iodates, chlorides, and carbonates. The addition of tartaric acid to a solution of iodide of potassium gives hydriodic acid, which has no action on starch. It also produces iodic acid, if iodates are present, which, reacting on the hydriodic acid, liberates iodine and develops the blue colour,

$$5HI + HIO_3 = 3I_2 + 3H_2O.$$

Iodide of potassium also sometimes contains sulphates and bromides. Sulphates may be detected by chloride of barium, which occasions a white precipitate, insoluble in nitric acid. Bromides may be detected as follows :—Add to a solution of the suspected iodide a solution of one part of sulphate of copper and two and a quarter parts of sulphate of iron : the whole of the iodine is thrown down in the form of iodide of copper (Cu_2I_2), but the bromine, as well as any chlorine which may be present, remains in solution. The bromine is then to be detected in the mixed liquid by adding a solution of chlorine (or hydrochloric acid and chlorinated lime) and then some ether : the chlorine disengages the bromine, which dissolves in the ether, to which it communicates a hyacinth red colour. Iodide of potassium readily becomes contaminated with *metallic matter* derived from the vessels in which it is crystallised. I have procured samples of it, in octahedral crystals, which contain traces of lead and tin, derived, I presume, from the metallic vessels in which the salt had been prepared. Such impurities may easily be detected with sulphuretted hydrogen.

Properties.—Its taste is acrid saline, somewhat similar to common salt. It fuses at a red heat, and at a very high temperature volatilises unchanged. It decrepitates when heated. Its aqueous solution dissolves iodine. Besides the starch test mentioned above, its character as an iodide may also be recognised by the following tests: —A solution of corrosive sublimate occasions a vermilion-red precipitate (*red iodide of mercury*) soluble in excess of either reagent. A solution of acetate of lead produces a yellow precipitate (*iodide of lead*). Neutral nitrate of mercury or calomel occasions the formation of *green iodide of mercury.* Perchloride of platinum renders the solution brownish-red, $\mathbf{PtI_4}$. When oil of vitriol and heat are applied to iodide of potassium violet-coloured vapours of iodine are evolved.

Physiological Effects.—Both the physiological effects and therapeutical uses of iodide of potassium show that its operation is analogous to that of iodine.

The *local action* of iodide of potassium is that of an irritant. When taken internally in large doses, it not unfrequently occasions nausea, vomiting, pain and heat of stomach, and purging, but it is much less energetic in its action than free iodine; and therefore may be given in larger doses, and continued for a long period, without evincing the same tendency to produce disorder of the stomach and intestinal canal.

Iodide of potassium *becomes absorbed* and is carried out of the system by the different secretions, in which, as well as in the blood, it may be easily detected. Moreover, it deserves especial notice that it has been found in the urine several days after it has been swallowed. To detect it in the urine, add first starch to the cold secretion, then a few drops of nitric acid (or solution of chlorine), and the blue iodide of starch will be formed if an iodide be present.

The *remote* or *constitutional effects* of iodide of potassium are very analogous to those of iodine. Diuresis is a common consequence of its use. Relaxation of the bowels is not unfrequent. Occasionally ptyalism has been observed. Dr. Wallace mentions that irritation of the throat is produced by it. Increased secretion from, and pain of, the mucous membrane lining the nasal passages have been observed. I have repeatedly remarked, that the pocket-handkerchiefs used by patients who are taking this salt acquire a distinct odour of iodine.

Great discrepancy exists in the statements of authors as to the effects of given doses of iodide of potassium. 'The average dose of this medicine,' says Dr. Williams, 'is eight grains; carried beyond that quantity it purges; and even limited to that quantity, it requires some management to obviate nausea.' In two cases mentioned by Dr. Wallace, a drachm of this salt taken in divided doses, caused vomiting, colicky pains, and slight diarrhœa. Mr. Erichsen has reported a case of extreme irritation of the nasal, conjunctival, and bronchial mucous membrane produced by five grains; and Dr. Laurie has known seven and a half grains, given in three doses, cause serious symptoms; and in two cases he thinks death was the consequence of small doses. On the other hand, Dr. Elliotson gave three-quarters of an ounce daily (in doses of a quarter of an ounce), for many weeks, without inconvenience; and Dr. Buchanan states that half an ounce may be given at a dose without producing pain of the stomach or bowels, purging, or any hurtful effect. Furthermore, both physicians vouch for the purity of the salt employed. Payen gave 60 grains daily, and Ricord 135, without any serious effects. It is difficult to explain such discrepancies. But I cannot help thinking that peculiarities of constitution and morbid conditions of system (especially affections of the stomach) are principally concerned in modifying the tolerance of this salt.

Therapeutic Uses.—Having so fully detailed the uses of iodine, it is unnecessary to notice at any length those of iodide of potassium, since they are for the most part identical. Thus it has been employed in bronchocele, scrofula, in chronic diseases, accompanied with induration and enlargement of various organs, in leucorrhœa, secondary syphilis, periostitis, articular rheumatism, and dropsies. As a remedy for the hard periosteal node brought on by syphilis, it was first employed by Dr. Williams, who obtained with it uniform success. At the end of from five to ten days its mitigating effects are felt; the pains are relieved, the node begins to subside, and in the majority of cases disappears altogether. In the tubercular forms of venereal eruptions, Dr. Williams found it beneficial. Syphilitic ulcers of the throat rapidly heal under its use. In Dr. Wallace's lectures are some valuable observations on the use of iodide of potassium in venereal diseases. In chronic rheumatism accompanied with alteration in the condition of the textures of the joint, it is, in some cases, remarkably successful. Iodide of potassium has been administered in ascites by Dr. Martin Solon, and subsequently by M. Thirion, of Namur. The medicine was given in two-grain doses several times a day, and its use continued for many weeks together. In one instance 800 grains were taken in three months, effecting a permanent cure. Mr. Rodwell speaks of its beneficial effects in the treatment of housemaid's knee. A strong solution constantly applied (rest being enjoined) has, in the experience of Mr. Rodwell, caused the swelling to subside more rapidly than any other plan of treatment. One of the most important uses of this salt is in the treatment of chronic poisoning by lead and mercury. According to M. Melsens, the iodide of potassium dissolves the insoluble compounds formed in the body with albumen and fibrin, in chronic poisoning with lead and mercury. These combinations being dissolved by the iodide are excreted by the kidneys and other secretory organs, and may be detected in the urine, &c. Dr. Parkes relates a case of lead poisoning in which the metal was detected in the urine immediately after the administration of iodide of potassium. Dr. Budd, who has given a full translation of the memoir by M. Melsens, states that he has observed instances in which mercurial salivation has come on during the use of iodide of potassium, the mercury which had been previously fixed in the body having been liberated under the solvent influence of the iodide of potassium; the mercury thus set free having been the cause of the ptyalism. The excessive use of iodide of potassium has been frequently attended with serious effects. Dr. Flagg, of Charleston, U.S., has observed the following pathological effects of the long-continued use of the compound: tumefaction of the gums, salivation, epigastric pain, diarrhœa, diuresis, coryza, eczema, purpura, conjunctivitis, augmented secretion of the genital mucous membranes, and cerebral excitement.

Administration.—Iodide of potassium may be employed alone or in conjunction with iodine, forming what is called ioduretted iodide of potassium. If it occasions nausea, this effect may often be prevented by the addition of aromatic spirit of ammonia. It is usually given in doses of from three to ten grains.

[§ SOLUTION OF IODIDE OF POTASSIUM. (Appendix II.)

Take of

Iodide of Potassium	1 ounce.
Distilled Water	10 fluid ounces.

Dissolve and filter.]

Used as a test.

[§ UNGUENTUM POTASSII IODIDI. *Ointment of Iodide of Potassium.*

Take of

Iodide of Potassium	64 grains.
Carbonate of Potash . . .	4 grains.
Distilled Water	1 fluid drachm.
Prepared Lard	1 ounce.

Dissolve the iodide of potassium and carbonate of potash in the water, and mix thoroughly with the lard.]

By keeping, this ointment, if free alkali be not present, is apt to acquire a yellowish colour, obviously from a little iodine being set free. In some cases this may depend on the iodine being contaminated with a little iodate of potash. It usually, however, arises from the action of the fatty acid (formed as the fat becomes rancid); hydriadic acid is thus produced, which soon by the action of atmospheric oxygen gives oxygen and free iodine. Krieger states that a few drops of liq. potassæ added to this ointment will preserve from four to eight ounces for months from the yellow discoloration, or restore the white in the ointment that has become yellow. The carbonate of potash is added with the same object.

[§ **Linimentum Potassii Iodidi cum Sapone.** *Liniment of Iodide of Potassium and Soap.*

Take of

Hard Soap cut small	$1\frac{1}{2}$ ounce.
Iodide of Potassium	$1\frac{1}{2}$ ounce.
Glycerine	1 fluid ounce.
Oil of Lemon	1 fluid drachm.
Distilled Water	10 fluid ounces.

Dissolve the soap in seven fluid ounces of the water by the heat of a water bath. Dissolve the iodide of potassium and glycerine in the remainder of the water, and mix the two solutions together. When the mixture is cold add the oil of lemon, and mix the whole thoroughly.]

This is a convenient form for applying iodide of potassium externally in many cases.

If made with Castile soap, it forms, usually, an unstable mixture, the solid and liquid parts of which separate when it has been kept for some time. If made with good curd soap, containing animal fat, it forms a mixture resembling 'cold cream,' which keeps well in that state without change. If made with a true oleic acid soap, (p. 198) it forms a tremulous jelly-like mixture, which also keeps well.

[§ Solution of Iodate of Potash. (Appendix II.) (Iodate of Potash=KO,IO_5 or $\mathbf{KIO_3}$.)

Take of

Iodine	50 grains.
Chlorate of Potash	50 grains.
Nitric Acid	8 minims.
Distilled Water	$10\frac{1}{2}$ fluid ounces.

Rub the iodine and chlorate of potash together to a fine powder; place the mixture in a Florence flask, and, having poured upon it half an ounce of the water acidulated with the nitric acid, digest at a gentle heat until the colour of the iodine disappears. Boil for one minute; then transfer the contents of the flask to a capsule, and evaporate to perfect dryness at 212°. Finally dissolve the residue in the remaining ten ounces of distilled water; filter the solution, and keep it in a stoppered bottle.]

The iodine here replaces the chlorine of the chlorate of potash $2KClO_3 + I_2 = 2KIO_3 + Cl_2$. The nitric acid is merely added to facilitate the action, and is all expelled, with the chlorine, by boiling.

The solution of iodate of potash is used as a test for sulphurous acid, iodine being liberated,

$$2KIO_3 + 6H_2SO_3 = K_2SO_4 + 6H_2SO_4 + I_2.$$

[§ **Potassii Bromidum.** *Bromide of Potassium.* KBr or **KBr**.]

History.—First described by Balard in 1826.

Synonyms.—Hydrobromate of potash. Potassium or potassic bromide.

Preparation.—[§ Take of

Solution of Potash . . .	2 pints.
Bromine	4 fluid ounces, or a sufficiency.
Wood Charcoal, in fine powder	2 ounces.
Boiling distilled Water . .	$1\frac{1}{2}$ pint.

Put the solution of potash into a glass or porcelain vessel, and add the bromine in successive portions, with constant agitation, until the mixture has acquired a permanent brown tint. Evaporate to dryness; reduce the residue to a fine powder, and mix this intimately with the charcoal. Throw the mixture, in small quantities at a time, into a red-hot iron crucible, and when the whole has been brought to a state of fusion, remove the crucible from the fire and pour out its contents. When the fused mass has cooled dissolve it in the water, filter the solution through paper, and set it aside to crystallise. Drain the crystals, and dry them with a gentle heat. More crystals may be obtained by evaporating the mother liquor and cooling. The salt should be kept in a stoppered bottle.]

The action here is exactly parallel to that which occurs in the production of iodide of potassium. The bromine, reacting upon the potash, forms bromide and bromate of potassium,

$$6KHO + 3Br_2 = 5KBr + KBrO_3 + 3H_2O;$$

this latter is deoxidised by the charcoal into bromide of potassium, $2KBrO_3 + 3C_2 = 2KBr + 6CO$.

[§ *Characters.*—In colourless cubical crystals, with no odour, but a pungent saline taste, readily soluble in water, less soluble in spirit. Its aqueous solution gives a white crystalline precipitate with tartaric acid ($KHC_4H_4O_6$). When its solution in water is mixed with a little chlorine, chloroform agitated with it, on falling to the bottom, exhibits a red colour (**Br**). Ten grains require for complete decomposition 840 grain-measures of the volumetric solution of nitrate of silver. A solution of the salt mixed with mucilage of starch and a drop of an aqueous solution of bromine or chlorine does not exhibit any blue colour.]

The latter test shows the absence of iodine. If more nitrate of silver than the quantity above stated be required, the presence of a chloride may be suspected. The method employed by Rose for detecting minute quantities of the chlorides in bromides, is the following:—If pure bromide of potassium, mixed with an excess of bichromate of potash, be distilled with concentrated sulphuric acid into excess of solution of caustic ammonia, pure bromine distils over, and the ammoniacal liquor, which contains only hydrobromate of ammonia, remains perfectly colourless. But if the bromide contained a chloride, both bromine and the so-called chlorochromic acid CrO_2Cl_2 distil over and the ammoniacal liquor becomes yellow, owing to the formation of chromate of ammonia: chromic acid may be detected in the solution by acetate of lead, nitrate of silver, or any of the usual tests. A solution of bromide of potassium should also give no precipitate with chloride of barium, thus showing the absence of carbonates and sulphates.

Properties.—It is permanent in the air, and is neutral to test papers. When heated it decrepitates, and at a red heat fuses without suffering decomposition.

Physiological Effects.—Under the continued use of bromide of potassium, enlargements of the spleen and liver, and swellings of the lymphatic glands, have disappeared; so that it appears to agree with iodine, mercury, and the alkalies, in being liquefacient and resolvent. Dr. Williams thought that it possessed 'unusual, if not specific, powers in the cure of diseases of the spleen.' I gave it in doses of five grains to a boy of about fourteen years old, affected with enlarged spleen, consequent on intermittent fever, for several weeks; but the boy derived but little benefit from the treatment. In most cases it acts as a diuretic. M. Huette states that this compound possesses narcotic and anæsthetic powers of a very peculiar and energetic kind, especially when taken in large doses for several days. The effects are dull headache, drowsiness, stupor, and delirium, general loss of sensibility, and loss of power in the lower extremities. These symptoms, however, rapidly subside under the use of purgatives, when the medicine is discontinued. But, even in small doses, it rapidly and completely annihilates, for a time, the sensibility of the pharynx and velum palati, to such an extent that those parts may be tickled without exciting the least effort at deglutition. It also diminishes excitement, and produces general torpor of the generative organs.

Therapeutics.—In 1828, Pourché employed this salt with benefit in the treatment of bronchocele and scrofula; it was taken internally, and applied externally in the form of ointment. In 1836 it was introduced into the London Pharmacopœia, in consequence of the great success obtained from the use of it in a case of enlarged spleen under the care of Dr. Williams. In this, and in three other successful cases of the same disease, it was used internally only. It did not, however, realise the expectations that had been formed of its powers, and in 1851 it was omitted from the Pharmacopœia. It is now again made officinal, chiefly on account of its *sedative effects on the generative organs.* M. Thielman and Dr. Pfeiffer used it successfully, in doses of 30 grains, in painful erections and neuralgia of the neck of the bladder. In this country also it has been found to relieve nymphomania, priapism, certain forms of menorrhagia, and convulsive diseases dependent on uterine irritation (GARROD). It would probably be useful in reflex paraplegia arising from the same cause. Its peculiar *anæsthetic* effect on the laryngo-pharyngeal region greatly facilitates operations on that part.

Administration.—It is exhibited in the form of a pill or solution, in doses of from four to ten grains three times a-day.

Potassii Cyanidum. *Cyanide of Potassium.* KC_2N or **KCN.**

Synonyms.—Potassic or potassium cyanide.

Preparation.—In an impure state it is usually procured as follows:—

Take of

Ferrocyanide of Potassium, deprived of its water of crystallisation . . .	8 parts.
Carbonate of Potash, dried	3 parts.

Heat the two salts, previously mixed together, to dull redness in a covered iron crucible, until the effervescence is over. Then allow the crucible to rest for a short time, until the metallic iron has had time to subside. Lastly, pour out the white salt upon a stone slab, and immediately enclose it in an air-tight jar.

Ferrocyanide of potassium, when heated alone, undergoes decomposition in a manner which may be very simply expressed. This salt contains the elements of two molecules of cyanide of potassium and one of cyanide of iron. By heat the cyanide of potassium is unaffected, while the cyanide of iron is converted into an insoluble compound of carbon and iron.

In the process described above, the loss of salt which necessarily occurs when the ferrocyanide is employed alone, is avoided; but the product contains a certain proportion of cyanate of potash. The reaction which occurs is as follows:—

$$K_4FeC_6N_6 + K_2CO_3 = 5KCN + KCNO + Fe + CO_2.$$

The carbonic acid gas escapes with effervescence, whilst the iron separates in the metallic state.

Characters.—It deliquesces in the air, gives out the odour of hydrocyanic acid, and undergoes decomposition. It cannot be long kept in a state of solution, being changed into formiate of potash and ammonia, $\mathbf{KCN + 2H_2O = KCHO_2 + NH_3}$.

It is unchanged by a full red-heat, provided air be excluded; when heated with the access of air or oxygen, it is converted to cyanate of potash, $\mathbf{2KCN + O_2 = 2KCNO}$.

Owing to this property it forms an admirable reducing agent.

The cyanide forms double salts with most of the metals; when mixed with metallic solutions, it occasions a large number of precipitates which, in the majority of instances, are soluble in an excess of the cyanide of potassium. It is by reason of this property largely employed in electro-plating the baser metals with gold and silver, as well as in photography.

If a small quantity of sulphate of iron be added to the solution, well agitated, and the liquid acidulated with hydrochloric acid, Prussian blue is formed [See **Hydrocyanic Acid**]. The salt frequently contains large quantities of carbonate of potash; as much as half its weight or more is often found in commercial samples. The carbonate is left undissolved by alcohol. Thirteen grains of pure cyanide of potassium require 1,000 grain-measures of the volumetric solution of nitrate of silver (B. P.), in order that a permanent precipitate may commence to form. It must not be forgotten, in testing the commercial salt, that it contains one molecule of cyanate to every five molecules of cyanide, 81 to 375 parts.

Uses.—The cyanide is very little used in pharmacy. It is chiefly employed in electro-plating; and a soap ('cyanogen-soap') is prepared from it, which is used for the removal of stains produced by silver on the skin. The stains of marking-ink on linen should be first wetted with iodide of potassium, and a strong solution of the cyanide then applied.

[§ **Potassæ Prussias Flava.** *Yellow Prussiate of Potash.*

Synonym.—Ferrocyanide of potassium.

$$K_2FeC_6N_3 + 3HO \text{ or } \mathbf{K_4FeC_6N_63H_2O}.$$

A salt obtained by fusing animal substances, such as the cuttings of horns, hoofs, and skins, with carbonate of potash in an iron pot, lixiviating the crude product with water, and purifying the salt by crystallisation.]

Whenever animal matter containing nitrogen is heated with potassium or its salts, cyanide of potassium is formed.

In the manufacture of the yellow prussiate, cyanide of potassium is first produced; the mass when cold is lixiviated with water, and the evaporated solution yields crystals of ferrocyanide. The requisite iron is derived from the iron pots and stirrers used in the operation, or if necessary, scraps of iron are added. During the solution of the iron, oxygen is absorbed, and the liquid then contains hydrate of potash, $6KCN + Fe + H_2O + O = K_4FeC_6N_6 + 2KHO$, but probably hydrogen is also evolved.

$$6KCN + Fe + 2H_2O = K_4FeC_6N_6 + 2KHO + H_2.$$

A little sulphide of potassium is formed during the fusion ; partly from the sulphur of the animal matters, and partly by the reduction of the sulphate of potash in the pearlash. If the fused mass be thrown, whilst hot, into water, great loss will ensue, from the conversion of the nitrogen into ammonia.

[§ *Characters and Tests.*—In large yellow crystals, permanent in the air, soluble in water, insoluble in alcohol. The aqueous solution precipitates deep blue with persulphate of iron, (Fe_4Fcy_3,) brick-red with sulphate of copper (Cu_2Fcy), and white with acetate of lead (Pb_2Fcy). Heated with diluted sulphuric acid, hydrocyanic acid vapours are evolved.]

Properties.—The crystals have a peculiar toughness and flexibility somewhat analogous to selenite. They have a sweetish, yet somewhat bitter, saline taste. When moderately heated they evolve about 12 per cent. of water of crystallisation, and are converted into a white powder (anhydrous ferrocyanide of potassium). When heated to redness in contact with air, the salt is decomposed, and the residuum consists of cyanide of potassium, oxide of iron, and carbon. Sulphuretted hydrogen, the sulphurets, alkalies, and tincture of galls, give no precipitate with a solution of this salt; showing that the iron which it contains is in some remarkable state of combination. Hence it is believed that it contributes to the formation of a radicle to which the potassium is united. Ferrocyanides cannot be regarded as merely double cyanides. If a solution of the ferrocyanide of potassium be boiled with red oxide of mercury, percyanide of mercury is formed in the solution, and a mixture of peroxide and cyanide of iron is precipitated. The presence of potassium is best shown by calcining the salt, and detecting potash by the usual tests in the residuum.

[§ SOLUTION OF YELLOW PRUSSIATE OF POTASH. (Appendix II.)

Take of

Yellow Prussiate of Potash, in crystals	$\frac{1}{4}$ ounce.
Distilled Water	5 fluid ounces.

Dissolve and filter.]

Used as a test for various metals, especially iron. It throws down, with the protosalts of that metal, a white precipitate (*ferro-*

cyanide of potassium and iron), which by exposure to the air becomes blue (*basic Prussian blue*). With the persalts of iron it forms a deep blue (*Prussian blue*); with the salts of copper a deep brown (*ferrocyanide of copper*); and with those of lead a white precipitate (*ferrocyanide of lead*).

Potassæ Prussias Rubra. [§ *Red Prussiate of Potash.* (Appendix I.) $K_3,Fe_2C_{12}N_6$ or $\mathbf{K_6Fe_2C_{12}N_{12}}$.]

Synonym.—Ferricyanide of potassium.

Prepared by passing chlorine through a solution of the ferrocyanide, until the liquid ceases to give a blue precipitate with a persalt of iron,

$$\mathbf{2K_4FeC_6N_6 + Cl_2 = 2KCl + K_6Fe_2C_{12}N_{12}}.$$

Properties.—The crystals are known by their ruby-red colour; they are slightly efflorescent. They are soluble in about four parts of water, but are insoluble in alcohol. They give a copious dark blue precipitate with the protosalts of iron.

[§ *Test.*—Its solution in water gives no precipitate with persulphate of iron] (yielding merely an olive-green or brown coloration, thus distinguishing it from the ferrocyanide, and also showing its freedom from any traces of the latter left unchanged).

[§ SOLUTION OF RED PRUSSIATE OF POTASH. (Appendix II.)

Take of

Red Prussiate of Potash, in crystals .	$\frac{1}{4}$ ounce.
Distilled Water	5 fluid ounces.

Dissolve and filter.]

Used to indicate the perfect peroxidation of solution of persulphate of iron, citrate of iron and ammonia, and peroxide of iron; also to show that the iron exists as ferrous salt in sulphate of iron, iodide of iron, and saccharated carbonate of iron.

[§ **Potassæ Nitras.** *Nitrate of Potash.* KO,NO_5 or $\mathbf{KNO_3}$.]

Synonyms.—Nitre, saltpetre, potassium or potassic nitrate.

History.—It is found in various parts of the East, on the surface of the earth, and therefore it seems probable that it was known at a very early period. Moreover, the Chinese and Hindoos were acquainted in very ancient times with the art of making gunpowder and fireworks. In the East Indies, Egypt, Persia, Spain, and other parts of the world, but especially in warm countries, large quantities of nitre are found in the soil. It would appear to be formed below, and to be brought to the surface of the soil by efflorescence. It is found either disseminated throughout the soil, or as an incrustation upon the surface. It is probable that it is formed by the oxidation of ammonia, a product of the putrefaction of azotised organic matters, in the presence of the bases contained in the soil. The potash is easily accounted for, being a constituent of, for instance, felspar and mica. The ammonia may occasionally be in part derived from the air; and it is even possible that the nitrogen and oxygen of the air may, under certain circumstances, enter into direct combination.

Production.—The nitrate of potash employed in this country is obtained by the purification of the native nitre of India; but in some parts of the world it is procured by the purification of what is commonly called artificial nitre; that is, nitre obtained by cultivation. With few exceptions, the localities which naturally afford nitre are within the tropics; while the production of this salt in the temperate zones is effected chiefly by the intervention of man. In India the nitre is prepared from saline efflorescences scraped off old mud heaps, and buildings, &c. These are dissolved and filtered through a mud filter at the lower part of which is a layer of wood ashes, the carbonate of potash of which converts any nitrate of lime or magnesia into nitrate of potash. The liquor is then evaporated and crystallised, yielding a nitre containing from 45 to 70 per cent. of nitrate of potash. The purer and cleaner-looking kinds are called *East India refined.* The loss which it suffers in refining—or, in other words, the impurities which it contains—is technically designated *refraction.* In the artificial production of nitre, animal refuse, and especially dung, urine, &c., are mixed with cinders, lime, marl, &c., and exposed in heaps for two or three years. The mass is then lixiviated, treated with wood-ashes, and the liquors filtered off and crystallised.

The Pharmacopœia prescribes,

[§ Nitrate of potash of commerce purified, if necessary, by crystallisation from solution in distilled water.

Characters and Tests.—In white crystalline masses or fragments of striated six-sided prisms, colourless, of a peculiar cool saline taste. Thrown on the fire it deflagrates; warmed in a test tube with sulphuric acid and copper wire it evolves ruddy fumes. Its solution acidulated with hydrochloric acid gives a yellow precipitate with perchloride of platinum. ($2KClPtCl_4$.) Its solution is not affected by chloride of barium or nitrate of silver (showing its freedom from sulphates and chlorides).]

Properties.—The crystals frequently have a portion of the mother liquor mechanically lodged in spaces in the crystals: hence dry nitre will sometimes yield a moist powder, in consequence of the escape of the liquor in the process of pulverisation. When heated, this water is expelled, the nitrate of potash fuses, and when cast in moulds forms the *nitrum tabulatum*; or, from its having formerly been cast into small balls, and stained of a plum colour, *sal prunella*. At a strong red heat it is decomposed, with the evolution of oxygen and the formation of nitrite of potash, and afterwards of a mixture of oxide and peroxide of potassium. One hundred parts of water at 32° dissolve 13·32 parts of this salt, but at 77° they dissolve 38 parts; and at 212°, they dissolve 246 parts. During the process of solution the temperature of the liquid is considerably reduced. In alcohol nitre is insoluble.

Nitrate of potash, when pure, undergoes no change by exposure to the air; but if nitrate of soda be present, this absorbs moisture. The presence of nitrate of soda is detected by the yellow colour which this salt communicates to flame; whereas that produced by potash only is violet. The crystalline form of nitrate of soda, as obtained on a microscope-slide, is a rhombic plate, that of a nitrate of potash a slender fluted prism.

Physiological Effects.—In *moderate doses*, nitre acts as a refrigerant, diuretic, and diaphoretic. Its refrigerant properties are best seen when the body is preternaturally hot, as in febrile disorders. Mr. Alexander found, in most of his experiments, that it had a powerful influence over the vascular system. Thus, on several occasions, a drachm of this salt, within a few minutes, reduced the frequency of the pulse from 70 to 60 beats. Diuresis is another effect. As the nitre can be detected in the urine, its operation as a diuretic depends, perhaps, on the local stimulus which is communicated to the renal vessels while the salt is passing through them. Full doses frequently produce pain in the stomach. As a diaphoretic, it is usually given in combination with tartarated antimony. Various effects on the blood have been ascribed to nitre. Zimmerman has suggested, that in thoracic inflammation nitre promotes absorption of the effused products by preventing the coagulation of the fibrine, and rendering the effused plasma more soluble, and thereby more readily absorbable. Another effect which this, in common with other saline substances, produces on the blood, is that of diminishing the adhesiveness of the blood-corpuscles for each other. A third chemical effect is the change which it occasions in the colour of the blood. If it be mixed with dark-coloured venous blood out of the body, it communicates to it a florid or arterial hue. Now as this salt, when taken into the stomach, becomes absorbed, it is not unreasonable to suppose that while mixed with the circulating blood it might have an analogous effect. Dr. Stevens asserts, that in the last stage of fever, when the blood is black, it has this effect. Moreover, he tells us that in a case which occurred in America, where a person swallowed an ounce of nitre by mistake, in place of Glauber's salts, the blood when drawn from a vein was completely florid, and remained as fluid as if the nitre had been added to it out of the body.

In *very large doses* (such for example, as one ounce or more), nitre has in several instances caused death; but the effects of it are not uniform, since, in other cases, this quantity has not appeared to have any very remarkable or obvious effect. It is probable that the operation of nitre is influenced by the quantity of aqueous liquid in which the salt is dissolved, and that the more we dilute, the less powerfully does it act as a poison. In no other way can we reconcile the discrepant statements in regard to the effects produced by an ounce of nitre.

Therapeutics.—It follows, from what has been stated in regard to the physiological effects of nitre, that the use of this substance is indicated when we wish to diminish preternatural heat, and to reduce the force and frequency of the pulse, as in febrile disorders, inflammatory affections (except, perhaps, those of the stomach, bowels, kidneys, and bladder), and hemorrhages (especially hæmoptysis).

In acute bronchitis it assists tartarated antimony in relieving congestion of the bronchial mucous membrane.

In acute rheumatism, large doses of nitre have been administered, apparently, in many cases, with great success. They were first employed about the middle of the last century by Dr. Brocklesby, who gave this salt to the extent of an ounce or more, dissolved in three, four, or five quarts of thin gruel, in twenty-four hours. Within three or four days the malady was much relieved, or even cured, under great sweating. Until the last ten or twelve years, this method of treatment had for the most part fallen into disuse. It has, however, lately been revived, principally by some French physicians. According to Dr. Henry Bennet, the revival is due to Gendrin. But Martin Solon, Stœber, Forget, and others, have borne evidence to the success of the practice. Bouchardat, however, observes that this method of treatment had been repeatedly tried in the practice of the Hôtel-Dieu; but the trials of it were not long continued. Aran states that the mean quantity employed in twenty-four hours was about one ounce. Bennet states that it should be given in a large quantity of weak lemonade or barley water, properly sweetened, in the proportion of about half an ounce of nitre to a pint and a half of gruel. Ill effects from its use are stated to be rare. In acute rheumatism, however, it sometimes fails to give any relief: in chronic rheumatism it is useless. According to Dr. Basham, nitrate of potash acts in cases of rheumatism by diminishing any excess of fibrin and by retarding or suspending its separation from the blood. He recommends one, two, or three ounces, largely diluted with water, to be given in the twenty-four hours. Dr. Rowland, of Charing Cross Hospital, states that the average duration of the disease after the commencement of the treatment by nitrate of potash was eight days. In some, relief was afforded almost immediately, in others later; in all, the occurrence of dangerous complications was less frequent. In no instance was there threatening of valvular disease. The dose never exceeded half an ounce: it was sometimes limited to 180 grains daily. By these smaller doses there is less risk of gastric or renal irritation than where ounce doses are given. No injurious consequences were observed in Dr. Rowland's cases. Dr. Farre has often tried it, but believes it to be far less efficacious than bicarbonate of potash. It is not often used as a diuretic, because its activity in this respect is not very great; but it is adapted to those cases which are accompanied with arterial excitement. Dr. Young has successfully employed nitrate of potash in the treatment of incontinence of urine in children. It acts, he says, as a stimulant to the bladder or its sphincter. In sore-throat it is mixed with white sugar, and gradually swallowed. A mixture of nitre and powdered gum has long been a favourite remedy for diminishing the scalding of gonorrhœa. Nitre, in large doses, has been employed in the treatment of scurvy, and with considerable success, according to the statement of Mr. Cameron. This accords with the views of Dr. Garrod, who attributes the antiscorbutic properties of lemon-juice to the potash salts contained in it. Some experiments have more recently been made on the relative value of nitrate of potash, citric acid, and lime-juice, as remedial agents in sea-scurvy; and the results have not been favourable to the use of nitrate of potash. Dr. Bryson, the Director-General of the Medical department of the Navy, has published an account of these experiments, which were instituted upon instructions given to the surgeons of convict ships. He says: 'There seems to be little reason to doubt, judging from the results in these trials, and from others, which were not so well conducted, that the alkaline salt (nitre) has not the antiscorbutic properties which have been ascribed to it.' Nitre was one of the salts employed by Dr. Stevens in the so-called saline treatment of fever, cholera, and other malignant diseases, to increase the amount of saline matter in the blood. Nitre is rarely employed as an *external agent*, except as a means of producing cold. Thus, five ounces of nitrate of potash, with five ounces of sal ammoniac, dissolved in sixteen ounces of water, reduce the temperature 40° F.; that is, from 50° to 10°, according to Mr. Walker. Hence, therefore, we sometimes employ this mixture, placed in a bladder, as an external application.

Administration.—Nitrate of potash may be given in doses of from ten to thirty grains, in the form of powder, mixed with sugar, or in solution. Barley water is a good vehicle, and should not contain more than eight grains in the ounce. If administered as a refrigerant, it should be dissolved in water and immediately swallowed, in order that the coldness of the solution may assist the action of the salt. If it is employed as a diuretic, we ought to give mild liquids plentifully, and keep the skin cool.

[§ **Potassæ Bichromas.** *Bichromate of Potash.* $KO,2CrO_3$ or $\mathbf{K_2Cr_2O_7}$.]

Synonyms.—Red chromate of potash. Potassic dichromate.

Preparation.—The chief ore of chromium is *chrome-ironstone,* $FeOCr_2O_3$. This is roasted with carbonate of potash and a small quantity of nitre in a reverberatory furnace. The process of oxidation which proceeds partly with the help of atmospheric oxygen, results in the production of chromate of potash and peroxide of iron. When complete, the soluble parts are removed by water, the solution acidified with sulphuric acid and allowed to crystallise. The salt is purified by re-crystallisation.

[§ *Characters and Tests.*—In large red, transparent four-sided tables; anhydrous; fuses below redness; at a higher temperature is decomposed, yielding green oxide of chromium and yellow chromate of potash; which may be separated by dissolving the latter in water. The bichromate dissolved in water gives a yellowish-white precipitate ($\mathbf{BaCrO_4}$) with chloride of barium, and a purplish-red precipitate ($\mathbf{Ag_2CrO_4}$) with nitrate of silver, and both these precipitates are soluble in diluted nitric acid. The solution, also, when digested with sulphuric acid and rectified spirit, acquires an emerald-green colour (being reduced to the condition of chrome-alum; the alcohol is oxidised and gives aldehyde).]

Bichromate of potash is employed as a very useful oxidising agent, both in the preparation of such compounds as valerianic acid, and as a reagent in qualitative and volumetric analysis.

[§ *Volumetric Solution of Bichromate of Potash.* $KO,2CrO_3 = 147{\cdot}5$ or $\mathbf{K_2Cr_2O_7} = 295$.

Take of

Bichromate of Potash . . .	147·5 grains.
Distilled Water	a sufficiency.

Put the bichromate of potash into the 10,000 grain flask, and having half filled the flask with water, allow the salt to dissolve; then dilute the solution with more water until it has the exact bulk of 10,000 grain-measures. 1,000 grain-measures of this solution contain 14·75 grains of the bichromate ($\frac{1}{10}$th of $KO,2CrO_3$ or $\frac{1}{20}$th of $\mathbf{K_2Cr_2O_7}$ in grains), and when added to a solution of a protosalt of iron acidulated with hydrochloric acid, are capable of converting

16·8 grains of iron ($\frac{1}{10}$th of 6Fe or $\frac{1}{20}$th of **6Fe** in grains) from the state of protosalt to that of persalt. (The reaction which takes place is as follows:—$K_2Cr_2O_7 + 14HCl + 6FeCl_2 = 2KCl + Cr_2Cl_6 + 7H_2O + 3Fe_2Cl_6$.)

Grammes and cubic centimètres may be employed instead of grains and grain-measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. Thus 14·75 grammes of bichromate of potash should be made to form 1,000 cubic centimètres of solution. 100 cubic centimètres of this solution contain 1·475 gramme of bichromate ($\frac{1}{100}$th of $KO,2CrO_3$ or $\frac{1}{200}$th of $K_2Cr_2O_7$ in grammes), and when added to a solution of protosalt of iron acidulated with hydrochloric acid, are capable of converting 1·68 gramme of iron ($\frac{1}{100}$th of 6Fe or $\frac{1}{200}$th of **6Fe** in grammes) from the state of protosalt to that of persalt.

This solution is used for determining the proportion of protoxide of iron in the following preparations. It is known that the whole of the protosalt has been converted into a persalt when a minute drop of the liquid, placed in contact with a drop of the solution of red prussiate of potash on a white plate, ceases to strike with it a blue colour.

	British Weights and Measures.				Metrical Weights and Measures.		
	Grs. of Substance	=	Gr.-meas. of Vol. Sol.	or	Grms. of Substance	=	C.C. of Vol. Sol.
Ferri Arsenias. .	20	=	170	or	2·0	=	17·0
„ Carb. Sacch. .	20	=	330	or	2·0	=	33·0
„ Oxid. Magn. .	20	=	83	or	2·0	=	8·3
„ Phosphas .	20	=	250	or	2·0	=	25·0]

Potassæ Chromas. *Chromate of Potash.*

Neutral or Yellow Chromate. KO,CrO_3 or K_2CrO_4.

Obtained in lemon yellow, very soluble, crystals by neutralising exactly a solution of bichromate by carbonate of potash and evaporating.

[§ **Potassæ Permanganas.** *Permanganate of Potash.*

KO,Mn_2O_7 or $KMnO_4$.

Take of

Caustic Potash	5 ounces.
Black Oxide of Manganese, in fine powder .	4 ounces.
Chlorate of Potash	$3\frac{1}{2}$ ounces.
Diluted Sulphuric Acid	a sufficiency.
Distilled Water	$2\frac{1}{2}$ pints.

Reduce the chlorate of potash to fine powder, and mix it with the oxide of manganese; put the mixture into a porcelain basin, and add to it the caustic potash, previously dissolved in four ounces of the water. Evaporate to dryness on a sand bath, stirring diligently to prevent spurting. Pulverise the mass, put it into a covered Hessian or Cornish crucible, and expose it to a dull red heat for an hour, or till it has assumed the condition of a semi-fused mass. Let it cool, pulverise it, and boil with a pint and a half of the water. Let the insoluble matter subside, decant the fluid, boil again with half a pint of the water, again decant, neutralise the united liquors accurately with the diluted sulphuric acid; and evaporate till a pellicle forms. Set aside to cool and crystallise. Drain the crystalline mass, boil it in six ounces of the water, and strain through a funnel the throat of which is lightly obstructed by a little asbestos. Let the fluid cool and crystallise, drain the crystals, and dry them by placing them under a bell jar over a vessel containing sulphuric acid.]

The mass after fusion is dark-green and contains manganate of potash and chloride of potassium, the residue of the chlorate:

$$6KHO + KClO_3 + 3MnO_2 = 3K_2MnO_4 + KCl + 3H_2O.$$

Upon neutralising the solution with sulphuric acid, the manganate is changed into permanganate and peroxide of manganese; the latter is insoluble.

$$3K_2MnO_4 + 2H_2SO_4 = K_2Mn_2O_8 + 2K_2SO_4 + MnO_2.$$

The solutions must not be filtered through paper or linen; and care must be taken to avoid contact with any kind of organic matter, since such substances immediately remove oxygen from the salt with production of brown peroxide of manganese.

[§ *Characters and Tests.*—Dark purple slender prismatic crystals, inodorous, with a sweet astringent taste, soluble in water. A single small crystal suffices to form with an ounce of water a rich purple solution, which, when mixed with a little rectified spirit and heated, becomes yellowish-brown. The crystals heated to redness decrepitate, evolve oxygen gas, and leave a black residue, from which water extracts potash, recognised by its alkaline reaction, and by its giving, when acidulated with hydrochloric acid, a yellow precipitate with perchloride of platinum. Entirely soluble in cold water. Five grains dissolved in water require for complete decoloration a solution of forty-four grains of granulated sulphate of iron acidulated with two fluid drachms of diluted sulphuric acid] (persulphate of iron, sulphate of manganese, and sulphate of potash being formed).

[§ * **Liquor Potassæ Permanganatis.** *Solution of Permanganate of Potash.*

Permanganate of potash 4 grains in each ounce of distilled water.]

Therapeutics.—Permanganate of potash has been administered internally in diabetes, and may be given in doses of two to four grains, in solution, three or four times daily. Its principal use, however, is as an external or topical application, when it acts as an escharotic, disinfectant, antiseptic, and deodorising agent. It is employed for cleansing gangrenous, cancerous, and other foul ulcers and wounds; as a wash or gargle for the mouth or throat, for removing fetid odours and cleansing ulcerations in these parts; and as an injection for ulcerations of the vagina, &c.

[§ **Potassæ Acetas.** *Acetate of Potash.*
$KO,C_4H_3O_3$ or $\mathbf{KC_2H_3O_2}$.]

Synonyms.—Potassium or potassic acetate.

History.—Described first by Raymond Lully in the thirteenth century; it has been known at different times by various fantastic appellations.

Preparation.—[§ Take of

Carbonate of Potash . .	20 ounces.
Acetic Acid . . .	2 pints, or a sufficiency.

To the acetic acid, placed in a thin porcelain basin, add gradually the carbonate of potash, filter, acidulate, if necessary, with a few additional drops of the acid, and having evaporated to dryness, raise the heat cautiously so as to liquefy the product. Allow the basin to cool, and when the salt has solidified, and while it is still warm, break it in fragments, and put it into stoppered bottles.]

The reaction between the acid and the carbonate is very simple :— $\mathbf{K_2CO_3 + 2HC_2H_3O_2 = 2KC_2H_3O_2 + H_2O + CO_2}$. To obtain a perfectly white mass, pure acetic acid should be used; and to prevent the salt from becoming yellow or brown during the evaporation of the solution, a slight excess of acid should be present.

[§ *Characters and Tests.*—White foliaceous satiny masses, very deliquescent, with a watery solution of which, tartaric acid causes a crystalline precipitate, sulphuric acid the disengagement of acetic acid, and a dilute solution of perchloride of iron strikes a deep-red colour. Neutral to test-paper, entirely soluble in rectified spirit. Its solution is unaffected by sulphide of ammonium.]

Properties.—It is odourless, but has a pungent saline taste and a soapy feel. It is very soluble both in water and alcohol; indeed, in water it is one of the most soluble salts we are acquainted with.

At 60°, 100 parts of the salt will dissolve in 102 parts of water. A current of carbonic acid precipitates the potash as carbonate, from a strong alcoholic solution of this salt.

Physiological Effects.—A quarter of an ounce causes purging, which is sometimes accompanied with griping. In smaller doses, more especially if largely diluted, it acts as a diuretic and mild diaphoretic. In its passage to the kidneys it becomes decomposed, and is converted into carbonate of potash, which may be detected in the urine.

Therapeutics.—In this country it was until lately rarely employed, except as a diuretic in dropsical complaints. It is a valuable adjunct to other renal excitants. On the Continent it is administered in various diseases as an alterative or resolvent; for example, in scirrhus of the pylorus, chlorosis, and visceral and glandular enlargements. It may be employed in the uric acid diathesis, to render the urine alkaline. It is of course improper when phosphatic deposits are observed in the urine. Acetate of potash has been usefully employed in some diseases of the skin. Dr. Easton, of Glasgow, has related a series of cases of psoriasis, eczema, and lepra, in which he has found the administration of acetate of potash attended with signal benefit. The cure was much more speedy than under the use of any other remedies. The salt was administered alone, and was followed by a great increase in the amount of urine. The smallest quantity passed in these cases was 54 oz. in the twenty-four hours, while the largest was 120 oz. Under the use of this salt, it was found that the urine was not only passed in larger quantity, but that the proportion of the solid constituents was increased. Mr. Hilton has given acetate of potash in doses of thirty grains with benefit in gonorrhœa. The antiphlogistic property of the salt, combined with its alkalising effect on the urine, produced the good results. Acetate of potash has also been lately used in acute rheumatism, in doses of thirty grains every four hours by several London physicians, and it is believed to exercise a very beneficial influence in the treatment of the disease.

Administration.—It is given as a diuretic in doses of from twenty to sixty grains, dissolved in some mild diluent. In larger doses, as a quarter of an ounce, it acts as a purgative.

[§ Solution of Acetate of Potash. (Appendix II.)

Take of

Acetate of Potash	$\frac{1}{2}$ ounce.
Distilled Water	5 fluid ounces.

Dissolve and filter.]

Used as a test for tartaric acid, with whose solutions it gives a white crystalline precipitate of acid tartrate of potash.

[§ **Potassæ Tartras.** *Tartrate of Potash.*
$2KO,C_8H_4O_{10}$ or $\mathbf{K_2C_4H_4O_6}$.]

Synonyms.—Neutral or bibasic tartrate of potash. Soluble tartar. Potassium or dipotassic tartrate.

Preparation.—[§ Take of

Acid Tartrate of Potash	20 ounces, or a sufficiency.
Carbonate of Potash .	9 ounces, or a sufficiency.
Boiling distilled Water .	$2\frac{1}{2}$ pints.

Dissolve the carbonate of potash in the water; add by degrees the acid tartrate of potash, and if, after a few minutes' boiling, the liquid is not neutral to test-paper, make it so by the careful addition of more of the carbonate or of the acid tartrate. Then filter, concentrate till a pellicle forms on the surface, and set it aside to cool and crystallise. More crystals may be obtained by evaporating and cooling the mother-liquor. Drain the crystals, dry them by exposure to the air in a warm place, and preserve them in a stoppered bottle.]

The decomposition which occurs is thus expressed:—

$$\mathbf{2KHC_4H_4O_6 + K_2CO_3 = 2K_2C_4H_4O_6 + H_2O + CO_2}.$$

[§ *Characters and Tests.*—In small colourless four or six-sided prisms. Heated with sulphuric acid it forms a black tarry fluid, evolving inflammable gas and the odour of burned sugar. Acetic acid added sparingly to its solution causes the separation of a white crystalline precipitate (of acid tartrate). Entirely dissolved by its own weight of water. 113 grains, heated to redness till gases cease to be evolved, leave an alkaline residue, which requires for exact neutralisation 1,000 grain-measures of the volumetric solution of oxalic acid.]

It may contain excess of acid tartrate or of carbonate, either of which is easily recognised,—the one by litmus, the other by turmeric paper. The sulphates may be detected by chloride of barium throwing down a white precipitate insoluble in nitric acid.

Properties.—Taste saline, and somewhat bitter. It is neutral to test-papers, and does not deliquesce on exposure to the air, unless carbonate of potash be present, which, however, is often the case. When heated to redness it is decomposed, leaving as a residue charcoal and carbonate of potash. When heated, the salt evolves the odour of caramel. The tartrate is readily distinguished from the acid tartrate by its greater solubility, and its want of acidity. Chloride of calcium precipitates a solution of the tartrate, but not of the acid tartrate of potash.

Physiological Effects.—This salt is a gentle purgative and diuretic. Like the other vegetable salts of the alkalies, it is decomposed in the system, and converted into the carbonate, in which state it is found in the urine, to which it communicates alkaline properties. It is said to have the power of preventing the griping of other more active cathartics, as senna and scammony; but, from my own personal observations, I doubt the correctness of this statement.

Therapeutics.—It is employed as a mild purgative, or as an adjunct to other more active purgatives, as the infusion of senna. It may be used in lithiasis to render the urine alkaline, in which case it must be given in the form of a dilute solution.

Administration.—It may be administered as a purgative, in doses of from a quarter to half an ounce, or even an ounce.

[§ **Potassæ Tartras Acida.** *Acid Tartrate of Potash.*

Synonym.—Potassæ bitartras. Cream of tartar.

$$KO,HO,C_8H_4O_{10} \text{ or } \mathbf{KHC_4H_4O_6}.$$

An acid salt obtained from the crude tartar which is deposited during the fermentation of grape-juice.]

History.—In its impure form, as a deposit from wine, it must have been known at a very early period. It is a constituent of many vegetable juices, such as those of grapes, tamarinds, and many others.

Production.—All the acid tartrate of commerce is obtained during the vinous fermentation. It exists in solution in grape-juice; but being very slightly soluble in a mixture of alcohol and water, it is deposited when sufficient alcohol is produced, and forms a crust on the sides of the cask. In this state it is known in commerce under the name of *crude tartar*, or *argol*, which is termed *white* or *red*, according as it is obtained from white or red wine. *Argol*, or *crude tartar*, occurs in crystalline cakes of a brown or reddish colour, and is composed of the acid tartrate of potash, tartrate of lime, colouring and extractive matter. It is purified by solution, treatment with charcoal and alumina (clay), to remove the colouring matter, and crystallisation.

[§ *Characters and Tests.*—A gritty white powder, or fragments of cakes crystallised on one surface; of a pleasant acid taste, sparingly soluble in water, insoluble in spirit. Heated in a crucible it evolves inflammable gas and the odour of burned sugar, and leaves a black residue (*black flux*). This effervesces with diluted hydrochloric acid, and forms a solution which when filtered gives a yellow precipitate with perchloride of platinum and when neutralised by ammonia is rendered slightly turbid by oxalic acid (from the presence of a small quantity of lime). 188 grains heated to redness till gas ceases to be evolved, leave an alkaline residue, which requires for exact neutralisation 1,000 grain-measures of the volumetric solution of oxalic acid.]

Properties.—Acid tartrate of potash is soluble in about 190 parts of cold, and 18 of boiling water; the addition of alcohol diminishes its solubility. Acetate of lead added to a solution of the acid tartrate forms a copious white precipitate, tartrate of lead: lime water has the same effect; but the tartrate of lime is dissolved by an excess of the acid tartrate. Mixed with alkaline carbonates, it produces effervescence. The saturated aqueous solution gives no precipitate with perchloride of platinum.

Impurities.—Acid tartrate of potash when pure is quite white. As found in commerce it usually contains from 2 to 5 per cent. of tartrate of lime, and sometimes a little sulphate of lime; and hence a little carbonate of lime may be detected in black flux. This is of no material consequence in a medicinal point of view. If the powdered acid tartrate be adulterated with either alum, bisulphate of potash, or sulphate of lime, the fraud may be detected by chloride of barium, which causes a white precipitate (*sulphate of baryta*) insoluble in nitric acid. Sulphuretted hydrogen and solution of ferrocyanide of potassium should produce no change in a solution of this salt. The addition of oxalate of ammonia to a saturated cold solution of the acid tartrate is sufficient for the detection of lime, as the oxalate of lime formed is quite insoluble in tartaric acid and acid tartrate of potash.

Physiological Effects.—When taken in *small doses*, diluted with water, it acts as a refrigerant and diuretic; in *larger doses* (as a quarter of an ounce) it purges, and frequently creates flatulence and griping. By continued use it disorders the digestive functions, and causes emaciation, most probably from defective nutrition. In *excessive doses* it produces inflammation of the stomach and intestines.

Therapeutics.—Acid or bitartrate of potash is frequently employed to form a refrigerant drink in febrile and inflammatory diseases. It allays thirst, diminishes preternatural heat, and reduces vascular action. As a *diuretic* in dropsical complaints, it is used either in the same way or taken in the form of an electuary. As a *purgative* it is not usually exhibited alone, but, in general, with jalap, sulphur, senna, or some other purgative. Thus, in dropsical complaints, especially in acute anasarca, a very valuable hydragogue cathartic is a mixture of jalap and acid tartrate of potash (compound powder of jalap). In skin diseases and affections of the rectum (as piles, stricture, and prolapsus), a very useful purgative is an electuary composed of sulphur and acid tartrate of potash (confection of sulphur), and confection of senna. An effervescing aperient may be prepared by mixing 180 grains of the acid tartrate with 150 grains of carbonate of soda: the resulting salt is the tartrate of soda and potash. As a *tooth-powder*, acid tartrate of potash is sometimes used, on account of its gritty qualities: a very good dentifrice consists of equal parts of acid tartrate, powdered rhatany root, and myrrh.

Administration.—As a hydragogue cathartic, the dose is half an ounce; as an aperient, 60 to 120 grains; as a diuretic, 20 to 60 grains, in repeated doses.

Potassæ Boro-tartras. *Boro-tartrate of Potash.*

Prepared by dissolving 40 parts of cream of tartar and 10 parts of crystallised boracic acid in 240 parts of water, and evaporating the solution either to dryness or to a syrupy consistence, and then spreading it on plates to dry. The compound thus obtained has a sour taste, is incapable of crystallising, and is soluble in water in all proportions. It has, however, been observed on several occasions to solidify suddenly from a concentrated solution. The solid opaque mass so obtained consists of granules; it may be reconverted into the ordinary soluble vitreous condition by boiling in water.

Boro-tartrate of potash partakes of the medicinal properties of cream of tartar and borax. Its great solubility gives it an advantage over cream of tartar. In doses of from half an ounce to an ounce it acts as a cooling purgative. In smaller doses it is diuretic, and is said to be emmenagogue. It has been employed in dropsical affections, amenorrhœa, hepatic congestion, and various other maladies. As a resolvent it is given in doses of twenty grains. It has been recommended by Mr. Ure as a solvent for lithic acid calculi.

[§ **Potassæ Citras.** *Citrate of Potash.*

$3KO,C_{12}H_5O_{11}$ or $K_3C_6H_5O_7$.

Take of

Carbonate of Potash . . .	8 ounces, or a sufficiency.
Citric Acid, in crystals . . .	6 ounces, or a sufficiency.
Distilled Water	2 pints.

Dissolve the citric acid in the water, add the carbonate of potash gradually, and, if the solution be not neutral, make it so by the cautious addition of the acid or the carbonate of potash. Then filter, and evaporate to dryness, stirring constantly after a pellicle has begun to form, till the salt granulates. Triturate in a dry warm mortar, and preserve the powder in stoppered bottles.]

Citric acid decomposes carbonate of potash with effervescence in the manner shown by this equation:—

$$2H_3C_6H_5O_7 + 3K_2CO_3 = 2K_3C_6H_5O_7 + 3H_2O + 3CO_2.$$

[§ *Characters and Tests.*—A white powder of saline feebly acid taste, deliquescent, and very soluble in water. Heated with sulphuric acid it forms a brown fluid, gives off an inflammable gas, and evolves the odour of acetic acid. Its solution, mixed with a solution of chloride of calcium, remains clear till it is boiled, when a white precipitate separates (*citrate of lime*, which is less soluble in hot than in cold water), readily soluble in acetic acid. Its solution, acidulated with hydrochloric acid, gives a yellow precipitate with perchloride of platinum. ($2KCl,PtCl_4$.) 102 grains heated to redness till gases cease to be evolved leave an alkaline residue (carbonate of potash), which requires for exact neutralisation 1,000 grain-measures of the volumetric solution of oxalic acid.]

Physiological Effects.—Citrate of potash resembles the other vegetable salts of potash in being diuretic, but it is less liable to purge. It is converted after absorption, into carbonate of potash, which is found in the urine, and renders that secretion alkaline.

Therapeutics.—Citrate of potash, in its solid state, is a new remedial agent in the Pharmacopœia, but it has been long used in the form of the effervescing draught made by adding citric acid to bicarbonate of potash. In that form, however, much of the value of the medicine was due to the carbonic acid evolved during the commixture of the two constituents. This salt is useful in febrile disorders, as a diuretic, in uric acid gravel, and generally in cases where it is desirable to diminish the acidity of the urine.

Dose, 20 to 60 gr.

Potassæ Oxalates. *Oxalates of Potash.*

Acid oxalate or binoxalate. KHC_2O_4,H_2O. Found in species of *oxalis* and *Rumex*, also in rhubarb and other plants. Obtained by dividing a solution of oxalic acid into two equal parts, saturating one with carbonate of potash and then adding the other, and crystallising.

The salt usually known as *Salt of sorrel* is a *superacid oxalate* or *quadroxalate*, KHC_2O_4, $H_2C_2O_4$, $2H_2O$.

This salt is made by neutralising a solution of one part of oxalic acid with carbonate of potash and then adding three parts more of acid. It is employed for removing ink-stains and iron mould from linen, and for decolourising straw.

[§ **Sapo Mollis.** *Soft Soap.*

Soap made with olive oil and potash.]

Chiefly oleate of potash.

Preparation.—The oil is boiled with a solution of caustic potash until the whole has become saponified and has the appearance of thin glue. The separation of the made soap from the glycerine and excess of water is then effected by means of a strong solution of potash or by evaporation, since salt decomposes it into hard soap (soda soap) and chloride of potassium.

[§ *Characters.*—Yellowish-green, inodorous, of a gelatinous consistence. Soluble in rectified spirit; not imparting an oily stain to paper (showing its freedom from earthy admixture and unsaponified oil). Incinerated it yields an ash which is very deliquescent]; carbonate of potash.

Potassæ Hypophosphis. *Hypophosphite of Potash.*
KO,PH_2O_3 or $\mathbf{KH_2PO_2}$.

This salt is prepared either by boiling phosphorus with liquor potassæ and cautiously evaporating to dryness; or by adding carbonate of potash to hypophosphite of lime till a precipitate is no longer thrown down, then filtering and evaporating. Its medicinal properties are similar to those of hypophosphite of lime.

SODIUM (*Natrium*). Na or **Na**=23.

History.—This metal was discovered by Sir H. Davy about the same time as potassium, which it resembles in many respects. In combination it is found in the mineral kingdom, in the waters of the ocean, in plants (especially those which grow in, or on the borders of, the sea), and in many animal fluids.

Preparation and Properties.—It is procured by distillation of the carbonate with charcoal.

Sodium, the metallic basis of soda, in colour resembles silver, but is of a soft waxy consistence like potassium. Its specific gravity is 0·97. It rapidly oxidises by exposure to the air, or when dropped upon water, but the action is seldom sufficiently violent to cause spontaneous inflammation. It burns with a brilliant yellow flame. It is best preserved under Persian naphtha.

Characteristics of compounds of sodium.—From compounds of potassium they are distinguished by causing no precipitate with perchloric or tartaric acid (unless the solution be very concentrated), nor with perchloride of platinum, and by the yellow tinge which they communicate to flame. The only substance capable of producing a precipitate in moderately dilute solutions of soda is antimoniate of potash, which causes a crystalline precipitate of antimoniate of soda. This test, however, is not applicable if other bases than those now mentioned be present. Sometimes the crystalline form of soda salts (as of the sulphate and nitrate) is resorted to as a means of distinguishing them from the potash salts.

Sulphide of ammonium and carbonate of ammonia give no precipitate with the salts of sodium.

[§ Soda Caustica. *Caustic Soda.*

Hydrate of soda, NaO,HO or **NaHO** with some impurities.

Take of

Solution of Soda	2 pints.

Boil down the solution of soda rapidly in a silver or clean iron vessel, until there remains a fluid of oily consistence, a drop of which when removed on a warmed glass rod solidifies on cooling. Pour the fluid on a clean silver or iron plate or into moulds, and, as soon as it has solidified, break it in pieces, and preserve it in stoppered green-glass bottles.

Characters and Tests.—Hard and greyish-white, very alkaline and corrosive. It imparts a yellow colour to flame, and its solution in water acidulated by nitric acid gives only scanty white precipitates with nitrate of silver and chloride of barium (indicating traces of sulphates and chlorides). Forty grains dissolved in water leave scarcely any sediment, and require for neutralisation about 900 grain-measures of the volumetric solution of oxalic acid.]

The general characteristics of caustic soda resemble those of caustic potash; the impurities most commonly met with, and the means of detecting them, are also similar.

Therapeutics.—It may be used for the same purposes as caustic potash. It has the advantage of being less deliquescent, but is inferior in power as an escharotic.

[§ Liquor Sodæ. *Solution of Soda.*

Take of

Carbonate of Soda	28 ounces.
Slaked Lime	12 ounces.
Distilled Water	1 gallon.

Dissolve the carbonate of soda in the water; and, having heated the solution to the boiling point in a clean iron vessel, gradually mix with it the slaked lime, and continue the ebullition for ten minutes with constant stirring. Then remove the vessel from the fire; and, when by the subsidence of the insoluble matter the supernatant liquor has become perfectly clear, transfer it by means of a siphon to a green-glass bottle furnished with an air-tight stopper, and add distilled water, if necessary, to make it correspond with the tests of specific gravity and neutralising power.]

The reaction here is exactly similar to that which occurs in the production of solution of potash,

$$Na_2CO_3 + Ca2HO = 2NaHO + CaCO_3.$$

This preparation contains four grains less soda in the fluid ounce than Liq. Sodæ, *Lond.*

[§ *Tests.*—Specific gravity, 1·047. Four hundred and fifty-eight grains by weight (one fluid ounce) require for neutralisation 470 grain-measures of the volumetric solution of oxalic acid, corresponding to 4·1 per cent. by weight of hydrate of soda, NaO,HO or **NaHO**. It does not effervesce when added to an excess of diluted hydrochloric acid, mixed with an equal volume of distilled water it gives no precipitate with solution of lime or oxalate of ammonia. When it is treated with an excess of diluted nitric acid, and evaporated to dryness, the residue forms with water a clear solution, which is only slightly precipitated by chloride of barium or by nitrate of silver, and not at all by ammonia. One fluid ounce contains 18·8 grains of hydrate of soda.]

As in solution of potash, a small quantity of chlorides and sulphates is almost always present, indicated by the turbidity with nitrate of silver and chloride of barium. It is also liable to contain silica and alumina—the former indicated by the presence of an insoluble residue after evaporation with excess of nitric acid; the latter by the formation of a gelatinous precipitate on the addition of ammonia to this solution. Freedom from undecomposed carbonate of soda is shown by its non-effervescence with acids, and its non-precipitation by solution of lime; from excess of lime by its remaining clear on the addition of oxalate of ammonia.

Therapeutics.—Solution of soda was originally introduced into the London Pharmacopœia to be employed in the preparation of oxysulphuret of antimony. It is now placed in the Materia Medica of the British Pharmacopœia as a substance employed medicinally. It has not been much used at present, but as its action is probably very similar to that of solution of potash, it may be employed for the same purposes, or substituted for it, if solution of potash is found to disagree.

Dose, 10 min. to 1 fl. drm.

[§ Volumetric Solution of Soda. (Appendix III.)

(Hydrate of soda, NaO,HO = 40 or **NaHO** = 40.)

Take of

Solution of Soda	a sufficiency.
Distilled Water	a sufficiency.

Fill a burette with the solution of soda, and cautiously drop this into sixty-three grains of purified oxalic acid dissolved in about two ounces of water, until the acid is exactly neutralised as indicated by litmus. Note the number of grain-measures (n) of the solution used, and having then introduced 9,000 grain-measures of the solution of soda into a graduated jar, augment this quantity by the addition of water until it becomes $\frac{9,000 \times 1,000}{n}$ grain-measures. If, for example, n = 930, the 9,000 grain-measures should be augmented to $\frac{9,000 \times 1,000}{930}$ = 9,677 grain-measures. One thousand grain-measures of this solution contain one equivalent in grains (40 grains) of hydrate of soda, and will therefore neutralise one equivalent in grains of any monobasic acid. Grammes and cubic centimètres may be employed instead of grains and grain-measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. One hundred cubic centimètres contain $\frac{1}{10}$th of an equivalent in grammes (four grammes) of hydrate of soda, and will neutralise $\frac{1}{10}$th of an equivalent in grammes of an acid.

This solution is used for testing the following substances :—

	British Weights and Measures.			Metrical Weights and Measures.		
	Grs. wt. of Substance.	=	Grn.-measures of Vol. Sol.	Grms. wt. of Substance.	=	C.C. of Vol. Sol.
Acetum . . .	445·4	=	402	44·54	=	40·2
Acid Acetic . .	182·0	=	1000	18·20	=	100·0
„ „ Dil. . .	440·0	=	313	44·00	=	31·3
„ „ Glac. . .	60·0	=	990	6·00	=	99·0
„ Citric . .	70·0	=	1000	7·00	=	100·0
„ Hydrochl. . .	114·8	=	1000	11·48	=	100·0
„ „ Dil. . .	345·0	=	1000	34·50	=	100·0
„ Nitric . .	90·0	=	1000	9·0	=	100·0
„ „ Dil. . .	361·3	=	1000	36·13	=	100·0
„ Nit. Hydroch. Dil.	352·4	=	920	35·24	=	92·0
„ Sulph. . .	50·6	=	1000	5·06	=	100·0
„ „ Arom. .	304·2	=	830	30·42	=	83·0
„ „ Dil. . .	359·0	=	1000	35·90	=	100·0
„ Tart. . . .	75·0	=	1000	7·50	=	100·0

[§ **Sodæ Carbonas.** *Carbonate of Soda.*

$NaO, CO_2 + 10HO$ or $\mathbf{Na_2CO_3. 10H_2O}$.

Obtained from the ashes of marine plants, or produced by chemical decomposition with chloride of sodium.]

Synonyms.—Neutral, or mono-carbonate of soda. Carbonate of sodium. Disodic carbonate.

History.—Probably known to the ancients as *nitrum*, under which term they confounded several salts with nitrate of potash.

Production.—The commercial sources of carbonate of soda are three—viz. native soda, known as *natron* or *trona*, a *sesqui*carbonate of soda, found as an efflorescence on the borders of large lakes in various parts of the world ; the ashes of marine plants ; and common salt or sulphate of soda. The ashes of marine plants employed for this purpose, are of two kinds—one, called *barilla*, obtained from phænogamous plants growing near the sea; the other, termed *kelp*, procured from cryptogamic plants growing in the sea; both these, as well as the native *natron*, containing large quantities of sulphate of soda, and other impurities. They may be purified by lixiviation and repeated crystallisation. Carbonate of soda is now, however, almost wholly prepared from common salt (chloride of sodium). This is first converted into sulphate by the action of sulphuric acid, as in the process for making hydrochloric acid,

$$2NaCl + H_2SO_4 = Na_2SO_4 + 2HCl.$$

A good deal of sulphate of soda is also obtained as a waste product from the manufacture of chlorinated lime. The sulphate of soda is mixed with its own weight of ground chalk (carbonate of lime) and half its weight of coal-dust, and the mixture strongly heated in a reverberatory furnace. In this process two consecutive changes occur: in the first place, the carbon of the coal deoxidises the sulphate of soda, the products being carbonic oxide and sulphide of sodium, $Na_2SO_4 + 2C_2 = Na_2S + 4CO$. In the second place, the sulphide of sodium and carbonate of lime interchange their constituents, and give rise to carbonate of soda and sulphide of calcium, $Na_2S + CaCO_3 = Na_2CO_3 + CaS$. To prevent, in the subsequent operation of lixiviation, the decomposition of the carbonate of soda by the sulphide of calcium, twice as much carbonate of lime is used as is necessary to undergo exchange of constituents with the sulphide of sodium: this excess of carbonate of lime is deprived of its carbonic acid by the heat, and the resulting lime combines with the sulphide of calcium to form an almost insoluble oxysulphide of calcium. The crude mass is lixiviated with luke-warm water, and the carbonate of soda and caustic soda thereby separated from the more difficultly soluble oxysulphide of calcium. The solution, by evaporation, deposits crystals of monohydrous carbonate of soda, and the mother-liquor yields a dark crystalline mass, composed of carbonate of soda, caustic soda, sulphide of sodium, and some hyposulphite of soda, formed by the oxidation of Na_2S. This is roasted in a reverberatory furnace, to get rid of the sulphur. Or it is calcined with coal-dust or sawdust. The sulphate of soda is converted into sulphide of sodium, and subsequently into carbonate of soda; and the caustic soda combines with carbonic acid. The product is called *soda ash* or *soda salts*, and contains about 50 per cent. of alkali. From this, crystallised carbonate of soda is obtained by lixiviating it with water, straining the solution, and evaporating. The salt is usually crystallised in iron pans. It may be obtained pure by repeated crystallisations, but generally contains traces of sulphates.

[§ *Characters and Tests.*—In transparent colourless laminar crystals of a rhombic shape, efflorescent, with a harsh alkaline taste and strong alkaline reaction. It imparts a yellow colour to flame, and dissolves with effervescence in diluted hydrochloric acid, forming a solution which does not precipitate with perchloride of platinum. By heat it undergoes aqueous fusion, and then dries up, losing 63 per cent. of its weight. When supersaturated with nitric acid it precipitates only slightly with chloride of barium or nitrate of silver. One hundred and forty-three grains require for neutralisation at least 960 grain-measures of the volumetric solution of oxalic acid.

$$\left.\begin{array}{c}\text{20 grains of}\\ \text{Carbonate of Soda}\end{array}\right\}\ \text{neutralise}\ \left\{\begin{array}{l}\text{9·7 grains of Citric Acid.}\\ 10\tfrac{1}{2}\ \text{grains of Tartaric Acid.]}\end{array}\right.$$

The tests show its freedom from more than small quantities of sulphates and chlorides. The presence of hyposulphite of soda is detected by hydrochloric acid, which causes the evolution of sulphurous acid gas, and the precipitation of sulphur, or by the addition of a strong solution of nitrate of silver. If hyposulphite of soda be present a white precipitate, becoming rapidly yellow and brownish-black (sulphide of silver), is produced.

Properties.—Carbonate of soda is insoluble in alcohol. It is dissolved in twice its weight of water at 60°, and in less than its own weight at 212° F.

Physiological Effects.—Carbonate of soda is less acrid and caustic, and has a milder and less unpleasant taste, than carbonate of potash; but in other respects the effects of these salts are very similar. On the other hand, it is more caustic and irritant than the bicarbonate of soda, though in consequence of the large amount of its water of crystallisation it contains little more than half as much soda.

Therapeutics.—Carbonate of soda is used in most of the same cases as carbonate of potash; it is far less frequently employed than the bicarbonate of soda; and as its uses are the same, these will be stated under the latter salt.

Administration.—Crystallised carbonate of soda is exhibited in doses of from 10 to 30 grains.

[§ **Sodæ Carbonas Exsiccata.** *Dried Carbonate of Soda.*

NaO,CO_2 or $\mathbf{Na_2CO_3}$.

Take of

Carbonate of Soda . . . . . 8 ounces.

Expose the carbonate of soda in a porcelain capsule to a rather strong sand heat until the liquid which first forms is converted into a dry cake; and, having rubbed this to powder, enclose it in a stoppered bottle.]

This salt, having been deprived by heat of the water contained in the crystallised carbonate, is well adapted for administration in the form of pill.

Dose, 3 to 10 grains.

[§ **Sodæ Bicarbonas.** *Bicarbonate of Soda.*
$NaO,HO,2CO_2$ or $\mathbf{NaHCO_3}$.]

Synonyms.—Acid carbonate of sodium, hydro-sodic carbonate, &c., commonly called in the shops 'carbonate of soda,' the normal disodic carbonate [the salt last described] being denominated simply 'soda.'

Natural History.—It is a constituent of the mineral waters called *alkaline* or *acidulo-alkaline*, as those of Carlsbad and Seltzer.

Preparation.—[§ ⁂ Take of

Carbonate of Soda	2 pounds.
Dried Carbonate of Soda . . .	3 pounds.
White Marble, in fragments . .	4 pounds.
Hydrochloric Acid	1 gallon.
Water	2 gallons.
Distilled Water	a sufficiency.

With the same apparatus employed for preparing bicarbonate of potash pass the carbonic acid, generated by the action of the hydrochloric acid on the marble, into the carbonates of soda previously well triturated together, until the gas ceases to be absorbed. Pour upon the damp salt which is formed, half its weight of cold distilled water, and shake it occasionally during the course of half-an-hour; then drain the undissolved portion, and dry it by exposure to the air.]

$$\mathbf{Na_2CO_3 + H_2O + CO_2 = 2NaHCO_3.}$$

The mixture of the dried and crystallised carbonates of soda is employed to avoid the presence of too much water, which would cause the bicarbonate to be deposited in large crystals instead of the usual crystalline powder. The salt is washed with cold distilled water, to remove any unchanged neutral carbonate.

[§ *Characters and Tests.*—In powder or small opaque irregular scales, white, of a saline not unpleasant taste. Imparts a yellow colour to flame. Dissolves with much effervescence in diluted hydrochloric acid, forming a solution in which perchloride of platinum causes no precipitate. A solution of the salt in cold water gives a white and not a coloured precipitate with solution of perchloride of mercury. When supersaturated with nitric acid, its solution scarcely precipitates with chloride of barium or nitrate of silver (showing its freedom from sulphates and chlorides). Eighty-four grains exposed to a red heat leave fifty-three of an alkaline residue, which require for neutralisation 1,000 grain-measures of the volumetric solution of oxalic acid.

20 grains of Bicarbonate of Soda	neutralise	16·7 grains of Citric Acid, or 17·8 grains Tartaric Acid.]

Properties.—By exposure to the air bicarbonate of soda effloresces superficially. When heated it evolves carbonic acid and water, and becomes the anhydrous carbonate. It dissolves in thirteen parts according to V. Rose, or eight parts according to Berthollet, of cold water. By heat, the solution loses first one quarter, and subsequently one half of its carbonic acid. This salt is less soluble than the carbonate, and is distinguished from it by the same tests which serve in the case of bicarbonate of potash. The pulverulent bicarbonate of soda of the shops is frequently contaminated with a small quantity of the carbonate.

Physiological Effects.—The effects of this salt are analogous to those of bicarbonate of potash, than which it has a somewhat less disagreeable taste and a slighter local action. It is less caustic and irritant than the crystallised carbonate of soda, while its effect as an antacid is greater, in consequence of the larger percentage of soda.

Therapeutics.—It is employed as an *antacid* in those forms of dyspepsia which are attended with an inordinate quantity of acid in the stomach; as a *lithonlytic* in those kinds of lithiasis which are accompanied with an excessive secretion of uric acid and the urates; as a *resolvent* or *alterative* in certain forms of inflammation, in glandular affections, in syphilis, and scrofula; and as a *diuretic* in some dropsical complaints. A mixture of an aqueous solution of the bicarbonate of soda with a vegetable acid, taken in a state of effervescence, is an agreeable and refreshing drink for allaying thirst, checking sickness, and diminishing febrile heat. The resulting soda-salt undergoes partial decomposition in its passage through the system, and is converted into carbonate, which is found in the urine. Hence, therefore, these effervescing preparations may be employed as diuretics and lithonlytics, instead of the simple carbonate or bicarbonate of soda, than which they are more agreeable. On the other hand they are highly objectionable, and are to be carefully avoided, in the treatment of phosphatic deposits in the urine. Alluding to these cases, Dr. Prout observes: 'Were I required to name the remedy calculated to do the most mischief, I should name the common saline draught formed of potash or soda, and *some vegetable acid.*' This opinion, however, is stated by Dr. O. Rees and Dr. A. Taylor to be directly opposed to the views of others who have treated of the phosphatic diathesis, whose experience goes to show that the greatest benefit is occasionally observed from the use of the citrate and tartrate of potash in certain forms of phosphatic deposit.

Administration.—The dose of this salt is from ten grains to sixty grains. The principal consumption of bicarbonate of soda is in the preparation of the effervescing draught, soda powders, and Seidlitz powders: in these the bicarbonate is mixed with a vegetable acid (either citric or tartaric, usually the latter).

[§ **Borax.** *Borax.*

Synonym.—Sodæ biboras, *Dub.*

$$NaO,2BO_3+10HO \text{ or } \mathbf{Na_2B_4O_7.10H_2O}.$$

A native salt. It is also made artificially by boiling together, in proper proportions, boracic acid and carbonate of soda.]

History.—The word borax is derived from the Arabic *bourak*, a term applied by the Arabians to the *νίτρον* or *nitrum* of the Greeks and Romans.

Borax is a substance peculiar to the mineral kingdom. It has been found in some mineral waters, as those of San Restituta, in Ischia. It occurs also in the waters of certain lakes, especially those of Thibet and Persia, crystallising on the edges and shallows of the lake, whence it is taken up in large masses, which are broken and dried. It is imported usually from Calcutta, under the name of *tincal* or *crude borax*, in the form of flattened six-sided prisms, covered with a greasy unctuous substance, said by Vauquelin to be a fatty matter saponified by soda: the colour is yellowish, bluish, or greenish. Mojon states that the greenish-grey matter which surrounds some kinds of rough borax contains native boron. Borax of a superior quality is said to be procured in China, where it called *pong-cha* or *pounxa*.

Preparation.—The native boracic acid of Tuscany is convertea into borax in the following way:—Dissolve carbonate of soda in water contained in tubs lined with lead and heated by steam. Add coarsely pulverised boracic acid. The evolved gas is passed through sulphuric acid to detain any ammonia which may be contained in it. Boil the liquor and let it stand for ten or twelve hours. Then draw it off into wooden crystallising vessels lined with lead. The crude borax so procured is purified by recrystallisation. This is the origin of the major part of the borax of the present day.

[§ *Characters and Tests.* — In transparent colourless crystals, sometimes slightly effloresced, with a weak alkaline reaction; insoluble in rectified spirit, soluble in water. A hot saturated solution, when acidulated with any of the mineral acids, lets fall, as it cools, a scaly crystalline deposit (boracic acid), the solution of which in spirit burns with a green flame. 191 grains dissolved in 10 fluid ounces of distilled water require for saturation 1,000 grain-measures of the volumetric solution of oxalic acid.]

Properties.—Borax usually occurs in large, colourless, transparent prisms, belonging to the oblique prismatic system. There is an octahedral variety, obtained by crystallisation from a hot solution and containing $5H_2O$. In commerce we frequently meet with it in irregular-shaped masses. Its taste is saline, cooling, and somewhat alkaline. It reacts on turmeric paper like an alkali. By exposure to dry air, it effloresces slowly and slightly. When heated, it melts in its water of crystallisation, swells up, and forms a light, white, porous substance, called *calcined borax.* At a higher temperature it fuses into a transparent glass, called *glass of borax*, which is anhydrous borax, $Na_2B_4O_7$. It is soluble in twelve parts of cold, or in two parts of hot water. Borax is much more soluble in glycerine than in water.

Physiological Effects.—Its *local* action is that of a mild irritant: applied to sores, it excites smarting; and, when taken into the stomach in large doses, it causes vomiting. The *constitutional effects* are probably those of a mild refrigerant and diuretic. Wöhler and Stehberger detected it in the urine, so that it passes out of the system unchanged. Borax is usually regarded as an agent exercising a specific influence over the uterus; promoting menstruation, alleviating the pain which sometimes attends this process, facilitating parturition, diminishing the pain of accouchement, and favouring the expulsion of the placenta and lochia. Borax has been regarded as producing the effects of alkalies on the system. The conclusions drawn by Dr. Binswanger from his physiological and chemical researches on boracic acid and borax, are as follows:— In a pharmacological point of view, this salt resembles carbonate or bicarbonate of soda. Like the carbonate it has an alkaline reaction, acts as an antacid, and, when in solution, absorbs carbonic acid, and dissolves fibrine, albumen, casein, and uric acid. Swallowed in large doses it occasions oppression of stomach, nausea, and vomiting. It becomes absorbed, and is afterwards eliminated by the kidneys and other secreting organs. Binswanger detected it in the blood of the portal vein, in the bile, and the saliva. It has, therefore, doubtless, an influence on the process of chymification. In very large and repeated doses it produces the injurious effects of the alkalies; as inflammation of the stomach and bowels, disordered digestion, and a scorbutic condition. On Binswanger himself the use of it caused an impetiginous eruption. The author asserts that borax has no peculiar or specific effect on the nervous system, sexual organs, or mucous surfaces. It has no specific power of exciting uterine contractions, of promoting menstruation, or of curing aphthous affections; though, like the carbonated alkalies, it may, by relaxing muscular fibres, slightly relieve spasm of the uterus or by its liquefacient properties promote the evacuation of menstrual blood, or by its mild alkaline qualities improve the condition of the skin and mucous surfaces. As a lithonlytic for uric acid, Binswanger considers it more useful than any other salt; for, though its solvent power for this acid is inferior to that of carbonate of lithia, the rarity of the latter salt renders it less available. Borax acts as a solvent for uric acid, by yielding up part of its soda to form the more soluble urate of soda; but it has no power of preventing the formation of this acid. It acts merely as a lithonlytic, that is, as a solvent for the already-formed acid.

Therapeutics.—As a *local agent*, borax is employed as a detergent in aphthæ and ulceration of the mouth. In some skin diseases it has been used with great benefit. In pityriasis versicolor (called also *liver spots* or *chloasma*), a strong solution of borax (as thirty grains of borax in an ounce of water) is a most valuable remedy. It should be applied by a sponge or rag. A solution of thirty grains of borax in eight ounces of rose-water is sometimes employed as a useful cosmetic. *Unguentum boracis* (composed of sixty grains of borax to one ounce of lard) has been applied to inflamed and painful hemorrhoidal tumours, and to cracked nipples.

Internally, it has been used as a lithonlytic; as a diuretic in dropsical affections; and with the view of influencing the uterus in the cases before mentioned. Dr. Copland recommends it, in conjunction with ergot of rye, to promote uterine contractions.

Dose, 30 to 60 grains.

[§ **Mel Boracis.** *Borax Honey.*

Take of

Borax, in fine powder	64 grains.
Clarified Honey	1 ounce.

Mix.]

A convenient form for the employment of borax in the aphthæ of children.

[§ **Glycerinum Boracis.** *Glycerine of Borax.*

Take of

Borax, in powder	1 ounce.
Glycerine	4 fluid ounces.

Rub them together in a mortar until the borax is dissolved.]

Dissolved in water either of the above preparations may be employed as a gargle in ulceration of the mouth and throat.

[§ **Sodæ Phosphas.** *Phosphate of Soda.*

$2NaO,HO,PO_5+24HO$ or $Na_2HPO_4.12H_2O$.]

Synonyms.—Common or rhombic phosphate of soda. Disodic phosphate, &c.

History.—This salt was known in the early part of the last century under the name *sal mirabile perlatum.* It occurs in nature principally as a constituent of animal fluids.

Preparation.—[§ ⁑ It may be obtained by the following process :—

Take of

Bone Ash, in powder .	10 pounds.
Sulphuric Acid . .	56 fluid ounces.
Distilled Water . .	$4\frac{1}{2}$ gallons, or a sufficiency.
Carbonate of Soda .	16 pounds, or a sufficiency.

Mix the bone ash with the sulphuric acid, and after twenty-four hours add a gallon of the water. Digest for forty-eight hours, adding water as it evaporates. Add another gallon of the water, digest for an hour, filter through calico, and wash what remains until it has almost ceased to have an acid reaction. Concentrate the filtrate to a gallon, let it rest for twenty-four hours, and filter again. Heat the filtrate to near the boiling-point, add the carbonate of soda previously dissolved in two gallons of water till it ceases to form a precipitate, and the fluid has acquired a feeble alkaline reaction. Filter through calico, evaporate the clear liquor till a film forms on the surface, and set it aside to crystallise. Dry the crystals without heat.]

The products obtained by the mutual reaction of sulphuric acid and bone ash are carbonic acid, sulphate of lime, and a soluble acid or superphosphate of lime; the latter remains in solution, while the sulphate is, for the most part, precipitated.

$$\overbrace{Ca_3 2PO_4 + CaCO_3}^{\text{Bone-Ash.}} + 3H_2SO_4 = 3CaSO_4 + CaH_4 2PO_4 + CO_2 + H_2O$$

On the addition of carbonate of soda to the liquor, phosphate of soda is formed in solution.

$$CaH_4 2PO_4 + Na_2CO_3 = CaHPO_4 + Na_2HPO_4 + H_2O + CO_2$$

It may assist the comprehension to observe that the soluble 'superphosphate' contains the elements of this precipitable phosphate united with those of phosphoric acid.

$$CaH_4 2PO_4 \text{ contains } CaHPO_4 + H_3PO_4$$

It is this last which may be regarded as furnishing the phosphate of soda, $H_3PO_4 + Na_2CO_3 = Na_2HPO_4 + H_2O + CO_2$. An insoluble phosphate of lime is precipitated, and carbonic acid escapes. A slight excess of carbonate of soda promotes the formation of crystals of phosphate.

[§ *Characters and Tests.*—In transparent colourless rhombic prisms, terminated by four converging planes, efflorescent, tasting like common salt. It imparts a yellow colour to flame. Its solution has a faintly alkaline reaction, it gives a yellow precipitate with nitrate of silver (Ag_3PO_4), the resulting fluid acquiring an acid reaction. Heated to dull redness it loses 63 per cent. of its weight, leaving a residue, which, when dissolved in water, gives with chloride of barium a precipitate almost entirely soluble in diluted nitric acid] (showing its comparative freedom from sulphates).

Properties.—The crystals of phosphate of soda require for their solution four times their weight of cold, or twice their weight of hot water: they are nearly insoluble in alcohol. They react feebly on vegetable colours like alkalies. When heated, they undergo the watery fusion, and form a white mass called pyrophosphate of soda ($Na_4P_2O_7$). From this, and from metaphosphate of soda ($NaPO_3$), the officinal salt is distinguished by the yellow colour of its precipitate with nitrate of silver, both of these affording white precipitates.

Physiological Effects.—In doses of an ounce, or an ounce and a half, it acts as a mild antiphlogistic purgative, like sulphate of soda. In smaller doses it operates like other saline substances. Being an important and essential constituent of the healthy blood, it has been supposed that this salt would be less obnoxious to the organism than those salines which are not constituents of the body, and that it would pass into the system more readily. Moreover, some benefit has been expected from its influence as an agent acting on the blood, sometimes supplying a deficient ingredient and modifying its crasis.

Therapeutics.—As a purgative, it has been employed in the diseases of children and delicate persons, in preference to other saline substances, on account of its slight taste and mild action on the stomach. It is well adapted for febrile and inflammatory disorders. It is one of the substances which have been employed in cholera to restore to the blood its deficient saline matters. On account of its supplying phosphoric acid, it has been supposed to be particularly applicable in those diseases in which there is a deficiency of phosphate of lime in the bones, but with doubtful efficacy. It has been administered in *diabetes.* It has been resorted to for the purpose of supplying the system with an ingredient in which it was supposed to be deficient; in this malady the phosphates of the urine are stated to be diminished. Simon, however, declares that the amount of earthy phosphates in diabetic urine is not much below the normal average. Nicolas, Gueudeville, Dr. Latham, and Dr. Sharkey, have employed phosphate of soda in diabetes with asserted benefit. It is said to promote the healthy action of the stomach, to keep the bowels regular, and to lessen the discharge of urine. It is one of the substances which have been employed as a solvent for uric acid calculi.

Dose, as an alterative, 20 to 40 grains; as a purgative, 1 ounce to $1\frac{1}{2}$ ounce.

[§ **Solution of Phosphate of Soda.** (Appendix II.)

Take of

Phosphate of Soda, in crystals	.	1 ounce.
Distilled Water	.	10 fluid ounces.

Dissolve and filter.]

Sodæ Hypophosphis. *Hypophosphite of Soda.*

NaO,PH_2O_3 or $\mathbf{NaH_2PO_2}$.

This salt is prepared by adding carbonate of soda, in solution, to solution of hypophosphite of lime as long as a precipitate is formed, separating the soluble hypophosphite of soda from the precipitate, and evaporating the former to dryness at a gentle heat. It is said to be subject to explosion if much heat is applied in the evaporation.

Its medicinal properties are similar to those of Hypophosphite of Lime, which see.

Sulphites of Soda.

If an excess of sulphurous acid gas is passed through a solution of one part of crystallised carbonate of soda in two parts of water, the solution, as it cools, deposits crystals of the acid sulphite of soda, $\mathbf{NaHSO_3,4H_2O}$. By saturating this with carbonate of soda the normal or neutral sulphite of soda is obtained, $\mathbf{Na_2SO_37H_2O}$.

These and other sulphites are used in medicine on account of the sulphurous acid they contain, which is liberated by contact of the salt with one of the stronger mineral acids.

[§ **Hyposulphite of Soda.** (Appendix I.)

NaO,S_2O_2+5HO or $\mathbf{Na_2H_2S_2O_4.4H_2O}$.]

Preparation.—This salt may be readily obtained by passing sulphurous acid gas into a solution of carbonate of soda to which sulphur has been added: carbonic acid is evolved, and hyposulphite of soda remains in solution,

$$\mathbf{Na_2CO_3 + S + SO_2 + H_2O = Na_2H_2S_2O_4 + CO_2}.$$

Properties.—The crystals are odourless and have a cool, afterwards bitter, taste. They readily dissolve in water, but not in alcohol. If sulphuric, nitric, or hydrochloric acid be added to a strong solution of this salt, sulphurous acid is disengaged, and sulphur is precipitated. With nitrate of silver in excess the hyposulphite of soda yields a white precipitate, $\mathbf{Ag_2H_2S_2O_4}$, which ultimately becomes black, owing to its conversion into sulphide of silver, $\mathbf{Ag_2S}$, which precipitates, and sulphuric acid, which remains in solution. If the hyposulphite be in excess, then the white hyposulphite of silver which is at first formed is immediately redissolved.

[§ *Test.*—24·8 grains decolorise 100 measures of the volumetric solution of iodine.]

Hyposulphite of soda and iodine react as follows:—

$$2Na_2H_2S_2O_4 + I_2 = 2NaI + Na_2S_4O_6 + 2H_2O,$$

yielding iodide of sodium and tetrathionate of sodium.

[§ **Volumetric Solution of Hyposulphite of Soda.** (Appendix III.)

Take of

Hyposulphite of Soda, in crystals .	280 grains.
Distilled Water	a sufficiency.

Dissolve the hyposulphate of soda in 10,000 grain-measures of water. Fill a burette with this solution and drop it cautiously into 1,000 grain-measures of the volumetric solution of iodine until the brown colour is just discharged. Note the number of grain-measures (n) required to produce this effect; then put 8,000 grain-measures of the same solution into a graduated jar and augment this quantity by the addition of distilled water until it amounts to $\frac{8{,}000 \times 1{,}000}{n}$ grain-measures.

If, for example, n = 950; the 8,000 grain-measures of solution should be diluted to the bulk of $\frac{8{,}000\ 1{,}000}{950} = 8{,}421$ grain-measures. 1,000 grain-measures of this solution contain 24·8 grains of the hyposulphite ($\frac{1}{10}$th of 2 ($NaOS_2O_2,5HO$) or $\frac{1}{10}$th of $Na_2H_2S_2O_44H_2O$ in grains), and therefore correspond to 12·7 grains of iodine ($\frac{1}{10}$th of an equivalent). Grammes and cubic centimètres may be employed instead of grains and grain-measures, but for convenience $\frac{1}{10}$th of the numbers should be taken. 100 cubic centimètres of this solution contain 2·48 grammes of the hyposulphite ($\frac{1}{100}$th of 2($NaOS_2O_2,5HO$) or $\frac{1}{100}$th of $Na_2H_2S_2O_44H_2O$ in grammes) and therefore correspond to 1·27 gramme of iodine ($\frac{1}{100}$th of an equivalent).

This solution is used for testing the following substances. In each case, excepting that of iodum, a solution of iodide of potassium and hydrochloric acid are added to the substance, and the amount of iodine so liberated is indicated by this solution.

	British Weights and Measures.				Metrical Weights and Measures.		
	Grs. of Substance.	=	Gr.-measures of Vol. Sol.	or	Grms. wt. of Substance.	=	C. C. of Vol. Sol.
Calx Chlorata . .	10·0	=	850	or	1·00	=	85·0
Iodum . . .	12·7	=	1000	or	1·27	=	100·0
Liq. Calc. Chloratæ .	60·0	=	500	or	6·00	=	50·0
,, Chlori . .	439·0	=	750	or	43·90	=	75·0
,, Sodæ Chloratæ	70·0	=	500	or	7·00	=	50·0]

[§ **Sodæ Sulphas.** *Sulphate of Soda.*

$NaO,SO_3 10HO$ or $\mathbf{Na_2SO_4,10H_2O}$.]

Synonyms.—Glauber's salt. Sulphate of sodium. Disodic sulphate, &c.

Preparation.—[§ It may be obtained from the residue ($\mathbf{NaHSO_4}$) left in the manufacture of hydrochloric acid, by neutralising it with carbonate of soda and crystallising from solution in water.]

$$\mathbf{2NaHSO_4 + Na_2CO_3 = 2Na_2SO_4 + CO_2 + H_2O.}$$

[§ *Characters.*—In transparent oblique prisms; has a salt and bitter taste; effloresces on exposure to the air; soluble in water, insoluble in spirit. Exposed to heat in a porcelain crucible it loses 55·9 per cent. of water. Heated with solution of potash no odour of ammonia is evolved and no precipitate is formed. (A precipitate would probably indicate the presence of sulphate of manganese; this might be confirmed by adding solution of chlorinated lime, which causes a brown precipitate of peroxide of manganese.) Imparts a yellow colour to flame. Fifty grains of it dissolved in distilled water and acidulated with hydrochloric acid, give by addition of chloride of barium a white precipitate, which when it has been washed and dried, weighs 72·2 grains.] Manufacturers of chloride of lime, who procure chlorine from common salt by means of sulphuric acid and oxide of manganese, use the residue, which they merely saturate with lime, for making sulphate of soda. From the possibility of a portion of manganese being left with the sodium salt, the test above quoted is introduced into the Pharmacopœia.

Physiological Effects.—It is a mild but efficient cooling laxative or purgative salt, promoting secretion and exhalation from the mucous membrane of the stomach and bowels, without causing inflammation or fever. Taken in full doses it acts as an antiplastic, reducing considerably the proportion of coagulable fibrin in the blood.

Uses.—It is employed as a common purgative, either alone or added to other purgatives. It is applicable in fevers and inflammatory affections, where we want to evacuate the bowels without increasing or causing febrile disorder.

Dose, $\frac{1}{2}$ ounce to 1 ounce.

[§ **Sodii Chloridum.** *Chloride of Sodium.* NaCl or **NaCl.**]

Synonyms.—Common or culinary salt. Muriate of soda. Sodium or sodic chloride.

History.—The earliest notice of salt occurs in the writings of Moses (Genesis xix., Levit. ii.) An enormous quantity of this salt is contained in the waters of the ocean. At an average calculation, sea-water contains 2·5 per cent. of chloride of sodium. It is found also in great abundance in mineral waters. It has not hitherto been found in the oldest stratified rocks, but is met with, in various places, in all the later formations, either in solid masses (rock salt), or in brine springs. It is also found in plants which grow by the sea side, in the blood and urine of man, &c.

Preparation.—The salt consumed in this country is chiefly procured from the salt mines of Cheshire and Worcestershire, where large deposits of rock salt are found in the *new red sandstone.* On the Continent similar deposits of even greater extent are found in other formations. The brine, formed either naturally in the mine or by the intentional admission of water, is pumped up to the surface and evaporated, the crystals of salt as they form being removed.

In France, and on the shores of the Mediterranean, salt is procured from sea-water by solar evaporation, and is then called *bay-salt.*

[§ *Characters and Tests.*—In small white crystalline grains, or transparent cubic crystals, free from moisture, has a purely saline taste, imparts a yellow colour to flame, is soluble in water. The solution is not precipitated by perchloride of platinum, but gives with nitrate of silver a white precipitate soluble in ammonia but insoluble in nitric acid] (**AgCl**).

Properties.—The crystals of chloride of sodium are anhydrous. When free from all foreign matters, chloride of sodium is permanent in the air; but ordinary salt is slightly deliquescent, owing to the presence of small quantities of the chlorides of magnesium or calcium. When heated, it decrepitates (more especially the coarse-grained or bay-salt); at a red heat it fuses; and at a still higher temperature it is volatilised. Hot and even boiling water dissolves very little more salt than cold water. At 60° it requires about twice and a half its weight of water to dissolve it.

Physiological Effects.—Salt is an irritant in its local operation. Thus, applied to the skin and the mucous membranes, it causes redness. Taken into the stomach in large quantity (as in the dose of a tablespoonful or more), it excites vomiting; and, when thrown into the large intestines, produces purging. In moderate quantities it promotes the appetite and assists digestion and assimilation. If used too freely, it occasions thirst. In large doses it operates as an irritant poison.

Therapeutics.—The following are some of the most important therapeutical uses of chloride of sodium :—

As a *vomit,* it has been recommended in malignant cholera in preference to other emetics. In narcotic poisoning, in the absence of the stomach-pump and the ordinary emetic substances, it may also be employed. The dose of it is one or two tablespoonfuls in a tumblerful of water. A teaspoonful of flour of mustard assists its action. As a *purgative* it is seldom employed, except in the form of enema. One or two tablespoonfuls of common salt, dissolved in a pint of gruel, form a very useful clyster for promoting evacuations from the bowels. It has been used in some diseases with the view of *restoring the saline qualities of the blood*, especially in cholera. Properly diluted, and injected into the veins in cholera, it acts as a powerful stimulant and restorative; the pulse, which was before imperceptible, usually becomes almost immediately restored, and, in some cases, reaction and recovery follow. Common salt has been employed as an *anthelmintic*. For this purpose it is exhibited in large doses by the mouth; or, when the worms are lodged in the rectum, a strong solution is administered in the form of enema. When leeches have crept into the rectum, or have been accidentally swallowed, a solution of salt should be immediately used. As a *chemical antidote*, chloride of sodium may be administered in poisoning by nitrate of silver. As an *alterative and tonic*, it is useful in scrofula and glandular diseases. As an *astringent* in hemorrhages, dysentery, and diarrhœa, it has been administered in combination with lime-juice or lemon-juice. It is frequently employed as a *dentifrice*.

Administration.—As a tonic and alterative, the dose is from ten to sixty grains. As an emetic, from two to three tablespoonfuls in five or six ounces of warm water. As a cathartic, from half an ounce to an ounce.

[§ **Liquor Sodæ Chloratæ.** *Solution of Chlorinated Soda.*]

A mixed solution of hypochlorite of soda, chloride of sodium, and bicarbonate of soda.

[§ ⁂ *Preparation.*—Take of

Carbonate of Soda	12 ounces.
Black Oxide of Manganese, in powder .	4 ounces.
Hydrochloric Acid	15 fluid ounces.
Distilled Water	2 pints.

Dissolve the carbonate of soda in thirty-six fluid ounces of the water, and pass into the solution the chlorine, slowly generated from the oxide of manganese and hydrochloric acid, washing the gas through the remainder of the water. Preserve the liquid in a cool and dark place.]

By the action of the chlorine on the solution of carbonate of soda, there are formed hypochlorite of soda, chloride of sodium, and bicarbonate of soda, thus,

$$2Na_2CO_3 + Cl_2 + H_2O = NaClO + NaCl + 2NaHCO_3.$$

The essential and characteristic properties of this solution depend on the hypochlorite of soda. It is the Liqueur de Labarraque, or Labarraque's disinfecting fluid.

[§ *Characters and Tests.*—A colourless alkaline liquid, with astringent taste and feeble odour of chlorine (hypochlorous acid). It decolourises sulphate of indigo. It effervesces with hydrochloric acid, evolving chlorine and carbonic acid, and forming a solution which does not precipitate with perchloride of platinum. Specific gravity, 1·103. Seventy grains by weight, added to a solution of twenty grains of iodide of potassium in four fluid ounces of water, and acidulated with two fluid drachms of hydrochloric acid, require for the discharge of the brown colour which the mixture assumes, 500 grain-measures of the volumetric solution of hyposulphite of soda. It is not precipitated by oxalate of ammonia.]

By the mutual reaction of the Liq. Sodæ Chloratæ and the iodide of potassium, in an acidified solution, iodine is set at liberty,

$$NaClO + NaCl + 2HCl + 2KI = 2NaCl + 2KCl + H_2O + I_2.$$

The hyposulphite in decolourising the liquid gives rise to iodide and tetrathionate as explained under Hyposulphite of Soda. The absence of precipitate with oxalate of ammonia shows that chlorinated lime has not been substituted for or mixed with it.

A solution of chlorinated soda should not yield a precipitate on the addition of a solution of sulphate of magnesia. If a precipitate be obtained, it indicates the presence of carbonate of soda, and the consequent imperfect saturation of the liquid with chlorine.

Physiological Effects.—I am unacquainted with any experiments made to determine the physiological effects of chlorinated soda on man. In *moderate* or *small doses*, it has been denominated stimulant, tonic, astringent, antiseptic, and febrifuge. But these terms give no real explanation of the nature of those organic changes which it gives rise to, and from which its therapeutical value is derived.

Therapeutics.—The solution of chlorinated soda is employed as a *disinfectant*, *antiseptic*, and, in cases of poisoning by the hydrosulphurets, sulphuretted hydrogen, and hydrocyanic acid, as an *antidote*. But for most of these purposes chlorinated lime is employed instead of chlorinated soda, since its properties are analogous, and, being manufactured on a very extensive scale for the use of bleachers, it can be obtained more conveniently and cheaply. On this account, therefore, and to avoid repetition, I must refer to the article **Chlorinated Lime**, for information respecting the above uses of chlorinated soda. I would remark, however, that in several cases where I have carefully tried and compared the two compounds, I give the decided preference to chlorinated soda. As an antiseptic, Labarraque also preferred the latter preparation, on the ground that by the process of disinfection it becomes chloride of sodium, which is not a deliquescent salt; whereas the chloride of calcium generated by chlorinated lime attracts water from the atmosphere, and thereby furnishes one of the conditions (viz. moisture) necessary to the putrefactive process. Hence, in his opinion, while chlorinated lime will serve equally well for mere disinfection, chlorinated soda is preferable when we wish at the same time to prevent a renewal of putrefaction.

Chlorinated soda is employed internally in all diseases commonly termed *putrid* or *malignant*—as typhus fever and scarlatina maligna. It is indicated when there are great prostration of strength, fetid evacuations, and a dry and furred tongue. In such cases I have seen it of essential service, improving the quality of the secretions, producing a moist state of the skin, preventing collapse, and altogether acting most beneficially. It may be administered both by the mouth and the rectum.

As a *local* remedy, it is employed in diseases attended with fetid discharges, not merely as a disinfectant and antiseptic—that is, as a chemical agent destroying fetor, and preventing the putrefaction of dead matters (as gangrenous parts, the discharges from wounds and ulcers), although in these respects it is most valuable,—but as a means of stopping or relieving morbid action by changing the action of the living tissues. It frequently puts a stop to the further progress of gangrene; promotes the separation of the dead from the living parts; improves the quality of the secretions; and, at the same time, diminishes their quantity when this is excessive. It is applied to ulcers of various kinds (common, phagedenic, cancerous, syphilitic, and scrofulous) when attended with foul discharges, or a disposition to slough. It is of great service in some affections of the mucous surfaces. Thus it is used as a gargle to check ptyalism and affections of the mouth, whether arising from mercury or other causes. In scarlatina maligna, we apply it to check ulceration and sloughing of the throat. In coryza and ozæna, it has been injected into the nostrils with considerable benefit. In fetid and excessive discharges from the vagina and neck of the uterus or bladder, it is employed as an injection with at least temporary relief. It has also been applied in some skin diseases; as tinea capitis, eczema, scabies, and prurigo pudendi. The above are only a few of the cases in which chlorinated soda has been used with most marked benefit. In conclusion, I may add that there are few, if any, remedies, the uses of which, as local agents, are so valuable and extensive as chlorinated soda and lime.

Administration.—It may be administered internally in doses of from twenty to thirty drops or more, diluted with some mild aqueous liquid. For a *gargle* it may be diluted with fifteen, and for a *lotion* with ten or fifteen parts of water.

Antidotes.—See **Calx Chlorata.**

[§ **Cataplasma Sodæ Chloratæ.** *Chlorine Poultice.*

Take of

Solution of Chlorinated Soda . .	2 fluid ounces.
Linseed Meal	4 ounces.
Boiling Water	8 fluid ounces.

Mix the linseed meal gradually with the water, and add the solution of chlorinated soda, with constant stirring.]

Applied to foul and sloughing ulcers.

[§ **Sodæ Nitras.** *Nitrate of Soda.* NaO,NO_5 or $\mathbf{NaNO_3}$.

A native salt, purified by crystallisation from water.]

Synonyms.—Cubic nitre. Chili saltpetre or South American nitre. Nitrate of sodium. Sodium or sodic nitrate.

History.—Discovered and examined in the middle of last century. Native nitrate of soda is found in South Peru. It exists in large beds, a few feet below the saline soil, or forming that soil in various places. It is found in distinct strata, a thin layer of brown loam separating the parts.

Preparation.—Crude nitrate of soda is obtained by crystallisation from a boiling saturated solution of the native salt; it is afterwards purified by resolution and crystallisation.

[§ *Characters and Tests.*—In colourless obtuse rhombohedral crystals, having a cooling saline taste. Thrown on the fire it deflagrates; warmed in a test-tube, with sulphuric acid and copper wire, it evolves ruddy fumes. It is soluble in about two parts of cold distilled water. The solution gives no precipitate with nitrate of silver or chloride of barium (chlorides and sulphates absent).]

The yellow colour which it communicates to flame, as well as the shape of the crystals, readily distinguish it from nitrate of potash.

[§ **Sodæ Arsenias.** *Arseniate of Soda.*

$2NaO,HO,AsO_5+14HO$ or $\mathbf{Na_2HAsO_4,7H_2O}$.

Take of

Arsenious Acid	10 ounces.
Nitrate of Soda	$8\frac{1}{2}$ ounces.
Dried Carbonate of Soda . .	$5\frac{1}{2}$ ounces.
Boiling distilled Water . . .	35 ounces.

Reduce the dry ingredients separately to fine powder, and mix them thoroughly in a porcelain mortar. Put the mixture into a large clay crucible, and cover it with the lid. Expose to a full red heat till all effervescence has ceased, and complete fusion has taken place. Pour out the fused salt on a clean flagstone, and as soon as it has solidified, and while it is still warm, put it into the boiling water, stirring diligently. When the salt has dissolved, filter the solution through paper, and set it aside to crystallise. Drain the crystals, and, having dried them rapidly on filtering paper, enclose them in stoppered bottles.]

The arsenious acid is oxidised at the expense of the nitrate of soda, and when the effervescence caused by the escape of the nitrous and carbonic acid gases is over, the fused mass consists of the pyroarseniate of sodium ($Na_4As_2O_7$).

$$As_2O_3 + Na_2CO_3 + 2NaNO_3 = Na_4As_2O_7 + CO_2 + N_2O_3.$$

By boiling with water this arseniate combines with a molecule and gives the ordinary salt; $Na_4As_2O_7 + H_2O = 2Na_2HAsO_4$.

[§ *Characters and Tests.*—In colourless transparent prisms, soluble in water; the solution is alkaline, giving white precipitates (arseniates) with chloride of barium, chloride of calcium, and sulphate of zinc, and a brick-red precipitate with nitrate of silver (Ag_3AsO_4), all of which are soluble in nitric acid. Heated to 300° it loses 40·38 per cent. of its weight. A watery solution of ten grains of the residue, treated with 53 grain-measures of the volumetric solution of soda, continues to give a precipitate with the volumetric solution of nitrate of silver until 1,613 grain-measures of the latter have been added.]

Therapeutics.—Arseniate of soda, first officially ordered in the British Pharmacopœia, may be used in the same cases as the arsenical solution, over which it has the advantage of possessing a definite form, and probably of being somewhat milder in its action. It is used in the form of solution.

Dose, $\frac{1}{16}$ to $\frac{1}{8}$ grain.

[§ **Liquor Sodæ Arseniatis.** *Solution of Arseniate of Soda.*

Take of

Arseniate of Soda (rendered anhydrous by a heat not exceeding 300°) . .	4 grains.
Distilled Water	1 fluid ounce.

Dissolve.]

Dose, 5 to 10 min.

[§ **Sodæ Acetas.** *Acetate of Soda.*

$NaO,C_4H_3O_3+6HO$ or $NaC_2H_3O_23H_2O$.]

Preparation.—Acetate of soda is procured by saturating acetic acid by carbonate of soda, and evaporating the solution so that crystals may form.

$$2HC_2H_3O_2 + Na_2CO_3 = 2NaC_2H_3O_2 + H_2O + CO_2.$$

Properties.—This salt crystallises in oblique rhombic prisms. Its taste is cooling, saline, and bitterish. Exposed to the air at ordinary temperatures, the crystals undergo little change; but in dry and warm air they effloresce and become anhydrous. When heated, they first undergo the watery fusion, then give out their water of crystallisation, and afterwards enter into igneous fusion. When incinerated in a close vessel the residue is *soda flux*, a mixture of carbonate of soda and charcoal, which possesses an advantage over black flux, in not being deliquescent. As an acetate, this salt is recognised by the evolution of the vapour of acetic acid when oil of vitriol is poured over it; and by the production of fragrant acetic ether when rectified spirit is boiled with this mixture. It is soluble in about three parts of cold water, and is slightly soluble in alcohol.

[§ *Characters and Tests.*—In transparent colourless crystals, soluble in water, forming a solution neutral to test-paper. The solution when dilute is not precipitated by chloride of barium or nitrate of silver.] These tests indicate freedom from sulphates and chlorides.

[§ **Solution of Acetate of Soda.** (Appendix II.)

Take of

Acetate of Soda	$\frac{1}{2}$ ounce.
Distilled Water	5 fluid ounces.

Dissolve and filter.]

Used in the process for indicating the constituents of phosphate of lime.

[§ **Sodæ Valerianas.** *Valerianate of Soda.*

$NaO,C_{10}H_9O_3$ or $\mathbf{NaC_5H_9O_2}$.

Take of

Amylic Alcohol (fousel oil) . .	4 fluid ounces.
Bichromate of Potash . . .	9 ounces.
Sulphuric Acid	$6\frac{1}{2}$ fluid ounces.
Solution of Soda	a sufficiency.
Distilled Water	$\frac{1}{2}$ gallon.

Dilute the sulphuric acid with ten fluid ounces of the water, and dissolve the bichromate of potash in the remainder of the water with the aid of heat. When both liquids are cold, mix them with the fousel oil in a matrass with occasional brisk agitation, until the temperature of the mixture has fallen to about 90°. Connect the matrass with a condenser, and distil until about half a gallon of liquid has passed over. Saturate the distilled liquid accurately with the solution of soda, remove any oil which floats on the surface, evaporate till watery vapour ceases to escape, and then raise the heat cautiously so as to liquefy the salt. When the product has cooled and solidified, break it into pieces, and immediately put it into a stoppered bottle.]

By the action of sulphuric acid on bichromate of potash, chromic acid is formed, the oxygen of which, half uniting with hydrogen from the amylic alcohol, and half with the residue of that body, chrome-alum, valerianic acid and water result: thus,

$$3C_5H_{12}O + 2K_2Cr_2O_7 + 8H_2SO_4$$
$$= 3C_5H_{10}O_2 + 2\,(K_2SO_4,Cr_23SO_4) + 11H_2O,$$

since every molecule of $C_5H_{12}O + O_2 = C_5H_{10}O_2 + H_2O$.

The valerianic acid at the same time in part reacts upon the unaltered fousel oil, giving rise to a compound ether, valerianate of amyl, $HC_5H_9O_2 + C_5H_{12}O = C_5H_{11},C_5H_9O_2 + H_2O$. These two resultants distilling over together, are decomposed by the soda,

$$HC_5H_9O_2 + NaHO = NaC_5H_9O_2 + H_2O \text{ and}$$
$$C_5H_{11},C_5H_9O_2 + NaHO = NaC_5H_9O_2 + C_5H_{12}O.$$

So that, according to the last equation, a certain quantity of fousel oil is regenerated and is removed.

[§ *Characters.*—In dry white masses without alkaline reaction, entirely soluble in rectified spirit, and giving out a powerful odour of valerian on the addition of diluted sulphuric acid.]

Dose, 1 to 5 grains.

[§ **Soda Tartarata.** *Tartarated Soda.*

$NaO,KO,C_8H_4O_{10}+8HO$ or $NaKC_4H_4O_6.4H_2O$.

Synonyms.—Sodæ et potassæ tartras, 1864. Sodæ potassio tartras, *Lond.*] Tartrate of potash and soda. Potassio-tartrate of soda. Sal de Seignette. Rochelle salt. Tartrate of potassium and sodium.

History.—Discovered by Seignette, an apothecary at Rochelle, in 1672.

Preparation.—[§ Take of

Acid Tartrate of Potash, in powder	16 ounces or a sufficiency.
Carbonate of Soda . . .	12 ounces or a sufficiency.
Boiling distilled Water . .	4 pints.

Dissolve the carbonate of soda in the water, add gradually the acid tartrate of potash, and, if after being boiled for a few minutes the liquid has an acid or alkaline reaction, add a little carbonate of soda, or acid tartrate of potash till a neutral solution is obtained. Boil and filter; concentrate the liquor till a pellicle forms on the surface, and set it aside to crystallise. More crystals may be obtained by again evaporating as before.]

In this process a neutral salt is formed, while carbonic acid is disengaged.

$$2KHC_4H_4O_6 + Na_2CO_3 = 2KNaC_4H_4O_6 + H_2O + CO_2.$$

[§ *Characters and Tests.*—In colourless transparent prisms or halves of prisms of the right-rhombic order, generally eight-sided, tasting like common salt. Heated with sulphuric acid it blackens, evolving inflammable gases and the odour of burnt sugar. It imparts a yellow colour to flame. A strong solution gives a crystalline precipitate with a small quantity of acetic acid (owing to the formation of acid tartrate of potash). Entirely soluble in cold water. One hundred and forty-one grains heated to redness till gases cease to be evolved, leave an alkaline residue which requires for neutralisation 1,000 grain-measures of the volumetric solution of oxalic acid.]

Properties.—The salt may be easily recognised by the shape and size of the crystals. Exposed to the air, the crysals slightly effloresce. When heated, they undergo watery fusion, evolve their water of crystallisation, and are decomposed : the residue consists of charcoal and the carbonates of potash and soda. They are readily soluble in cold, and still more so in hot water.

Physiological Effects.—It is a mild, laxative, cooling salt, very analogous in its effects to the tartrate of potash. When given in the form of dilute solution, and so as not to excite purging, it becomes absorbed, and renders the urine alkaline.

Therapeutics.—It is commonly employed as a mild aperient for females and other delicate persons. It may be used with advantage by those who are subject to excessive secretion of uric acid or the urates.

Administration.—It is given in doses of from a quarter of an ounce to an ounce. It should be exhibited largely diluted with water. A very convenient mode of exhibition is in combination with bicarbonate of soda and tartaric acid in an effervescing condition.

[§ **Sodæ Citro-Tartras Effervescens.** *Effervescent Citro-Tartrate of Soda.*

Take of

Bicarbonate of Soda, in powder . .	17 ounces.
Tartaric Acid, in powder . . .	8 ounces.
Citric Acid, in powder	6 ounces.

Mix the powders thoroughly, place them in a dish or pan of suitable form, heated to between 200 and 220°, and when the particles of the powder begin to aggregate, stir them assiduously until they assume a granular form; then by means of suitable sieves, separate the granules of uniform and most convenient size, and preserve the preparation in well-closed bottles.]

This is intended to represent the so-called 'Effervescing Citrate of Magnesia,' which is usually composed of bicarbonate of soda, with tartaric, or a mixture of tartaric and citric acids, and sometimes a small quantity of sulphate of magnesia.

It forms an agreeable effervescing saline draught when mixed with water.

[§ **Sapo Durus.** *Hard Soap.*

Soap made with olive oil and soda.]

Preparation.—The oil (olive oil) is boiled with a solution of soda till the whole forms a thick viscid solution. The alkali is added gradually, and when the saponification is complete, the soap is separated from the excess of alkali, the glycerine, and the superfluous water, by the addition of common salt. The soap rises to the surface, and is ladled off into moulds, where it is stirred to promote the separation of the liquid. It may be further purified by repeating the process of dissolving in alkaline ley, and separating by the addition of salt.

Theory of Saponification.—The fixed oils and fats are mixtures of two or more fatty salts. *Stearin* (e.g. tallow), *margarin* (the solid matter deposited by oils in cold weather), olein (the fluid portion of oils), cocinin (cocoa-butter), and palmitin (the solid portion of palm oil), are most frequently employed in soap-making. Regarding, for simplicity, olive oil as consisting of olein, the change which occurs upon its resolution into soap and glycerine by the action of an alkali, is expressed in the following equation :—

$$C_3H_53C_{18}H_{33}O + 3NaHO = 3NaC_{18}H_{33}O + C_3H_8O_3;$$

where it appears that olein (as well as stearin and the rest) possesses the constitution of a compound ether, that is, it is a salt of the trivalent radicle glyceryl, C_3H_5. The soap which results is also a salt.

[§ *Characters.*—Greyish-white, dry, inodorous ; horny and pulverisable when kept in dry warm air ; easily moulded when heated. Soluble in rectified spirit, not imparting an oily stain to paper. Incinerated, it yields an ash which does not deliquesce.]

The tests show its freedom from insoluble soaps, earthy admixture, and unsaponified oil ; the insoluble soaps, however, are frequently present. Soft soap (potash soap) yields a deliquescent ash. Acids decompose soap, causing the separation of the fatty acid. The earthy salts also decompose soap, and it is to their presence that the hardness, i.e. power of *curdling* soap, of sea, spring, and well water is due. Sulphate of lime, for example, would behave thus :—

Soap + *Sulphate of Lime*, give *Alkaline Sulphate* + *Insoluble Calcareous Soap.*

Marbled Castile soap is made by adding sulphate of iron to the soap, and stirring it about; the dark-coloured streaks of iron soap gradually become red by oxidation. Ordinary *mottled* soap of the best quality is, however, a spontaneous product, the small quantity of iron necessary being probably derived from the moulds.

Physiological Effects.—Soap acts very much like the alkalies already noticed. Its local operation, however, is much less energetic than either the caustic or even the carbonated alkalies. Hence it may be administered in considerable doses without causing irritation or inflammation. It promotes the secretion of urine, and communicates alkaline properties to this fluid. In large doses it acts as a purgative.

Therapeutics.—As an *antacid*, soap is employed in poisoning by the mineral acids: it should be administered in the form of a strong solution, which effectually neutralises the acid without acting as an irritant. So also in those forms of dyspepsia which are attended with an excessive formation of acid, soap may be usefully employed to neutralise it. External parts burnt with the strong mineral acids, or with phosphorus, should be washed with a solution of soap. As a *lithonlytic*, soap has been used in those forms of lithiasis in which uric acid prevails. A mixture of soap and lime-water was once considered a most powerful solvent for urinary calculi. As a *purgative*, soap is rarely exhibited alone: in combination with rhubarb, it may be employed with considerable benefit in habitual constipation and disordered conditions of the biliary functions. In the form of enema, a strong solution of it is sometimes used with great relief to dissolve hardened fæces, and to relieve obstinate constipation. Laennec found soap a very convenient and useful *expectorant* in dry catarrh. *Externally*, soap is frequently employed on account of its detergent, lubricating, and discutient qualities. Thus in tinea capitis, scabies, and various other skin diseases, ablution night and morning with soap-water greatly contributes to the cure.

Administration.—The usual dose of soap, taken in a pilular form, is from 5 to 30 gr. In cases of poisoning by the mineral acids, half a pint of strong solution of soap should be instantly administered.

Pharmaceutic Uses.—Soap is used in pharmacy to render other medicines more soluble, or to give a proper consistence to various substances for the making of pills.

Oleic Acid Soda Soap.

Mr. C. H. Wood has given a process in the 'Pharmaceutical Journal,' for producing by a very easy process an *oleic acid soda* *soap*, which is well suited for the preparation of soap liniment, and for other uses in pharmacy. It is as follows:—

Take of

Almond Oil . . .	$1\frac{1}{4}$ pound.
Sulphuric Acid . . .	1 ounce (by weight)
Solution of Soda . . .	10 pints.

Add the acid to the oil, stirring the mixture. Allow this to remain for twenty-four hours. Then pour it into the solution of soda, contained in a clean iron vessel, and apply heat. Very shortly after it boils the liquid becomes perfectly bright and transparent; the fire is then removed, and the whole allowed to become perfectly cold. The soap is then found as a coherent cake floating on the liquor. It may be purified by dissolving it in ten pints of boiling water, and separating the soap by the addition of a strong solution of five ounces of common salt.

[§ **Linimentum Saponis.** *Liniment of Soap.*

Take of

Hard Soap, cut small . . .	$2\frac{1}{2}$ ounces.
Camphor	$1\frac{1}{4}$ ounce.
Oil of Rosemary	3 fluid drachms.
Rectified Spirit	18 fluid ounces.
Distilled Water	2 fluid ounces.

Mix the water with the spirit, and add the oil of rosemary, the soap, and the camphor. Macerate for seven days at a temperature not exceeding 70° with occasional agitation, and filter.]

If the temperature employed be much above this, the liniment is liable to gelatinise.

Liniment of soap is used as a stimulant and discutient, as well as, on account of its lubricating qualities, in local pains, sprains, bruises, rheumatism, &c. It is a constituent of liniment of opium.

[§ **Emplastrum Saponis.** *Soap Plaster.*

Take of

Hard Soap	6 ounces.
Lead Plaster	$2\frac{1}{4}$ pounds.
Resin	1 ounce.

To the lead plaster, melted by a gentle heat, add the soap and the resin, first liquefied; then, constantly stirring, evaporate to a proper consistence.]

This plaster, spread on leather, is used as a discutient and mechanical support. It is a constituent of iodide of lead plaster and the warm plaster.

LITHIUM. *Lithium.* L or **L** = 7.

Natural History.—Lithium is the metallic base of the alkali lithia (so called from λίθος, a stone, because it was supposed to be exclusively found in the mineral kingdom). It is of a reddish-white colour, and is the lightest of all known solid or liquid bodies, having a specific gravity 0·594.

Lithium is a constituent of several minerals (*petalite*, *triphane* or *spodumene*, *lepidolite*, *amblygonite*, &c.). It is also found in many mineral waters; in those of Pyrmont and Sliatsch it exists in the form of sulphate; in the Kreuznach waters as the chloride; and in the waters of Aix-la-Chapelle and Burtscheid it is found in combination with phosphoric acid and soda.

[§ **Lithiæ Carbonas.** *Carbonate of Lithia.* LO,CO_2 or $\mathbf{L_2CO_3}$.]

Preparation.—Obtained by adding a strong solution of carbonate of ammonia to a solution of either sulphate of lithia or chloride of lithium; or by decomposing sulphate of lithia by acetate of baryta, and calcining the resulting acetate of lithia, by which it is converted into the carbonate.

[§ *Characters and Tests.*—In white powder or in minute crystalline grains, alkaline in reaction, soluble in 100 parts of cold water, insoluble in alcohol. It dissolves with effervescence in hydrochloric acid; and the solution evaporated to dryness leaves a residue of chloride of lithium, which communicates a red colour to the flame of a spirit lamp, and, redissolved in water, yields a precipitate (phosphate of lithia $\mathbf{L_3PO_4}$) with phosphate of soda. Ten grains of the salt neutralised with sulphuric acid and afterwards heated to redness leave 14·86 grains of dry sulphate of lithia; which, when redissolved in distilled water, yields no precipitate with oxalate of ammonia or solution of lime (showing its freedom from lime, magnesia, alumina, &c.).]

In taste it resembles bicarbonate of soda. It dissolves more readily in water holding in solution carbonic acid, by which bicarbonate of lithia is formed. It is in this state, probably, that it exists in many mineral waters. By dissolving carbonate of lithia in hot water, filtering and slowly exaporating the solution, crystals of the carbonate are formed: they are said to be anhydrous. A solution of one part of the carbonate in 1000 parts of water has an alkaline reaction.

[§ ⁂ **Liquor Lithiæ Effervescens.** *Effervescing Solution of Lithia. Lithia Water.*

A solution of ten grains of carbonate of lithia to the pint, in water charged with carbonic acid under a pressure of seven atmospheres.]

[§ *Characters and Tests.*—Effervesces strongly when the containing vessel is opened, carbonic acid gas escaping. The liquid is clear and sparkling, and has an agreeable acidulous taste. Half a pint of it evaporated to dryness, yields five grains of a white solid residue, answering to the tests for carbonate of lithia.

Dose, 5 to 10 fluid ounces.]

Therapeutics.—Carbonate of lithia acts as a diuretic, and, according to the experience of Dr. Garrod, has more influence in rendering the urine alkaline than the same quantity of the carbonates of soda and potash. He considers that, on account of the small amount of lithia which forms a salt with uric acid, and the much greater solubility of this salt than of the urates of soda or potash, it may be given with great advantage in certain states of the system in which urate of soda is liable to be deposited in the tissues, as in gout, &c.

Dose, 3 to 6 grains.

[§ **Lithiæ Citras.** *Citrate of Lithia.* $3LO,C_{12}H_5O_{11}$ or $\mathbf{L_3C_6H_5O_7}$.

Take of

Carbonate of Lithia . . .	50 grains.
Citric Acid, in crystals . . .	90 grains.
Warm distilled Water . . .	1 fluid ounce.

Dissolve the citric acid in the water, and add the carbonate of lithia in successive portions, applying heat until effervescence ceases, and a perfect solution is obtained. Evaporate by a steam or sand bath till water ceases to escape, and the residue is converted into a viscid liquid. This should be dried in an oven or air chamber at the temperature of about 240°, then rapidly pulverised, and enclosed in a stoppered bottle.

Characters and Tests.—A white amorphous powder, deliquescent, and soluble in water without leaving any residue. Heated to redness it blackens, evolving inflammable gases; and the residue, neutralised by hydrochloric acid, yields with rectified spirit a solution which burns with a crimson flame. Twenty grains of the salt, burned at a low red heat with free access of air, leave 10·6 grains of white residue ($\mathbf{L_2CO_3}$).]

Therapeutics.—Citrate of lithia may be used for the same purposes as the carbonate.

Dose, 5 to 10 grains.

BARIUM. Ba = 68·5 or **Ba** = 137.

The metallic basis of the alkaline earth *baryta*, BaO or **BaO.**

Characters of the Salts of Barium.—The alkaline carbonates, phosphates, oxalates, &c., throw down white precipitates, soluble in dilute hydrochloric or nitric acid. Sulphuric acid and the sulphates precipitate sulphate of baryta, insoluble in water and acids. When moistened with hydrochloric acid the compounds of barium give to the blow-pipe flame an evanescent green tint.

Baryta. BaO or **BaO.**

Prepared by calcining nitrate of baryta. It forms a grey substance, which slakes on the addition of water, evolving much heat, and producing the hydrate, Ba2HO.

Baryta Water is best prepared by dissolving crystallised sulphide of barium in distilled water and digesting with an excess of precipitated oxide of copper. $\mathbf{BaS + CuO + H_2O = CuS + Ba2HO}$. The solution, if moderately strong, deposits crystals ($Ba2HO,8H_2O$).

It forms a very delicate test for carbonic acid gas and carbonates.

Barii Peroxydum. *Peroxide of Barium.* BaO_2 or $\mathbf{BaO_2}$.

Obtained by passing a stream of atmospheric air over baryta kept at a dull red heat. It is used for preparing peroxide of hydrogen.

Barii Chloridum. [§ *Chloride of Barium.* (Appendix I.) BaCl,2HO or $\mathbf{BaCl_2.2H_2O}$.]

Prepared by dissolving the native or precipitated carbonate of baryta, or the artificial sulphide of barium, in hydrochloric acid, to saturation; evaporating to dryness, redissolving and crystallising.

Properties.—Colourless rhombic plates, soluble in about twice their weight of water at the ordinary temperature. It is insoluble in strong nitric acid or hydrochloric acid: this fact should be borne in mind when using it as a test.

[§ **Solution of Chloride of Barium.** (Appendix II.)

Take of

Chloride of Barium, in crystals .	1 ounce.
Distilled Water	10 fluid ounces.

Dissolve and filter.]

Used as a test for sulphuric acid and soluble sulphates, with which it produces a white precipitate of sulphate of baryta, insoluble in nitric acid.

Barytæ Nitras. *Nitrate of Baryta.* BaO,NO_5 or $\mathbf{BaNO_3}$.

Anhydrous octahedra obtained by dissolving the carbonate in dilute nitric acid and crystallising. Frequently employed as a test in the same way as the chloride.

CALCIUM. Ca = 20 or **Ca** = 40.

The metallic base of the alkaline earth, *lime*.

Immense quantities of calcium salts, principally the carbonate (the various *limestones*), are found in the strata forming the earth's crust. Extensive deposits of the sulphate also occur. In the organised kingdom the phosphate may be mentioned as being the chief consolidating matter of bone.

Characteristics of Calcium Salts.—The alkaline carbonates and phosphates give white precipitates soluble in acids. Oxalates furnish a white precipitate which is *insoluble* in acetic acid. Sulphates precipitate sulphate of lime unless the solution be very dilute; in that case a little spirit makes the precipitate appear. The chloride and nitrate are easily soluble in alcohol.

[§ Calx. *Lime.*

An alkaline earth, CaO or **CaO**, with some impurities, obtained by calcining chalk or limestone so as to expel carbonic acid.]

For use in the arts a kind of wind furnace called a *kiln* is employed. Steam or a current of air facilitates the escape of the carbonic acid; this effect is probably mechanical, and is due to the diffusion of one gas into another.

[§ *Characters and Tests.*—In compact mases of a whitish (grey) colour, which readily absorb water, and which, when rather less than their weight of water is added, crack and fall into (white) powder with the development of much heat. The powder obtained by this process of slaking, when agitated with distilled water gives, after filtration, a clear solution which has an alkaline reaction, and yields a white precipitate ($\mathbf{CaC_2O_4}$) with oxalate of ammonia. The powder obtained by slaking dissolves without much residue and without effervescence, in diluted hydrochloric acid, and if the solution thus formed be evaporated to dryness and the residue redissolved in water, only a very scanty precipitate (alumina) forms on the addition of saccharated solution of lime.]

Lime has an acrid, alkaline taste, and reacts powerfully on vegetable colours as an alkali. It is difficult of fusion; but by the oxyhydrogen flame it may be both fused and volatilised. Exposed to the air, it attracts water and carbonic acid. It is slightly soluble in water. Its solubility in this liquid is very remarkable, cold water dissolving more than hot. According to Mr. Phillips—

A pint of water	at	32°	dissolves	13·25	grains.
,,	,,	60°	,,	11·6	,,
,,	,,	212°	,,	6·7	,,

So that water at 32° dissolves nearly twice as much lime as water at 212°.

Impurities.—The lime used in the arts is never absolutely pure, but usually contains variable quantities of carbonate of lime, silica, alumina, oxide of iron, and sometimes magnesia. Absolutely pure lime can scarcely be obtained, except from Iceland spar or the artificial carbonate. Even when made from white marble it usually contains alumina.

Physiological Effects.—Quicklime, like the fixed alkalies, is a powerful escharotic and irritant. This action is well seen in the ophthalmia produced by the lodgment of small particles of lime in the eye.

When applied to suppurating or mucous surfaces, lime water checks or stops secretion, and produces dryness of the part: hence it is termed a desiccant. In this property it differs from the fixed alkalies.

When administered *internally*, it neutralises the free acid of the gastric juice, diminishes the secretions of the gastro-intestinal membrane, and thereby occasions thirst and constipation. It frequently gives rise to uneasiness of stomach, disordered digestion, and not unfrequently to vomiting. After its absorption, it increases the secretion of the urine, and diminishes the excessive formation or deposition of uric acid and the urates. With this exception, it does not, like the alkalies, promote the action of the different secreting organs, but, on the other hand, diminishes it, and has in consequence been termed an astringent. But it does not possess the corrugating action of the astringent vegetables, or of many of the metallic salts, —it is rather a drying remedy, or desiccant. In this respect lime differs from the alkalies, but is analogous to the oxide of zinc.

A power of exciting and changing the mode of action of the absorbent vessels and glands has been ascribed to lime water, and probably with foundation. At any rate, under the use of it glandular enlargements have become softer and smaller. In other words, it operates as a resolvent. Sundelin says that the excessive use of lime does not, as in the case of the alkalies, bring about a scorbutic diathesis, but a general drying and constriction, analogous to that caused by zinc. Lime, in *large doses*, acts as a poison: the symptoms in one case were thirst, burning in the mouth, burning pain in the belly, obstinate constipation, and death in nine days.

Therapeutics.—Quicklime has been employed as a *caustic*, but alone is now rarely resorted to. It is sometimes applied in the form of *potassa cum calce*, Ph. Lond., and is a constituent of the ordinary depilatories. As an *antidote*, lime water, in conjunction with milk, was recommended by Navier in poisoning by arsenious acid. In the absence of more appropriate antidotes, lime water may be administered in poisoning by the common mineral and oxalic acids. As a *lithonlytic* it possessed at one time considerable celebrity. As an *antacid* in dyspepsia, accompanied by acidity of stomach, it is sometimes useful. Mixed with an equal measure of milk, which completely covers its offensive taste, it is one of the best remedies in our possession for nausea and vomiting dependent on irritability of stomach. We have found a diet exclusively of lime water and milk to be more effectual than any other plan of treatment in dyspepsia, accompanied with vomiting of food. It often relieves the superficial but painful ulceration on the mucous membrane of the mouth observed in dyspeptics. In this case, one part of the solution to two or three of milk is usually sufficient. In the dyspepsia of gouty and rheumatic subjects, and which is usually accompanied with a copious secretion of uric acid by the kidneys, I have seen lime water serviceable. As a *desiccant* or *astringent*, it is useful as a wash for ulcers attended with excessive secretion. In some scrofulous ulcers in which I have employed it, its power of checking secretion has been most marked. In diarrhœa, when the mucous discharge is great, and the inflammatory symptoms have subsided, lime water is useful as an astringent. As an injection in leucorrhœa and gleet, it sometimes succeeds where other remedies have failed. The internal use of lime water has also been serviceable in checking secretion from various other parts, as from the bronchial membranes, the bladder, &c.

[§ **Calcis Hydras.** *Slaked Lime.*

Hydrate of lime, CaO,HO or CaH_2O_2 with some impurities.

Take of

Lime	2 pounds.
Distilled Water	1 pint.

Place the lime in a metal pot, pour the water upon it, and when vapour ceases to be disengaged cover the pot with its lid, and set it aside to cool. When its temperature has fallen to that of the atmosphere, put the slaked lime on an iron-wire sieve, and by gentle agitation cause the fine powder to pass through the sieve, rejecting what is left. Put the powder into a well-stoppered bottle, and keep it excluded as much as possible from the air.

Slaked lime should be recently prepared.]

[§ **Liquor Calcis.** *Solution of Lime.*

Synonyms.—Aqua calcis. Lime water.

Take of

Slaked Lime	2 ounces.
Distilled Water	1 gallon.

Put the lime into a stoppered bottle containing the water, and shake well for two or three minutes. After twelve hours the excess of lime will have subsided, and the clear solution may be drawn off with a siphon as it is required for use, or transferred to a green-glass bottle furnished with a well-ground stopper.] When the whole of the solution has been withdrawn from the bottle in which it was made, a fresh solution may be obtained by shaking the sediment at the bottom of the bottle with another gallon of distilled water; and if the lime be pure and the bottle accurately stopped, the process may be repeated four or five times.

[§ *Test.*—Ten fluid ounces require for neutralisation at least 200 grain-measures of the volumetric solution of oxalic acid, which corresponds to 5·6 grains of lime CaO or **CaO**.]

Dose, 1 to 4 fluid ounces.

[§ **Liquor Calcis Saccharatus.** *Saccharated Solution of Lime.*

Take of

Slaked Lime	1 ounce.
Refined Sugar, in powder	2 ounces.
Distilled Water	1 pint.

Mix the lime and the sugar by trituration in a mortar. Transfer the mixture to a bottle containing the water, and having closed this with a cork shake it occasionally for a few hours. Finally separate the clear solution with a siphon, and keep it in a stoppered bottle.]

Lime and sugar form a compound considerably more soluble in water than pure lime, the above preparation containing at least twelve times as much lime as the ordinary solution. The addition of more sugar will increase the proportion still further. It is on this account more useful in some cases as a reagent, and also as a therapeutic agent when diluted or mixed with other remedies.

Dose, $\frac{1}{2}$ drachm to 2 or 3 drachms.

[§ *Tests.*—Specific gravity, 1·052. 460·2 grains by weight (1 fluid ounce) require for neutralisation 254 grain-measures of the volumetric solution of oxalic acid, which corresponds to 7·11 grains of lime in 1 fluid ounce.]

[§ **Linimentum Calcis.** *Liniment of Lime.*

Take of

Solution of Lime	2 fluid ounces.
Olive Oil	2 fluid ounces.

Mix together with agitation.]

It has long been celebrated as an application to burns and scalds, and is employed for this purpose at the Carron iron works; hence its name Carron oil. It is also very useful in healing tedious blisters.

Carbonate of Lime. CaO,CO_2 or $\mathbf{CaCO_3}$.

History.—Some varieties, e.g. marble and chalk, were known and employed in the most remote periods of history. It forms a considerable portion of the known crust of the earth. It is found in the inferior stratified rocks, but more abundantly in the different groups in the fossiliferous rocks, particularly towards the central and higher parts of the series. In the crystallised form it constitutes *calcareous spar* and *arragonite.* The first of these is most extensively distributed, and presents itself under many varieties of shapes. Granular carbonate of lime (the *granular limestone* of mineralogists) more commonly occurs in beds, but sometimes constitutes entire mountains. The whitest and most esteemed primitive limestone is that called *statuary marble.* That from Carrara, on the eastern coast of the Gulf of Genoa, being very pure, should be employed for pharmaceutical purposes. *Chalk* constitutes the newest of the secondary rocks, and occurs abundantly in the southern parts of England. It lies in beds, and contains an abundance of organic remains. There are various other forms of carbonate of lime, constituting the substances called by mineralogists *stalactitic carbonate of lime*, *oolite*, *pisolite*, *marl*, and *tufa.* Carbonate of lime is an ordinary ingredient in mineral and common waters, being held in solution by carbonic acid, and therefore deposited when this is expelled by boiling or otherwise. It is an abundant constituent of animals, especially of the lower classes. Thus in the Radiate animals we find it in the hard parts of Corals and Madrepores; in the Molluscs (as in the oyster), it is in the shells. In the articulated animals it forms, with phosphate of lime, the crusts which envelope these animals (as the crab and lobster); and in the higher classes it is found in bone, but the quantity of it here is very small.

Several forms of carbonate of lime have been at different times employed in medicine:—viz. *marble*, *chalk*, *prepared chalk*, and *precipitated carbonate of lime*; prepared oyster-shells; prepared crabs' claws; the so-called *crabs' eyes* (concretions from the stomach of the crab); red coral; the spines of fossil cidaris and other echinodermata.

[§ **Marmor Album.** *White Marble.* CaO,CO_2 or $\mathbf{CaCO_3}$.

Hard white crystalline native carbonate of lime in masses. Used in producing carbonic acid gas.]

[§ **Creta.** *Chalk.*

Native friable carbonate of lime. Used in producing carbonic acid gas.] Though cheaper than marble, it is generally less convenient for use, as it froths with an acid.

[§ **Creta Præparata.** *Prepared Chalk.*

Chalk, freed from most of its impurities (soluble saline matter, flinty and gritty particles) by elutriation, and afterwards dried in small masses which are usually of a conical form.

Characters and Tests.—A white amorphous powder, effervescing with acids, and dissolving with only a slight residue, in diluted hydrochloric acid. This solution, when supersaturated with solution of ammonia, gives, upon the addition of oxalate of ammonia, a copious white precipitate. The salt formed by dissolving the prepared chalk in hydrochloric acid, if rendered neutral by evaporation to dryness and redissolved in water, gives only a very scanty precipitate on the addition of saccharated solution of lime (showing its freedom from any considerable admixture of silica, alumina, oxide of iron, magnesia, or phosphate of lime).]

Physiological Effects.—The local effects of chalk are those of an absorbent, antacid, and mild *desiccant.* When swallowed, it neutralises the free acid of the gastric juice, and in this way alone must, by continued use, injure the digestive functions. It causes constipation—an effect commonly observed from the use of a few doses in diarrhœa. By the action of the free acids of the alimentary canal, it is converted into one or more soluble calcareous salts, which become absorbed. Hence the continued use of carbonate of lime is attended with the constitutional effects of the calcareous salts; and, consequently, the statements which have been made as to the influence of chalk over the lymphatic vessels and glands, and its effect in diminishing excessive secretion, may be correct. After chalk has been used for some time, the bowels should be cleared out, as it is apt to form into hard balls, and to lodge in the folds of the intestines.

Therapeutics.—As an *absorbent* and *desiccant*, prepared chalk is used as a dusting powder in moist excoriations, ulcers, the intertrigo of children, burns and scalds, erysipelatous inflammation, &c. In the form of ointment it has been recommended in ulcers. As an *antacid*, it is exhibited in those forms of dyspepsia which are accompanied with excessive secretion of acid; and as an antidote in poisoning by the mineral and oxalic acids. It has also been used in some diseases which have been supposed to depend on, or be accompanied by, excess of acid in the system—as in gouty affections, which are usually attended with the excessive production of uric acid; and in rachitis, which some have ascribed to a preponderance of phosphoric acid, or to a deficiency of lime in the system.

To diminish alvine evacuations, it is employed in diarrhœa. Its efficacy can hardly be referred solely to its antacid properties, for other antacids are not equally successful, but to its desiccating properties already referred to. Moreover, in many cases of diarrhœa in which chalk is serviceable, no excess of acidity can be shown to exist in the bowels. Aromatics are useful adjuncts to chalk in most cases of diarrhœa. In old obstinate cases, astringents (as logwood, catechu, or kino) may be conjoined with great advantage; and in severe cases, accompanied with griping pains, opium.

Administration.—Prepared chalk is given in the form of powder or mixture, in doses of from 10 to 60 grains.

[§ **Mistura Cretæ.** *Chalk Mixture.*

Take of

Prepared Chalk	$\frac{1}{4}$ ounce.
Gum Acacia, in powder . . .	$\frac{1}{4}$ ounce.
Syrup	$\frac{1}{2}$ fluid ounce.
Cinnamon Water	$7\frac{1}{2}$ fluid ounces.

Triturate the chalk and gum acacia with the cinnamon water, then add the syrup and mix.]

An ounce and a half contains about twenty grains of chalk.

[§ **Pulvis Cretæ Aromaticus.** *Aromatic Powder of Chalk.*

Synonym.—Confectio aromatica, *Lond.*

Take of

Cinnamon Bark, in powder . . .	4 ounces.
Nutmeg, in powder } Saffron, in powder } of each . .	3 ounces.
Cloves, in powder	$1\frac{1}{2}$ ounce.
Cardamom Seeds, in powder . . .	1 ounce.
Refined Sugar, in powder . . .	25 ounces.
Prepared Chalk	11 ounces.

Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle.]

This powder differs from the London Aromatic Confection in containing, in 100 grains, 22 instead of 34 of chalk, and 25 instead of 16 of aromatics.

Dose, 30 to 60 grains.

[§ **Pulvis Cretæ Aromaticus cum Opio.** *Aromatic Powder of Chalk and Opium.*

Take of

Aromatic powder of Chalk . . .	$9\frac{3}{4}$ ounces.
Opium, in powder	$\frac{1}{4}$ ounce.

Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle.]

Forty grains contain one grain of opium.

Dose, 10 to 40 grains.

[§ **Calcis Carbonas Præcipitata.** *Precipitated Carbonate of Lime.*

CaO,CO_2 or $\mathbf{CaCO_3}$.

Take of

Chloride of Calcium	5 ounces.
Carbonate of Soda	13 ounces.
Boiling distilled Water . . .	a sufficiency.

Dissolve the chloride of calcium and the carbonate of soda each in two pints of the water; mix the two solutions, and allow the precipitate to subside. Collect this on a calico filter, wash it with boiling distilled water until the washings cease to give a precipitate with nitrate of silver, and dry the product at the temperature of 212°.]

Decomposition :—$\mathbf{Na_2CO_3 + CaCl_2 = CaCO_3 + 2NaCl}$.

[§ *Characters and Tests.*—A white crystalline powder, insoluble in water, dissolving in hydrochloric acid with effervescence. The solution, when neutralised by ammonia, lets fall a copious white precipitate, on the addition of oxalate of ammonia. With diluted nitric acid it gives a clear solution, which, if perfectly neutral, and deprived of carbonic acid by boiling, is not precipitated by saccharated solution of lime added in excess, or by the solution of nitrate of silver (showing its freedom from alumina, magnesia, phosphate of lime, &c., and also from any chloride of sodium left in the precipitate through imperfect washing).]

Pure carbonate of lime is a tasteless, odourless solid. When heated to redness in a current of air, its carbonic acid is expelled, leaving quick-lime. There is considerable difficulty, however, in expelling carbonic acid from perfectly dry chalk. It is almost insoluble in water, one part of carbonate requiring 35,000 parts of water to dissolve it. It is much more soluble in carbonic acid water : the solution reddens litmus, but changes the yellow colour of turmeric paper to brown; by boiling, or exposure to the air the carbonic acid is evolved, and the carbonate of lime deposited.

Sometimes sulphate of lime is substituted for the precipitated carbonate. The fraud may be readily detected by the addition of either hydrochloric or nitric acid: no effervescence takes place with sulphate of lime. If sulphate be mixed with carbonate of lime, the fraud may be detected as follows :—Digest in dilute hydrochloric acid until effervescence ceases: the carbonate will be dissolved, and the sulphate for the most part will be left undissolved. By boiling in water, a small portion of sulphate is dissolved, and, by the addition of chloride of barium to the solution, the presence of sulphuric acid may be recognised.

Dose, 20 to 60 grains.

Calcis Phosphas. *Phosphate of Lime.* $3CaO,PO_5$ or $\mathbf{Ca_3 2PO_4}$.

Synonyms.—Tricalcic phosphate. Bone phosphate.

History.—Of the three orthophosphates of lime, the tricalcic salt obtained from bones is the only one employed in medicine. Combined with fluoride and chloride of calcium, it occurs in the minerals called *apatite*, *moroxite*, *phosphorite*, and *asparagus stone.* It occurs in most soils, especially in some varieties of chalk, in greater or less abundance, being probably derived from the bones of animals. It abounds in *coprolites*, substances supposed to be the fossil excrements of reptiles. It is a constituent of both animals and vegetables. It forms the principal part of the earthy matter of the bones of the *vertebrata* and of the crustaceous envelopes of the *articulata.*

[§ **Os Ustum.** *Bone Ash.*

The residue of (ox and sheep) bones, which have been burned to a white ash in contact with air. Consists principally of phosphate of lime mixed with about 10 per cent. of carbonate of lime, and a little fluoride of calcium and phosphate of magnesia.]

When bones are ignited in close vessels, they yield as a fixed residue *bone black.* If, however, they are calcined in open vessels, the whole of the carbonaceous matter is burnt off, and the white product is called *bone ash* or *bone earth.* A similar product (*Burnt Hartshorn; Cornu Ustum, Lond.*) is obtained by calcining the antler of the deer (*Cervus elaphus*).

[§ **Calcis Phosphas.** *Phosphate of Lime.* $3CaO,PO_5$ or $Ca_3P_2O_8$.

Take of

Bone Ash . .	4 ounces.
Hydrochloric Acid .	6 fluid ounces.
Water . . .	2 pints.
Solution of Ammonia	12 fluid ounces, or a sufficiency.
Distilled Water .	a sufficiency.

Digest the bone ash in the hydrochloric acid, diluted with a pint of water until it is dissolved. Filter the solution, if necessary; add the remainder of the water, and afterwards the solution of ammonia, until the mixture acquires an alkaline reaction; and having collected the precipitate on a calico filter, wash it with boiling distilled water as long as the liquid which passes through occasions a precipitate when dropped into solution of nitrate of silver acidulated with nitric acid. Dry the washed product at a temperature not exceeding 212°.]

By digestion with hydrochloric acid, the phosphate of lime is dissolved, and the carbonate of lime is decomposed, with the evolution of carbonic acid, and the formation of water and chloride of calcium. On the addition of ammonia, the phosphate is precipitated. It is washed to deprive it of all traces of chloride of calcium and chloride of ammonium.

[§ *Characters and Tests.*—A light white amorphous powder, insoluble in water, but soluble without effervescence in diluted nitric acid; the solution continues clear when an excess of acetate of soda is added to it, but lets fall a white precipitate on the subsequent addition either of a little oxalate of ammonia, or of perchloride of iron.

(As oxalate of lime and phosphate of iron are soluble in nitric acid the acetate of soda is added in excess, by which acetic is substituted for nitric acid.)

Ten grains dissolve perfectly and without effervescence in diluted hydrochloric acid, and the solution yields with ammonia a white precipitate ($3CaO,PO_5$) insoluble in boiling solution of potash, and weighing 10 grains when washed and dried.]

The non-effervescence indicates freedom from carbonates, and the weight obtained, after boiling with solution of potash, proves the absence of alumina.

Physiological Effects.—As this salt is a general constituent of the animal structures, especially of the osseous tissues, it, or its components, are essential constituents of our food. Man obtains more of this ingredient than the wants of his system require, from the corn, potatoes, milk, and meat on which he feeds: the excess is eliminated by the bowels and the various secretions. When absorbed it increases, incontestably, the presence of calcareous salts in the bones, the blood, and the urine; but any deficiency of phosphate of lime in the tissues or fluids of the body is far more likely to arise from defective absorption or assimilation than from any deficiency of this salt in the food. Large doses disorder the stomach and the digestion, by their difficult solubility.

Therapeutics.—It has been administered in rickets, with the view of promoting the deposition of bone-earth in the bones. The peroxide of iron may be advantageously conjoined with it.

Dose, 10 to 20 grains.

Calcis Hypophosphis. *Hypophosphite of Lime.*

Synonym.—Hypophosphite of calcium.

$$CaO,PH_2O_3 \text{ or } \mathbf{CaH_4P_2O_4}$$

Take of

Slaked Lime	4 pounds.
Phosphorus	1 pound.
Water	4 gallons.

Mix the lime and water, add the phosphorus, and heat them to about 140° F., maintaining this temperature while phosphuretted hydrogen continues to be evolved. Remove excess of lime from the solution thus formed, by passing a current of carbonic acid through it; then after filtration, evaporate at a gentle heat, removing the hypophosphite as it separates in colourless crystals, which have a pearly lustre.

It is soluble in about six parts of water, and has a bitter taste.

Dose, 2 to 5 grains.

Therapeutics. — The hypophosphites were introduced by Dr. Churchill and have been used in phthisis, but they are supposed to exercise all the beneficial effects of phosphorus without causing the ill effects which sometimes result from the administration of that element in the uncombined state. They are reputed to be tonic, alterative, stimulant, and nervine stimulant. They are used in cases of general debility, especially where phosphates are deficient —in chorea, epilepsy, leucosythemia, anæmia, &c. Hypophosphite of lime is an important constituent in 'Parishe's Chemical Food.'

[§ **Calcii Chloridum.** *Chloride of Calcium.* $CaCl$ or $CaCl_2$.

It may be formed by neutralising hydrochloric acid with carbonate of lime, adding a little solution of chlorinated lime and slaked lime to the solution, filtering, evaporating until it becomes solid, and finally drying the salt at about 400°.]

Chloride of calcium is a secondary product in the manufacture of the hydrated carbonate of ammonia, as well as of solution of ammonia.

It should be kept in a well-closed bottle.

[§ *Characters and Tests.*—In white agglutinated masses, dry, but very deliquescent, evolves no chlorine or hypochlorous acid on the addition of hydrochloric acid, and is entirely soluble in twice its weight of water, also in alcohol. The aqueous solution is not precipitated by the addition of lime water.] This test shows its freedom from alumina and iron.

Anhydrous chloride of calcium is a white, translucent solid, of a crystalline texture. Its taste is bitter and acrid. It is fusible but not volatile. It has a great affinity for water, and is therefore used to absorb it from gases and from ether, chloroform, &c. It readily dissolves in its own weight of water at 60° F., or in a much smaller quantity of hot water.

The solution crystallises with some difficulty, forming crystals which contain $6H_2O$.

Therapeutics.—It has been used with success as a stimulant of the lymphatic glandular system, and as a tonic and deobstruent, in doses of five to fifteen grains, given in solution. In large doses it acts as an irritant poison.

[§ Solution of Chloride of Calcium. (Appendix II.)

Take of

Chloride of Calcium . . .	1 ounce.
Distilled Water	10 fluid ounces.

Dissolve and filter.]

Used as a test, chiefly for tartrates, citrates, and oxalates.

[§ Solution (Saturated) of Chloride of Calcium. (Appendix II.)

Take of

Chloride of Calcium . . .	4 ounces.
Distilled Water	5 fluid ounces.

Dissolve and filter.]

Used for determining the percentage of nitrous ether in spirit of nitrous ether.

[§ **Calx Chlorata.** *Chlorinated Lime.*

A product obtained by exposing slaked lime to the action of chlorine gas as long as the latter is absorbed. It possesses bleaching and disinfecting properties.]

Preparation.—Obtained by passing chlorine gas over slaked lime. The chlorine is usually generated in large, nearly spherical, leaden vessels heated by steam. The ingredients employed are binoxide of manganese, chloride of sodium, and diluted sulphuric acid. The gas is washed by passing it through water, and is then conveyed by a leaden tube into the combination room, where the slaked lime is placed in shelves or trays, piled over one another to the height of five or six feet, cross bars between each, keeping them about an inch asunder, that the gas may have free room to circulate. The combination room is built of siliceous sandstone, and is furnished with windows, to allow the operator to judge how the impregnation is going on. Four days are usually required, at the ordinary rate of working, for making good marketable bleaching powder (chlorinated lime). It is generally represented to be a mixture or compound of hypochlorite and chloride of calcium, produced as shown in the following equation:—

$$2(\mathrm{Ca2HO}) + 2\mathrm{Cl}_2 = \mathrm{CaCl}_2 + \mathrm{Ca2ClO} + 2\mathrm{H}_2\mathrm{O}.$$

There is, however, some reason to doubt the correctness of this view of its composition, as alcohol does not dissolve out chloride of calcium from it when added to the dry powder. As met with in commerce, there is always some uncombined lime in it.

[§ *Characters and Tests.*—A dull-white powder with a feeble odour of chlorine, partially soluble in water. The solution evolves chlorine copiously upon the addition of oxalic acid, and deposits at the same time oxalate of lime. Ten grains mixed with thirty grains of iodide of potassium, and dissolved in four fluid ounces of water, produce, when acidulated with two fluid drachms of hydrochloric acid, a reddish solution, which requires for the discharge of its colour at least 850 grain-measures of the volumetric solution of hyposulphite of soda, corresponding to 30 per cent. of chlorine liberated by hydrochloric acid.] (See **Liquor Chlori.**)

Free iodine is the cause of the colour, as the following equation shows:—

$$CaCl_2 + Ca2ClO + 4KI + 4HCl = 2CaCl_2 + 2H_2O + 4KCl + 2I_2.$$

Exposed to the air, it attracts carbonic acid, evolves hypochlorous acid, and is thereby converted into a mixture of carbonate of lime and chloride of calcium, the latter of which deliquesces. When heated, it evolves oxygen gas, sometimes also chlorine gas, and becomes converted into a mixture of chloride of calcium and chlorate of lime, which has no bleaching properties;

$$9CaCl_2 + 9Ca2ClO = 6O_2 + 17CaCl_2 + Ca2ClO_3.$$

Composition.—The quantity of chlorine absorbed by slaked lime varies with the pressure, the degree of exposure, and the quantity of water present. Hence the substance sold as chlorinated lime is not a uniform product. Good samples of commercial chloride of lime, or bleaching powder, contain, on an average, not more than 36 per cent. of available chlorine: and, on the small scale, hydrate of lime cannot be made to absorb more than 40 per cent.

Physiological Effects.—The *local* action of chlorinated lime is that of an irritant and caustic. A solution of it applied to suppurating and mucous surfaces is a powerful desiccant, probably in part at least from the uncombined lime in solution. When the secretions are excessive and extremely fetid, it not only diminishes their quantity, but much improves their quality; so that, considered in reference to suppurating and mucous surfaces, it is not only a desiccant, but, in a morbid condition of these parts, a promoter of healthy action. Applied in the form of ointment (composed of a drachm of chlorinated lime to an ounce of fatty matter) to scrofulous swellings, Cima found that it provoked suppuration, caused strong redness, promoted the suppurating process, and dispersed the surrounding hardness.

Taken *internally*, in *small doses* (as from three to six grains, dissolved in one or two ounces of water), it sometimes causes pain and heat in the stomach, and occasionally, according to Cima, purging. Under the continued use of it, hard and enlarged absorbent glands have become softer and smaller, from which circumstance it has been supposed to exercise a specific influence over, and to promote the healthy action of, the lymphatic system. During its employment, Cima says he did not find it necessary to give purgatives. Dr. Reid gave it in the epidemic fever which raged in Ireland in 1826, and he tells us that it rendered the tongue cleaner, abated the delirium, and promoted the cutaneous functions. In dysentery, it soon put a stop to the bloody evacuations, the umbilical pain, and the tenesmus.

Therapeutics.—Chlorinated lime and soda are extensively employed as disinfectants (or rather deodorisers) and antiseptics. Chlorine gas stands unrivalled for its power of destroying putrid odours and checking putrefaction, and where uninhabited chambers or buildings are to be purified, fumigations with this gas should be adopted. But its powerful action on the organs of respiration precludes its use in inhabited places; and, in such cases, chlorinated lime, on account of its cheapness, may be substituted. When these substances are in contact with organic matter, it is supposed that the hypochlorite gives out oxygen, and is converted into a metallic chloride; the oxygen being the effective deodorising and antiseptic agent; or it may act by abstracting hydrogen. When, however, the solution of the hypochlorite is exposed to the air, carbonic acid is abstracted by the lime, and hypochlorous acid immediately reacts on any organic matter present. Hence these hypochlorites, when exposed to the air, evolve chlorine so slowly, and in such moderate quantities, as not to produce any noxious effects, although their action on organic matters is very powerful. Their most obvious effect is that of destroying the unpleasant odour of putrid matter. Their action on sulphuretted hydrogen, ammonia, and hydrosulphuret of ammonia (substances evolved by decomposing animal matters), can be readily and easily demonstrated. Other odorous principles given out by putrid matters are, by the experience of most persons, admitted to be destroyed by the alkaline hypochlorites. The alkaline hypochlorites possess another valuable property—that of stopping or checking the putrefactive process; and hence they are called antiseptics. These two properties render the alkaline hypochlorites most valuable agents to the medical practitioner. We apply them to gangrenous parts, to ulcers of all kinds attended with foul secretions, to compound fractures accompanied with offensive discharges, to the uterus in various diseases of this viscus attended with fetid evacuations: in a word, we apply them in all cases accompanied with offensive and fetid odours. As I have already remarked, with respect to chlorinated soda, their efficacy is not confined to an action on dead parts, or on the discharges from wounds and ulcers; they are of the greatest benefit to living parts, in which they induce more healthy action, and the consequent secretion of less offensive matters. Furthermore, in the sick chamber, many other occasions present themselves on which the power of the hypochlorites to destroy offensive odours will be found of the highest value: as, to counteract the unpleasant smell of dressings or bandages, of the urine in various diseases of the bladder, and of the alvine evacuations. In typhus fever, a handkerchief, or piece of calico, dipped in a weak solution of an alkaline hypochlorite, and suspended in the sick chamber, will be often of considerable service both to the patient and the attendants.

The power of the hypochlorites to destroy *infection* or *contagion*, and to prevent the propagation of epidemic diseases, is less obviously and satisfactorily ascertained than their capability of destroying *odour*. Various statements have been made in order to prove the disinfecting power of the hypochlorites with respect to typhus and other infectious fevers. But, without denying the utility of these agents in destroying bad smells in the sick chamber, and in promoting the recovery of the patient by their influence over the general system, I may observe that I have met with no facts which are satisfactory to my mind as to the chemical powers of the hypochlorites to destroy the infectious matter of fever. Nor am I convinced that these medicines are preservative against the plague. Six individuals clothed themselves with impunity in the garments of men who had died of the plague, but which garments had been plunged for six hours in a solution of chlorinated soda. But, as Bouillaud has truly observed, the experiments, to be decisive, should have been made with clothing which had already communicated the plague to the wearers of it. Bousquet mixed equal parts of a solution of chloride of soda and the vaccine lymph, and found that the latter still possessed the power of producing the usual cow-pock vesicle. These are a few of the facts which are adverse to the opinion that the alkaline hypochlorites possess the power of preventing the propagation of infectious, contagious, or epidemic diseases. In opposition to them there are but few positive facts to be adduced. Coster found that a solution of hypochlorite of soda destroyed the infectious properties of the syphilitic poison, and of the poison of rabid animals. The statements of Labarraque and others as to the preservative powers of the hypochlorites in typhus, measles, and other zymotic diseases, are too loose and general to enable us to attach much value to them.

Considered in reference to medical police, the power of the alkaline hypochlorites to destroy putrid odours and prevent putrefaction is of vast importance. Thus chlorinated lime may be employed to prevent the putrefaction of corpses previously to interment, to destroy the odour of exhumed bodies during medico-legal investigations, to destroy bad smells, and prevent putrefaction in dissecting-rooms and workshops in which animal substances are employed (as cat-gut manufactories), to destroy the unpleasant odour from privies, sewers, drains, wells, docks, &c., to disinfect (?) ships, hospitals, prisons, and stables. The various modes of applying it will readily suggest themselves. For disinfecting corpses, a sheet should be soaked in a pailful of water containing a pound of the salt, and then wrapped around the body. For destroying the smell of dissecting-rooms, a solution of the salt may be employed by means of a garden watering-pot. When it is considered desirable to cause the rapid evolution of chlorine gas, hydrochloric acid may be added to chlorinated lime.

Solution of chlorinated lime or soda is the best *antidote* in poisoning by sulphuretted hydrogen, sulphide of ammonium, sulphide of potassium, and hydrocyanic acid. It should be administered by the stomach, and a sponge or handkerchief soaked in the solution held near the nose, so that the vapour may be inspired. If a person be required to enter a place suspected of containing sulphuretted hydrogen, a handkerchief moistened with a solution of chloride of lime should be applied to the mouth and nostrils, so that the inspired air may be purified before it passes into the lungs. It was by breathing air impregnated with the vapour arising from chlorinated lime, that the late Mr. Roberts (the inventor of the miner's improved safety lamp) was enabled to enter and traverse with safety the sewer of the Bastile, which had not been cleansed for thirty-seven years, and which was impregnated with sulphuretted hydrogen.

A solution of chlorinated lime has been used as a wash in some skin diseases. Derheims used a strong solution with great success in scabies. This mode of curing itch is much cleaner and more agreeable than the ordinary method by sulphur frictions. It has likewise been found successful in tinea capitis.

It has also been employed with great benefit in ophthalmia. The solution used was composed of from a scruple to three or four drachms of chlorinated lime, and an ounce of water. It was dropped into the eye, or injected by a syringe, or applied by means of a camel's-hair pencil. I have found a weak solution of the chloride successful in the purulent ophthalmia of infants. Gubian proposed it to prevent the pitting from small-pox. The fully maturated pustules are to be opened and washed with a weak solution of this salt: dessication takes place very promptly, and no marks or pits are said to be left behind.

It has been used internally with great success by Dr. Reid in the epidemic fever of Ireland. In some of the very worst cases it acted most beneficially, causing warm perspiration, rendering the tongue cleaner and moister, checking diarrhœa, and inducing quiet sleep.

In disease of the pulmonary organs, resulting from febrile excitement, Dr. Reid also found it advantageous. In dysentery likewise it was most valuable. He used it by the mouth, and also in the form of clyster. It corrected the intolerable stench of the evacuations, and improved their appearance. Cima used it both internally and externally in scrofula.

Administration.—Internally, chlorinated lime may be given in doses of from one grain to five or six grains, dissolved in one or two ounces of water, sweetened with syrup. As the dry salt of the shops deposits hydrate of lime when put into water, the solution should be filtered to get rid of this.

Antidotes.—Administer albuminous liquids (as eggs beat up with water), or milk, or flour and water, or oil, or mucilaginous drinks, and excite vomiting; combat the gastro-enteritis by the usual means. Carefully avoid the use of acids, which would cause the evolution of chlorine gas in the stomach.

[§ **Liquor Calcis Chloratæ.** *Solution of Chlorinated Lime.*

Take of

Chlorinated Lime	1 pound.
Distilled Water	1 gallon.

Mix well the water and the chlorinated lime by trituration in a large mortar, and, having transferred the mixture to a stoppered bottle, let it be well shaken several times for the space of three hours. Pour out now the contents of the bottle on a calico filter, and let the solution which passes through be preserved in a stoppered bottle.]

When chlorinated lime is digested in water, the hypochlorite of lime and chloride of calcium, as well as a small portion of caustic lime, are dissolved: any carbonate, and the excess of caustic lime, remain undissolved.

Properties.—The solution, which has a slight yellow colour, first reacts on vegetable colours as an alkali, and afterwards bleaches them, especially if an acid be added. Solution of chlorinated lime, when an acid is present, decomposes organic colours and putrid substances. The bleaching power on litmus is very slowly evinced unless an acid be present: carbonic acid causes the decoloration to be speedily effected. If air be blown through putrid blood, and then through a solution of chlorinated lime, carbonate of lime is precipitated, and the air is disinfected; but if air be first passed through putrid blood, then through caustic potash or milk of lime (to abstract the carbonic acid), and afterwards through a solution of chlorinated lime, it retains its stinking quality. The bleaching and deodorising properties depend, probably, on the oxidation of the colouring or offensive matter: if an excess of a strong acid be employed in the process, chlorine is evolved, which produces oxygen at the expense of the elements of water. In some cases the action may, however, be owing to the great affinity of the chlorine for the hydrogen of the organic substance exposed to its action.

[§ *Tests.*—Specific gravity, 1·035. Sixty grains by weight mixed with twenty grains of iodide of potassium dissolved in four fluid ounces of water, when acidulated with two fluid drachms of hydrochloric acid, gives a red solution which requires for the discharge of its colour 500 grain-measures of the volumetric solution of hyposulphite of soda, corresponding to thirteen grains of available chlorine in a fluid ounce.]

[§ **Plaster of Paris.** (Appendix I.)

Native sulphate of lime, $CaO, SO_3 + 2HO$ or $\mathbf{CaSO_4\ 2H_2O}$, deprived of water by heat.]

[§ Solution of Sulphate of Lime. (Appendix II.)

Take of

Plaster of Paris	$\frac{1}{4}$ ounce.
Distilled Water	1 pint.

Rub the plaster of Paris in a porcelain mortar for a few minutes with two ounces of the water, introduce the mixture thus obtained into a pint bottle containing the rest of the water, shake well several times, and allow the undissolved sulphate to subside. When this has occurred, filter.]

Used as a test for the presence of oxalic acid in tartaric acid.

MAGNESIUM. Mg = 12 or **Mg** = 24.

The metallic basis of magnesia.

Usually obtained by decomposing the anhydrous chloride by sodium. A white metal, very light (S.G. 1·7), much resembling zinc, and burning like it with a brilliant white flame, producing magnesia. Compounds of magnesium are widely diffused through nature, but are not so common as those of calcium. Chloride of magnesium exists in sea water, and the sulphate in some springs. Carbonate of magnesium forms an important ingredient in dolomite, a mineral which constitutes entire mountain masses.

Characteristics of the Salts of Magnesium.—Sulphuretted hydrogen and sulphide of ammonium have no action upon them. Carbonate of ammonia causes a white precipitate, which is re-dissolved on addition of sal ammoniac. A mixture of ammonia and phosphate of soda gives a white precipitate of ammonio-phosphate of magnesia, insoluble in chloride of ammonium. Oxalate of ammonia gives no precipitate except in strong solutions.

[§ **Magnesia.** *Magnesia.* MgO or **MgO**.

Take of

Carbonate of Magnesia . . . . 4 ounces.

Put it into a Cornish or Hessian crucible closed loosely by a lid, and expose it to a low red heat until a small quantity taken from the centre of the crucible, when it has cooled, and dropped into dilute sulphuric acid, causes no effervescence.] The product should be preserved in corked bottles.

[§ *Characters and Tests.*—A white powder, insoluble in water, but readily dissolved by acids without effervescence. Its solution in hydrochloric acid, when neutralised by a mixed solution of ammonia and chloride of ammonium, gives a copious crystalline precipitate when phosphate of soda is added to it (ammonio-phosphate of magnesia). Dissolved in nitric acid, and neutralised with a mixture of ammonia and chloride of ammonium, it does not give any precipitate with oxalate of ammonia, or chloride of barium.]

[§ ⁂ **Magnesia Levis.** *Light Magnesia.*

Prepared precisely in the same manner as *Magnesia*, substituting light for heavy carbonate.]

[§ *Characters.*—A bulky white powder, differing from the preceding preparation only in its greater levity, the volumes corresponding to the same weight being to each other in the ratio of three and a half to one.]

When moistened it reacts as an alkali on test-papers. It is very slightly soluble in water, and like lime, is more soluble in cold than in hot water. Dr. Fyffe states that it requires 5,142 parts of cold, and 36,000 parts of hot water to dissolve it. Unlike lime, it evolves scarcely any heat when mixed with water. By the combined voltaic and oxyhydrogen flames it has been fused by Mr. Brande. It absorbs carbonic acid slowly from the atmosphere. Its solution in acids does not occasion any precipitate with the ferrocyanides, sulphides, oxalates, or bicarbonates; but the neutral alkaline carbonates throw down a white precipitate (*carbonate of magnesia*). Magnesia is insoluble in caustic alkaline solutions, and is thereby distinguished from alumina. Its solution in sulphuric acid is remarkable for its great bitterness.

When it has been subjected to an insufficient heat during its preparation, or when it has been exposed for some time to the air, it will be found to contain some carbonate of magnesia. Its freedom from carbonate is shown by its dissolving in dilute mineral acids without effervescence. It should dissolve in diluted sulphuric acid by heat, without leaving any residue.

Physiological Effects.—When taken into the stomach, magnesia neutralises the free acids contained in this organ and in the intestines, and forms therewith soluble magnesian salts. In full doses it acts as a laxative; but as it occasions very little serous discharge, Dr. Paris ranks it among purgatives 'which urge the bowels to evacuate their contents by an imperceptible action upon the muscular fibres.' Part of its laxative effect probably depends on the action of the soluble magnesian salts which it forms by union with the acids of the alimentary canal. Magnesia exercises an influence over the urine analogous to that of the alkalies; that is, it diminishes the quantity of uric acid in the urine, and when continued for too long a period occasions the deposit of the earthy phosphates in the form of white sand. On account of its great insolubility, it requires a longer time to produce these effects than the alkalies. When taken in too large quantities and for a long period it has sometimes accumulated in the bowels to an enormous extent.

Therapeutics.—As an *antacid*, it is as efficacious as the alkalies, while it has an advantage over them in being less irritant and not caustic, and therefore is not apt to occasion disorder of the digestive organs. It may be employed to neutralise acids introduced into the stomach from without (as in cases of poisoning from mineral acids), or to prevent the excessive formation of, or to neutralise when formed, acid in the animal economy. Thus it is administered to relieve heartburn arising from, or connected with, the secretion of an abnormal quantity of acid by the stomach; its efficacy is best seen in persons of a gouty or rheumatic diathesis, in which the urine contains excess of uric acid. It will be found of great value in those urinary affections in which alkaline remedies are indicated, but in which potash and soda have created dyspeptic symptoms. It is a most valuable anti-emetic in cases of sympathetic vomiting, especially in that which occurs during pregnancy.

As a *laxative*, magnesia is much employed in the treatment of the diseases of children. It is tasteless, mild in its operation, and antacid—qualities which render it most valuable as an infant's purgative. In flatulency, it is combined with some carminative water; in diarrhœa, with rhubarb. It is employed as a purgative by adults in dyspeptic cases, in affections of the rectum, as piles and stricture, and in diarrhœa.

Administration.—As a purgative, the dose for adults is from twenty to sixty grains; for infants, from two to ten grains. As an antacid, the dose is from ten to thirty grains twice a day. It may be conveniently given in milk.

Carbonate of Magnesia.

Natural History.—Native, anhydrous, neutral carbonate of magnesia, called *magnesite*, is found in various parts of Europe, Asia, and America. The mineral called *hydromagnesite*, a hydrous carbonate of magnesia, accompanies magnesite in India and in America. Carbonate of magnesia, in conjunction with carbonate of lime, occurs in some mineral waters. *Magnesite* constitutes a range of low hills in Hindostan. The mineral, *dolomite*, when crystalline, usually consists of a molecule each of carbonate of lime and carbonate of magnesia. Frequently, however, the magnesia is deficient. Native carbonate of magnesia, from India, has been imported in considerable quantities into this country; but has been found, as I am informed, unsaleable here. The samples offered for sale in the year 1837 consisted of reniform, opaque, dull masses, adherent to the tongue, having a conchoidal fracture and considerable hardness. Internally, they were whitish; externally, greyish, or yellowish-white. The same substance (I presume) was brought over in 1838 in the calcined state, and was offered for sale as *Indian calcined magnesia.* It was nearly white. It has also been imported, in enormous quantities, from the island of Eubœa, and has been used extensively for the manufacture of sulphate of magnesia.

[§ **Magnesiæ Carbonas.** *Carbonate of Magnesia.*

$(MgO,CO_2)_3+MgO+5HO$ or $(\mathbf{MgCO_3})_3.\mathbf{MgO}.5\mathbf{H_2O}$.

Take of

Sulphate of Magnesia	10 ounces.
Carbonate of Soda	12 ounces.
Boiling distilled Water . . .	a sufficiency.

Dissolve the sulphate of magnesia and the carbonate of soda each in a pint of the water; mix the two solutions, and evaporate the whole to perfect dryness by means of a sand bath. Digest the residue for half an hour with two pints of the water, and having collected the insoluble matter on a calico filter, wash it repeatedly with distilled water, until the washings cease to give a precipitate with chloride of barium. Finally, dry the product at a temperature not exceeding 212°.]

The precipitate is produced by the following reaction :—

$$4MgSO_4 + 4Na_2CO_3 + 4H_2O$$
$$= 3MgCO_3.Mg2HO.3H_2O + 4Na_2SO_4 + CO_2.$$

From the aggregation of this crystalline precipitate during the evaporation to dryness, this preparation has a greatly increased density when compared with the next.

[§ *Characters and Tests.*—A white granular powder, which dissolves with effervescence in the diluted mineral acids, yielding solutions which, when first treated with chloride of ammonium, are not disturbed by the addition of an excess of solution of ammonia, but yield a copious crystalline precipitate upon the addition of phosphate of soda (ammonio-phosphate of magnesia). With excess of hydrochloric acid it forms a clear solution in which chloride of barium causes no precipitate. Another portion of the solution super-saturated with ammonia gives no precipitate with oxalic acid or sulphuretted hydrogen (showing freedom from lime and lead). Fifty grains calcined at a red heat are reduced to twenty-two (indicating the right percentage of magnesia).]

[§ **Magnesiæ Carbonas Levis.** *Light Carbonate of Magnesia.*

$(MgO,CO_2)_3+MgO+5HO$ or $\mathbf{(MgCO_3)_3.MgO.5H_2O}$.

Take of

Sulphate of Magnesia . . .	10 ounces.
Carbonate of Soda	12 ounces.
Distilled Water	a sufficiency.

Dissolve the sulphate of magnesia and the carbonate of soda each in half a gallon of the water, mix the two solutions cold, and boil the mixture in a porcelain dish for fifteen minutes. Transfer the precipitate to a calico filter, and pour upon it repeatedly boiling distilled water, until the washings cease to give a precipitate with chloride of barium. Lastly, dry by a heat not exceeding 212°.]

By the mutual reaction of solutions of sulphate of magnesia and carbonate of soda we ought apparently to obtain, by double decomposition, sulphate of soda and carbonate of magnesia; it appears, however, that water decomposes part of the latter; some of its carbonic acid is expelled, and a combination of hydrate of magnesia with carbonate precipitated. (See **Magnesiæ Carbonas.**)

[§ *Characters.*—A very light powder, which, when examined under the microscope, is found to be partly amorphous with numerous slender prisms intermixed. The other characters and tests are the same as those of carbonate of magnesia.]

Carbonate of magnesia should be perfectly white and tasteless. The water in which it has been boiled should have no alkaline reaction on turmeric paper, nor throw down anything on the addition of nitrate of silver; by which the absence of alkaline carbonates and chlorides is proved. Carbonate of magnesia is sometimes contaminated with oxide of lead, derived from the vessels in which it is prepared; this may be detected by sulphuretted hydrogen or sulphide of ammonium, producing a brown or black coloration.

Physiological Effects.—The effects of carbonate of magnesia are nearly the same as those of pure magnesia. Its local operation must be somewhat milder than that of the latter, but the difference is hardly perceptible in practice. As the carbonate effervesces with acids, it is more apt to create flatulence when swallowed.

Therapeutics.—The uses of the carbonate are the same as those of calcined magnesia; except where the object is to neutralise acid in the alimentary canal (as in cardialgia, and in poisoning by the mineral acids), when the latter preparation is to be preferred, on account of its not effervescing with acids, and thereby not causing flatulency.

Administration.—The dose of carbonate of magnesia as a purgative is from ten to sixty grains; as an antacid, from five to twenty grains.

[§ ⁂ **Liquor Magnesiæ Carbonatis.** *Solution of Carbonate of Magnesia.*

Synonym.—Fluid magnesia.

Take of

Sulphate of Magnesia	2 ounces.
Carbonate of Soda	$2\frac{1}{2}$ ounces.
Distilled Water	a sufficiency.

Dissolve the two salts separately; then mix and boil them together. Collect the precipitated carbonate of magnesia, and wash it thoroughly. Mix the precipitate with a pint of distilled water, and saturate it with carbonic acid, passed in under slight pressure. Filter after twenty-four hours, and again pass carbonic acid gas into the filtered solution. Preserve it in a bottle securely closed.

Contains about thirteen grains of carbonate of magnesia in a fluid ounce.]

[§ *Characters and Tests.*—Effervesces slightly or not at all when the containing vessel is first opened. The liquid is clear, and free from any bitter taste. A fluid ounce of it, evaporated to dryness, yields a white solid residue, which, after being calcined, weighs not less than five grains. This residue is insoluble in water, and answers to the tests for magnesia.]

This solution affords an agreeable and effective method of administering carbonate of magnesia. It is antacid and mildly laxative. It is employed in dyspepsia, acidity of stomach, and in uric acid diathesis. It may also be used in the preparation of effervescing citrate of magnesia by the addition of citric acid or lemon juice.

Dose, 1 to 2 fluid ounces.

[§ **Magnesiæ Sulphas.** *Sulphate of Magnesia.*
$MgO,SO_3 + 7HO$ or $\mathbf{MgSO_4.7H_2O}$.]

Synonyms.—Epsom salts, sulphate of magnesium, magnesium or magnesic sulphate.

History.—Originally procured from the Epsom Waters by Dr. Grew, at the end of the 17th century. It is a constituent of sea and many mineral waters, as in the bitter purging waters of Epsom, from which its name of Epsom salts was derived. It occurs also as an efflorescence on other minerals, forming the *hair salt* of mineralogists; and, with sulphate of soda and a little chloride of magnesium, constitutes *reussite.*

Preparation.—The two great sources of the sulphate of magnesia of English commerce are *dolomite* and *magnesite.* Dolomite or magnesian limestone, is a mixture or combination of the carbonates of magnesia and lime. It crystallises in rhombohedra. It occurs in enormous quantities in various counties of England (as those of Somerset, York, and Nottingham), and is largely employed for building: York Minster and Westminster Hall are built of it.

The dolomite is either treated at once with sulphuric acid, and the mixed sulphates of lime and magnesia separated by crystallisation; or it is calcined, the resulting lime and magnesia converted into hydrates by moistening with water, the lime removed by a carefully adjusted quantity of hydrochloric acid, and the residue treated with sulphuric acid or sulphate of iron. When sulphuric acid is employed the magnesia dissolves in the acid forming the sulphate and water; if digested with sulphate of iron, ferrous hydrate is precipitated, which becomes brown by oxidation and is filtered off. $\mathbf{FeSO_4 + Mg2HO = MgSO_4 + Fe2HO}$. Magnesite is merely digested in large tanks with dilute sulphuric acid to saturation, and is then evaporated and crystallised.

[§ *Characters and Tests.*—In minute colourless and transparent rhombic prisms, possessing a bitter taste. It readily dissolves in water, and the solution gives copious white precipitates with chloride of barium (sulphate), and with a mixed solution of ammonia, chloride of ammonium, and phosphate of soda (ammonio-phosphate of magnesia). Its aqueous solution at ordinary temperatures is not precipitated by oxalate of ammonia (showing the absence of lime), nor should it give a brown precipitate with chlorinated lime or soda (iron and manganese absent). The precipitate given by carbonate of soda, when obtained from a boiling solution of one hundred grains of the salt, should, when well washed, dried, and heated to redness, weigh 16·26 grains.]

When heated, the crystals undergo watery fusion, then give out their water of crystallisation, become anhydrous, and at a high temperature undergo the igneous fusion, and run into a white enamel, but without suffering decomposition. Exposed to the air they very slowly and slightly effloresce. They dissolve in their own weight of water at 60°, and in three-fourths of their weight of boiling water. They are insoluble in alcohol, which also precipitates this salt from a strong aqueous solution. The crystals are isomorphous with those of sulphate of zinc, and cannot be distinguished from them by the eye ; but sulphide of ammonium added to sulphate of zinc throws down white sulphide of zinc ; with sulphate of magnesia there is no visible change.

The sulphate of magnesia met with in the shops is usually sufficiently pure for all medicinal purposes. It should be colourless, and its dilute solution should undergo no change when mixed with yellow or red prussiate of potash, or sulphide of ammonium.

Physiological Effects.—In moderate doses, sulphate of magnesia is a mild and perfectly safe antiphlogistic purgative, which promotes the secretion as well as the peristaltic motion of the alimentary canal. It does not occasion nausea and griping, like some of the vegetable purgatives, nor has it any tendency to create febrile disorder or inflammatory symptoms; but, on the other hand, has a refrigerant influence: hence it is commonly termed a cooling powder. In small doses, largely diluted with aqueous fluids, it becomes absorbed, and slightly promotes the action of other emunctories: thus, if the skin be kept cool, and moderate exercise be conjoined, it acts as a diuretic.

Therapeutics.—On account of the mildness and safety of its operation, its ready solubility, and its cheapness, sulphate of magnesia is by far the most commonly employed purgative, both by the public and the profession. The only objection to its use is its bitter and unpleasant taste. To state all the cases in which it is administered would be to enumerate nearly the whole catalogue of known diseases. It must, therefore, be sufficient to mention, that it is excellently well adapted as a purgative for febrile and inflammatory diseases, obstinate constipation, ileus, lead colic, even incarcerated hernia, narcotic poisoning, &c. It may be used as an antidote in poisoning by the salts of lead and baryta.

Administration.—As a purgative, it is usually administered in doses of from half an ounce to an ounce and a half; but if taken in the morning fasting, a smaller dose will suffice. In delicate females, sixty grains, or even less, will usually produce the desired effect. Some carminative or aromatic (as peppermint water or tincture of ginger) is frequently conjoined, to obviate flatulency. In febrile and inflammatory diseases, the solution may be acidulated with dilute sulphuric acid with great advantage; or the sulphate may be dissolved in the acid infusion of roses. It is frequently used as an adjunct to infusion of senna, whose purgative effect it promotes, but whose griping tendency it is said to check. In dyspeptic cases, accompanied with constipation, it is conjoined with bitter infusions (as of quassia, gentian, and calumba). As a purgative enema, an ounce or more of it may be added to the ordinary clyster.

[§ **Enema Magnesiæ Sulphatis.** *Enema of Sulphate of Magnesia.*

Synonym.—Enema catharticum, *Edin.*, *Dubl.*

Take of

Sulphate of Magnesia . . .	1 ounce.
Olive Oil	1 fluid ounce.
Mucilage of Starch	15 fluid ounces.

Dissolve the sulphate of magnesia in the mucilage of starch, add the oil, and mix.]

SOLUTION OF AMMONIO-SULPHATE OF MAGNESIA. (Appendix II.)

Take of

Sulphate of Magnesia . . .	1 ounce.
Chloride of Ammonium . . .	$\frac{1}{2}$ ounce.
Solution of Ammonia . . .	$\frac{1}{2}$ fluid ounce.
Distilled Water	a sufficiency.

Dissolve the sulphate of magnesia and chloride of ammonium in eight fluid ounces of the water, and to the solution add the ammonia, and as much distilled water as will make up the bulk to ten fluid ounces. Filter it.]

Used as a test for phosphoric acid and phosphates.

Magnesiæ Citras. *Citrate of Magnesia.*

Prepared by saturating a solution of citric acid with either magnesia or its carbonate. It is a white, pulverulent, insipid salt, and, when aided by a slight excess of the acid, soluble in water. The effervescing citrate of magnesia of the shops is often nothing more than a mixture of tartaric acid and bi-carbonate of soda with a little sulphate of magnesia, dried and granulated. The best samples, however, contain citric as well as tartaric acid.

Effervescing solution of citrate of magnesia constitutes a very agreeable effervescing draught.

Take of

Citric Acid	$\frac{1}{2}$ drachm.
Distilled Water	1 ounce.
Syrup of Orange-peel	2 drachms.

Mix. To be taken with about an ounce and a half of the liquor magnesiæ carbonatis.

ALUMINIUM. Al=27·5.

The metallic basis of the earth alumina, a remarkably light, ductile, sonorous metal, with bright silvery lustre, scarcely tarnishing at all by exposure to the air.

Alumen. *Alum.*

History.—Alum is mentioned by many ancient writers, but it has been asserted that the alum by them referred to was sulphate of iron, and that the invention of our alum was certainly later than the twelfth century. It is found native in the neighbourhood of volcanoes, and constitutes the mineral called *native alum.*

Preparation.—The mineral from which it is procured in this country is called *aluminous slate*, *aluminous shale*, or *aluminous schist.* This substance varies somewhat in its composition in different localities, but always contains sulphide of iron, alumina, carbon, and sometimes a salt of potash. The most extensive alum manufactory in Great Britain is at Hurlet, near Paisley. Here the aluminous schist lies between the stratum of coal and limestone. By the action of the air it undergoes decomposition, and falls down on the floor of the mine. The sulphur attracts oxygen from the air, and is converted into sulphuric acid, which combines partly with the iron, and partly with the alumina. By lixiviation, a solution of the sulphates of iron and alumina is obtained: this is evaporated in large brick cisterns, and when sufficiently concentrated is run into coolers, where the sulphate of iron crystallises, and the sulphate of alumina remains in the mother-liquors. To the latter, when heated, sulphate or chloride of potassium or ammonium is added, by which crystals of alum are obtained: these are purified by a second crystallisation. The alum of commerce often contains both potash and ammonia.

[§ *Characters and Tests.*—In colourless transparent crystalline masses, exhibiting the faces of the regular octahedron, and having an acid, sweetish, astringent taste. Its aqueous solution gives with caustic potash or soda a white precipitate (alumina), soluble in an excess of the reagent, and the mixture evolves ammonia, especially when heated. The aqueous solution gives an immediate precipitate with chloride of barium (sulphate of baryta); it does not acquire a blue colour from the addition of yellow or red prussiate of potash.]

The ferrocyanides, the oxalates, and sulphuretted hydrogen, occasion no precipitate in a solution of pure alum. Sulphide of ammonium, the caustic alkalies or their carbonates, and phosphate of soda, throw down white precipitates: that produced by the alkalies is soluble in an excess of alkali, but is insoluble in solutions of the carbonated alkalies: these characters show the presence of alumina. Potash may be detected in it by adding excess of ammonia, filtering, evaporating to dryness and calcining the residue; then if anything is left, test it with perchloride of platinum and hydrochloric acid. By exposure to the air it slowly and slightly effloresces. Alum dissolves in eighteen times its weight of cold, and in less than its own weight of boiling water.

Under the name of *roche* (or rock) alum there is sold frequently a factitious article, consisting of crystalline fragments of alum coloured with Venetian red or Armenian bole.

Physiological Effects.—Alum acts chemically on the animal tissues and fluids. If a solution of it in water be added, in certain proportions, to albumen, it causes a white precipitate. It also forms insoluble combinations with milk and with gelatine. These phenomena explain the action of alum on the fibrinous, albuminous, and gelatinous constituents of the living tissues. The compound which alum forms with albumen is soluble in acetic and in hydrochloric acids, and the alumina is precipitable from these solutions neither by ammonia nor by potash.

The immediate *topical* effect of a solution of alum is that of an astringent—namely, corrugation of fibres and contraction of small vessels, by virtue of which it checks or temporarily stops exhalation and secretion, and produces paleness of parts by diminishing the diameters of the small blood-vessels. It is by these local effects that alum, when taken internally, causes dryness of the mouth and throat, somewhat increases thirst, checks the secretions of the alimentary canal, and thereby diminishes the frequency and increases the consistency of the stools. But when alum is applied to a part in larger quantities, and for a longer period, the astriction is soon followed by irritation, and the paleness by preternatural redness. And thus, taken internally in large doses, alum excites nausea, vomiting, griping, purging, and even an inflammatory condition of the intestinal canal — effects which may be perhaps induced by small quantities in persons endowed with unusual or morbid sensibility of the stomach and bowels. Ordinarily, however, tolerably large doses of alum may be given without any unpleasant effects. Thus from 60 to 120 grains, properly diluted, have been given within twenty-four hours; and in colica pictonum as much as 180 grains have been administered in one dose. Employed as an emetic, it produces less prostration than antimony or ipecacuan.

Alum becomes *absorbed*. Orfila detected alumina in the liver, spleen, and urine of animals to whom alum had been administered. After its absorption, alum appears to act as an astringent or astringent tonic on the system generally, and to produce more or less general astriction of the tissues and fibres, and a diminution of secretion. Such, at least, appear to be its effects in some passive hemorrhages and mucous discharges. Kraus observes that the urine becomes remarkably acid from the use of alum.

Therapeutics.—Alum is employed both as an external or topical, and as an internal remedy.

As a topical remedy.—Solutions of alum are sometimes employed *to produce contraction or corrugation of the tissues*, and thereby to prevent displacement of parts, especially when accompanied with excessive secretion. Thus it is used as a gargle in relaxation of the uvula with evident advantage. In the early stage of prolapsus of the rectum, a solution of alum, applied as a wash, is sometimes of service, especially when the disease occurs in infants. Washes or injections containing alum are of occasional benefit in prolapsus of the uterus. In hemorrhages, whether proceeding from an exhalation or exudation from the extremities or pores of the minute vessels, or from the rupture of a blood-vessel, a solution, or in some cases the powder, of alum, may be used with advantage as a *styptic*, to constringe the capillary vessels, and close their bleeding orifices. Thus in epistaxis, when it is considered advisable to arrest hemorrhage, assistance may be gained by the injection of alum into the nostrils, or by the introduction of lint moistened with the solution. Where this fails to give relief, finely-powdered alum may be employed in the manner of snuff. In hemorrhage from the mouth or throat, or from the gums in scurvy, or after the extraction of teeth, gargles containing alum are useful. In hæmatemesis, as well as in intestinal hemorrhage, alum whey may be administered; though, of course, no reliance can be placed on it, as the hemorrhage usually depends on circumstances which astringents merely cannot be expected to obviate. In uterine hemorrhage, a sponge soaked in a solution of alum may be introduced into the vagina with good effect. To check the hemorrhoidal flux when immoderate, washes or enemata containing alum may be employed. To stop the bleeding after leech-bites in children, a saturated solution, or the powder of alum, may be applied to the punctures.

In certain inflammations, alum has been used as a *repellent*; that is, it has been applied to the inflamed part in order to produce contraction of the distended vessels, and thereby to diminish the quantity of blood in the seat of the disease in a manner almost mechanical. Thus, in the first stage of ophthalmia it is sometimes considered expedient to cut short the disease by the application of a strong astringent solution (as a saturated solution of alum or of acetate of lead); and whatever difference of opinion exists as to the propriety of these applications in the first stage of ophthalmia, all are agreed as to their value after the violence of vascular action has been subdued. In the treatment of the purulent ophthalmia of infants, no remedy is perhaps equal to an alum wash. The wash should contain eight grains of alum in an ounce of water, and should be introduced between the lids *every quarter of an hour.* Thus used, the wash seldom fails.

In diphtheria, great importance has been attached to the employment of local applications. In order to promote the expulsion of the false membrane, Bretonneau recommends the insufflation of finely-powdered alum. This is effected by placing a drachm of it in a tube, and blowing it into the throat. Velpeau has extended the use of alum to other inflammatory affections of the throat, as those arising in scarlatina and small-pox. In these cases, powdered alum may be applied to the affected part by means of the finger. Gargles containing this salt will be found useful in most kinds of sore-throat, ulcerations of the mouth and gums, aphthæ, &c. Alum has been employed as an *astringent*, to diminish or stop excessive secretion from the mucous surfaces. Thus a weak solution of this salt is used to check profuse ptyalism, whether from the use of mercury or other causes; and to remove gleet or leucorrhœa. In old-standing diarrhœas, it has been administered, in combination with the vegetable astringents (kino, for example), with occasional advantage. It is also applied to check profuse secretion from ulcers. Alum curd is sometimes applied to ecchemoses and to inflamed eyelids. Sir Everard Home used to apply it to scrofulous tumours.

As an internal remedy.—In typhoid fever, two to five grains of alum, given every hour, have been found very successful in checking the exhausting diarrhœa. In the treatment of *lead colic*, alum has been found particularly successful. It allays vomiting, abates flatulence, mitigates pain, and opens the bowels more certainly than any other medicine, and frequently when other powerful remedies have failed. It should be given in full doses (as from twenty to forty grains), dissolved in some demulcent liquid (as gum-water), every three or four hours. Opium and (according to Dr. Copland) camphor may be advantageously conjoined.

Alum is administered *internally* in several other diseases: in passive or asthenic hemorrhages from distant organs; as hæmoptysis, menorrhagia, and other uterine hemorrhages, and hæmaturia; in colliquative sweating, pertussis in the chronic form, diabetes, gleet, gonorrhœa, and leucorrhœa. In the three latter diseases it may be combined with cubebs. In chronic dysentery and diarrhœa, alum has been held in great repute. Dr. Meigs, of Philadelphia, has given a teaspoonful of powdered alum as an emetic in cases of croup, and prefers it to any other emetic in this disease.

Administration.—The dose of alum is from ten to forty grains. It may be taken in the form of powder, or made into pills with some tonic extract, or in solution. To prevent nausea, an aromatic (as nutmeg) should be conjoined. A pleasant mode of exhibition is in the form of *alum whey*, prepared by boiling a hundred and twenty grains of powdered alum with a pint of milk, then straining: the dose is a wineglassful. For an emetic, thirty to sixty grains may be given in a teaspoonful or two of water. In prescribing alum, it is to be remembered that the vegetable astringents decompose it; by which the astringent property of the mixture is probably diminished. For topical uses, alum is employed in the form of powder, solution, and poultice. For an injection or gargle, twenty grains in an ounce of water forms a solution of suitable strength. Alum curd is made by agitating a small portion of alum with white of egg till it forms a curd. This is applied between two pieces of thin linen.

Antidote.—In a case of poisoning by alum, let the contents of the stomach be immediately evacuated. Promote vomiting by the use of tepid diluents. The inflammatory symptoms are to be combated by the usual antiphlogistic means. Small doses of carbonate of soda may be given at intervals. This will decompose the salt and render it inert.

[§ **Alumen Exsiccatum.** *Dried Alum.*

Take of

Alum . . . . 4 ounces.

Heat the alum in a porcelain dish or other suitable vessel till it liquefies, then raise and continue the heat, not allowing it to exceed 400°, till aqueous vapour ceases to be disengaged, and the salt has lost 47 per cent. of its weight. Reduce the residue to powder, and preserve it in a well-stopped bottle.]

In the preparation of this substance, care must be taken not to apply too great a heat, lest a portion of the salt itself be decomposed. On this account, a shallow earthen vessel is preferable to a crucible.

Dried alum does not dissolve so readily in water as the crystallised salt. When moistened, it resumes its water of crystallisation with evolution of heat. It is employed as a mild escharotic, to destroy exuberant spongy granulations; as those commonly known under the name of proud flesh.

CERIUM. Ce = 46 or **Ce** = 92.

This metal occurs in cerite and other minerals of somewhat rare occurrence. Some of its salts have been used in medicine during the last few years, and one, the oxalate, has been introduced into the Pharmacopœia.

[§ **Cerii Oxalas.** *Oxalate of Cerium.*
$2CeO,C_4O_6 + 6HO$ or $\mathbf{CeC_2O_4.\ 3H_2O}$.

A salt which may be obtained as a precipitate, by adding solution of oxalate of ammonia to a soluble salt of cerium.

Characters and Tests.—A white granular powder, insoluble in water, decomposed at a dull red heat into a reddish-brown powder, which dissolves completely and without effervescence in boiling hydrochloric acid, and the resulting solution gives with solution of sulphate of potash, a white crystalline precipitate. If the salt be boiled with solution of potash and filtered, the filtrate is not affected by solution of chloride of ammonium, but when supersaturated with acetic acid it gives with chloride of calcium a white precipitate, which is soluble in hydrochloric acid. Ten grains when incinerated, lose 5·2 grains in weight.

Dose, 1 to 2 grains.]

Therapeutics.—Oxalate of cerium has been used, it is said, with good effect, for preventing the sickness accompanying pregnancy, and generally for allaying irritable states of the stomach. It acts as a nervine tonic, in the same way as subnitrate of bismuth or nitrate of silver.

CHROMIUM. Cr = 26·25 or **Cr** = 52·5.

Chromic Acid. CrO_3 or $\mathbf{CrO_3}$.

Obtained in crimson needles by the action of sulphuric acid upon bichromate of potash. It is a powerful oxidising and bleaching agent, highly corrosive, and very soluble in water. (See **Bichromate of Potash.**)

MANGANESIUM. Mn = 27·5 or **Mn** = 55.

[§ **Manganesii Oxidum Nigrum.** *Black Oxide of Manganese.*
MnO_2 or $\mathbf{MnO_2}$.]

Natural History.—The oxide of manganese used in chemistry and pharmacy is the native anhydrous binoxide, called by mineralogists pyrolusite. It is found in great abundance in Cornwall, Devonshire, Somersetshire, and Aberdeenshire, whence much of what is met with in commerce is obtained. Pyrolusite is also found in Saxony, Hesse, Bohemia, Hungary, Silesia, France, and other countries of Europe.

Preparation.—Native binoxide of manganese, after being raised from the mine, is broken into small pieces about the size of peas, and then washed, to separate the earthy impurities. It is afterwards ground in mills to an impalpable powder.

[§ *Characters and Tests.*—A heavy black powder, which dissolves almost entirely in hydrochloric acid with evolution of chlorine, and gives off oxygen when heated to redness. Used for producing chlorine.]

Native binoxide of manganese is tasteless, odourless, and insoluble in water; it usually contains oxide of iron, carbonate of lime, sulphate of baryta, and argillaceous matter. Its purity is judged of either by the quantity of oxygen which it is capable of yielding, or by the quantity of chlorine set free when this oxide and hydrochloric acid are allowed to act on each other. The quantity of chlorine set free can be estimated by the quantity of sulphate of iron which it peroxidises. The brown varieties are inferior to the black ones.

Manganesii Chloridum. *Chloride of Manganese.* MnCl or $\mathbf{MnCl_2}$.

Occurs in some mineral waters, as at Kreuznach. It is obtained as a by-product in the manufacture of chlorine from peroxide of manganese and hydrochloric acid. The residuary liquor in this process contains chloride of manganese and perchloride of iron. To separate the latter, first boil down, to drive off the excess of acid; then divide the solution into two parts; precipitate one by excess of carbonate of soda, wash this precipitate thoroughly, and then mix it with the remaining portion of the original solution. The carbonate of manganese in the precipitate decomposes the perchloride of iron, precipitates peroxide of iron, and leaves chloride of manganese in solution. The filtered liquid yields, on evaporation, rose-red or nearly colourless crystals of the chloride, $\mathbf{MnCl_24H_2O}$.

This salt may be used for preparing other compounds of manganese.

ARSENICUM. *Arsenic.* As or **As** = 75.

Natural History.—Arsenic is peculiar to the mineral kingdom. It occurs in the metallic state, and in combination with oxygen, with sulphur, and with other metals. There are two native compounds of it with oxygen—namely, *arsenious acid* and *arsenic acid*, the latter being found in combination with bases, forming *arseniates*. Two sulphides, also, are found native—namely, *orpiment* and *realgar*.

Properties.—Metallic arsenic is very hard, very brittle, and crystalline. The form of its crystal is the rhombohedron. The colour of the metal varies from tin-white to steel-grey. It possesses considerable brilliancy, but soon tarnishes in the air, and becomes dull and dark grey. Sp. gr. 5·6 to 5·9. At a low red heat it volatilises without fusing, and yields a vapour having an alliaceous odour: in the open air this vapour becomes oxidised, and yields white fumes of arsenious acid. The physical characters of the metal differ somewhat, according as this exists in the mass, in the form of a ring lining a glass tube, or in that of a spot on a plate of glass, porcelain, or mica. Metallic arsenic, when swallowed, is capable of acting as a powerful poison, probably by becoming oxidised and converted into arsenious acid.

[§ **Acidum Arseniosum.** *Arsenious Acid.*

Synonym.—Arsenicum album, *Edin.*

AsO_3 or $\mathbf{As_2O_3}$.]

History.—Arsenious acid, commonly termed *white arsenic*, is first distinctly mentioned by Geber, who is supposed to have lived in the eighth century. Hippocrates and Dioscorides employed orpiment under the name of *ἀρσενικόν*. Arsenious acid is rare as a mineral.

Preparation.—Arsenious acid is prepared in Silesia, Bohemia, Saxony, and Cornwall, by roasting the ores of cobalt, tin, and iron, the arsenious acid vapours being condensed in a pulverulent form in the flues or condensing chambers. This rough acid is refined by sublimation, and forms the white arsenic of commerce. The Pharmacopœia directs commercial arsenious acid to be further purified by resublimation.

[§ *Characters and Tests.*—Occurs as a heavy white powder, or in sublimed masses which usually present a stratified appearance, caused by the existence of separate layers differing from each other in degrees of opacity. When slowly sublimed in a glass tube, it forms minute brilliant and transparent octahedral crystals. It is sparingly soluble in water, and its solution gives with ammonio-nitrate of silver a canary-yellow precipitate (arsenite of silver), insoluble in water, but readily dissolved by ammonia and by nitric acid. Sprinkled on a red-hot coal, it emits an alliaceous odour. It is entirely volatilised at a temperature not exceeding 400°. Four grains of it dissolved in boiling water with eight grains of bicarbonate of soda discharge the colour of 808 grain-measures of the volumetric solution of iodine.]

By the action of iodine upon arsenious acid, hydriodic and arsenic acids result; both are colourless, and therefore as long as arsenious acid remains in the liquid the volumetric solution of iodine will be deprived of colour. When the oxidation is complete, the next addition of iodine remains visible.

$$\mathbf{2I_2 + As_2O_3 + 5H_2O = 4HI + 2H_3AsO_4.}$$

A clear watery solution of arsenious acid has a very feeble acid reaction on litmus. Its taste is feeble. By evaporation on a glass plate it yields octahedral crystals. It yields a white precipitate with lime water of arsenite of lime; when acidified, a yellow precipitate of sulphide of arsenic, with sulphuretted hydrogen, soluble in solution of ammonia; a green precipitate of arsenite of copper (Scheele's green) with ammonio-sulphate of copper. When mixed with zinc, and either sulphuric or hydrochloric acid, it evolves arseniuretted hydrogen gas, $\mathbf{AsH_3}$ (*Marsh's test*), which has an alliaceous odour, and burns with a bluish-white flame, depositing a black spot of arsenic on a cold plate of porcelain held directly above the jet; and lastly, when boiled with hydrochloric acid and clean copper foil, it gives a grey metallic coating of arsenic to the latter (*Reinsch's test*). If arsenious acid be intimately mixed with freshly-ignited but cold charcoal, or, still better, with a mixture of charcoal and carbonate of soda, both well dried, and heated in a glass tube, the acid is deoxidised, and yields metallic arsenic, which is sublimed into a cooler portion of the tube, where it condenses and forms a metallic crust: $\mathbf{As_2O_3 + 3C = 2\,As + 3CO}$.

Physiological Effects. Of very small or *therapeutical doses.*—In very small quantities (as one-sixteenth or one-twelfth of a grain) no obvious effects are usually produced by the use of arsenic, unless it be continued for a long period. Indeed, some writers go so far as to assert that it is a strengthening remedy, and that it improves the appetite, invigorates digestion, promotes assimilation and secretion, excites the muscular and nervous functions—in a word, acts as a *tonic.* I cannot, however, subscribe to this doctrine. It is, indeed, true that patients sometimes experience a temporary increase of appetite from the use of small doses of arsenic; and it is also certain that this remedy is frequently beneficial in agues and other diseases in which tonics have been found efficacious. But the analogy between the action of arsenious acid and that of the vegetable tonics stops here.

The following is an abstract of the symptoms produced by the *long-continued employment of small doses* of arsenious acid, but which are more or less modified in different cases:—Disorder of the digestive functions, characterised by flatulence, sensation of warmth, or actual pain, in the stomach and bowels; loss of appetite; thirst, nausea, and vomiting; purging, or at least a relaxed condition of the bowels, and griping; furred tongue, with dryness and tightness of the mouth and throat, or with salivation. Quick, small, and sometimes irregular pulse; oppressed respiration, with a dry cough. The body wastes—the stomach being frequently so irritable that no food can be retained in it. Headache, giddiness, and want of sleep, are frequently observed. The limbs become painful, feeble, trembling, subject to convulsions; occasionally benumbed, and ultimately paralysed. The cutaneous system is, in some cases, affected, an eruption makes its appearance, and now and then the hair and nails fall off. Swelling of the feet and of the face is not unfrequently observed; and under these symptoms the patient gradually sinks, in some cases retaining his consciousness to the last, but at other times delirium or stupor supervening.

Of excessive or poisonous doses (*acute poisoning*).—The symptoms produced by the ingestion of a large dose of arsenious acid are not invariably alike. They are either such as indicate gastro-enteritis; namely, heat and constriction of the throat, abdominal pain, vomiting, diarrhœa, bloody stools, and tenesmus; or such as indicate great depression of the vascular and nervous systems; namely, faintness, cold clammy sweats, irregular action of the heart, palpitation, and dyspnœa; or tremor, convulsions, delirium, coma, and paralysis.

It is important to determine *what is the smallest fatal dose of arsenious acid.* It is not easy, however, to give a positive answer to this question. Dr. Christison says, 'the smallest actually fatal dose I have hitherto found recorded is $4\frac{1}{2}$ grains. The subject was a child four years old, and death occurred in six hours. In this instance, however, the poison was taken in solution.' Dr. Letheby has reported a case in which two grains and a half proved fatal in 36 hours: the patient was a robust girl. More recently, a case has been recorded in which there was reason to suspect that the death of a woman was produced by half an ounce of Fowler's mineral solution (= 2 grs. of arsenious acid). Dr. Alfred Taylor considers that from two to three grains may be regarded as a fatal dose. However, under certain circumstances, enormous quantities have been swallowed with very trivial effects. Half an ounce has been taken immediately after dinner, and the only effect produced was violent vomiting. Here it is evident that the distension of the stomach with food saved the individual's life.

When arsenious acid is swallowed, or otherwise applied to a living surface, it becomes absorbed. The absorption of it is now no longer a matter of doubt; for arsenic has been detected in the blood, in the animal tissues (liver, spleen, kidneys, stomach, and muscles), and in the urine. The parts principally influenced by arsenious acid are the alimentary canal, and other mucous surfaces, as the conjunctiva, the cerebro-spinal centres, the heart, the lungs, the skin, and the salivary glands.

Therapeutics.—The action of arsenious acid in disease appears to entitle it to be regarded as an *antiperiodic*, an *alterative*, and *antispasmodic.*

In *intermittent fevers and other periodical diseases*, it has been employed with great success. For its introduction into practice in these cases in this country, we are indebted to the late Dr. Fowler, of Stafford. The reports published by Dr. Fowler, of the good effects of arsenic in periodical diseases have been amply confirmed by the subsequent experience of the profession generally. No remedy has been more successful in the treatment of ague. It will not unfrequently put a stop to the disease even when cinchona or the sulphate of quinia has failed. Dr. Brown, who has used it in many hundreds of cases, never saw any permanently ill effect arise from it; he considers it superior to crude bark, but inferior to quinia; over both it has the advantage of cheapness and tastelessness. In agues accompanied with inflammatory conditions, in which cinchona and sulphate of quinia are apt to disagree, arsenic may, according to Dr. Brown, be sometimes administered with the best effects. It is also very successful in relapses after the use of the above remedies. Some trials have been made by MM. Maillot, Andral, and Girbal, in order to determine the comparative value of arsenic and quinia in the treatment of ague. They agree in their conclusions that, although possessing considerable remedial power over agues, yet it is a less prompt and less certain remedy than sulphate of quinia. On the other hand, M. Boudin, Physician-General to the French troops in Algeria, states that he cured numerous cases of ague with 1-100th of a grain of arsenious acid, one third of the cases having previously resisted quinia.

In various *chronic affections of the skin*, particularly the scaly diseases (lepra, psoriasis, and pityriasis), eczema, and impetigo, arsenic is one of our most valuable agents. I can confidently recommend it in lepra, having seen a large number of cases benefited by it. Frequently the disease is relieved without any obvious constitutional effect. According to Mr. Hunt, arsenic exercises an 'almost omnipotent influence' over non-syphilitic cutaneous diseases: and he ascribes the numerous failures in the treatment of these maladies to one or more of the following sources:—1st, the syphilitic character of the disease being overlooked; 2ndly, the administration of arsenic during the inflammatory or febrile state of the disease; 3rdly, the use of it on an empty stomach; 4thly, the exhibition of the remedy in too large doses, and at intervals too distant. He recommends five minims of Fowler's solution three times a day, to begin with, and as soon as the conjunctivitis appears, to reduce the dose; and he deprecates the employment of gradually increasing doses. These are the regulations under which I have usually given it; and although I can bear testimony to the great value of arsenic in skin disease, my experience does not authorise me to ascribe to it the 'almost omnipotent influence' which Mr. Hunt has done, for I have repeatedly witnessed its failure as a therapeutical agent in some of these maladies, especially in superficial lupus, psoriasis guttata, and obstinate eczema. Mr. Hunt considers that the state of the conjunctiva may always be allowed to regulate the dose, and he so regulates it, if possible, that the eyelids shall continue tender through the whole course. Dr. Farre has not found conjunctivitis occur nearly so frequently as Mr. Hunt's remark implies. He has repeatedly cured both skin disease and chorea by a course of arsenic of some weeks' duration, without being able to discover any increased redness or tenderness of the conjunctiva.

Some *chronic affections of the nervous system* have been benefited by arsenious acid; for example neuralgia, especially when periodic, and chorea. In hemicrania and neuralgia of the brow, or brow ague, arsenic seldom fails as medicine. In chorea, I have seen great advantage attend its use;—in fact, I know of no remedy for this disease equal to arsenic, which, in a large proportion of cases, acts almost as a specific. It has also relieved angina pectoris.

Arsenic is contraindicated in plethoric habits. 'It operates best,' according to Mr. Hunt, 'in persons of lax fibre and languid circulation and cold and moist skin, and who pass pale and plentiful urine, i.e., in persons to whom iron is suitable.'

Arsenious acid has long been employed as an *external application.* It has been applied and recommended by Sir A. Cooper, Dupuytren, and other high authorities; but its use is always attended with some danger. As a remedy for cancer it is never employed by the best surgeons of the present day, because experience has fully shown that it is incapable of curing genuine cancer, while it endangers the lives of the unfortunate patients. But in some forms of fevers and unmanageable ulcerations, as lupus, arsenical applications are employed with occasional benefit when all other local remedies fail. Dupuytren employed in lupus an arsenical dusting powder, composed of ninety-nine parts of calomel and one part of arsenious acid. Sir A. Cooper recommends an arsenical ointment (arsenious acid, sublimed sulphur, of each one part; spermaceti ointment, eight parts). Cazenave says he has seen arsenical applications used by Biett, and has himself employed them many times, without having met with one instance of injurious consequences. In *onychia maligna*, Mr. Luke regards an arsenical ointment (composed of arsenious acid, 2 grains, and spermaceti ointment, 1 ounce) as almost specific.

Administration.—Arsenious acid may be administered, in substance, in doses of from one-sixteenth to one-eighth of a grain, made into pills with crumb of bread. In making a mass of pills, great care should be taken that the arsenic be equally divided; for this purpose it should be well rubbed in a mortar with some fine powder (as sugar) before adding the bread crumb. A much safer mode of exhibition is to give this potent remedy in the form of solution with potash (as the *liquor arsenicalis*). Whether given in the solid or liquid form, it is best to exhibit it immediately after a meal, when the stomach is filled with food; for when given on an empty stomach (as in the morning, fasting), it is much more apt to occasion gastric disorder. It is sometimes advisable to conjoin opium, either to enable the stomach to retain it, or to check purging. In debilitated constitutions, quinia or other tonics may be usefully combined with it. Its effects are to be carefully watched, and whenever any unpleasant symptoms (as vomiting, griping, purging, swelling or redness of the eyelids, dryness of throat, ptyalism, headache, or tremors) make their appearance, it will, of course, be advisable to diminish the dose, or suspend for a few days the use of the remedy. Indeed, when none of these symptoms occur, it is not proper to continue its use more than two weeks without intermitting its employment for a day or two, in order to guard against the occasional ill consequences resulting from the accumulation of the poison in the system, for it has on more than one occasion proved fatal when used as a medicinal agent.

Antidotes.—In cases of poisoning by arsenic, several indications require to be fulfilled:—

1. The first object to be effected is *to expel the poison from the stomach.* For this purpose the stomach-pump should be immediately applied. If this be not in readiness, and vomiting have not commenced, tickle the throat with a feather or the finger, and administer an emetic of sulphate of copper or sulphate of zinc. Promote vomiting by diluent and demulcent liquids; as milk, white of egg and water, flour and water, gruel, sugared water, broths, linseed-tea, oil and lime-water, or a mixture of milk, lime-water, and albumen. The liquid serves to promote vomiting; the demulcents (mucilage, albumen, oil, casein, or sugar), invest the poisonous particles, and, therefore, act as mechanical antidotes; while the lime-water is useful by diminishing the solubility of the arsenious acid. Olive oil, on which, according to Dr. Paris, the Cornish miners rely with confidence, can only act mechanically in the way just mentioned.

To expel arsenious acid from the intestines, castor oil is the best purgative.

2. The second object is *the employment of chemical antidotes.*

Of these there are none for arsenic on which much reliance can be placed. Those recommended are:—animal charcoal, hydrated peroxide of iron, magnesia, and lime-water. But none of these are efficacious as chemical agents unless the poison be in solution. Now, as arsenic is almost invariably taken in a solid form, it follows that the benefit which may be obtained by the use of these agents is generally to be ascribed to their action as mechanical antidotes.

With respect to the hydrated peroxide of iron, at least twelve parts of oxide, prepared by ammonia, and moist, are required for each part of arsenic in solution, as it only acts chemically on the *solution.* Dr. T. R. Beck recommends that we should administer to an adult a tablespoonful at least, and to children a dessertspoonful, every five or ten minutes, until relief from the urgent symptoms is obtained. Highly-calcined magnesia has been lately revived as a chemical antidote for arsenic. When in the gelatinous or hydrated state, it abstracts arsenious acid from its solution by forming with it a difficultly-soluble arsenite of magnesia.

3. Another indication is the use of *dynamical antidotes.* Opium is here a very valuable agent. It is undeniable that it is in most cases of great service. If the stomach rejects it, we may employ it in the form of clysters. When there is much depression and collapse, brandy and other stimulants are sometimes requisite.

[§ **Liquor Arsenicalis.** *Arsenical Solution.*

Synonyms.—Liquor potassæ arsenitis, Lond. *Fowler's solution.*

Take of

Arsenious Acid	80 grains.
Carbonate of Potash . . .	80 grains.
Compound Tincture of Lavender .	5 fluid drachms.
Distilled Water	a sufficiency.

Place the arsenious acid and the carbonate of potash in a flask with ten ounces of the water, and apply heat until a clear solution is obtained. Allow this to cool. Then add the compound tincture of lavender, and as much distilled water as will make the bulk one pint.]

Arsenious acid dissolves in alkaline carbonates more readily than in water, but it decomposes them slowly, and a small quantity only of arsenite of potash exists in the officinal solution.

[§ *Characters and Tests.*—A reddish liquid, alkaline to test-paper, and having the odour of lavender. Specific gravity, 1·009. After being acidulated with hydrochloric acid it gives with sulphuretted hydrogen a yellow precipitate, which is brightest when the arsenical solution has been previously diluted. 441·5 grains (1 fluid ounce) boiled for five minutes with ten grains of bicarbonate of soda and then diluted with six fluid ounces of water to which a little mucilage of starch has been added, does not give with the volumetric solution of iodine a permanent blue colour until 808 grain-measures have been added, corresponding to four grains of arsenious acid in one fluid ounce.]

The action in the last of these tests is the same as that given under arsenious acid. No blue colour can be produced until all the arsenious acid has been converted into arsenic acid.

Dose, 2 to 8 minims.

[§ ⁂ **Liquor Arsenici Hydrochloricus.** *Hydrochloric Solution of Arsenic.*

Take of

Arsenious Acid, in powder	. .	80 grains.
Hydrochloric Acid	. . .	2 fluid drachms.
Distilled Water to make up 1 pint.]		

This solution corresponds in strength to Liq. Arsenicalis; it is nearly three times the strength of Liq. Arsenici Chloridi, *Lond.* De Valangin's mineral solution was a similar but weaker solution.

Acidum Arsenicum. *Arsenic Acid.* $3HO,AsO_5$ or $\mathbf{H_3AsO_4}$.

This compound is prepared by boiling arsenious acid with excess of nitric acid, $\mathbf{As_2O_3 + 2HNO_3 + 2H_2O = 2H_3AsO_4 + N_2O_3}$. By evaporating to dryness the anhydride, $\mathbf{As_2O_5}$, a white very deliquescent substance, is obtained. By redissolving this in water, arsenic acid is reproduced, and may with care be obtained in crystals. Arsenic acid neutralises alkalies forming soluble arseniates which give with nitrate of silver a chocolate-red precipitate.

It has been employed extensively by the calico printers and as an agent of oxidation in the manufacture of aniline red. It is used in medicine only in combination.

Arsenici Teriodidum. *Teriodide of Arsenic.* AsI_3 or $\mathbf{AsI_3}$.

This compound is prepared by gently heating in a Florence-flask a mixture of one part of finely pulverised arsenicum and five parts of iodine; the iodide is afterwards to be sublimed. Thus obtained, it is an orange-red volatile solid, soluble in water.

In its medicinal properties it combines the effects of arsenious acid and iodine.

Dose, $\frac{1}{10}$ grain.

Liquor Arsenici et Hydrargyri Hydriodatis. *Dubl. Solution of Iodide of Arsenic and Mercury. Donovan's Solution.*

Take of

Pure Arsenic, in fine powder	. .	6 grains.
Pure Mercury	. . . . .	16 grains.
Pure Iodine	. . . . .	$50\frac{1}{2}$ grains.
Alcohol	. . . . . .	$\frac{1}{2}$ drachm.
Distilled Water	. . . . .	a sufficiency.

Rub together the arsenic, mercury, iodine, and spirit until a dry mass is obtained, and having triturated eight ounces of the water with this in successive portions, let the whole be transferred to a flask and heated until it begins to boil. When cooled and filtered, let as much distilled water be added to it as will make the bulk of the solution exactly eight fluid ounces and six drachms.

The iodine combines with the metals; it is about sufficient to convert the arsenic into teriodide, $\mathbf{AsI_3}$, and the mercury into periodide, $\mathbf{HgI_2}$. Each fluid drachm of this solution contains a quantity of iodide of arsenic equivalent to one-eighth of a grain of arsenious acid; and of periodide of mercury equivalent to a quarter of a grain of peroxide.

The colour of the solution is greenish-yellow, its taste is slightly styptic. It produces immediate and copious precipitates with tincture of opium and with salts of morphia. Hence, if opiates are to be used during the exhibition of this arsenico-mercurial liquor, they must be taken at different periods of the day.

Soubeiran has proposed to make this solution by employing the two iodides previously prepared separately. They may be used in the following proportions :—

Red Iodide of Mercury . . .	$172\frac{1}{2}$ grains.
Teriodide of Arsenic	$188\frac{1}{2}$ grains.
Distilled Water	40 ounces.

The solution contains almost exactly one part of each of the iodides in one hundred parts.

Both Donovan's and Soubeiran's solutions contain the teriodide of arsenic and periodide of mercury, and therefore combine the effects of both these salts. It sometimes occasions ptyalism.

Dose, 10 to 30 minims.

Arsenici Sulphidum Rubrum. *Red Sulphide of Arsenic. Realgar.* AsS_2 or $\mathbf{As_2S_2}$.

It occurs in the mineral kingdom, both massive and crystallised. Commercial realgar is an artificial product prepared by submitting to distillation arsenical pyrites. It is met with in the form of red vitreous masses or as a red powder. At the present time it is not employed for medicinal purposes, but is used by pyrotechnists and as a pigment.

Arsenici Sulphidum Flavum. *Yellow Sulphide of Arsenic. Orpiment. King's Yellow.* AsS_3 or $\mathbf{As_2S_3}$.

This is found native and is also prepared artificially. Artificial orpiment prepared by submitting to distillation a mixture of arsenious acid and sulphur is much more poisonous than native orpiment, as it contains according to Guibourt, 94 per cent. of arsenious acid and only 6 per cent. of the sulphide. This latter may be thrown down pure by passing a current of sulphuretted hydrogen into an acidified solution of arsenious acid. Like realgar, it was employed in medicine by the ancients, but at the present time it is not in use excepting as a constituent of some depilatories.

ANTIMONY. (*Stibium.*) Sl or Sb=122.

History and Properties.—Antimony is a brittle, highly crystalline metal of a bluish-white colour, bright metallic lustre, and sp. gr. 6·7; when submitted to a high temperature with exposure to the air it burns, giving off dense vapours of the oxide.

This substance is not now used in medicine in the metallic state. In former times everlasting or perpetual pills and emetic cups were made of it.

[§ ⁂ **Antimonii Oxidum.** *Oxide of Antimony.*

SbO_3 or $\mathbf{Sb_2O_3}$.

Take of

Solution of Chloride of Antimony	16 fluid ounces.
Carbonate of Soda	6 ounces.
Water	2 gallons.
Distilled Water	a sufficiency.

Pour the antimonial solution into the water, mix thoroughly, and set aside until the precipitate which forms shall have subsided. Remove the supernatant liquid by a siphon, pour on a gallon of distilled water, agitate well, let the precipitate subside, again withdraw the fluid, and repeat the processes of affusion of distilled water, agitation, and subsidence, until the fluid has only a feeble acid reaction on litmus paper. To the precipitate add the carbonate of soda previously dissolved in two pints of distilled water, leave them in contact for half an hour, stirring frequently, collect the deposit on a calico filter, and wash with boiling distilled water until the washings cease to give a precipitate with a solution of nitrate of silver acidulated by nitric acid. Lastly, dry the product at a heat not exceeding 212°.]

When the solution of chloride of antimony is diluted with water, a white precipitate of *oxychloride of antimony* is produced, which becomes crystalline by standing. The compound when crystalline has the formula $\mathbf{2SbCl_3.5Sb_2O_3}$. By treating this precipitate with carbonate of soda, the remaining portion of chloride of antimony is decomposed, with the formation of chloride of sodium, and carbonic acid. The precipitate then consists of oxide of antimony :

$$2SbCl_3 5Sb_2O_3 + 3Na_2CO_3 = 6Sb_2O_3 + 6NaCl + 3CO_2.$$

[§ *Characters and Tests.*—A greyish-white powder, fusible at a low red heat, insoluble in water, but readily dissolved by hydrochloric acid. The solution, dropped into distilled water, gives a white deposit, at once changed to orange (Sb_2S_3) by sulphuretted hydrogen. It dissolves entirely when boiled with an excess of the acid tartrate of potash.]

Physiological Effects.—Oxide of antimony is the active part of all the medicinal preparations of antimony. Its medicinal properties are similar to those of tartarated antimony ; but in consequence of its great insolubility, except in acids, its action is slower and milder. It has been little used at present in England, but Dr. Christison states that in its action it is diaphoretic, sedative, expectorant, emetic, and laxative.

Therapeutics.—It has been employed chiefly in Scotland and Ireland as a diaphoretic and sedative in catarrh and pneumonia, and in the early stage of febrile diseases; but its effects hitherto have been far from uniform. Three or four grains were found by Dr. Christison to produce not only diaphoresis, but frequently nausea and even vomiting; while at other times the same quantity produced no appreciable effect. Dr. Clark, of Aberdeen, found thirty or forty grains sometimes apparently inert.

Administration.—Dose, 1 to 4 grains. It may be given in confection of roses.

[§ **Pulvis Antimonialis.** *Antimonial Powder.*]

History.—Dr. James, who died in 1776, prepared a celebrated patent medicine, long known as *James's powder* (*pulvis Jacobi*). The specification which Dr. James lodged in the Court of Chancery is so ambiguously worded, that his powder cannot be prepared by it. Hence the present preparation has been introduced into the Pharmacopœia as a substitute for it, and for the Pulvus Antimonii Compositus, *Lond.*, and the Pulvis Antimonialis, *Edin.* and *Dubl.*, none of which have been found satisfactory.

Preparation.—[§ Take of

Oxide of Antimony	1 ounce.
Phosphate of Lime	2 ounces.

Mix them thoroughly.]

Physiological Effects.—Dr. Pereira attributed the inequality in the operation of the former antimonial powders to the presence or absence of oxide of antimony, and to the uncertain quantity of this ingredient when present. The following examples were given:—Mr. Hawkins gave sixty grains morning and evening without any obvious effect; and the late Dr. Duncan, jun., administered doses of twenty and thirty grains several times a day, without inducing vomiting or purging. Dr. Elliotson found even 120 grains nearly inert; nausea alone being in some of the cases produced. In these instances it probably contained little or no oxide.

But, on the other hand, a considerable number of practitioners have found it to possess activity. Dr. Paris observes, that 'it will be difficult for the chemist to persuade the physician that he can never have derived any benefit from the exhibition of antimonial powder.' I am acquainted with one case in which it acted with great activity. A workman employed in the manufacture of this powder in the laboratory of an operative chemist in London, took a dose of it (which, from his account, was estimated at half a teaspoonful), and, to use his own words, 'it nearly killed him.' It occasioned violent vomiting, purging, and sweating. *Dr. James's powder*, which some practitioners consider as more active and certain than our late antimonial powders, appears to be equally inconstant in its operation. Dr. D. Munro, who frequently used this powder, and saw Dr. James himself, as well as other practitioners, administer it, observes:—'Like other active preparations of antimony, it sometimes acts with great violence, even when given in small doses; at other times a large dose produces very little visible effects. I have seen three grains operate briskly both upwards and downwards; and I was once called to a patient to whom Dr. James had himself given five grains of it, and it purged and vomited the lady for twenty-four hours, and in that time gave her between twenty and thirty stools; at other times I have seen twenty grains produce little or no visible effect.' The present powder avoids one source of uncertainty by containing a definite quantity, 33 per cent. of the oxide; but is, of course, still liable to the uncertainty and variableness which arises from the insolubility of the oxide.

Therapeutics.—Antimonial powder is employed as a sudorific in fevers and rheumatic affections. In the former it is given either alone or in combination with mercurials; in the latter, it is frequently conjoined with opium as well as with calomel. In chronic skin diseases it is sometimes exhibited with alteratives.

Administration.—The usual dose of it is from 3 to 10 grains, in the form of powder or bolus.

[§ **Antimonium Nigrum.** *Black Antimony.*

Synonym.—Prepared sulphuret of antimony, 1864.

Native sulphide of antimony SbS_3 or $\mathbf{Sb_2S_3}$ purified from siliceous matter by fusion, and afterwards reduced to fine powder.]

History.—Black sulphide of antimony was known in the most ancient times, being used by the Asiatic and Greek ladies as a pigment for the eyebrows. It is found native in various parts of the world, especially in Hungary, in the Hartz, in France, in Cornwall, and in Borneo. From the latter place it is imported into this country by way of Singapore, being brought over as ballast in the vessels.

[§ *Characters and Tests.*—A greyish-black crystalline powder. It dissolves almost entirely in boiling hydrochloric acid, evolving sulphuretted hydrogen] ($\mathbf{Sb_2S_3 + 6HCl = 2SbCl_3 + 3H_2S}$).

Properties.—The fused sulphide (called *common* or *crude antimony*) occurs in commerce in roundish masses, called loaves or cakes: these, when broken, present a striated crystalline appearance, a dark steel or lead grey colour, and a metallic brilliancy. Specific gravity about 4·6. By roasting it is converted into *antimony ash*, a mixture of oxide and sulphide. The crude antimony of commerce frequently contains the sulphides of iron, lead, arsenic, and copper.

Glass of antimony is obtained by first roasting the black sulphide and then fusing the product in an earthen crucible. Mr. Phillips says that it consists principally of oxide of antimony, some sulphide, and about 5 per cent. of silica.

Saffron of antimony. Crocus antimonii; crocus metallorum.—Obtained by deflagrating a mixture of equal parts of black sulphide of antimony and nitrate of potash; the resulting fused mass (sometimes called *liver of antimony*) is to be separated from the scoria, reduced to fine powder, boiled in water, and repeatedly washed.

Liver of antimony is also obtained by fusing together black sulphide of antimony and carbonate of potash or soda; or by roasting black antimony until part of the sulphur has been burned away, and oxide of antimony formed, then fusing the mixture of sulphide and oxide, which on cooling forms a vitreous mass, having a brown or liver colour. This last is the best method of preparing it.

[§ **Antimonium Sulphuratum.** *Sulphurated Antimony.*

Synonyms.—Antimonii oxysulphuretum, *Lond.*; antimonii sulphuretum aureum, *Edin.*; antimonii sulphuretum præcipitatum, *Dubl.*

Sulphide of antimony, SbS_3 or $\mathbf{Sb_2S_3}$, with a small and variable amount of oxide of antimony, SbO_3 or $\mathbf{Sb_2O_3}$.

Take of

Black Antimony	10 ounces.
Solution of Soda	$4\frac{1}{2}$ pints.
Diluted Sulphuric Acid . . .	a sufficiency.
Distilled Water	a sufficiency.

Mix the black antimony with the solution of soda and boil for two hours with frequent stirring, adding distilled water occasionally to maintain the same volume. Strain the liquor through calico, and, before it cools, add to it by degrees the diluted sulphuric acid till the latter is in slight excess. Collect the precipitate on a calico filter, wash with distilled water till the washings no longer precipitate with chloride of barium, and dry at a temperature not exceeding 212°.]

When the common black sulphide of antimony is boiled with a solution of caustic soda, sulphide of sodium and oxide of antimony are produced, $6NaHO + Sb_2S_3 = 3Na_2S + Sb_2O_3 + 3H_2O$: the former combines with and dissolves some sulphide of antimony, while the latter unites with soda, probably forming two salts of the composition, Na_3SbS_3, and Na_3SbO_3. When sulphuric acid is added to the strained liquor, it decomposes these compounds, precipitating sulphide of antimony. The oxide is wholly, or in great part, reconverted into sulphide of antimony,

$$Na_3SbS_3 + Na_3SbO_3 + 3H_2SO_4 = 3Na_2SO_4 + Sb_2S_3 + 3H_2O.$$

From Mr. Phillips's analysis, it would appear that some oxide of antimony escapes decomposition, and is contained in the precipitated product. If the solution is allowed to cool before the addition of the sulphuric acid, another brownish oxysulphide is deposited; this constitutes *mineral kermes*. The brilliant coloured sulphide of commerce probably contains the higher sulphide of antimony Sb_2S_5. This is formed either by the addition of a little sulphur, or by the action of atmospheric oxygen during prolonged ebullition of the alkaline solution.

[§ *Characters and Tests.*—An orange-red powder, readily dissolved by caustic soda, also by hydrochloric acid with the evolution of sulphuretted hydrogen and the separation of a little sulphur. Sixty grains of this preparation, dissolved in hydrochloric acid and dropped into water, give a white precipitate (oxychloride of antimony), which, when washed and dried, weighs about 53 grains.]

Sulphurated antimony is odourless and almost tasteless. It is insoluble in cold water, and only slightly soluble in solution of ammonia. Heated in the air, it burns, evolves sulphurous acid, and leaves a greyish residue (Sb_2O_3).

By boiling in a solution of acid tartrate of potash, it loses, according to Mr. Phillips, 12 per cent.—the amount of oxide which it is presumed to contain.

Physiological Effects.—The medicinal activity of this preparation is greater in proportion to the quantity of oxide of antimony which it may contain. In small doses, it is employed as an alterative, expectorant, and diaphoretic; in somewhat larger doses, it causes nausea and sweating, and sometimes vomiting; in still larger quantities, it excites both vomiting and purging.

Therapeutics.—It is principally employed as an *alterative* in chronic diseases, particularly cutaneous affections, glandular enlargements, secondary syphilis, rheumatism, and diseases of the liver. In these complaints it is usually associated with mercurials (especially calomel), and sometimes with either guaiacum or narcotics.

Administration.—As an alterative, the dose is from 1 to 3 or 4 grains; as an emetic, from 5 to 20 grains.

[§ **Liquor Antimonii Chloridi.** *Solution of Chloride of Antimony.*]

History.—Basil Valentine was acquainted with this preparation, which has had various appellations; such as oil or butter of antimony, muriate of antimony, &c.

[§ Take of

Black Antimony	1 pound.
Hydrochloric Acid	4 pints.

Place the black antimony in a porcelain vessel; pour upon it the hydrochloric acid, and, constantly stirring, apply to the mixture, beneath a flue with a good draught, a gentle heat, which must be gradually augmented as the evolution of gas begins to slacken, until the liquid boils. Maintain it at this temperature for fifteen minutes; then remove the vessel from the fire, and filter the liquid through calico into another vessel, returning what passes through first, that a perfectly clear solution may be obtained. Boil this down to the bulk of two pints, and preserve it in a stoppered bottle.]

By the action of liquid hydrochloric acid on sulphide of antimony, we obtain chloride of antimony, while sulphuretted hydrogen escapes; $\mathbf{Sb_2S_3 + 6HCl = 2SbCl_3 + 3H_2S}$. The chloride of antimony thus obtained is dissolved in excess of liquid hydrochloric acid. In order to deepen the colour of the commercial butter of antimony, pernitrate of iron is sometimes added to it.

[§ *Characters and Tests.*—A heavy liquid, usually of a yellowish-red colour. A little of it dropped into water gives a white precipitate (oxychloride of antimony), and the filtered solution lets fall a copious deposit on the addition of nitrate of silver (chloride of silver). If the white precipitate formed by water be treated with sulphuretted hydrogen it becomes orange-coloured ($\mathbf{Sb_2S_2}$). The specific gravity of the solution is 1·47. One fluid drachm of it mixed with a solution of a quarter of an ounce of tartaric acid in four fluid ounces of water, forms a clear solution, which, if treated with sulphuretted hydrogen, gives an orange precipitate, weighing, when washed and dried at 212°, at least 22 grains.]

If solution of chloride of antimony be submitted to distillation, the water and excess of hydrochloric acid are first expelled. If, therefore, our object be to obtain the pure chloride, it may be procured by changing the receiver as soon as the distilled product crystallises on cooling.

Therapeutics.—In medicine it is employed only as a caustic. It usually acts without causing much pain or inflammation, and after the separation of the eschar, produces a clean healthy surface. It is sometimes used as an application to parts bitten by rabid animals or venomous serpents; its liquidity enabling it to penetrate into and corrode all parts of the wound. It is also applied to ulcers to repress excessive granulations. Richter and Beer have employed it in staphyloma: the mode of applying it is as follows:—Dip a camel's-hair pencil, or a point of lint, into the liquid, and apply it to the tumour until a whitish crust is perceived, when the whole is to be immediately washed away by means of a larger pencil dipped first into milk and afterwards into milk and water.

[§ **Antimonium Tartaratum.** *Tartarated Antimony.*

$KO,SbO_3,C_8H_4O_{10} + 2HO$ or $\mathbf{KSbC_4H_4O_7.H_2O}$.

Synonyms.—Antimonii potassio-tartras, *Lond.*; antimonium tartarizatum, *Edin.* and *Dubl.*; emetic tartar,] stibiated tartar, kali tartaricum stibiatum, &c.

History.—This salt was first publicly noticed in 1631, by Hadrian de Mynsicht. But the preparation was in all probability suggested by a treatise published in Italy in 1620.

[§ Take of

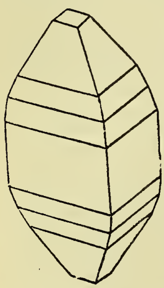
Oxide of Antimony	5 ounces.
Acid Tartrate of Potash, in fine powder .	6 ounces.
Distilled Water	2 pints.

Mix the oxide of antimony and acid tartrate of potash with sufficient distilled water to form a paste, and set aside for twenty-four hours. Then add the remainder of the water, and boil for a quarter of an hour, stirring frequently. Filter, and set aside the clear filtrate to crystallise. Pour off the mother-liquor, evaporate to one-third, and set aside, that more crystals may form. Dry the crystals on filtering paper at the temperature of the air.]

$$\mathbf{2KHC_4H_4O_6 + Sb_2O_3 = 2KSbC_4H_4O_7 + H_2O}.$$

[§ *Characters and Tests.* In colourless transparent crystals exhibiting triangular facets, soluble in water, and less so in proof spirit. It decrepitates and blackens upon the application of heat. Its solution in water gives with hydrochloric acid a white precipitate, soluble in excess, and which is not formed if tartaric acid be previously added. Twenty grains dissolve without residue in a fluid ounce of distilled water at 60°, and the solution gives with sulphuretted hydrogen an orange precipitate (Sb_2S_3), which, when washed and dried at 212°, weighs 9·91 grains.]

Tartarated antimony crystallises in white, inodorous, rhombic octahedrons, whose lateral planes are striated. By exposure to the air the crystals become opaque. Their taste is feebly sweetish, then styptic and metallic. They dissolve in fourteen or fifteen parts of water at 60° F., and in two parts at 212°. The aqueous solution slightly reddens litmus. Tartarated antimony is not soluble in alcohol. If heated on charcoal by the blowpipe, the metal is first reduced, and then a part is reoxidised, and deposited on the charcoal in the form of a white powder or crystalline needles (Sb_2O_3).



In the crystalline state, the purity of this salt is easily determined. The crystals should be well formed, perfectly colourless, transparent, or opaque, and, when dropped into a solution of sulphuretted hydrogen, form an orange-coloured deposit (Sb_2S_3). When pure, the powder of this salt is perfectly white. Some ignorant druggists prefer a yellowish-white powder; and I am informed by a manufacturer of this salt, that he is obliged to keep two varieties (one white, the other yellowish-white) to meet the demands of his customers! The yellow tint is owing to the presence of iron, which is readily detected in the salt by the blue colour immediately produced in its solution by adding first a few drops of diluted sulphuric acid, and then ferrocyanide of potassium. This test should not precipitate or in any way affect solution of the pure salt. A dilute solution of tartarated antimony occasions no precipitate with chloride of barium: it produces a white precipitate (unless the solutions be very dilute) with nitrate of silver, and which is soluble in excess of water (showing freedom from sulphates and chlorides).

Physiological Effects. 1. *Local.*—Tartarated antimony is a powerful local irritant. Its irritant properties may be regarded as peculiar or specific. When applied to the epidermis it causes an eruption of painful pustules, resembling those of variola or ecthyma. I am acquainted with no agent which produces an eruption precisely like that caused by tartarated antimony. The facility with which it is produced varies considerably in different individuals, and in the same individual at different times. A pustular eruption has been met with in the mouth, œsophagus, and small intestines, from its internal use, and white aphthous spots have been observed on the velum and tonsils. But these effects are rare. Severe inflammation of the throat has sometimes followed the employment of antimony.

We have further evidence of the local irritation produced by tartarated antimony in its action on the stomach and intestines. When swallowed in full doses, it gives rise to vomiting (whence its name *emetic tartar*) and purging, and pain in the epigastric region. After death, redness of the gastro-intestinal membrane has been found. However, it would appear, from the experiments of Magendie, that part of this effect should be referred to the specific influence which this salt exerts over the stomach, independently of its direct local irritation, since the same symptoms have been induced by its application to wounds, and by its injection into the veins. Occasionally, constitutional effects (nausea, vomiting, and griping pains) have appeared to result from its application to the skin. In one instance death resulted from its employment: the patient was an infant two years of age, and death occurred in forty-eight hours. These effects, if really produced by this salt, occur very rarely.

2. *Constitutional.*—Taken internally, *in small doses*, tartarated antimony increases the secretion and exhalation of the gastro-intestinal membrane, and of the liver and pancreas. Subsequently, it acts powerfully on other emunctories; thus it causes sweating, without any very marked vascular excitement; it renders the mucous membranes (especially the bronchial membrane) moister, and, when the skin is kept cool, promotes the secretion of urine. These effects are produced more certainly and speedily by this salt than by any other antimonial preparation. *In somewhat larger doses*, it excites nausea, frequently with vomiting, depresses the nervous functions, relaxes the tissues (especially the muscular fibres), and occasions a feeling of great feebleness and exhaustion. These symptoms are accompanied or followed by increased secretion and exhalation from the different emunctories, but especially from the skin, as above mentioned. Of all emetic substances, this creates the most nausea and depression. *In excessive doses*, it has, in a few instances, acted as an irritant poison, and even occasioned death. In one case twenty, in another twenty-seven grains, nearly proved fatal. In a third, forty grains caused death. The symptoms in the latter case were vomiting, hypercatharsis, convulsions, epigastric pain and tumefaction, and delirium. Death occurred four days after the ingestion of the poison. Were the above cases not well authenticated, we should be disposed to ascribe the dangerous symptoms and death to some other circumstance rather than to the use of the

above-mentioned quantities of emetic tartar; for of late years this salt has been extensively employed in enormous and repeated doses with perfect safety. Rasori has given an ounce or more in twenty-four hours, and many ounces during the course of a disease, without occasioning either vomiting or abundant alvine evacuations. Laennec has confirmed, to a certain extent, the statements of Rasori. He gave twenty, forty, and even ninety grains within twenty-four hours (usually in doses of one, two, or three grains) without ever having seen any injurious consequences. The usual effects which I have observed from the continued use of one or two grain doses are nausea, vomiting, and purging, which in most cases are much diminished, or entirely cease, after the use of the medicine for a day or two. Perspiration I have found to be a frequent effect. In all the instances above referred to in which these large doses were administered, the patients were affected with inflammatory diseases. Now it is to this morbid state, or *diathesis*, that, according to Rasori, we ought to ascribe the *tolerance* of these immense quantities of this powerful medicine. Consequently, if the opinion be worth anything, the susceptibility to its influence should increase as the disease subsides—a circumstance which Rasori asserts really takes place. But in this the theoretical views of this distinguished Italian have probably led him to overlook the truth. 'It is certainly true,' observes Laennec, 'that after the acute period of the disease [peri-pneumonia], the tolerance diminishes, or sometimes entirely ceases; but it is more common to find the patient become habituated to the use of the medicine, insomuch that during convalescence, and when he has begun to use food as in health, he will take daily, without knowing it, six, nine, twelve, or even eighteen grains of emetic tartar.' Though I have seen this salt extensively employed in both public and private practice, I have never met any satisfactory cases supporting Rasori's assertion of the diminished tolerance when the patient becomes convalescent. Moreover, large doses have been taken by healthy individuals without any remarkable effects. Alibert saw, at the Hospital St. Louis, a man who took thirty grains of this salt in order to poison himself, but suffered no remarkable inconvenience from it. Lebreton reports the case of a girl who swallowed three-quarters of an ounce at once as a poison: oil was immediately given; vomiting took place, and she soon recovered. Other published cases might be brought forward in proof of the slight effects of large doses, but I must content myself with referring to the memoir of Magendie for a notice of them. I may add, however, that this distinguished physiologist concludes that the comparative slightness of the effects arose from the evacuation of the salt a few moments after its ingestion; though in several, at least, of the cases this was not proved, and in one it certainly did not happen: it was that of a man who swallowed twenty-seven grains of this salt, and did not vomit.

The action of large doses of tartarated antimony on the circulation and respiration is usually that of a sedative. This has been very frequently, though not constantly, observed. In one case of pneumonia, the daily use of from six to eight grains reduced the pulse, in nine days, from 120 to 34 beats per minute, and diminished the number of inspirations from 50 to 18. In another, the pulse descended, in three days, from 72 to 44 beats per minute. The loss of muscular power, the diminution of the frequency of the pulse, the fainting, the cramps and convulsions, the delirium and insensibility, caused by emetic tartar in poisonous doses, are referable to the depressing influence of this substance on the nervous system.

The *absorbent system* is supposed to be stimulated to greater activity by emetic tartar, in consequence of the disappearance of serous and synovial effusions under its use. Laennec ascribed the efficacy of it in pneumonia to the increased activity of the interstitial absorption.

The action of tartarated antimony may therefore be described as diaphoretic, expectorant, diuretic, nauseant, emetic, purgative, sedative, absorbent, and locally irritant.

Mode of Action.—Tartarated antimony, when swallowed, becomes absorbed, and may be detected in the blood and viscera, especially the liver. It is eliminated by the urine, in which secretion it can readily be recognised.

Therapeutics.—As an *emetic*, this salt is generally given in doses of one or two grains, frequently in combination with ten or fifteen grains of ipecacuan. When we use vomiting, not merely to evacuate the contents of the stomach, as in cases of narcotic poisoning, but as a means of making an impression on the system, and thereby of putting a sudden stop to the progress of a disease, it is by far our best emetic. It is with this view that it is sometimes employed in the early stages of fever, especially when accompanied by gastric or bilious disorder. Tartarated antimony is used as a vomit, with considerable success, in the early stage of inflammatory diseases; especially in croup, tonsillitis, swelled testicle, bubo, and ophthalmia. Here, also, the success of the remedy is in proportion to its early application. In croup it should be given to excite, in the first instance, vomiting, and afterwards prolonged nausea. Under this plan of treatment I have seen two or three slight cases completely recover without the use of any other remedial agent. Dr. Copland also bears testimony to the success of the practice. Dr. Cheyne recommends half a grain of emetic tartar to be dissolved in a tablespoonful of water, and given to a child two or three years of age every half-hour till sickness and vomiting are produced; and in two hours after the last act of vomiting, the same process is to be recommenced, and so repeated while the strength will admit. Another disease which is relieved by the occasional use of emetics is *hooping-cough.* It should be administered, at the commencement of the disease, every or every other day. It will diminish the violence and length of the fits of spasmodic coughing, and promotes expectoration. Tartarated antimony is particularly valuable in this disease, in consequence of being tasteless, and, therefore, peculiarly adapted for exhibition to children. In derangements of the hepatic functions, indicating the employment of emetics, this salt is usually preferred to other vomiting agents, on account of its supposed influence in promoting the secretion of bile. It has been repeatedly *injected into the veins* to excite vomiting. The usual dose is two or three grains dissolved in two ounces of water; but in some cases six grains have been injected. The effects are unequal: when vomiting does occur it is not always immediate; frequently it does not take place at all. In several cases of choking, from the lodgement of pieces of meat in the œsophagus, injection has been used with great success: vomiting was produced, and with it the expulsion of the meat. As a *nauseant,* to reduce the force of the circulation and the muscular power, emetic tartar is frequently of considerable service. Thus, in dislocations of the larger joints (the hip and shoulder, for example), nauseating doses of it are employed to diminish the resistance of the muscles opposing the reduction. Even in strangulated hernia it has been given.

Tartarated antimony, in large doses, is a most powerful and valuable remedy in the treatment of inflammation. On this subject I have already offered some remarks. As an emetic, nauseant, or diaphoretic, it has long been in use in pneumonia. As a remedy for inflammation, independent of its evacuant effects, we are indebted for it to Rasori, who first used it in the years 1799 and 1800, in an epidemic fever which raged at Genoa. Subsequently he exhibited it much more extensively, and in larger doses, in pneumonia. This mode of treatment was tried and adopted in France, first by Laennec, and in this country by Dr. Balfour. Its value as an antiphlogistic is now almost universally admitted. Laennec's mode of using this salt, and which, with some slight modification, I believe to be the best, is the following:—Immediately after bleeding, give one grain of emetic tartar, dissolved in two ounces and a half of some mild fluid: this is to be repeated every two hours for six times, and then suspended for seven or eight hours, if the symptoms are not urgent, or if there be any inclination to sleep. But if the disease has already made progress, or if the oppression be great, or the head affected, continue the medicine until amendment takes place; and, in severe cases, increase the dose to two, or two and a half grains. The only modification in this plan, which I would venture to propose, is, to begin with a somewhat smaller dose (say one-third or one-half of a grain), and gradually increase it; for, in consequence of the violent vomiting which one grain has sometimes produced, I have found patients positively refuse to continue the use of the medicine. From my own experience I should say, that tartarated antimony is nearly as serviceable when it causes moderate sickness and slight purging, as when it occasions no evacuation. Laennec observes, that 'in general the effect of emetic tartar is never more rapid or more efficient than when it gives rise to no evacuation; sometimes, however, its salutary operation is accompanied by a general perspiration. Although copious vomiting and purging are by no means desirable, on account of the debility and hurtful irritation of the intestinal canal which they may occasion, I have obtained remarkable cures in cases in which such evacuations had been very copious.' A few drops of tincture of opium may be sometimes conjoined with the antimony, to check its action on the alimentary canal. In *pleurisy*, tartarated antimony does not succeed so well as in inflammation of the substance of the lungs. 'It, indeed, reduces speedily the inflammatory action,' says Laennec, 'but when the fever and pain have ceased, the effusion does not always disappear more rapidly under the use of tartar emetic than without it.' I have sometimes conjoined opium (always after copious blood-letting) with advantage. In *bronchitis* (both acute and chronic), it may be most usefully employed in conjunction with the usual antiphlogistic agents. In *articular rheumatism*, next to pneumonia, emetic tartar has been found by some practitioners (especially by Laennec) more efficacious than in any other inflammatory affection: the usual duration of the complaint, when treated by this remedy, was found by Laennec to be seven or eight days. Synovial effusions (whether rheumatic or otherwise) have, in some cases, given way rapidly to the use of this salt. In *arachnitis*, Laennec has seen all the symptoms disappear, under the use of it, in forty-eight hours. In three instances of acute hydrocephalus, all the symptoms disappeared in the same space of time. In *phlebitis*, in *inflammation of the mammæ* occurring after delivery, in *ophthalmia*, and various other inflammatory affections, emetic tartar has been successfully employed as an antiphlogistic. Tartarated antimony is one of our most valuable sudorifics, being oftentimes available when other agents of this class are inadmissible: for example, when we are desirous of producing diaphoresis, in fevers and other diseases which are accompanied with preternatural vascular action about the head, or congestion of the brain, the use of opiate sudorifics (as the powder of ipecacuan and opium) is objectionable; whereas emetic tartar may be employed with safety, since it has no tendency to increase disorder of the nervous system, but to reduce cerebral excitement. In the advanced stage of typhus fever, accompanied with intense cerebral excitement, manifested by loss of sleep, delirium, &c., Dr. Graves has obtained most beneficial results from the use of emetic tartar and opium. The same combination has been employed with great success in delirium tremens, as well as in delirium of erysipelas, scarlatina, and measles, by Dr. Law. *As an expectorant*, in various pulmonary affections, small doses of this salt are frequently employed with advantage.

As a local irritant applied to the skin, it is used in the same cases as vesicatories, over which it has the advantage of not affecting the urino-genital organs. When it is desirable to keep up long-continued irritation, blisters are in some cases preferable. In *chronic diseases of the chest* it is used with the greatest advantage. I have found it much more serviceable than blisters. In employing it, one part of the chest may be rubbed with the ointment until the eruption is produced; and then, after the interval of a day or two, another part: thus keeping up irritation by a succession of applications to different parts of the chest for several months. In this way it is found to be most serviceable in chronic catarrh, pneumonia, and pleurisy. Even in lingering phthisis, I have seen the cough and pain alleviated by the occasional use of antimonial frictions. The objection to its use is the painful character of the eruptions. In *hooping cough* it is also serviceable. In *laryngitis* it is occasionally of great service; as also in various *affections of the joints*, especially chronic inflammation of the capsular ligament, or of the synovial membrane, hydrops articuli, particularly when connected with inflammation, and tumours of various kinds about the joints. In *tic douloureux* it has also been employed with benefit. In the *paralysis* of children, the region of the spine should be rubbed with the ointment. Its effects are most beneficial, especially where one leg only is affected. It is sometimes necessary to keep an eruption out for many weeks. In *hysteria*, the same application to the spine has been found serviceable.

Administration.—The dose of tartarated antimony, *in substance*, is, as a diaphoretic and expectorant, $\frac{1}{12}$ to $\frac{1}{6}$ of a grain: as a nauseant, from $\frac{1}{4}$ to $\frac{1}{2}$ a grain; as an emetic, from 1 to 2 grains; as an antiphlogistic, from $\frac{1}{2}$ a grain to 3 or 4 grains. This salt is, however, rarely employed in substance. Sometimes a grain of it, mixed with ten or fifteen grains of powdered ipecacuan, is employed as an emetic. A mixture of one grain with sixteen grains of sulphate of potash may be employed, in doses of from two to four grains, as a substitute for antimonial powder, to promote diaphoresis. In *solution*, it is commonly employed as an expectorant, diaphoretic, nauseant, or emetic, in the form of antimonial wine. When used as an antiphlogistic, an aqueous solution of greater strength may be administered: it should be made with boiling distilled water in a glass vessel (as a Florence flask). For external use, tartarated antimony is employed in the form of *liniment*, *ointment*, or *plaster*. A saturated solution is a very useful liniment: it is prepared by pouring an ounce and a half of boiling water over sixty grains of emetic tartar, and allowing the solution to stand till cold. In many cases it will be found preferable to the ointment, being the mildest, least painful, and cleanest. Another mode of employing it externally, is by sprinkling from ten to sixty grains of the salt, in fine powder, over a Burgundy pitch plaster.

Antidote.—Promote vomiting by tepid bland liquids. The antidote is said to be tannic acid, and vegetable substances which contain it (as cinchona bark, tea, galls, catechu, &c.). Opium is a most valuable agent for checking excessive evacuations. Venesection and the warm bath have been used to relieve the gastro-enteritis.

[§ **Vinum Antimoniale.** *Antimonial Wine.*

Take of

Tartarated Antimony	40 grains.
Sherry	1 pint.

Dissolve.]

Each fluid ounce contains two grains of emetic tartar. It is important that sherry, and not an inferior kind of wine, be employed; for the latter frequently contains matters which precipitate the oxide of antimony. If the wine be good, and the salt pure, no precipitate is formed in the solution, unless it be kept for a long period, when decomposition of the salt ensues.

Therapeutics.—Antimonial wine is used, as a diaphoretic or expectorant, in doses of from ten to thirty minims frequently repeated; as a nauseant, from one to two fluid drachms; as an emetic, about half a fluid ounce, or two fluid drachms given at intervals of about ten minutes for four or five times, until the desired effect is produced: as an emetic for children, from thirty minims to a fluid drachm.

[§ **Unguentum Antimonii Tartarati.** *Ointment of Tartarated Antimony.*

Take of

Tartarated Antimony, in fine powder .	$\frac{1}{4}$ ounce.
Simple Ointment	1 ounce.

Mix thoroughly.

This ointment contains nearly twice as much tartarated antimony as Unguentum Antimonii Tartarizati, *Dubl.*]

In the preparation of this ointment it is important that the tartarated antimony be in the state of a very fine powder, in order to avoid the irritation produced by rubbing gritty particles on the skin.

Therapeutics and Administration.—This ointment is applied *externally* as follows: A portion, about the size of a small nut, is to be rubbed on the skin night and morning. After the use of it for two or three times, the painful condition of the part thereby induced commonly prevents further employment of friction. It is sometimes applied, spread on linen, without rubbing. By either of these methods a crop of painful pustules is produced; but the facility and rapidity with which they are developed, varies considerably in different individuals. Occasionally, adventitious eruptions have appeared in other parts of the body, which have been ascribed to absorption of antimony into the system. But I believe, with Rayer, that they arise from the inadvertent application of the ointment to these parts. This ointment is used as a counter-irritant in various chronic maladies: thus it is applied to the chest in pulmonary affections, and to the joints in chronic diseases (whether rheumatic or otherwise). It should only be applied to sound portions of the skin, and, therefore, leech-bites, the scarifications from cupping, and wounds, are to be carefully avoided, for severe inflammation, and even gangrenous ulceration, may be produced by not attending to this caution. I have before mentioned, that in a very few cases severe and even fatal constitutional disorder has appeared to have resulted from the use of antimonial ointment.

[§ BISMUTHUM. *Bismuth.* Bi or **Bi** = 210.]

History.—First mentioned in 1529. The term bismuth is derived from a name, *wismuth*, given to it by the German miners, 'because it blooms like a beautiful meadow (wiesematte).'

Natural History.—Bismuth occurs only in the mineral kingdom. It is found in Cornwall, Saxony, Bohemia, the United States, and other localities. It is met with in the metallic state (*native bismuth*), and in combination with sulphur and with oxygen.

Preparation.—It is chiefly obtained from native bismuth by melting the metal out of its matrix.

Properties.—It is a reddish-white metal, composed of brilliant broad plates, and readily crystallisable in cubes or regular octahedrons. It is moderately hard, brittle, pulverisable, fusible at 476° F.

When strongly heated in the air, it takes fire, and burns with a faint blue flame, emitting a yellow smoke (Bi_2O_3). In close vessels it may be volatilised.

[§ A crystalline metal. As met with in commerce it is generally impure.]

[§ **Bismuthum Purificatum.** *Purified Bismuth.*

Take of

Bismuth	10 ounces.
Nitrate of Potash, in powder	2 ounces.

Put the bismuth and one ounce of the nitrate of potash into a crucible, and heat them to a temperature at which both the metal and the salt are fused. Continue the heat, constantly stirring the contents of the crucible, for fifteen minutes or until the salt has solidified into a slag over the metal. Then remove the salt, add the remainder of the nitrate of potash to the bismuth in the crucible, and repeat the process as before. Finally, pour the bismuth, while fused, into a suitable mould, and allow it to cool.] This process is sufficient to deprive the crude metal of the sulphur, lead, and arsenic, with which it is usually contaminated. It will still retain, however, small quantities of silver and copper if these were present in the crude bismuth.

[§ *Characters and Tests.*—A crystalline metal of a greyish-white colour, with a distinct roseate tinge. Specific gravity 9·83. Dissolved in a mixture of equal volumes of nitric acid and distilled water it forms a solution which by evaporation yields colourless crystals that are decomposed on the addition of water, giving a white precipitate. If the mother-liquor from which the crystals have been separated be added to solution of carbonate of ammonia, the precipitate formed and the solution are free, or nearly free, from colour.] Bismuth and its salts are best characterised by the formation of a white precipitate, as explained above, on the addition of water to their solution in nitric or hydrochloric acid. This white compound is distinguished from the similar precipitate furnished by antimony, in not forming an orange precipitate with sulphuretted hydrogen, but one that is nearly black.

[§ **Bismuthi Subnitras.** *Subnitrate of Bismuth.*

$BiO_3,NO_5,2HO$ or $BiNO_4.H_2O$.]

Synonyms.—Bismuthum album, 1864, bismuthi nitras, *Lond.*; pearl white, magistery of bismuth, trisnitrate of bismuth, bismuth oxynitrate, &c.

[§ Take of

Purified Bismuth, in small pieces	2 ounces.
Nitric Acid	4 fluid ounces.
Distilled Water	a sufficiency.

Mix the nitric acid with three ounces of distilled water, and add the bismuth in successive portions. When effervescence has ceased, apply for ten minutes a heat approaching that of ebullition, and decant the solution from any insoluble matter that may be present. Evaporate the solution until it is reduced to two fluid ounces, and pour it into half a gallon of distilled water. When the precipitate which forms has subsided, decant the supernatant liquid, add half a gallon of distilled water to the precipitate, stir them well together, and after two hours decant off the liquid, collect and drain the precipitate in a calico filter, press it with the hands, and dry it at a temperature not exceeding 150°.]

In the first part of this process we obtain a trinitrate of bismuth by the reaction of the bismuth on the nitric acid. Nitric oxide is evolved, $Bi_2 + 8HNO_3 = 2(Bi3NO_3) + 2NO + 4H_2O$. Water decomposes the trinitrate of bismuth, and causes the precipitation of subnitrate of bismuth, leaving a small quantity of nitrate in solution together with nitric acid,

$$Bi3NO_3 + H_2O = BiONO_3 + 2HNO_3.$$

[§ *Characters and Tests.*—A heavy white powder in minute crystalline scales, blackened by sulphuretted hydrogen; insoluble in water, but soluble in nitric acid mixed with half its volume of distilled water, forming a solution which poured into water gives a white precipitate. It forms with sulphuric acid diluted with an equal bulk of water a solution which is blackened by sulphate of iron. The nitric acid solution gives no precipitate with diluted sulphuric acid, nor with solution of nitrate of silver.] Its freedom from any carbonate as of lead or lime is known by its dissolving in nitric acid without effervescence. Recently phosphate of lime has been employed as an adulterant: it may be detected as follows. To one part of the salt of bismuth dissolved in weak nitric acid add two parts of citric acid; dissolve with the aid of a little water, and add an excess of solution of ammonia. Any phosphate will be deposited in the course of a few minutes as a bulky precipitate.

Physiological Effects.—In *small doses* it acts locally as an astringent, diminishing secretion. On account of the frequent relief given by it in painful affections of the stomach, it is supposed to act on the nerves of this viscus as a sedative. It has also been denominated tonic and antispasmodic. Vogt says, that when used as a cosmetic, it has produced a spasmodic trembling of the face, ending in paralysis. *Large medicinal doses* disorder the digestive organs, occasioning pain, vomiting, purging, &c.; and sometimes affecting the nervous system, and producing giddiness, insensibility, with cramps of the extremities. On the other hand, M. Monneret states, after several years' trial of this medicine, that it may be given in much larger doses than are usually administered, and that it is then of the greatest value in gastro-intestinal affections, especially those attended with fluxes.

Therapeutics.—It has been principally employed in those chronic affections of the stomach which are unaccompanied by any organic disease, but which apparently depend on some disordered condition of the nerves of this viscus; and hence the efficacy of the remedy is referred to its supposed action on these parts. It has been particularly used and recommended to relieve gastrodynia and cramp of the stomach, to allay sickness and vomiting, and as a remedy for pyrosis or waterbrash. In the latter disease I give it in the form of a powder, in doses of twenty grains thrice daily, in conjunction with hydrocyanic acid mixture, and the patient rarely fails to obtain marked benefit from its use. It is also used in ulcer of the stomach. Dr. Theophilus Thompson recommends it in doses of five grains, combined with gum arabic and magnesia, in the diarrhœa accompanying phthisis; and he thinks that, both in efficacy and safety, it surpasses our most approved remedies for that complaint. I have used it, with advantage, in the form of ointment, applied to the septum nasi, in ulceration of this part, and as a local remedy in chronic skin diseases.

Administration.—The usual dose of this remedy is from five to twenty grains. I seldom commence with less than twenty grains, and have repeatedly exhibited thirty grains without the least inconvenience. It may be administered in the form of powder, lozenge, or pill. The *ointment* which I have above referred to was composed of sixty grains of white bismuth, and half an ounce of spermaceti ointment.

[§ **Trochischi Bismuthi.** *Bismuth Lozenges.*

Take of

Subnitrate of Bismuth	1440 grains.	2
Carbonate of Magnesia	4 ounces.	2 ½
Precipitated Carbonate of Lime	6 ounces.	3 5/6
Refined Sugar	29 ounces.	
Gum Acacia, in powder	1 ounce.	
Mucilage of Gum Acacia	2 fluid ounces.	
Rose Water	a sufficiency.	

Mix the dry ingredients, then add the mucilage, and form the whole into a proper mass with rose water. Divide the mass into 720 lozenges, and dry these in a hot-air chamber with a moderate heat.

Each lozenge contains two grains of subnitrate of bismuth.]

[§ **Bismuthi Carbonas.** *Carbonate of Bismuth.*

$2(BiO_3,CO_2),HO$ or $2(Bi_2CO_5).H_2O$.

Take of

Purified Bismuth, in small pieces	2 ounces.
Nitric Acid	4 fluid ounces.
Carbonate of Ammonia	6 ounces.
Distilled Water	a sufficiency.

Mix the nitric acid with three ounces of distilled water, and add the bismuth in successive portions. When effervescence has ceased, apply for ten minutes a heat approaching that of ebullition, and afterwards decant the solution from any insoluble matter that may be present. Evaporate the solution until it is reduced to two fluid ounces, and add this in small quantities at a time to a cold filtered solution of the carbonate of ammonia in two pints of distilled water, constantly stirring the mixture as it is formed. Collect the precipitate on a calico filter, and wash it with distilled water until the washings pass tasteless. Remove now as much of the adhering water as can be separated from the precipitate by slight pressure with the hands, and finally dry the product at a temperature not exceeding 150°.]

The nitrate of bismuth which is formed by the action of the acid upon the metal is decomposed by the carbonate of ammonia, effervescence accompanying the reaction.

$$2(Bi3NO_3) + 3(NH_4)2CO_3 = Bi_2O_2CO_3 + 2CO_2 + 6NH_4NO_3.$$

[§ *Characters and Tests.*—A white powder, blackened by sulphuretted hydrogen; insoluble in water, but soluble with effervescence in nitric acid. When added to sulphuric acid coloured with sulphate of indigo the colour of the latter is not discharged. If to nitric acid mixed with half its volume of distilled water as much carbonate of bismuth be added as the acid will dissolve, one volume of this solution poured into twenty volumes of water will yield a white precipitate. The nitric acid solution gives no precipitate with diluted sulphuric acid or with solution of nitrate of silver.

Dose, 5 to 20 grains.]

[§ **Liquor Bismuthi et Ammoniæ Citratis.** *Solution of Citrate of Bismuth and Ammonia.*

Take of

Purified Bismuth	430 grains.
Nitric Acid	2 fluid ounces.
Citric Acid	2 ounces.
Solution of Ammonia, Distilled Water } of each	a sufficiency.

Mix the nitric acid with an ounce of distilled water, and add the bismuth in successive portions. When effervescence has ceased, apply for ten minutes a heat approaching that of ebullition, and decant the solution from any insoluble matter that may be present. Evaporate the solution until it is reduced to two fluid ounces, then add the citric acid previously dissolved in four ounces of distilled water, and afterwards the solution of ammonia in small quantities at a time until the precipitate formed is redissolved, and the solution is neutral or slightly alkaline to test-paper. Dilute with distilled water to the volume of one pint.]

This solution contains citrate of bismuth and ammonia as well as an equivalent quantity of nitrate of ammonia. It offers the advantage of mixing with water without decomposition.

[§ *Characters and Tests.*—A colourless solution, with a saline and slightly metallic taste. Specific gravity 1·122. Neutral or slightly alkaline to test-paper; mixes with water without change; heated with solution of potash it evolves ammonia, and yields a white precipitate. Hydrochloric acid added to it gives a white precipitate which is soluble in excess of the reagent. Three fluid drachms of the solution mixed with an ounce of distilled water, and treated with sulphuretted hydrogen in excess, yield a black precipitate, which collected, washed, and dried, weighs 9·92 grains.

One fluid drachm contains three grains of oxide of bismuth.

Dose, $\frac{1}{2}$ to 1 fluid drachm.]

Bismuthi Valerianas. *Valerianate of Bismuth.*

Metallic bismuth is to be dissolved in nitric acid mixed with an equal volume of water, and the solution evaporated so as to drive off as much as possible of the excess of nitric acid; it is then mixed with valerianate of soda containing a little free valeric acid. The precipitate which falls is to be carefully washed with distilled water, and dried at a very gentle heat.

ZINCUM. *Zinc.* **Zn** = 65.

History.—Although the ancients were acquainted with the method of converting copper into brass by means of an ore of zinc, we have no positive evidence that they knew metallic zinc. Albertus Magnus, who died in 1280, is the first writer who expressly mentions this metal.

It occurs only in the mineral kingdom. It is found in the form of oxide (*red zinc*), of sulphide (*blende* or *black jack*), of carbonate (*calamine*), of sulphate (*white vitriol*), of silicate (*electric calamine*), and combined with alumina (*automalite* or *gahnite*).

Preparation.—Zinc is usually procured from the native sulphide or carbonate of that metal. It may also be obtained from the silicate.

The picked ore, being broken into small pieces, is submitted to a dull red heat in a reverberatory furnace. By this process the sulphur of the sulphide is transformed into sulphurous acid, which escapes, and the zinc is oxidised, while the carbonate loses carbonic acid and water. The resulting oxide is then mixed with some carbonaceous substance (small coal or charcoal), and submitted to heat, by which the metal is reduced and vaporised. Sometimes the reduction is effected in a covered earthen crucible, the bottom of which is perforated by an iron tube, which terminates over a vessel of water situated in an apartment below the furnace. The gaseous products and zinc escape by this tube; and the latter is collected in the water.

Properties.—A bluish-white crystalline metal, of considerable lustre. Its sp. gr. is from 6·8 to 7·2. At common temperature it is tough; from 212° to 300° it is ductile and malleable, and may be readily rolled into thin leaves (*sheet zinc*); at 400° it is so brittle that it may be reduced to powder. It readily fuses, and, at a white heat, may be volatilised.

Commercial zinc is never pure. When immersed in dilute sulphuric acid, the zinc and any iron which may be present dissolve, leaving a black residue of carbon and sulphide of lead. Arsenic is also frequently present in small quantity, as well as traces of cadmium.

The ready solubility of commercial zinc in diluted sulphuric acid depends greatly on its impurity; for absolutely pure zinc is comparatively feebly acted on by this dilute acid.

Characteristics of salts of zinc.—A solution of any of them is precipitated white by alkalies. The precipitate is soluble in excess of the alkali, and the clear alkaline liquid so formed gives a white precipitate of sulphide of zinc on the addition of sulphide of ammonium. Ferrocyanide of potassium also gives a white ferrocyanide.

[§ ⁂ **Zincum Granulatum.** *Granulated Zinc.*

Zinc granulated by fusing and pouring it into cold water.]

Tests.—If the zinc be pure the hydrogen gas evolved when the metal is dissolved in dilute pure sulphuric acid will not blacken a piece of paper moistened with a solution of acetate of lead; and when ignited will give no dark stain to the lid of a porcelain crucible held low down in the flame (showing its freedom from sulphur and arsenic).

[§ **Zinci Oxidum.** *Oxide of Zinc.* ZnO or **ZnO**.]

History and Synonyms.—First prepared in 1735. When obtained by burning the metal in the air it was formerly called *nihilum album*, *philosopher's wool*, or flowers of zinc.

Preparation.—[§ Take of

Carbonate of Zinc . . . . . . 6 ounces.

Place the carbonate of zinc in a loosely-covered Hessian crucible, and expose it to a dull red heat, until a portion, taken from the centre of the contents of the crucible and cooled, no longer effervesces when dropped into diluted sulphuric acid. Let the crucible cool, and transfer the product to stoppered bottles.]

Carbonate of zinc, like carbonate of magnesia, loses carbonic acid gas and water by exposure to heat,

$$ZnCO_3.2Zn2HO.H_2O = 3ZnO + CO_2 + 3H_2O.$$

[§ *Characters and Tests.*—A soft, nearly white, tasteless, and inodorous powder, becoming pale-yellow when heated. Dissolves without effervescence in diluted nitric acid, forming a solution, which is not affected by chloride of barium or nitrate of silver, and gives with carbonate of ammonia a white precipitate, which dissolves entirely without colour in an excess of the reagent, forming a solution which is precipitated white by sulphide of ammonium.]

Oxide of zinc is sometimes prepared by heating the metal in a suitably arranged apparatus to a sufficient degree to cause its combustion. When so prepared, however, it often contains minute particles of the metal which cannot be completely got rid of.

Physiological Effects.—Applied to ulcerated or other secreting surfaces, it acts as a desiccant and astringent substance. On account of its insolubility, the absorption of it must be very slow. Taken into the stomach in large doses, it acts as a slight irritant, and provokes vomiting and sometimes purging. In small doses it may be taken for a considerable period without causing any obvious effects. Sometimes, under its employment, certain affections of the nervous system (as epilepsy, chorea, &c.) subside; from which we infer that it exercises some specific influence over this system: and it is, therefore, termed tonic, antispasmodic, and sedative. But the nature of its influence is not very obvious. By long-continued use it acts as a slow poison, and produces *tabes sicca.* A gentleman, for the cure of epilepsy, took daily, at an average, twenty grains of oxide till he had consumed 2,346 grains, which must have taken him about five months. At the end of this time he was found of a pale, earthy hue, wasted away, and almost idiotical: his tongue was thickly coated, the bowels were constipated, the inferior extremities cold and œdematous, the abdomen tumid, the superior extremities cold and shrivelled, and their skin dry, like parchment: the pulse was about sixty, thready, and scarcely perceptible. Under the use of purgatives, a light nutritive diet, with tonic and diuretic medicines, he rapidly recovered, but he remained subject to epileptic attacks.

Therapeutics.—Internally it has been commended in some spasmodic diseases, viz., epilepsy, chorea, hysteria, catalepsy, and hooping-cough; and in some painful affections, as neuralgia and gastrodynia. Though occasionally serviceable in some of these maladies, it has so frequently failed, that practitioners have ceased to place much confidence in it. Oxide of zinc has been found of great service, in five-grain doses, combined with extract of henbane or hemlock, in colliquative perspiration.

Externally it is employed in the form of powder, lotion, or ointment. As a *dusting powder* it is useful, by its mild, absorbent, and desiccant properties, and is applied to impetiginous, eczematous, and other chronic diseases of the skin, attended with profuse secretion. It is also used to allay or prevent excoriation in children and bedridden persons, and to remove chaps and cracks of the nipples. In painful ulcers, with copious discharge, it is not unfrequently beneficial by its desiccant and sedative properties. *Diffused through water* or a *mucilaginous solution* (in the proportion of a quarter of an ounce of the oxide to six or eight ounces of liquid), it is occasionally useful in eczema.

Administration.—Internally, it is administered in the form of pill or powder, in doses of from two or three grains gradually increased to eight, ten, or more.

[§ **Unguentum Zinci.** *Ointment of Zinc.*

Synonym.—Unguentum zinci oxidi 1864.

Take of

Oxide of Zinc	80 grains.
Benzoated Lard	1 ounce.

Add the oxide of zinc to the benzoated lard, previously melted with a gentle heat, and stir the mixture constantly while it cools.]

Used after burns and blisters, in conjunctivitis, and generally in the same diseases as the powder.

[§ **Zinci Carbonas.** *Carbonate of Zinc.*

$ZnO,CO_2 + 2ZnO + 3HO$ or $\mathbf{ZnCO_3,(ZnO)_2.3H_2O}$.]

History.—The native carbonate of zinc or calamine is found in England and also in Belgium, Hungary, Silesia, &c. It occurs crystallised or in earthy masses. It has long been used in medicine either as native carbonate or impure oxide, resulting from the calcination of the calamine, but having been greatly and systematically adulterated, it is now omitted from the Pharmacopœia, and pure carbonate or oxide is used in place of it. The carbonate of the Pharmacopœia is obtained as follows:—

[§ Take of

Sulphate of Zinc	10 ounces.
Carbonate of Soda	$10\frac{1}{2}$ ounces.
Boiling distilled Water . . .	a sufficiency.

Dissolve the carbonate of soda with a pint of the water in a capacious porcelain vessel, and pour into it the sulphate of zinc also dissolved in a pint of the water, stirring diligently. Boil for fifteen minutes after effervescence has ceased; and let the precipitate subside. Decant the supernatant liquor, pour on the precipitate three pints of boiling distilled water, agitating briskly; let the precipitate again subside, and repeat the processes of affusion of hot distilled water and subsidence, till the washings are no longer precipitated by chloride of barium. Collect the precipitate on calico, let it drain, and dry it with a gentle heat.]

Upon mixing carbonate of soda with sulphate of zinc double decomposition ensues, which results in the precipitation of carbonate of zinc; $ZnSO_4 + Na_2CO_3 = ZnCO_3 + Na_2SO_4$. This, however, immediately commences to undergo change, and when the effervescence is over two out of every three molecules of the carbonate have become converted into hydrate, and this combined with the remaining carbonate constitutes the officinal salt:—

$$3ZnCO_3 + 2H_2O = ZnCO_3,2(Zn2HO.H_2O) + 2CO_2.$$

[§ *Characters and Tests.*—White, tasteless, inodorous, insoluble in water; soluble, with effervescence and without residue, in diluted nitric acid. This solution is not affected by chloride of barium or nitrate of silver, and gives with carbonate of ammonia a white precipitate entirely soluble without colour in an excess of the reagent, forming a solution which is precipitated white by sulphide of ammonium.]

Therapeutics.—It has probably the same action as oxide of zinc, and may be used in the same cases, instead of the *calamine* of the Lond. and Ed. Pharmacopœias, which was at the best impure native carbonate of zinc, converted into oxide by calcination, and frequently, as met with in the shops, contained no zinc at all.

Calamina præparata. Lapis calaminaris. Calamine calcined, powdered, and prepared by elutriation in the manner of prepared chalk.

[§ **Zinci Sulphas.** *Sulphate of Zinc.*
$ZnO,SO_3 + 7HO$ or $\mathbf{ZnSO_4.7H_2O}$.]

History.—Known probably from the fourteenth century. It has had various names; as *sal vitrioli*, *white vitriol*, *white copperas*, &c.

Preparation.—[§ Take of

Granulated Zinc . .	16 ounces.
Sulphuric Acid . .	12 fluid ounces.
Distilled Water . .	4 pints.
Solution of Chlorine .	a sufficiency.
Carbonate of Zinc . .	$\frac{1}{2}$ ounce, or a sufficiency.

Pour the sulphuric acid previously mixed with the water on the zinc contained in a porcelain basin, and when effervescence has nearly ceased, aid the action by a gentle heat. Filter the fluid into a gallon bottle, and add gradually with constant agitation the solution of chlorine until the fluid acquires a permanent odour of chlorine. Add now with continued agitation the carbonate of zinc until a brown precipitate appears; let it settle, filter the solution, evaporate till a pellicle forms on the surface, and set aside to crystallise. Dry the crystals by exposure to the air on filtering paper placed on porous tiles. More crystals may be obtained by again evaporating the mother-liquor.]

In this process the zinc displaces the hydrogen of the sulphuric acid, forming sulphate of zinc in the liquid, hydrogen at the same time escaping as gas; $\mathbf{H_2SO_4 + Zn = ZnSO_4 + H_2}$. The chlorine is added to convert any iron or tin, which may have come into the solution from impurities in the zinc employed, into perchloride or persulphate, from which the corresponding oxide would be afterwards precipitated by the carbonate of zinc.

[§ *Characters and Tests.*—In colourless transparent prismatic crystals, with a strong metallic styptic taste. Its solution in water gives white precipitates with chloride of barium and sulphide of ammonium. Its watery solution is not tinged purple by tincture of galls; and when acidulated with sulphuric or hydrochloric acid, gives no precipitate with sulphuretted hydrogen. After it has been boiled for a few minutes with a little nitric acid, it yields with ammonia a white precipitate which is entirely soluble without colour in an excess of the reagent.]

The absence of coloration by tincture of galls shows its freedom from iron; the non-precipitation by sulphuretted hydrogen in the presence of free acid, the absence of arsenic, cadmium, copper, or lead; the entire solubility of the ammonia-precipitate in excess of ammonia, the absence of iron, magnesia, or lead; and the non-coloration of this solution, the absence of copper.

Properties.—The crystals are soluble in 2·28 times their weight of cold water, and less than their own weight of boiling water. They are insoluble in alcohol. In dry and warm air they effloresce. When heated they undergo the watery fusion; and if the liquid be rapidly cooled, it congeals into a granular, crystalline, white mass: if the heat be continued the salt becomes anhydrous, and at an intense heat is decomposed, leaving a residue of oxide of zinc.

Physiological Effects.—In *small and repeated doses* it acts as an astringent on the alimentary canal, checks secretion, and promotes a constipated condition of the bowels. It exercises a specific influence over the nervous system, manifested by its power of removing certain spasmodic affections: hence it is reputed antispasmodic. To the same influence is to be referred its power of preventing the recurrence of intermittent maladies, from which it has principally derived its denomination of a tonic. Its astringent effect is not confined to the bowels, but is manifested on the pulmonary and urethral mucous membranes, the secretions from which it diminishes: hence the advantage of its use in catarrhal affections of these parts. It does not appear to possess any power of checking cutaneous exhalation. In *full medicinal doses* it is a powerful but safe emetic; it excites speedy vomiting without giving rise to the same degree of distressing nausea occasioned by tartarated antimony. Dr. Cullen observes, that 'in order to render its effect certain, the dose must generally be large; and if this is not thrown out again immediately it is apt to continue a disagreeable nausea, or even a vomiting, longer than is necessary.' In *excessive doses* it acts as an irritant poison, causing vomiting, purging, coldness of the extremities, and fluttering pulse. The *local action* of it is that of an astringent and desiccant, and in a concentrated form, it is a powerful irritant and caustic.

Therapeutics.—As an *emetic* it is almost exclusively employed in cases of poisoning, especially by narcotics. In these cases it is the best evacuant we can administer, on account of its prompt action. As an *internal astringent* it is administered in chronic dysentery and diarrhœa, in chronic bronchial affections attended with profuse secretion, and in gleet and leucorrhœa. In the latter cases it is usually associated with terebinthinate medicines. As an *antispasmodic* it has been employed with occasional success in epilepsy, chorea, hysteria, spasmodic asthma, and hooping cough. I have little faith in its efficacy in any of these cases. As a *tonic*, it has been serviceable in agues; but it is far inferior to sulphate of quinia or arsenious acid. As a *topical astringent* sulphate of zinc is most extensively employed. We use its aqueous solution as a collyrium in chronic ophthalmia, as a wash for ulcers attended with profuse discharge, or with loose flabby granulations; as a gargle in ulcerations of the mouth, although I have found it for this purpose much inferior to a solution of sulphate of copper; as a lotion for chronic skin diseases; and as an injection in gleet and leucorrhœa.

Administration.—As an *emetic* the dose should be from twenty to thirty grains; as a *tonic*, *antispasmodic*, or *expectorant*, from one to five grains.

For external use, solutions are made of various strengths. They generally consist of from one to twenty grains in an ounce of water.

[§ **Zinci Chloridum.** *Chloride of Zinc.* ZnCl or $\mathbf{ZnCl_2}$.

Take of

Granulated Zinc . .	16 ounces.
Hydrochloric Acid . .	44 fluid ounces.
Solution of Chlorine . .	a sufficiency.
Carbonate of Zinc . .	½ ounce, or a sufficiency.
Distilled Water . .	1 pint.

Put the zinc into a porcelain basin, add by degrees the hydrochloric acid previously mixed with the water, and aid the action by gently warming it on a sand-bath until gas is no longer evolved. Boil for half an hour, supplying the water lost by evaporation, and allow it to stand on a cool part of a sand-bath for twenty-four hours, stirring frequently. Filter the product into a gallon bottle, and pour in the solution of chlorine by degrees, with frequent agitation, until the fluid acquires a permanent odour of chlorine. Add the carbonate of zinc, in small quantities at a time, and with renewed agitation, until a brown sediment appears. Filter through paper into a porcelain basin, and evaporate until a portion of the liquid, withdrawn on the end of a glass rod and cooled, forms an opaque white solid. Pour it out now into proper moulds, and when the salt has solidified, but before it has cooled, place it in closely stoppered bottles.]

The action of hydrochloric acid upon zinc merely consists in a replacement of the hydrogen of the acid by the metal, $\mathbf{Zn + 2HCl = ZnCl_2 + H_2}$. The effect of the addition of chlorine and of carbonate of zinc has been explained in the parallel process for sulphate of zinc.

[§ *Characters and Tests.*—Colourless opaque rods or tablets, very deliquescent and caustic; soluble almost entirely in water, alcohol, and ether. The watery solution is precipitated white by sulphide of ammonium (**ZnS**), and nitrate of silver (**AgCl**); but, if first acidulated with hydrochloric acid, it is not affected by sulphuretted hydrogen (which does not precipitate zinc from an acid solution). Its watery solution is not affected by chloride of barium or oxalate of ammonia, and is not tinged blue by the yellow or red prussiate of potash (showing its freedom from sulphate, chloride of calcium, and iron). Ammonia throws down a white precipitate entirely soluble in an excess of the reagent.]

Chloride of zinc unites with both albumen and gelatine to form difficultly soluble compounds, and hence it occasions precipitates with liquids containing these principles in solution. A process has been long used for the preservation of wood, and other vegetable matters, by impregnating them with a solution of chloride of zinc.

Physiological Effects.—Its *local* action on living tissues is, when in a concentrated solution, that of a caustic or escharotic, depending partly on its affinity for albumen and gelatine; so that when placed in contact with living parts into whose composition these organic compounds enter, the chloride exercising its affinity destroys the life of the part and unites with the albuminous and gelatinous matters present, and forms thus an eschar. Soon after it has been applied, a sensation of warmth is felt in the part, followed after a little time by a violent burning pain, which continues for seven or eight hours; that is, until the parts in contact with the chloride are dead. As a caustic, chloride of zinc is not inferior in power to chloride of antimony; nay, Vogt says it appears to him to be more powerful and to penetrate deeper. To this circumstance is owing, in great part, the efficacy of the chloride in various diseases in which it has been applied, and the healthy appearance of the sore after the separation of the eschar. There is no danger of any constitutional disorder arising from the absorption of the poison, as is the case with the arsenical and mercurial caustics.

In *large doses* it acts as an irritant or caustic poison, and, while it causes severe symptoms of alvine irritation, it seriously affects the nervous system. Thus it produces a burning sensation in the stomach, nausea, vomiting, anxiety, short breathing, small quick pulse, cold sweats, fainting, and convulsions. Several fatal cases of poisoning by chloride of zinc, in the impure state in which it is sold as disinfecting fluid, have already occurred. Taken *internally* in *small doses*, no obvious effects are produced.

Therapeutics.—*Internally*, chloride of zinc has been given in small but gradually increased doses in scrofula, epilepsy, and chorea. Commonly, however, this compound is employed *externally*: thus Papenguth used a dilute solution of it as a lotion in fistulous ulcers of a scrofulous nature. As a *caustic*, it has been applied to produce an issue, to destroy nævi materni; but it is principally employed at the present time to destroy parts affected with intractable forms of disease, such as canceroid, old syphilitic, or scrofulous ulcers, and condylomata, the cuticle having been first destroyed by caustic potash. The benefit is supposed not to depend merely on the escharotic effect, but on the chloride inducing a new action in the surrounding parts.

[§ ⁂ **Liquor Zinci Chloridi.** *Solution of Chloride of Zinc.*

Proceed precisely as in preparing chloride of zinc, except that the filtered liquid at the end of the process is to be evaporated only until reduced to two pints.

It contains 366 grains in 1 fluid ounce.]

Sir W. Burnett's Disinfecting and Antiseptic fluid is a solution of chloride of zinc, containing about 25 grains of zinc in 1 fluid drachm, and having a sp. gr. of about 2·0. In using it 1 pint is mixed with 5 gallons of water. It has been used for preserving anatomical subjects for dissection by injection into the blood-vessels. As a disinfectant and deodorizer its action depends principally on its power of decomposing sulphide of ammonium. It has but little action on sulphuretted hydrogen, and unlike chlorinated lime does not evolve any disinfecting vapour.

[§ **Zinci Acetas.** *Acetate of Zinc.*

$ZnO,C_4H_3O_3 + 2HO$ or $\mathbf{Zn(C_2H_3O_2)_2.2H_2O}$.

Take of

Carbonate of Zinc .	2 ounces.
Acetic Acid . .	5 fluid ounces, or a sufficiency.
Distilled Water .	6 fluid ounces.

Add the carbonate of zinc in successive portions to three ounces of the acetic acid previously mixed with the water in a flask; heat gently, add by degrees the remainder of the acid till the carbonate is dissolved; boil for a few minutes, filter while hot, and set it aside for two days to crystallise. Decant the mother-liquor; evaporate to one-half, and again set it aside for two days to crystallise. Place the crystals in a funnel to drain, then spread them on filtering paper on a porous tile, and dry them by exposure to the air at ordinary temperatures.]

In this process carbonate of zinc is converted by double decomposition with the acetic acid into acetate of zinc, water and carbonic acid, $\mathbf{ZnCO_3 + 2HC_2H_3O_2 = Zn2C_2H_3O_2 + H_2O + CO_2}$. The hydrate which the officinal carbonate also contains is at the same time converted into acetate of zinc and water.

[§ *Characters and Tests.*—Thin translucent and colourless crystalline plates of a pearly lustre, with a sharp unpleasant taste, evolving acetic acid when decomposed by sulphuric acid; soluble in water, and the solution precipitated pure white by sulphuretted hydrogen (**ZnS**). A dilute watery solution is not affected by chloride of barium or nitrate of silver; and, when slightly acidulated with hydrochloric acid, is not precipitated by sulphuretted hydrogen; after it has been boiled for a few minutes with a little nitric acid it yields with ammonia a white precipitate entirely soluble without colour in an excess of the reagent.] (For explanation see **Sulphate** and **Chloride of Zinc.**)

Physiological Effects.—Its effects are analogous to those of the sulphate of zinc. Its local action is astringent. Taken internally, in small doses, it acts as a tonic and antispasmodic; large doses occasion vomiting and purging.

Therapeutics.—It is rarely administered *internally*; but it is applicable as an emetic, tonic, and antispasmodic, in the same cases in which the oxide or sulphate of zinc is employed. As a *topical* remedy it is used, on account of its astringent qualities, in chronic ophthalmia, gleet, and leucorrhœa. In the latter stages of gonorrhœa I have found it far more successful than the sulphate. Sir A. Cooper recommended as the best injection which can be used in the third week of gonorrhœa, a mixture of six grains of sulphate of zinc and four ounces of dilute solution of subacetate of lead. Of course double decomposition takes place, and the active ingredient is the acetate of zinc. It is equally useful as a lotion in chronic eczema, impetigo, and other skin diseases which are attended with much serous or purulent discharge.

Administration.—When exhibited internally, as a tonic or antispasmodic, the dose is one or two grains gradually increased. As an emetic it is rarely administered: the dose is from ten to twenty grains: its operation is very safe. As a lotion or injection it is employed in the form of aqueous solution containing two or more grains of the salt to an ounce of water.

[§ **Zinci Valerianas.** *Valerianate of Zinc.*
$ZnO,C_{10}H_9O$ or $\mathbf{Zn(C_5H_9O_2)_2}$.

Take of

Sulphate of Zinc	$5\frac{3}{4}$ ounces.
Valerianate of Soda	5 ounces.
Distilled Water	a sufficiency.

Dissolve the sulphate of zinc and the valerianate of soda, each in two pints of the water; raise both solutions to near the boiling point, mix them, cool, and skim off the crystals which are produced. Evaporate the mother-liquor at a heat not exceeding 200°, till it is reduced to four ounces; cool again, remove the crystals which have formed, and add them to those which have been already obtained. Drain the crystals on a paper filter, and wash them with a small quantity of cold distilled water, till the washings give but a very feeble precipitate with chloride of barium. Let them now be again drained, and dried on filtering paper at ordinary temperatures.]

The following double decomposition here takes place :—

$$ZnSO_4 + 2NaC_5H_9O_2 = Zn2C_5H_9O_2 + Na_2SO_4.$$

The valerianate of zinc, being the less soluble salt, crystallises out first, and may be obtained free from adhering sulphate of soda by recrystallisation and washing.

[§ *Characters and Tests.*—In brilliant white pearly tabular crystals, with a feeble odour of valerianic acid, and a metallic taste; scarcely soluble in cold water or in ether, soluble in hot water and alcohol. Heated to redness in an open crucible it leaves a residue which, when dissolved in diluted sulphuric acid, yields with ammonia a precipitate which entirely dissolves in an excess of the reagent, and the resulting solution gives a white precipitate with sulphide of ammonium. Its solution in hot water is not precipitated by chloride of barium (showing freedom from sulphate). It gives when heated with diluted sulphuric acid a distillate which, when mixed with the solution of acetate of copper, does not immediately affect the transparency of the fluid (as would be the case were butyric acid present), but forms after a little time oily drops, which gradually pass into a bluish-white crystalline deposit (valerianate of copper).]

Much of the valerianate of zinc of commerce, especially that prepared in Paris, was found by Dr. Neligan to consist of butyrate of zinc, to which oil of valerian had been added.

Physiological Effects.—Valerianate of zinc is a nervine tonic, is antispasmodic, and anthelmintic, and is supposed to combine the antispasmodic properties of zinc and valerian. It has this advantage over the preparations of valerian, that it has less odour, but the active principle of valerian appears to be oil of valerian rather than valerianic acid, and the benefit of the two substances is, I think, most certainly obtained by giving sulphate of zinc with infusion and tincture of valerian.

Therapeutics.—It is used in hysteria, in hysterical neuralgia, and in the convulsions of young children, especially when these are caused by worms.

Administration.—Dose, 1 to 3 grains.

CADMIUM. *Cadmium.* Cd = 56 or **Cd** = 112.

This metal, which was discovered in 1817, occurs in some of the ores of zinc. It resembles tin in colour, but is somewhat harder. It tarnishes but little in the air, and is hardly acted upon by diluted sulphuric or hydrochloric acid in the cold. One of its salts has been introduced into the Pharmacopœia.

[§ **Cadmii Iodidum.** *Iodide of Cadmium.* CdI or $\mathbf{CdI_2}$.

It may be formed by direct combination of iodine and cadmium in the presence of water.

Characters and Tests.—In flat micaceous crystals, white, of a pearly lustre, which melt when heated to about 600°, forming an amber-coloured fluid. At a dull red heat violet-coloured vapours are given off. It is anhydrous and permanent in the air; freely soluble in water and in rectified spirit, and the solution reddens litmus paper. The aqueous solution gives a yellow precipitate with sulphuretted hydrogen or sulphide of ammonium, which is insoluble in excess of the latter; the solution also gives a white gelatinous precipitate with excess of solution of potash, the filtrate from which is unaffected by sulphide of ammonium. Ten grains, dissolved in water, and nitrate of silver added in excess, give a precipitate which, when washed with water and afterwards with half an ounce of solution of ammonia and dried, weighs 12·5 grains.]

[§ **Unguentum Cadmii Iodidi.** *Ointment of Iodide of Cadmium.*

Take of

Iodide of Cadmium, in fine powder . .	62 grains.
Simple Ointment	1 ounce.

Mix thoroughly.]

Iodide of cadmium has been proposed as a substitute for iodide of lead, in cases in which the use of lead may be objected to on account of its causing discolouration of the skin or other inconvenience.

STANNUM. *Tin.* Sn = 59 or **Sn** = 118.

History.—Tin has been known from the most remote periods of antiquity. The alchemists called it *Jove* or *Jupiter*. It is peculiar to the mineral kingdom. It occurs in two states; as an oxide, $\mathbf{SnO_2}$ (the *tin stone* and *wood tin* of mineralogists), and as a sulphide (*tin pyrites*, $2FeS,SnS_2 + 2Cu_2S,SnS_2$). It is found in both states in Cornwall, which has long been celebrated for its tin works.

Preparation.—In Cornwall *stream tin* (a variety of tin-stone) is smelted with charcoal or anthracite at a high temperature in a reverberatory furnace. The metal is subsequently made hot and then let fall from a height, or is struck with a hammer, by which it splits into a number of irregular prisms. This is *grain-tin.*

Properties.—In its massive form it is a yellowish-white metal, having a peculiar odour when rubbed or handled, and crackling when bent. Its sp. gr. varies from 7·178 to 7·299. It melts at 442° F., and at a white heat is volatilised. It is malleable, but is sparingly ductile.

Tin forms two chlorides, $SnCl_2$ and $SnCl_4$; the acidulated solution of the former of these gives with sulphuretted hydrogen a brown precipitate, SnS; the latter a yellow one, SnS_2.

[⁂ **Granulated Tin.** (Appendix I.)

Grain tin, granulated by fusing and pouring it into cold water.]

[§ Solution of Chloride of Tin. (Appendix II.)

Take of

Granulated Tin	1 ounce.
Hydrochloric Acid	3 fluid ounces.
Distilled Water	a sufficiency.

Dilute the acid in a flask with one fluid ounce of the water, and, having added the tin, apply a moderate heat until gas ceases to be evolved. Add as much of the water as will make up the bulk to five fluid ounces, and transfer the solution, together with the undissolved tin, to a bottle with an accurately-ground stopper.]

The action of tin upon hydrochloric acid is similar to that of zinc, hydrogen being evolved, and a chloride of the metal remaining in solution, $Sn + 2HCl = SnCl_2 + H_2$. The excess of metallic tin is necessary to prevent the formation of perchloride ($SnCl_4$).

Solution of chloride of tin is used to indicate the presence of mercury in ammoniated mercury, and as a test for the red oxide of mercury in grey powder.

PLUMBUM. *Lead.* $Pb = 103{\cdot}5$ or $Pb = 207$.

History.—This metal was known in the most remote ages of antiquity. The alchemists called it *Saturn.* It is found both in the metallic state (*native lead*?) and mineralised. It is met with combined with sulphur (*galena*), with selenium, with chlorine (*horn lead*), with oxygen (*native minium*), and also in the form of oxysalts (*carbonate*, *phosphate*, *sulphate*, *tungstate*, *molybdate*, *chromate*, and *arseniate*).

Preparation.—It is usually extracted from galena (PbS), which is roasted in reverberatory furnaces, by which it loses the greater part of its sulphur, as sulphurous acid, SO_2, and is converted into a mixture of lead, oxide of lead, sulphate of lead, and some undecomposed sulphide of lead. Oxide of lead readily decomposes sulphide of lead under the influence of heat, and produces sulphurous acid and metallic lead, $PbS + 2PbO = 3Pb + SO_2$. Sulphide of lead, and sulphate of lead also at a red heat, yield metallic lead and sulphurous acid, $PbS + PbSO_4 = Pb_2 + 2SO_2$.

The lead left in the scoria as sulphate, silicate, and oxide, is afterwards abstracted by smelting with coal and lime.

Properties.—It has a bluish-grey colour and considerable brilliancy. It may be crystallised, by cooling, in four-sided pyramids. It is malleable, but very imperfectly ductile. Its sp. gr. is 11·35. It has a peculiar odour when handled, and is known from tin by its producing a black discoloration on the fingers when rubbed. It fuses at 612° F., and at a red heat boils and evaporates. By exposure to the air it attracts, first oxygen, and then carbonic acid.

Pure distilled water has no action on lead, provided the gases (as air and carbonic acid) be excluded; but if these be admitted, a thin crust of hydrated oxy-carbonate of lead is soon formed. It is remarkable that the presence of most neutral salts, especially carbonates and sulphates, impairs the corrosive action of air and water, and, therefore, exerts a protective influence. The chlorides are the least protective. Hence, therefore, we can easily understand why leaden cisterns and pipes do not more frequently give a metallic impregnation to water; and why very pure well-water or rain-water is more apt than common well-water to become impregnated with lead.

Characteristics of the Salts of Lead.—Sulphuretted hydrogen gives the black sulphide: sulphuric acid and sulphates a white precipitate, $\mathbf{PbSO_4}$; chromate of potash a yellow precipitate, $\mathbf{PbCrO_4}$; and iodide of potassium a yellow precipitate, $\mathbf{PbI_2}$.

[§ **Plumbi Oxidum.** *Oxide of Lead.* PbO or **PbO.**

Synonyms.—Lithargyrum, 1864.] Plumbic oxide. Lead oxide.

Preparation.—Lead, when heated in the air so as to be converted into vapour, burns with a white light, and forms oxide of lead. If melted lead be exposed to a current of air, it is rapidly oxidated and converted into the protoxide of this metal. The oxidated skimmings are denominated *massicot.* These, when fused at a bright red heat, are separated from some intermixed metallic lead; the fused oxide forms, on solidifying, a brick-red mass, which readily separates into crystalline scales: these constitute *litharge.* Litharge is obtained as a secondary product in the cupellation of argentiferous lead. The alloy is melted on a porous vessel, called a *test* or *cupel*, and exposed to the blast of a bellows, by which the lead is oxidised, half-vitrified, and driven off into hard masses of a scaly texture, and in that state is called *litharge* or *silver stone.*

[§ *Characters and Tests.*—In heavy scales of a pale brick-red colour, completely soluble without effervescence in diluted nitric and acetic acids, either solution, when neutral, giving a copious yellow precipitate with iodide of potassium (iodide of lead). Its solution, in diluted nitric acid, when supersaturated with ammonia and then cleared by filtration, does not exhibit a blue colour (showing its freedom from copper).]

[§ Emplastrum Plumbi. *Lead Plaster.*

Synonym.—Emplastrum lithargyri, 1864.

Take of

Oxide of Lead, in fine powder . . .	4 pounds.
Olive Oil	1 gallon.
Water	$3\frac{1}{2}$ pints.

Boil all the ingredients together gently by the heat of a steam-bath, and keep them simmering for four or five hours, stirring constantly until the product acquires a proper consistence for a plaster, and adding more water during the process if necessary.]

Olive oil is a mixture of oleine and margarine. When boiled with litharge and water, the oxide of lead decomposes it with the formation of two insoluble soaps, consisting of oleate and margarate of lead, whilst glycerine remains dissolved in the water. The mixture of oleate and margarate of lead constitutes *emplastrum plumbi.* The following equation representing the reaction of oxide of lead and water upon oleine (oleate of glyceryl) will illustrate the nature of the change:—

$$\underset{\text{Oleine.}}{2(C_3H_53C_{18}H_{33}O_2)} + 3PbO + 3H_2O = \underset{\text{Oleate of Lead.}}{3(Pb2C_{18}H_{33}O_2)} + \underset{\text{Glycerine.}}{2(C_3H_53HO)}.$$

This is a great improvement on the preparations of previous pharmacopœias: it is the formula of the late Dr. Scott, of Bromley, and contains one-fourth more of olive oil than the Emplastrum Plumbi, *Lond.*

Properties.—It is met with in the shops in cylindrical rolls, of a greyish or yellowish-white colour, brittle when cold, but softening and ultimately fusing by heat. It is insoluble in water, and partially so in alcohol. It has no taste, but a slight though peculiar odour. When strongly heated, it decomposes, gives out inflammable gas, and leaves a carbonaceous residue, which, when heated in a close vessel, yields globules of lead. Ether dissolves oleate but not margarate of lead.

Effects and Uses.—This plaster is employed in surgery on account of its adhesiveness and the mildness of its local action; for it rarely excites irritation. It is used to keep the edges of wounds together in persons with delicate skins. Spread on calico it forms a good *strapping* for giving support and causing pressure in ulcers of the leg—a most successful mode of treating them, and for which we are indebted to Mr. Baynton. In pharmacy it serves as a basis for various other plasters.

[§ **Emplastrum Saponis.** *Soap Plaster.*

Take of

Hard Soap	6 ounces.
Lead plaster	$2\frac{1}{4}$ pounds.
Resin	1 ounce.

To the lead plaster, melted by a gentle heat, add the soap and the resin, first liquefied; then, constantly stirring, evaporate to a proper consistence.]

[§ ⁂ **Emplastrum Cerati Saponis.** *Soap Cerate Plaster.*

Take of

Hard Soap, in powder	10 ounces.
Yellow Wax	$12\frac{1}{2}$ ounces.
Olive Oil	1 pint.
Oxide of lead	15 ounces.
Vinegar	1 gallon.

Boil the vinegar with the oxide of lead, until the latter is dissolved; then add the soap and boil again until most of the moisture is evaporated; finally add the wax and oil melted together, and stirring constantly, evaporate to the proper consistence for a plaster.]

This is a popular and much approved application to corns, &c. It is a modification of the Ceratum Saponis of the *Lond. Pharm.*

Plumbi Oxidum Rubrum. *Red Oxide of Lead.* Pb_3O_4 or $\mathbf{Pb_3O_4}$.

Synonyms.—Red-lead. Minium.

Preparation.—By subjecting massicot or litharge to the air at a temperature of about 600°, it absorbs oxygen and furnishes red-lead. Red-lead has a well-known brilliant red colour. By a strong heat it gives out oxygen gas, and is converted into the protoxide. When digested in nitric acid, the nitrate is obtained in solution while the insoluble brown peroxide remains. It may be employed for the extemporaneous production of chlorine water by agitating it with proper proportions of common salt and sulphuric acid dissolved in water.

Plumbi Peroxidum. *Peroxide of Lead.* PbO_2 or $\mathbf{PbO_2}$.

Obtained by digesting red-lead in nitric acid, and well washing the insoluble residue. It is a dark brown powder, and when subjected to heat is the best source of pure protoxide of lead.

[§ **Plumbi Carbonas.** *Carbonate of Lead.*]

$2(PbO, CO_2) + HO,PbO$ or $\mathbf{2PbCO_3,Pb2HO}$.

History.—Ceruse or white-lead was known to the ancients, Hippocrates employed it in medicine. Carbonate of lead is found native, both crystallised and massive, in Scotland, England, &c. It is called *white-lead ore.*

Preparation.—Carbonate of lead is made by exposing plates, or bars, or other forms of lead to the vapour of acetic acid, and, at the same time, to air loaded with carbonic acid gas. In this country white-lead is extensively manufactured by the old or *Dutch* process which, it is said, yields a product superior as an oil pigment to that obtained by most other methods; as, for example, by transmitting a stream of carbonic acid gas through a solution of subacetate of lead.

[§ *Characters and Tests.*—A soft heavy white powder, blackened by sulphuretted hydrogen, insoluble in water, soluble with effervescence in diluted acetic acid without leaving any residue, and forming a solution which is precipitated white by sulphuric acid (sulphate of lead), and yellow by iodide of potassium (iodide of lead). The acetic solution, when treated with excess of sulphuretted hydrogen, boiled, and filtered, gives no precipitate with oxalate of ammonia.] This last test shows its freedom from carbonate of lime; its solubility in acetic acid without residue proves that it is not contaminated with sulphate of baryta.

Commercial white-lead seems to be somewhat variable in composition. In a general way it may be represented by the formula given at the head.

[§ **Unguentum Plumbi Carbonatis.** *Ointment of Carbonate of Lead.*

Take of

Carbonate of Lead, in fine powder . .	62 grains.
Simple ointment	1 ounce.

Mix thoroughly.]

Used as a cooling and desiccating application to excoriated surfaces or burns.

[§ **Plumbi Acetas.** *Acetate of Lead.*

$PbO,C_4H_3O_3 + 3HO$ or $\mathbf{Pb2C_2H_3O_2.3H_2O}$.]

History.—Raymond Lully and Isaac Hollandus were acquainted with this salt in the thirteenth century. It has been known by several appellations: as sugar of lead (saccharum saturni) acetated ceruse, &c.

Preparation.—[§ Take of

Oxide of Lead, in fine powder	24 ounces.
Acetic Acid	2 pints, or a sufficiency.
Distilled Water . . .	1 pint.

Mix the acetic acid and the water, add the oxide of lead, and dissolve with the aid of a gentle heat. Filter, evaporate till a pellicle forms, and set aside to crystallise, first adding a little acetic acid should the fluid not have a distinctly acid reaction. Drain and dry the crystals on filtering paper, without heat.]

As usual with a metallic oxide and an acid, double decomposition occurs, resulting in the production of acetate of lead and water :—

$$2HC_2H_3O_2 + PbO = Pb2C_2H_3O_2 + H_2O.$$

[§ *Characters and Tests.*—In white crystalline masses, slightly efflorescent, having an acetous odour, and a sweet astringent taste. Its solution in water slightly reddens litmus, gives a yellow precipitate with iodide of potassium (iodide of lead), and is precipitated white by sulphuric acid (sulphate of lead), acetic acid being set free. Its solution in distilled water is clear, or has only a slight milkiness (carbonate of lead), which disappears on the addition of acetic acid. Thirty-eight grains dissolved in water require for complete precipitation 200 grain-measures of the volumetric solution of oxalic acid.]

Properties.—In a dry and warm atmosphere the crystals are apt to be decomposed by the carbonic acid of the air, and thus to become partially insoluble. When heated, they fuse, give out their water of crystallisation, and, at a higher temperature, are decomposed ; yielding acetic acid, acetone, carbonic acid, inflammable gas, and water : the residuum is a pyrophoric mixture of lead and charcoal. Acetate of lead is soluble in both water and alcohol. A solution of the neutral acetate is partially decomposed by carbonic acid : a small quantity of carbonate of lead is precipitated, and a portion of acetic acid produced, which protects the remaining solution from further change.

Physiological Effects.—Applied to ulcers, mucous membranes, or other secreting surfaces, it acts as a desiccant and astringent. It reacts chemically on the albumen of the secretions and of the living tissues, and forms therewith compounds which are for the most part insoluble in water and acids. Hence the difficulty with which this salt becomes absorbed. Some of its compounds with organic substances are, however, rendered soluble in water by acids (as the acetic, hydrochloric, and lactic). In large quantities, acetate of lead taken into the stomach acts as an irritant, and causes symptoms of inflammation of the stomach, viz., vomiting, burning in the gullet and stomach, and tenderness at the pit of the stomach. These are usually accompanied with colica pictonum, and are not unfrequently followed by convulsions, coma, or local palsy.

The observations of Dr. A. T. Thomson, Van Swieten, Latham, and Christison have, however, shown that injurious effects from the use of large doses are very rare. I have repeatedly given five grains three times a day for ten days, without inconvenience. This dose was taken for a fortnight. The blue line on the gums was then very distinct, and the patient complained of griping pains in the bowels. Dr. Christison has given eighteen grains daily for eight or ten days without any unpleasant symptoms whatever, except once or twice slight colic. During its employment the gums should be frequently examined, in order that the earliest appearance of the blue line before referred to may be detected.

Therapeutics.—Acetate of lead is administered *internally* to diminish the diameter of the capillary vessels, and lesson circulation, secretion, and exhalation. Thus we employ it in profuse discharges from the mucous membranes; as from the lungs, alimentary canal, and even the urino-genital membrane. In the mild cholera, so common in this country towards the end of summer, I have found acetate of lead in combination with opium most efficacious where the chalk mixture failed. Dr. Latham speaks most favourably of the use of sugar of lead and opium in checking purulent or semi-purulent expectoration. I have repeatedly seen it diminish expectoration, but I have generally found it fail in relieving the night-sweats, though Fouquier supposed it to possess a specific power of checking them: they are more frequently benefited by diluted sulphuric acid. In sanguineous exhalations from the mucous membranes, as epistaxis, hæmoptysis, and hæmatemesis, and in uterine hemorrhage, it is employed with a view of diminishing the calibre of the bleeding vessels, and thereby of stopping the discharge; and experience has fully established its utility. It may be employed in both the active and passive states of hemorrhage. It is usually given in combination with opium. In bronchitis, with profuse secretion, it proves exceedingly valuable. It has been employed also as a remedy for mercurial salivation. It has been applied for this affection in the form of gargle by Sommé. Unless care be taken to wash the mouth carefully after its use, it is apt to blacken the teeth. On the same principles that we administer it to check excessive mucous discharges, it has been employed to lessen the secretion of pus in extensive abscesses attended with hectic fever. Drs. Neuhold and Hasserborne have used the acetate of lead in enemata, in cases of strangulated hernia, as first recommended by Neuber and Peitl, and have found great advantage from it. The quantity used has been from ten to forty grains in from six to twenty-four ounces of warm water.

As a *topical* remedy, we use acetate of lead as a sedative, astringent, and desiccant. An aqueous solution of it is applied to inflamed parts, or to secreting surfaces, to diminish profuse discharges. Thus we use it in phlegmonous inflammation, in ophthalmia, in ulcers with profuse discharges, in gonorrhœa and gleet. In the sloughing and ulceration of the cornea which attend purulent and pustular ophthalmia, its use should be prohibited, as it forms a white compound which is deposited on the ulcer, to which it adheres tenaciously, and in the healing becomes permanently and indelibly imbedded in the structure of the cornea. Acetate of lead, applied in the solid form or in strong solution, is stated to have been found of great service in the treatment of granular conjunctivitis by M. Cunin, of Brussels, but it has no advantage over sulphate of copper, and it leaves for several days a white glaze on the surface of the conjunctiva.

Administration.—Acetate of lead may be administered internally in doses of from one to ten grains. Dr. A. T. Thomson advises its exhibition in dilute distilled vinegar, to prevent its change into carbonate, which renders it more apt to occasion colic. It is usually exhibited in the form of pill, frequently in combination with opium. Dr. Farre says dilute acetic acid or oxymel is certainly a useful addition to the acetate when given in solution, but the utility of the acetic acid probably consists in its favouring the absorption of the acetate by retaining it in solution. Sulphuric acid (as in infusion of roses), sulphates (as of magnesia, and soda, and alum), phosphates and carbonates, render it inert: the carbonates, however, facilitate the production of colica pictonum. Common (especially spring) water, which contains sulphates, carbonates, and chlorides, is incompatible with this salt. Two grains dissolved in an ounce of water form an ordinary lotion.

[§ **Pilula Plumbi cum Opio.** *Pill of Lead and Opium.*

Take of

Acetate of Lead, in fine powder . .	36 grains.
Opium, in powder	6 grains.
Confection of Roses	6 grains.

Beat them into a uniform mass.]

Acetate of lead and opium react chemically on each other, and produce acetate of morphia and meconate with a little sulphate of lead. Experience, however, has fully established the therapeutic value of the combination. In hæmoptysis, profuse secretion of bronchial mucus, obstinate diarrhœa, Asiatic cholera, and dysentery, its effects are most valuable.

Dose, from 4 to 8 grains.

[§ **Suppositoria Plumbi Composita.** *Compound Lead Suppositories.*

Take of

Acetate of Lead	36 grains.
Opium, in powder	12 grains.
Benzoated Lard	42 grains.
White Wax	10 grains.
Oil of Theobroma	80 grains.

Melt the wax and oil of theobroma with a gentle heat, then add the other ingredients, previously rubbed together in a mortar, and having mixed them thoroughly, pour the mixture while it is fluid into suitable moulds of the capacity of fifteen grains; or the fluid mixture may be allowed to cool and then be divided into twelve equal parts, each of which shall be made into a conical or other convenient form for a suppository.]

[§ **Liquor Plumbi Subacetatis.** *Solution of Subacetate of Lead.*]

History.—This compound was known to Basil Valentine in the fifteenth century. It owes its reputation principally to M. Goulard. He called it *extract of Saturn.* It is frequently termed *Goulard's extract.*

Synonym.—Liquor plumbi diacetatis, *Lond.*

Preparation.—[§ Take of

Acetate of Lead . .	5 ounces.
Oxide of Lead, in powder	$3\frac{1}{2}$ ounces.
Distilled Water . .	1 pint, or a sufficiency.

Boil the acetate of lead and the oxide of lead in the water for half an hour, constantly stirring; then filter, and when the liquid is cold add to it more distilled water until the product measures twenty fluid ounces. Keep the clear solution in stoppered bottles.]

The acetate of lead dissolves and combines with oxide of lead to form a mixture of oxyacetates (principally $\mathbf{Pb_2O2C_2H_3O_2}$) commonly known under the collective designation *subacetate.* This process yields a uniform product.

[§ *Characters and Tests.*—A dense clear colourless liquid, with alkaline reaction and sweet astringent taste, becoming turbid by exposure to the air; and forming with mucilage of gum acacia an opaque white jelly. Sulphuric acid in excess gives a white precipitate ($\mathbf{PbSO_4}$), acetic acid being set free. Specific gravity, 1·26. 413·3 grains by weight (6 fluid drachms) require for perfect precipitation 810 grain-measures of the volumetric solution of oxalic acid.]

Its alkaline reaction and copious precipitation with carbonic acid, as well as with mucilage, distinguishes this solution from one of the neutral acetates.

Physiological Effects.—Its effects are analogous to those of the acetate. Its chemical action on the living tissues depends on its affinity for albumen and fibrine. Dr. A. T. Thomson asserts, from his experiments on animals, that the subacetate has more tendency to cause colic than the neutral acetate, because it is more readily converted into carbonate of lead. It is employed in medicine as a local astringent and sedative. Paralysis is said to have resulted from its external use.

Therapeutics.—It is employed, when diluted, to promote the resolution of external inflammation, to check profuse discharges from suppurating, ulcerated, and mucous surfaces, and to alleviate local pains. Thus it is applied to parts affected with either phlegmonous or erysipelatous inflammation, to whitloes, to inflamed tendons, aponeuroses, or absorbent glands; in ophthalmia; to contusions, sprains, burns, wounds (whether incised or lacerated); to blistered surfaces, ulcers, and abscesses. It is rarely given internally, but it is said to have proved successful in hydrophobia.

Administration.—It is employed diluted with water, added to poultices, or mixed with fatty matters, and applied as an ointment.

[§ **Liquor Plumbi Subacetatis Dilutus.** *Diluted Solution of Subacetate of Lead.*

Take of

Solution of Subacetate of Lead .	2 fluid drachms.
Rectified Spirit	2 fluid drachms.
Distilled Water	$19\frac{1}{2}$ fluid ounces.

Mix, and filter through paper. Keep the clear solution in a stoppered bottle.]

This preparation is commonly termed, in the shops, *Goulard water.* It should be transparent and colourless; but when prepared with common water it is more or less milky, owing to the formation of carbonate, sulphate, and chloride of lead. It is also more or less turbid if it be made with distilled water which has been exposed to the air, and in consequence has absorbed carbonic acid. The small quantity of spirit employed can be of no service. The quantity of the solution of subacetate of lead employed in making Goulard water is much too small; it should be, at least, three times, and in some cases I have used six times as much. I have never seen any ill effects from its use, though it is said to have become absorbed in some cases. The same objection applies to the use of this compound as to that of the neutral acetate, in ulceration of the cornea.

Goulard water is used as a cooling, sedative, and astringent wash in the cases already enumerated for the Goulard's extract. A poultice, composed of crumb of bread and Goulard water, is sometimes a very useful application to phlegmons, painful wounds, irritable ulcers, &c., &c.

[§ **Unguentum Plumbi Subacetatis Compositum.** *Compound Ointment of Subacetate of Lead.*]

Synonym.—Ceratum plumbi compositum, *Lond.*

[Take of

Solution of Subacetate of Lead .	6 fluid ounces.
Camphor	60 grains.
White Wax	8 ounces.
Oil of Almonds	1 pint.

Melt the wax with sixteen ounces of the oil by the heat of a water bath, remove the vessel, and, as soon as the mixture begins to thicken, gradually add the solution of subacetate of lead, and stir the mixture constantly while it cools ; then add the camphor dissolved in the rest of the oil, and mix thoroughly.]

This was called Goulard's cerate. It is employed as a dressing to wounds and ulcers, for the purpose of allaying irritation and appeasing pain. With the same views it is also applied to excoriated surfaces, burns, scalds, blistered surfaces, and irritable cutaneous affections. Opium is sometimes advantageously combined with it.

[§ **Plumbi Nitras.** *Nitrate of Lead.* $PbONO_5$ or $\mathbf{Pb2NO_3}$.]

History.—This salt was employed under the name *nitrum saturninum*, two centuries ago.

Preparation.—It may be easily prepared by dissolving in nitric acid a little diluted either metallic lead,

$$3Pb + 8HNO_3 = 3Pb2NO_3 + 2NO + 4H_2O,$$

or litharge,

$$PbO + 2HNO_3 = Pb2NO_3 + H_2O.$$

Red lead treated in the same way leaves a dark brown insoluble peroxide, $Pb_3O_4 + 4HNO_3 = 2Pb2NO_3 + PbO_2 + 2H_2O$.

[§ *Characters and Tests.*—In colourless octahedral crystals which are nearly opaque, permanent in the air, of a sweetish astringent taste, soluble in water and in alcohol. The aqueous solution is precipitated black (PbS) by sulphuretted hydrogen, white ($PbSO_4$) by diluted sulphuric acid, and yellow (PbI_2) by iodide of potassium. Added to sulphate of indigo it discharges the colour (showing it is a nitrate).]

[§ **Plumbi Iodidum.** *Iodide of Lead.* PbI or PbI_2.

Take of

Nitrate of Lead	. . . .	of each 4 ounces.
Iodide of Potassium	. . . .	
Distilled Water	. . . .	a sufficiency.

Dissolve the nitrate of lead, by the aid of heat, in a pint and a half, and the iodide of potassium in half a pint of the water, and mix the solutions. Collect the precipitate on a filter, wash it with distilled water, and dry it at a gentle heat.]

$$Pb2NO_3 + 2KI = PbI_2 + 2KNO_3.$$

Characters.—A fine yellow powder very sparingly soluble in cold water but readily soluble in boiling water; from which, on cooling, it separates in golden yellow brilliant scales. It combines with the alkaline iodides; it is also soluble in caustic potash, acetic acid, and in alcohol.

Therapeutics.—Iodide of lead has been administered, although rarely, in affections of the spleen, in doses of from half a grain to two or three grains. It is chiefly used as an external application to cancerous tumours, and scrofulous affections of the glands, joints, &c., in the form of plaster or ointment.

[§ **Emplastrum Plumbi Iodidi.** *Iodide of Lead Plaster.*

Take of

Iodide of Lead	. . . .	1 ounce.
Soap Plaster	. . . .	of each 4 ounces.
Resin Plaster	. . . .	

Add the iodide of lead in fine powder to the plasters previously melted, and mix them intimately.]

This plaster, which is of a yellow colour when first prepared, becomes nearly colourless when it has been kept for some time, in consequence of a double decomposition occurring between the iodide of lead and the soap of the soap plaster.

[§ **Unguentum Plumbi Iodidi.** *Ointment of Iodide of Lead.*

Take of

Iodide of Lead, in fine powder	. .	62 grains.
Simple Ointment	. . . . . .	1 ounce.

Mix thoroughly.]

Plumbi Tannas. *Tannate of Lead.*

Pure tannate of lead is obtained by adding tannin to a solution of acetate of lead; the precipitate is to be collected on a filter and dried.

Cataplasma ad decubitum.—Boil two ounces of bruised oak bark in a sufficient quantity of water to yield eight ounces of decoction. Strain and add two ounces of solution of subacetate of lead. The precipitate collected by a filter weighs about three ounces. Add to it while moist two drachms of rectified spirit. It is to be used while moist and of the consistence of a thick liniment.

FERRUM. *Iron.* Fe = 28 or Fe=56.

[§ Wrought iron in the form of wire or nails free from oxide.]

History.—This metal, called by the alchymists *Mars*, was known in very ancient times. It appears to have been the first mineral used internally. Iron is met with in both kingdoms of nature. It is found in the metallic state (*native iron*, meteoric and terrestrial), in combination with oxygen (*hæmatite*, *micaceous iron*, *brown iron stone*, and *magnetic iron ore*), with sulphur (*iron pyrites* and *magnetic pyrites*), with chlorine (in the mineral called *pyrosmalite*), and with an acid radicle (*carbonate*, *phosphate*, *sulphate*, *arseniate*), &c. It occurs in the ashes of most plants, and in the blood and some other parts of animals.

Extraction.—In England, iron is extracted principally from *clay iron ore*, an impure carbonate of iron; this is *roasted* on large heaps of coal, by which it loses carbonic acid, water, and sulphur. It is then *smelted* with a flux (in South Wales limestone; in the forest of Dean, clay) and coke. The flux and the earthy particles of the ore run down into a *slag*, the carbonate of iron is deprived of its oxygen by the carbon of the coke, and the iron, in combination with carbon, is melted and run into moulds. In order to deprive iron of the substances with which it is combined in cast-iron, the latter is successively submitted to the processes of *refining*, *puddling*, and *welding*, by which it is converted into *wrought-iron*. The essential objects of these processes are to burn off the carbon of the cast-iron and to oxidise the silicon, by which silicic acid is formed: this unites with oxide of iron.

Properties.—Pure iron has a whitish-grey colour. When polished, it has a high degree of brilliancy: its taste, when acted on by a solvent, is peculiar and generally styptic; when rubbed it becomes odorous. Its ductility and tenacity are great, its malleability comparatively small, its sp. gr. is 7·788, but it diminishes by rolling or drawing. It is strongly magnetic.

Characteristics of the salts of iron.—The protosalts (ferrous salts) give a white precipitate, which immediately becomes green and after a time brown, with the alkaline hydrates or carbonates; with ferricyanide of potassium a dark blue precipitate of ferricyanide of iron (Turnbull's blue). The per- or ferric salts give with the alkalies a rusty brown precipitate of hydrated peroxide; and with ferrocyanide of potassium, Prussian blue (ferric ferrocyanide $\mathbf{Fe_4Fcy_3}$).

Physiological Effects.—Iron is probably inert, or only acts mechanically, so long as it retains its metallic form; but it readily oxidises in the alimentary canal, and thereby acquires medicinal power. As acids promote this chemical change, acid wines and fruits assist in rendering the metal active, while alkalies and their carbonates have an opposite effect. The oxidisement of the iron is attended with the evolution of hydrogen gas, which gives rise to unpleasant eructations. Like the ferruginous preparations generally, the internal employment of iron causes blackening of the stools, owing to the formation of the hydrated sulphide of iron. Iron is one of the few metals which by mere oxidation is not rendered more or less poisonous. The salts of iron produce a black stain when applied to the tongue. The *local* effects of the sulphate, pernitrate, and perchloride of iron are those of caustics and irritants, and these preparations accordingly rank amongst poisons. Most of the ferruginous preparations are astringent; that is, they constringe the parts with which they are in contact, and thereby diminish secretions and check sanguineous discharges. Thus, when swallowed, they repress the secretions and exhalation of the gastro-intestinal membrane, and thereby render the alvine evacuations more solid, and even occasion costiveness. The sulphate, pernitrate, and perchloride of iron, are the most powerful of the ferruginous astringents. Administered in large quantities, or when the alimentary canal is in an irritable condition, all the compounds of iron are liable to excite heat, weight, and uneasiness at the præcordia, nausea, and even vomiting and sometimes purging. The oxides and the carbonate of iron are very mild topical agents.

Before the chalybeates can produce constitutional effects they must be absorbed; and Tiedemann, Gmelin, and Simon have shown that iron has been found in the urine and milk after the administration of ferruginous salts, as well as in increased quantity in the blood. The absorption of iron is generally assisted by its combination with vegetable bitters. The constitutional effects of iron are best observed in anæmia. If in this condition chalybeates are administered, the blood acquires a more scarlet colour, the skin assumes its natural tint, the lips and cheeks become more florid, the pulse becomes fuller and stronger, the temperature of the body is increased, and the muscular strength augmented. Preparations of iron are less liable to derange the stomach if taken with or after a meal.

Therapeutics.—The general indications for their use are debility, feebleness and inertia of the different organs of the body, atony (marked by a soft, lax, or flabby condition of the solids), defect of the red corpuscles of the blood (*anœmia*), or a watery condition of this fluid (*hydrœmia, leucophlegmatic temperament*).

The contra-indications are the reverse of these: great strength and activity of organs, excessive tonicity (characterised by a firm and tense condition of the solids), and redundancy of the red corpuscles of the blood,—as in general excess of the blood (*plethora*), in fever, in acute inflammation, and in the sanguine temperament. To these may be added congestion, or a tendency thereto, of important organs, especially of the brain and lungs, and intestinal irritation.

The following are some of the more important diseases in which chalybeates prove serviceable:—

1. In maladies attended with defect of the red corpuscles of the blood; as in anæmia, with or without irregularity of the uterine functions (chlorosis, amenorrhœa, dysmenorrhœa, and menorrhagia), and whether occurring spontaneously and without any obvious cause, or resulting from profuse discharges (hemorrhages, fluxes, as leucorrhœa, &c.), from food defective in either quantity or quality, and from deficiency of light and pure air. In these cases, the use of iron, conjoined with sufficient nourishing food, pure air, abundance of light, and, when necessary, the employment of purgatives, proves curative. But, when the anæmia or hydræmia is dependent on organic diseases,—as cancer, granular degeneration of the kidney, or morbus cordis—the use of iron can at best be palliative only.

2. In some chronic affections of the nervous system great benefit is obtained by the use of iron. Chorea in a large number of cases may be relieved, and oftentimes cured, by chalybeates; though, in general, I consider them inferior to arsenic, which usually cures chorea much more speedily and certainly than they do. Cases, however, sometimes occur in which the chalybeates are preferable; as where anæmia coexists. Epilepsy and hysteria are other nervous affections which are sometimes benefited by a course of iron, especially when they are attended with anæmia or uterine obstructions.

3. In diseases of the spleen the ferruginous compounds are occasionally found useful. 'I regard iron as a specific,' says Cruveilhier, 'in hypertrophy of the spleen, or chronic splenitis; whether primitive or consecutive to intermittent fevers.' After noticing the symptoms attending this condition (such as paleness of the lips, &c., great lassitude, abdominal and cephalic pulsations, brought on by

the slightest exertion, pain at the left side, disordered state of the digestive organs, accelerated pulse, and heart easily excited), he goes on to remark, 'By the aid of iron I have obtained the complete resolution of enlargements of the spleen, which have occupied half, or even two-thirds, of the abdomen.' Is not iron useful in these cases by removing the coexistent anæmia? In disease of the spleen, accompanied with enlargement of this organ, but unattended by anæmia, I have found it fail to give relief. In hypertrophy of the liver iron has not been found as beneficial as in hypertrophy of the spleen.

4. In scrofula and rickets the long-continued use of ferruginous compounds, in some cases combined with alkalies or iodine, has appeared to me on many occasions to be highly beneficial. In these cases iron proves most serviceable where there is a manifest tendency to anæmia, with a pale flabby condition of the solids.

[§ **Ferrum Redactum.** *Reduced Iron.*

Synonym.—Ferri pulvis, *Dubl.*

Metallic iron, with a variable amount of magnetic oxide of iron.

Take of

Hydrated Peroxide of Iron . . .	1 ounce.
Zinc, granulated	a sufficiency.
Sulphuric Acid	a sufficiency.
Chloride of Calcium	a sufficiency.

Introduce the hydrated peroxide of iron into a gun-barrel, confining it to the middle part of the tube by plugs of asbestos. Pass the gun-barrel through a furnace, and when it has been raised to a strong red heat, cause it to be traversed by a stream of hydrogen gas developed by the action on the zinc of some of the sulphuric acid diluted with eight times its volume of water. The gas before entering the gun-barrel must be rendered quite dry by being made to pass first through the remainder of the sulphuric acid, and then through a tube eighteen inches long, packed with small fragments of the chloride of calcium. The farther end of the gun-barrel is to be connected by a cork with a bent tube dipping under water; and when the hydrogen is observed to pass through the water at the same rate that it bubbles through the sulphuric acid, the furnace is to be allowed to cool down to the temperature of the atmosphere, the current of hydrogen being still continued. The reduced iron is then to be withdrawn, and enclosed in a dry stoppered bottle.]

The dilute sulphuric acid is decomposed by the zinc, hydrogen being evolved, and sulphate of zinc formed,

$$Zn + H_2SO_4 = H_2 + ZnSO_4.$$

The hydrogen passing over the heated peroxide of iron abstracts its oxygen, reducing it partly to the metallic state, partly to that of magnetic oxide, $Fe_2O_3 + 3H_2 = Fe_2 + 3H_2O$, and

$$3Fe_2O_3 + H_2 = 2Fe_3O_4 + H_2O.$$

The process is continued until it is evident that the hydrogen has ceased to absorb oxygen. It is necessary to keep up the stream of hydrogen until cold, as the reduced iron rapidly reabsorbs oxygen from the air while hot. There is some trouble in obtaining iron in this finely reduced state. If the heat be insufficient, the reduction is incomplete: if carried too high, the particles of iron may become aggregated in masses. This preparation has been for some time known on the Continent as *Quevenne's iron.* It was first introduced by MM. Quevenne and Miquelard under the name of *fer réduit.* It has been adopted in the Dublin Pharmacopœia, as well as in that of the United States, under the name of *pulvis ferri.*

[§ *Characters and Tests.*—A fine greyish-black powder, strongly attracted by the magnet, and exhibiting metallic streaks when rubbed with firm pressure in a mortar. It dissolves in hydrochloric acid with the evolution of hydrogen, and the solution gives a light-blue precipitate with the yellow prussiate of potash. Ten grains added to an aqueous solution of fifty grains of iodine and fifty grains of iodide of potassium, and digested in a small flask at a gentle heat, leave not more than five grains undissolved, which should be entirely soluble in hydrochloric acid.]

The iodine (dissolved by the aid of the iodide of potassium) combines with the metallic iron, and dissolves it, leaving the magnetic oxide, mingled with it, untouched. At least one-half of the preparation, therefore, should be metallic iron.

Physiological Effects and Uses.—As a medicine it possesses the properties of other ferruginous preparations, acting like the carbonate of the metal. In consequence of its fine state of division it is far more soluble in the fluids of the alimentary canal than iron filings. It has no inky flavour, and is not liable to blacken the teeth. As a chalybeate it is said to be objectionable, because it cannot be preserved from oxidation, and on account of the unpleasant eructations of hydrogen gas to which it gives rise. In reference to the first objection we may remark, that we have preserved iron perfectly bright, and without the least sign of oxidation, for many months, in a bottle filled with lime water and well stoppered. This might be made the preservative medium until it was required for use. It has been found a very efficacious form of iron in anæmia, probably in consequence of its very ready solubility in the alimentary canal.

Dose, from 1 to 10 grains, in the form of pill or bolus.

[§ **Trochisci Ferri Redacti.** *Reduced Iron Lozenges.*

Take of

Reduced Iron	720 grains.
Refined Sugar, in powder . .	25 ounces.
Gum Acacia, in powder . . .	1 ounce.
Mucilage of Gum Acacia . .	2 fluid ounces.
Distilled Water	1 fluid ounce or a sufficiency.

Mix the iron, sugar, and gum, and add the mucilage and water to form a proper mass. Divide into 720 lozenges, and dry these in a hot-air chamber with a moderate heat.

Each lozenge contains 1 grain of reduced iron.

Dose, 1 to 6 lozenges.]

[§ **Ferri Oxidum Magneticum.** *Magnetic Oxide of Iron.*

Synonyms.—Ferri oxidum nigrum, *Ed.*,] ferroso-ferric oxide, tri-ferric tetroxide, &c.

[§ Magnetic oxide of iron, Fe_3O_4 or $\mathbf{Fe_3O_4}$, combined with about 20 per cent. of water of hydration, and containing some peroxide of iron.]

Natural History.—It occurs in the mineral kingdom under the name of *magnetic iron ore*, the massive form of which is called *native loadstone*. It is found in Cornwall, Devonshire, Sweden, and other countries.

Preparation.—[§ Take of

Solution of Persulphate of Iron .	$5\frac{1}{2}$ fluid ounces.
Sulphate of Iron	2 ounces.
Solution of Soda	4 pints.
Distilled Water	a sufficiency.

Dissolve the sulphate of iron in two pints of the water, and add to it the solution of persulphate of iron, then mix this with the solution of soda, stirring them well together. Boil the mixture, let it stand for two hours, stirring it occasionally, then put it on a calico filter, and when the liquid has drained away, wash the precipitate with distilled water until what passes through the filter ceases to give a precipitate with chloride of barium. Lastly, dry the precipitate at a temperature not exceeding 120°.]

On the addition of soda to the mixed solution of protosulphate and persulphate of iron, a compound of the hydrated protoxide and peroxide of iron is precipitated. This is to be washed with water until all traces of sulphuric acid are got rid of, and carefully dried without heat to avoid further oxidation.

$$FeSO_4 + 2NaHO = Fe2HO + Na_2SO_4 \text{ and}$$
$$Fe_23SO_4 + 6NaHO = Fe_26HO + 3Na_2SO_4.$$
Then $$Fe2HO + Fe_26HO = Fe_38HO \text{ or } Fe_3O_44H_2O$$

[§ *Characters and Tests.*—Brownish black, destitute of taste, strongly attracted by the magnet. It dissolves without effervescence in hydrochloric acid diluted with half its volume of water, and the solution thus obtained gives blue precipitates with the red and yellow prussiates of potash. When a small quantity is heated in a dry test-tube by the flame of a lamp, a deposit of moisture takes place in the cool part of the tube. Twenty grains dissolved in hydrochloric acid continue to give a blue precipitate with the red prussiate of potash until 83 grain measures of the volumetric solution of bichromate of potash have been added (showing the quantity of protoxide converted into peroxide of iron).]

Therapeutics.—Its effects are similar to those of the chalybeates in general, and which have been already described. It does not produce local irritation. It is a more valuable preparation than the peroxide, in consequence of being more readily soluble in the fluids of the stomach.

Administration.—Dose, from 5 to 20 grains or more, twice or thrice daily.

[§ **Ferri Peroxidum Hydratum.** *Hydrated Peroxide of Iron.*

Synonyms.—Ferri peroxidum, 1864; Ferri sesquioxidum, *Lond.*; Ferrugo; Ferri oxidum rubrum, *Edin.*

Fe_2O_3,HO or $\mathbf{Fe_2O_3.H_2O}$.]

History.—Geber was acquainted with peroxide of iron, which he calls *crocus martis.* It was probably known long before his time. It is found native both in the hydrated and anhydrous state (*specular iron, micaceous iron*, or *iron glance*) (*red hæmatite and brown iron stone*). *Red ochre and Reddle*, or *red chalk*, are argillaceous substances, which owe their colour to peroxide of iron.

Preparation.—[§ Take of

Moist Peroxide of Iron . . . . 1 pound.

Dry it at a temperature not exceeding 212°, until it ceases to lose weight, then reduce it to fine powder.]

If this preparation be heated to a higher degree, it becomes more aggregated and of a darker colour, but less easily soluble in hydrochloric acid.

[§ *Characters and Tests.*—A reddish-brown powder, destitute of taste and not magnetic. It dissolves completely, though slowly, with the aid of heat in hydrochloric acid, diluted with half its volume of water, and the solution gives a copious precipitate with the yellow, but none with the red prussiate of potash. Heated to dull redness in a test-tube it gives off moisture.]

Physiological Effects.—It is termed alterative, tonic, and emmenagogue. Its obvious effects on the body are very slight. It produces blackness of the stools, and in large doses occasions nausea, a sensation of weight at the pit of the stomach, and sometimes dyspeptic symptoms. It possesses very little astringency. The constitutional effects arising from the continued use of it are those produced by the ferruginous compounds generally, and which have been before described.

Therapeutics.—It may be employed in any of the before-mentioned cases in which the ferruginous tonics are indicated. It has been strongly recommended as a remedy for neuralgia, and in some cases it gives complete, in others partial, relief. But in many instances no benefit whatever is obtained from its use, and in one case in which I prescribed it the patient fancied it increased her sufferings.

Administration.—The usual dose, as a tonic and emmenagogue, is from ten to thirty grains. In tic-douloureux it has been given in much larger quantities, as from a quarter to half an ounce. These enormous doses have sometimes been followed by very inconvenient accumulations of the oxide in the rectum. It may be administered in the form of a confection. To enable it to sit easily on the stomach, it may be combined with aromatics.

[§ **Emplastrum Ferri.** *Chalybeate Plaster.*

Take of

Hydrated Peroxide of Iron, in fine powder	1 ounce.
Burgundy Pitch	2 ounces.
Lead Plaster	8 ounces.

Add the peroxide of iron to the Burgundy pitch and lead plaster, previously melted together, and stir the mixture constantly till it stiffens on cooling.]

Use.—Spread on leather, it is employed as a mechanical support and slight stimulant in muscular relaxation, lumbago, and weakness of the joints.

[§ **Ferri Peroxidum Humidum.** *Moist Peroxide of Iron.*

Synonym.—Ferri peroxidum hydratum, 1864.

Hydrated peroxide of iron, with about 86 per cent. of uncombined water.

Take of

Solution of Persulphate of Iron .	4 fluid ounces.
Solution of Soda	33 fluid ounces.
Distilled Water	a sufficiency.

Mix the solution of persulphate of iron with a pint of the distilled water, and add this gradually to the solution of soda, stirring them constantly and briskly. Let the mixture stand for two hours, stirring it occasionally, then put it on a calico filter, and when the liquid has drained away, wash the precipitate with distilled water until what passes through the filter ceases to give a precipitate with chloride of barium. Lastly, enclose the precipitate, without drying it, in a stoppered bottle or other suitable vessel, from which evaporation cannot take place. This preparation, when used, should be recently made.]

By the admixture of the iron solution with that of the alkali double decomposition occurs, which is simply represented as follows :—

$$Fe_2 3SO_4 + 6NaHO = Fe_2 6HO + 3Na_2SO_4.$$

It is important to observe the directions in pouring the iron into the soda and not the soda into the solution of iron. In the latter case a hydrated oxysulphate is precipitated resembling the hydrated oxide in appearance but not in properties.

[§ *Characters and Tests.*—A soft moist pasty mass, of a reddish-brown colour. Dissolves readily in diluted hydrochloric acid without the aid of heat, and the solution gives a copious blue precipitate with the yellow but not with the red prussiate of potash. A little of it dried at 212° until it ceases to lose weight, gives off moisture when heated to dull redness in a test tube.]

It should be free from grittiness and leave on calcination about 12 per cent. of peroxide of iron.

Therapeutics.—Moist peroxide of iron has been chiefly employed as an antidote in poisoning by arsenious acid. Drs. Bunsen and Berthold were the first to assert the antidotal powers of this preparation. Their statements were confirmed by other experimentalists. On the other hand, others have denied its antidotal powers. It is generally admitted that if a sufficiently large quantity of the moist peroxide be added to a *solution* of arsenious acid, it combines with the acid and forms an insoluble precipitate. In such cases the moist peroxide would act as a chemical antidote. But it appears from the experiments of Dr. A. Taylor that, when the moist peroxide is mixed with arsenious acid in the form of powder, little or no chemical effect is produced. Now, as in most cases of arsenical poisoning the arsenious acid is taken in the form of powder, it follows that in such the moist peroxide would not act as a chemical antidote, though it would doubtless be serviceable as a mechanical antidote. In thirty-one cases in which it was given, recovery took place in twenty-nine. In one of these nearly a quarter of an ounce of arsenic had been taken. In the two unsuccessful cases the antidote could not be retained on the stomach.

Administration. — When exhibited as an antidote in arsenical poisoning it must be administered in very large doses in a recently precipitated state. Dr. Taylor and Dr. Maclagan say that twelve, Devergie thirty-two, parts of the moist oxide are required for every part of arsenious acid swallowed. Dr. Beck recommends that it should be given in the quantity of a tablespoonful every five or ten minutes, or as often as the patient can swallow it. If moist peroxide be not at hand, let the common red-brown oxide of iron be given with water as a substitute; for though not equally efficacious with the moist oxide, it appears to possess some antidotal power.

[§ **Ferri Carbonas Saccharata.** *Saccharated Carbonate of Iron.*

Carbonate of iron, FeO,CO_2 or $\mathbf{FeCO_3}$, mixed with peroxide of iron and sugar, the carbonate forming at least 57 per cent. of the 37 in B.P. mixture.

Take of

Sulphate of Iron	2 ounces.
Carbonate of Ammonia	$1\frac{1}{4}$ ounce.
Boiling Distilled Water	2 gallons.
Refined Sugar	1 ounce.

Dissolve the sulphate of iron and the carbonate of ammonia each in half a gallon of the water, and mix the two solutions with brisk stirring in a deep-cylindrical vessel, which is then to be covered as accurately as possible. Set the mixture by for twenty-four hours, and from the precipitate, which has subsided, separate the supernatant solution by a siphon. Pour on the remainder of the water, stir well, and, after subsidence, again remove the clear solution. Collect the resulting carbonate on a calico filter, and, having first subjected it to expression, rub it with the sugar in a porcelain mortar. Finally dry the mixture at a temperature not exceeding 212°.]

The sulphate of iron and carbonate of ammonia mutually decompose each other, forming sulphate of ammonia and carbonate of iron, $\mathbf{FeSO_4 + (NH_4)_2CO_3 = FeCO_3 + (NH_4)_2SO_4}$. By free exposure to the air the carbonate of iron absorbs oxygen, and becomes converted into peroxide, $\mathbf{2FeCO_3 + O = Fe_2O_3 + 2CO_2}$; it is necessary, therefore, in washing and collecting it, to keep it from contact with the air as much as possible. The presence of sugar has a powerful effect in preventing the oxidation.

[§ *Characters and Tests.*—Small coherent lumps of a grey colour, with a sweet very feeble chalybeate taste. It dissolves with effervescence in warm hydrochloric acid diluted with half its volume of water, and the solution gives but a very slight precipitate with chloride of barium. Twenty grains dissolved in excess of hydrochloric acid and diluted with water, continue to give a blue precipitate with the red prussiate of potash, until at least 330 grain-measures of the volumetric solution of bichromate of potash have been added.]

Therapeutics.—It is one of the most valuable of the ferruginous compounds, on account of the facility with which it dissolves in the fluids of the stomach, and becomes absorbed. Its local effects are very mild. Its uses are those of chalybeates in general, and which have been before mentioned.

Administration.—Dose, 5 to 10 grains. It may be given in syrup or with confection of roses, as in the following pill.

[§ **Pilula Ferri Carbonatis.** *Pill of Carbonate of Iron.*

Take of

Saccharated Carbonate of Iron . . .	1 ounce.
Confection of Roses	$\frac{1}{4}$ ounce.

Beat them into a uniform mass.]

This is a substitute for the Pilula Ferri Composita, *Lond.* It contains more than four times the quantity of carbonate of iron and no myrrh.

Dose, 5 to 10 grains.

[§ **Mistura Ferri Composita.** *Compound Mixture of Iron.*

Take of

Sulphate of Iron	25 grains.
Carbonate of Potash	30 grains.
Myrrh	60 grains.
Refined Sugar	60 grains.
Spirit of Nutmeg	4 fluid drachms.
Rose Water	$9\frac{1}{2}$ fluid ounces.

Reduce the myrrh to powder, add the carbonate of potash and sugar, and triturate them with a small quantity of the rose water, so as to form a thin paste; then gradually add more rose water and the spirit of nutmeg, continuing the trituration and further addition of rose water until about eight fluid ounces of a milky liquid is formed, then add the sulphate of iron dissolved in the remainder of the rose water, mix them together thoroughly, and preserve the mixture as much as possible from contact with the air.]

This is a professed imitation of Dr. Griffiths' celebrated antihectic or tonic mixture. In the preparation of it, double decomposition takes place: by the mutual reaction of carbonate of potash and sulphate of iron we obtain sulphate of potash, which remains in solution, and carbonate of iron, which is precipitated; $FeSO_4 + K_2CO_3 = FeCO_3 + K_2SO_4$. To prevent the latter attracting oxygen, it is to be preserved in a well-stoppered bottle. The quantity of carbonate of potash directed to be used is almost twice as much as is required to decompose the quantity of sulphate of iron ordered to be employed. The excess combines with the myrrh, and forms a kind of saponaceous compound, which assists in suspending the carbonate of iron in the liquid. When first made, this mixture has a greenish colour, owing to the hydrated ferrous carbonate; but by exposure to the air it becomes reddish, in consequence of the absorption of oxygen, by which peroxide of iron is formed, and carbonic acid evolved: hence it should only be prepared when required for use. The sugar has the effect of greatly retarding this oxidation.

Physiological Effects and Uses.—This is one of the most useful and efficacious ferruginous preparations, owing to its ready solubility, in consequence of which it is readily absorbed. Its constitutional effects are analogous to those of the ferruginous compounds in general already described. Its tonic and stimulant properties are promoted by the myrrh. The excess of alkaline carbonate must not be forgotten in estimating the sources of its activity. It is admissible in most of the cases in which ferruginous remedies are indicated; but it is especially serviceable in anæmia, chlorosis, atonic amenorrhœa, and hysterical affections. It is also employed with benefit in the hectic fever of phthisis and chronic mucous catarrh.

Dr. Graves gives it to check excessive bronchial secretions in doses of one or two fluid drachms in almond mixture. The usual *dose* is from one to two fluid ounces.

[§ **Ferri Phosphas.** *Phosphate of Iron.*

Phosphate of iron $3FeO, PO_5$ or $\mathbf{Fe_3 2PO_4}$, partially oxidated.

Take of

Sulphate of Iron	3 ounces.
Phosphate of Soda	$2\frac{1}{2}$ ounces.
Acetate of Soda	1 ounce.
Boiling Distilled Water	4 pints.

Dissolve the sulphate of iron in one half of the water, and the phosphate and acetate of soda in the remaining half. Mix the two solutions, and, after careful stirring, transfer the precipitate to a calico filter, and wash it with hot distilled water till the filtrate ceases to give a precipitate with chloride of barium. Finally, dry the precipitate at a temperature not exceeding 120°.]

Upon mixing phosphate of soda and sulphate of iron together a reaction ensues, which results in the formation of sulphuric acid as one of the products;

$$3FeSO_4 + 2Na_2HPO_4 = Fe_3 2PO_4 + 2Na_2SO_4 + H_2SO_4.$$

To avoid this the Pharmacopœia directs the employment of acetate of soda, which gives acetic acid in which the phosphate of iron has been thought to be less soluble :—

$$3FeSO_4 + 2Na_2HPO_4 + 2NaC_2H_3O_2 = Fe_32PO_4 + 3Na_2SO_4 + 2HC_2H_3O_2.$$

[§ *Characters and Tests.*—A slate-blue amorphous powder, insoluble in water, soluble in hydrochloric acid. The solution yields a precipitate with both the yellow and red prussiate of potash, that afforded by the latter being the more abundant; and when treated with tartaric acid and an excess of ammonia, and subsequently with the solution of ammonio-sulphate of magnesia, lets fall a crystalline precipitate (ammonio phosphate of magnesia). When the salt is digested in hydrochloric acid with a lamina of pure copper, a dark deposit does not form on the metal (showing its freedom from arsenic). Twenty grains, dissolved in hydrochloric acid continue to give a blue precipitate with red prussiate of potash until 250 grain-measures of the volumetric solution of bichromate of potash have been added.]

Therapeutics.—Dr. Venables proposed this preparation in the treatment of diabetes. Dr. Prout has also borne favourable testimony to its effect. He says it is an excellent remedy. It may also be used for the same purposes as other hematinics.

Dose, 2 to 10 grains.

[§ **Syrupus Ferri Phosphatis.** *Syrup of Phosphate of Iron.*

Take of

Granulated Sulphate of Iron . .	224 grains.
Phosphate of Soda	200 grains.
Acetate of Soda	74 grains.
Diluted Phosphoric Acid . .	$5\frac{1}{2}$ fluid ounces.
Refined Sugar	8 ounces.
Distilled Water	8 fluid ounces.

Dissolve the sulphate of iron in four ounces of the water, and the phosphate and acetate of soda in the remainder; mix the two solutions, and, after careful stirring, transfer the precipitate to a calico filter, and wash it with distilled water till the filtrate ceases to be affected by chloride of barium. Then press the precipitate strongly between folds of bibulous paper, and add to it the diluted phosphoric acid. As soon as the precipitate is dissolved, filter the solution, add the sugar, and dissolve without heat. The product should measure exactly twelve fluid ounces. It contains one grain of phosphate of iron, $3FeO,PO_5$ or $Fe_3P_2O_8$, in one fluid drachm.]

This is a solution of freshly precipitated phosphate of iron in dilute phosphoric acid, converted into a syrup by the addition of sugar, which prevents the peroxidation of the iron. It becomes brown when long kept, and this has been attributed to the production of peracetate of iron from a small quantity of acetic acid remaining in the precipitated phosphate, but it is more probably due to the action of phosphoric acid on the sugar. It is an agreeable preparation of phosphate of iron, and may be taken in *doses* of one or more fluid drachms.

Ferri Hypophosphis. *Hypophosphite of Iron.*
$FeOH_2PO_3$ or $\mathbf{Fe2PH_2O_2}$.

This salt and the syrup are best prepared by double decomposition from the lime salt.

The following process has been given for the syrup.

Syrupus Ferri Hypophosphitis. *Syrup of Hypophosphite of Iron.*

Take of

Granulated Sulphate of Iron	480 grains.
Hypophosphite of Lime	326 grains.
Diluted Phosphoric Acid	1 fluid ounce.
Water	$1\frac{1}{2}$ fluid ounce.
Syrup	9 scruples.

Dissolve without heat the sulphate of iron in the phosphoric acid previously mixed with the water. Rub the hypophosphite to fine powder, and pour on it the solution of the sulphate of iron. Triturate together for two or three minutes, then pour the mixture on to a piece of damped calico, and squeeze out the liquid as far as possible with the hands. Filter the solution so obtained into a measure-glass, and add to it seven times its volume of strong syrup. The resulting syrup contains two grains of hypophosphite of iron in each fluid drachm. The phosphoric acid is necessary to prevent the precipitation of an insoluble oxidised compound upon exposure to the air. (Wood, ' Pharm. Journ.,' 2nd ser. vol. ix. p. 461.)

[§ **Sulphide of Iron.** (Appendix I.) FeS or **FeS**.]

Natural History.—In the mineral kingdom sulphur and iron are frequently met with in combination. *Common* or *yellow iron pyrites.* usually called *mundic*, is a bisulphide of iron, $\mathbf{FeS_2}$. Sulphide of iron (ferrous sulphide **FeS**) is found in small quantity in some meteoric stones. The bisulphide does not yield sulphuretted hydrogen when treated with an acid.

Preparation.—[§ Produced by applying the end of a rod of iron, heated to a white heat at a blacksmith's forge, to the end of a roll of sulphur, and allowing the sulphide of iron as it is formed to run into a vessel of water.] An inferior sort, good enough, however, for pharmaceutic purposes, is obtained by heating one part of sublimed sulphur and three of iron filings in a crucible in a common fire till the mixture begins to glow, and then removing the crucible and covering it, until the action, which at first increases considerably, shall come to an end. The sulphur and iron enter into combination, and form sulphide of iron.

Properties.—If properly prepared, it gives out abundance of sulphuretted hydrogen gas, when mixed with either diluted sulphuric or hydrochloric acid, while a ferrous salt in solution is obtained.

Uses.—Employed in the production of sulphuretted hydrogen.

[§ **Ferri Sulphas.** *Sulphate of Iron.*
FeO, SO_3+7HO or $\mathbf{FeSO_4,7H_2O}$.]

History.—Sulphate of iron is one of the substances which Pliny termed chalcanthum. It is frequently termed *copperas*, and in consequence has been sometimes confounded with the salts of copper: *green vitriol*, *sal Martis*, and *vitriolated iron* are other names by which it is known. (See **Alum.**)

This salt is found native associated with iron pyrites by the decomposition of which it is formed. It is rarely met with native in the crystallised state.

Preparation.—[§ Take of

Iron Wire	4 ounces.
Sulphuric Acid	4 fluid ounces.
Distilled Water	$1\frac{1}{2}$ pint.

Pour the water on the iron placed in a porcelain dish, add the sulphuric acid, and when the disengagement of gas has nearly ceased, boil for ten minutes. Filter now through paper, and, after the lapse of twenty-four hours, separate the crystals which have been deposited from the solution. Let these be dried on filtering paper placed on porous bricks, and preserved in a stoppered bottle.]

The theory of this process is identical with that of sulphate of zinc; one atom of iron displaces the two atoms of hydrogen of the sulphuric acid, and they escape in the gaseous form;

$$\mathbf{Fe + H_2SO_4 = FeSO_4 + H_2}.$$

The *common green vitriol*, or *copperas*, or *crude sulphate of iron* of the shops is prepared by exposing heaps of moistened iron pyrites (bisulphide of iron) to the air for several months. In some places the ore is previously roasted. The moistening is effected by rain or by manual labour. Both constituents (iron and sulphur) are oxidised; the product is protosulphate of iron. But as the quantity of sulphur present is greater than is sufficient to convert the whole of the iron into sulphate, the excess is saturated either by the alumina contained in the clay mixed with the pyrites, or by the addition of old iron.

In the latter case the change would be represented somewhat as follows:—

$$FeS_2 + Fe + 4O_2 = 2FeSO_4.$$

[§ *Characters and Tests.*—In oblique-rhombic prisms, of a pale greenish-blue colour and styptic taste; insoluble in rectified spirit, soluble in water. The aqueous solution is clear, gives a white precipitate with chloride of barium (**$BaSO_4$**), a blue one with the red, and a nearly white or light-blue one with the yellow prussiate of potash (indicating that it is protosulphate). It gives no precipitate with sulphuretted hydrogen.]

The *common green vitriol*, or *copperas*, of the shops is a mixture of the sulphate with an insoluble yellowish oxysulphate of iron. The crystals should have a bluish tint; the sea-green colour of the commercial article is an indication of oxidation having commenced. It is liable to be contaminated with the salts of copper, zinc, manganese, alumina, magnesia, and lime. Copper may be recognised and removed from it by immersing a clean iron spatula in a solution of it: the iron becomes encrusted with copper. Copper may also be detected by adding excess of caustic ammonia to the ferruginous solution and filtering the liquid. If copper be present, the liquor will have an azure blue tint. The ammoniacal liquid should yield, by evaporation, no fixed residuum. It is difficult to deprive the salt of the other impurities above mentioned.

Physiological Effects.—This salt acts locally as a powerful astringent, and, when employed in a concentrated form, as an irritant. The latter effect depends on its chemical action on the organic constituents (albumen) of the tissues. The remote effects of sulphate of iron are analogous to those of other ferruginous compounds, which have been already described.

Swallowed *in small doses*, it has an astringent operation on the gastro-intestinal mucous membrane, and thereby diminishes the quantity of fluids secreted or exhaled: hence its continued use causes constipation. It becomes absorbed, and operates on the system as a tonic, stimulant, emmenagogue, and astringent. *In large medicinal doses* it readily excites pain, heat, or other uneasiness at the pit of the stomach, and not unfrequently causes nausea and vomiting: this is especially the case in irritable conditions of this viscus. *In excessive doses* it operates as an irritant poison.

Therapeutics.—Sulphate of iron is to be preferred to other ferruginous compounds in cases in which there is great relaxation of the solid parts, with immoderate discharges. When the long-continued use of ferruginous compounds is required, it is less adapted for administration than some other preparations of iron, on account of its local action on the alimentary canal. It is employed in lump, powder, or solution, as a styptic, to check hemorrhage from numerous small vessels. A solution of it is applied to ulcerated surfaces and to mucous membranes to diminish profuse discharges, as in chronic ophthalmia, leucorrhœa, and gleet. A solution of three drachms of the sulphate in five ounces of water has been used by Velpeau to repress erysipelas. *Internally*, it is administered in passive hemorrhages, on account of its supposed astringent influence over the system generally; also in immoderate secretion and exhalation—as in humid asthma, chronic mucous catarrh, old dysenteric affections, colliquative sweating, diabetes, leucorrhœa, and gleet. It has also been found serviceable against tapeworm. Dr. Farre says five grains combined with three of sulphate of quinia, and taken three or four times a day, rapidly diminish enlarged spleen.

Administration.—The *dose* of it is from one to five grains, in the form of pill. If given in solution, the water should be recently boiled, to expel the atmospheric air dissolved in it, the oxygen of which converts this salt into a persulphate. A very agreeable method of exhibiting sulphate of iron is in solution in carbonic acid water.

For local purposes, solutions of it are employed of various strengths, according to circumstances. In chronic ophthalmia, we may use one or two grains to an ounce of water; as an injection in gleet, from four to ten grains.

Used for the production of oxide of iron in many of the preparations of iron.

[§ **Pilula Aloes et Ferri.** *Pill of Aloes and Iron.*

Take of

Sulphate of Iron	$1\frac{1}{2}$ ounce.
Barbadoes Aloes, in powder	2 ounces.
Compound Powder of Cinnamon	3 ounces.
Confection of Roses	4 ounces.

Reduce the sulphate of iron to powder, rub it with the aloes and compound powder of cinnamon, and adding the confection make the whole into a uniform mass.

Dose, 5 to 10 grains.]

[§ **Ferri Sulphas Exsiccata.** *Dried Sulphate of Iron.*
FeO,SO_3,HO or $\mathbf{FeSO_4.H_2O}$.

Take of

Sulphate of Iron	4 ounces.

Expose it in a porcelain or iron dish to a heat commencing at 212°, but which may be finally raised to 400°, until aqueous vapour ceases to be given off. Reduce the residue to a fine powder, and preserve it in a stoppered bottle.]

By exposure to a moderate heat, the crystals lose $\frac{6}{7}$ths of their water of crystallisation; so that 85 grains of dried sulphate are equivalent to 139 grains of the crystallised sulphate, or 3 grains are equal to $4\frac{9}{10}$ grains of the crystals.

Use.—This is better adapted than the sulphate of iron for administration in the form of pills.

Dose, $\frac{1}{2}$ grain to 3 grains.

Ferri Sulphas Granulata. *Granulated Sulphate of Iron.*
FeO,SO_3+7HO or $\mathbf{FeSO_4.7H_2O}$.

[§ Take of

Iron Wire	4 ounces.
Sulphuric Acid	4 fluid ounces.
Distilled Water	$1\frac{1}{2}$ pint
Rectified Spirit	8 fluid ounces.

Pour the water on the iron placed in a porcelain capsule, add the sulphuric acid, and when the disengagement of gas has nearly ceased, boil for ten minutes, and then filter the solution into a jar containing the spirit, stirring the mixture so that the salt shall separate in minute granular crystals. Let these, deprived by decantation of adhering liquid, be transferred on filtering paper to porous tiles, and dried by exposure to the atmosphere. They should be preserved in a stoppered bottle.]

Sulphate of iron is very liable to become ochreous in consequence of portions of the solution from which it has been deposited adhering between the plates of the crystals. This is prevented in the above process by the salt at once forming hard grains in consequence of its want of solubility in the spirit, which latter also impedes oxidation during drying.

[§ *Characters and Tests.*—In small granular crystals of a pale-greenish blue colour. In other respects corresponds to the characters and tests for sulphate of iron.]

Free from opaque rust-coloured spots, and dissolving in water without leaving any ochrey residue. The aqueous solution gives no precipitate with sulphuretted hydrogen, and one nearly white with ferrocyanide of potassium.

[§ SOLUTION OF SULPHATE OF IRON. (Appendix II.)

Take of

Granulated Sulphate of Iron . .	10 grains.
Boiling distilled Water . . .	1 fluid ounce.

Dissolve and filter. This solution should be recently prepared.]

Used as a test for nitric acid, which turns it to a deep olive-green, owing to the formation and solution of nitric oxide (**NO**).

[§ **Liquor Ferri Persulphatis.** *Solution of Persulphate of Iron.*]

Persulphate of iron, $Fe_2O_3,3SO_3$ or $\mathbf{Fe_2 3SO_4}$, in solution in water.

[§ Take of

Sulphate of Iron .	8 ounces.
Sulphuric Acid .	of each 6 fluid drachms.
Nitric Acid . .	of each 6 fluid drachms.
Distilled Water .	12 fluid ounces, or a sufficiency.

Add the sulphuric acid to ten ounces of the water, and dissolve the sulphate of iron in the mixture with the aid of heat. Mix the nitric acid with the remaining two ounces of the water, and add the dilute acid to the solution of sulphate of iron. Concentrate the whole by boiling until, by the sudden disengagement of ruddy vapours, the liquid ceases to be black and acquires a red colour. A drop of the solution is now to be tested with red prussiate of potash, and if a blue precipitate forms, a few additional drops of nitric acid should be added, and the boiling renewed, in order that the whole of the sulphate may be converted into persulphate of iron. When the solution is cold, make the quantity eleven fluid ounces by the addition, if necessary, of distilled water.]

The result of adding an oxidising agent, like nitric acid, to a mixture of sulphuric acid and sulphate of iron is that the salt is converted into the persulphate, the hydrogen of the acids being simultaneously converted into water. When nitric acid is employed an evolution of nitric oxide occurs which at first combines with and blackens the protosulphate present. This black compound is subsequently decomposed.

$$6(\mathbf{FeSO_4}) + 3(\mathbf{H_2SO_4}) + 2(\mathbf{HNO_3}) = 3(\mathbf{Fe_2 3SO_4}) + 4\mathbf{H_2O} + 2\mathbf{NO}.$$

[§ *Characters and Tests.*—A dense solution of a dark-red colour, inodorous, and very astringent, miscible in all proportions with alcohol and water. Diluted with ten volumes of water it gives a white precipitate with chloride of barium ($\mathbf{BaSO_4}$), and a blue precipitate with yellow, but not with red prussiate of potash (showing that the conversion into persulphate is complete). Specific gravity, 1·441. One fluid drachm diluted with two ounces of distilled water gives upon the addition of an excess of solution of ammonia a precipitate which, when well washed and incinerated, weighs 11·44 grains.]

Alumen Ferricum. *Iron Alum.*

$KOSO_3Fe_2O_33SO_324HO$ or $\mathbf{K_2SO_4.Fe_23SO_4.24H_2O}$.

Prepared by mixing together solutions of persulphate of iron and sulphate of potash in equivalent proportions. Potash-iron-alum forms a beautiful salt of a pale violet colour, and crystallising like the other 'alums' in octahedra.

Ferri Perchloridum. *Perchloride of Iron.*

Fe_2Cl_3 or $\mathbf{Fe_2Cl_6}$.

Synonyms.—Sesquichloride of iron. Ferric chloride, &c.

History.—Known in the seventeenth century, but first accurately described by Sir H. Davy in 1811.

Preparation.—By heating the metal in an excess of chlorine gas the anhydrous chloride is obtained in the form of green spangles, volatile at a high temperature. The aqueous solution of this salt deposits crystals containing according to circumstances twelve or six molecules of water.

[§ **Liquor Ferri Perchloridi Fortior.** *Strong Solution of Perchloride of Iron.*

Synonym.—Liquor Ferri Perchloridi, 1864.]

Perchloride of iron ($\mathbf{Fe_2Cl_6}$) in solution in water.

[§ Take of

Iron Wire	2 ounces.
Hydrochloric Acid	12 fluid ounces.
Nitric Acid	9 fluid drachms.
Distilled Water	8 fluid ounces.

Mix eight fluid ounces of the hydrochloric acid with the distilled water, and in this dissolve the iron at a gentle heat. Filter the solution, add to it the remainder of the hydrochloric acid and the nitric acid, heat the mixture briskly until on the sudden evolution of red fumes the liquid becomes of an orange-brown colour, then evaporate by the heat of a water-bath until it is reduced to ten fluid ounces.]

By the action of hydrochloric acid upon metallic iron, hydrogen is evolved, the protochloride of iron produced,

$$\mathbf{Fe + 2HCl = FeCl_2 + H_2}.$$

This protochloride (containing excess of hydrochloric acid) is then, by the action of the nitric acid, converted into perchloride,

$6FeCl_2 + 6HCl + 2HNO_3 = 3Fe_2Cl_6 + 4H_2O + 2NO$. During the evaporation it should be well boiled to expel any nitric acid.

[§ *Characters and Tests*.—An orange-brown solution with a strong styptic taste, miscible with water and rectified spirit in all proportions. Diluted with water it is precipitated white by nitrate of silver (**AgCl**), and blue by yellow prussiate of potash, but not at all by red prussiate of potash (showing that the conversion into perchloride is complete). Specific gravity, 1·438. A fluid drachm of it diluted with two fluid ounces of water gives, upon the addition of an excess of solution of ammonia, a reddish-brown precipitate, which, when well-washed and incinerated, weighs 15·62 grains.]

[§ **Liquor Ferri Perchloridi.** *Solution of Perchloride of Iron.**

The same strength as tincture of perchloride of iron.

Take of

Strong solution of Perchloride of Iron	5 fluid ounces.
Distilled Water	15 fluid ounces.

Mix.]

[§ **Tinctura Ferri Perchloridi.** *Tincture of Perchloride of Iron.*

Synonym.—Tinctura Ferri Sesquichloridi, *Lond.*

Take of

Strong solution of Perchloride of Iron	5 fluid ounces.
Rectified Spirit	15 fluid ounces.

Mix, and preserve in a stoppered bottle.

Test.—Specific gravity 0·992.]

This tincture has one-fourth of the strength of Tinctura Ferri Sesquichloridi, *Dub.* It contains about as much perchloride of iron as the London tincture, but much less free acid, so that it can be used, if desirable, in larger doses.

Physiological Effects.—Tincture of perchloride of iron is, in its local action, one of the most powerful of the preparations of iron. It acts as an energetic astringent and styptic, and in large doses as an irritant. When swallowed in large medicinal doses it readily disorders the stomach. The general or constitutional effects of this preparation agree with those of other ferruginous compounds. It appears to possess, in addition, powerfully diuretic properties. Indeed, it would seem to exercise some specific influence over the whole of the urinary apparatus; for, on no other supposition can we explain the remarkable effects which it sometimes produces in

* This is one-fourth the strength of Liquor Ferri Perchloridi, 1864.

affections of the kidneys, bladder, uretha, and even the prostate gland. It usually constipates the bowels.

Therapeutics.—It is sometimes, though not frequently, used as a topical agent. Thus it is applied as a *caustic* to venereal warts, and to spongy granulations. As an *astringent* it is sometimes employed as a local application to ulcers attended with a copious discharge; or as a *styptic* to stop hemorrhage from numerous small vessels, or from leech bites, or after the extraction of teeth. In the form of a weak solution, the perchloride has been employed in surgery for the purpose of effecting the cure of aneurism without operation. A case in which a cure was thus effected by M. Jobert has been brought before the French Academy. A small trochar was introduced into the sac; the blade was then withdrawn, and six drops of a solution of perchloride of iron were injected through the canula into the interior of the sac. The injection was repeated, and some severe local and constitutional symptoms followed; nevertheless the sac was ultimately converted to a solid hard tumour. The severe symptoms following the injection were chiefly due to arteritis excited by the irritating action of the perchloride on the walls of the injured vessel. Perchloride of iron in M. Jobert's opinion should be restricted in its employment chiefly to the treatment of traumatic aneurisms, in sacs lately formed and free from inflammation. He regards it as a dangerous method of treatment when the aneurismal sac is inflamed, or when changes of any duration have rendered its walls degenerate and diseased. M. Pravaz had previously employed the tincture of perchloride of iron for the same purpose. As applied to the treatment of aneurismal tumours it has generally been found by French surgeons to be very successful. It frequently causes immediate coagulation of the contents of an aneurismal sac. This is followed by inflammation and suppuration: a small puncture gives exit to a purulent serosity, and within a short period an eschar is cast off, while the tumour itself contracts to the size of a small nut. This plan of treatment is more especially adapted to aneurisms of those vessels the trunks of which are not accessible for ligature. The following are the principal phenomena observed on the injection of the perchloride into an artery. 1. The formation of primary and secondary clots. 2. The infiltration of plastic lymph into the sheath of the artery, and adhesion of the clots. 3. The elimination of the disorganised parts. 4. Hypertrophy of the middle coats. 5. The encysting of the clots. 6. The disappearance of the secondary clots and plastic formations. 7. Occlusion of the artery. As this liquid is a powerful irritant, there is necessarily some risk attending its use in the treatment of aneurisms.

M. Malgaigne has brought before the Academy of Medicine of Paris a series of cases which tend to show that the above injections are not only very often ineffectual, but that they are fraught with much danger. In one instance death took place from phlebitis after the use of this injection, and many cases of failure have been brought forward. M. Velpeau and M. Roux do not, however, join M. Malgaigne in his condemnation of the use of the perchloride, and think that further trials should be made, especially as regards erectile tumours. The injection of a coagulating fluid, although merely a few drops at a time, into an aneurismal sac, is a proceeding which should not be lightly undertaken, especially as compression and the ligature offer such favourable chances of controlling the disease. Still, it would be a valuable discovery if either the perchloride of iron, or any other powerfully coagulating substance, could be made to cause the obliteration of an aneurism of those vessels which a ligature cannot reach. Cautious trials might perhaps be continued, and it may be that a most beneficial innovation is at hand.

Internally it may be employed as a *tonic* in any of the cases in which the other ferruginous compounds are administered, and which I have already mentioned. It is one of our best remedies in anæmia and chlorosis. It has been especially commended in scrofula. Mr. Hamilton Bell has employed this tincture with great success in the treatment of erysipelas. The bowels are first to be freely opened. The tincture is then given, in mild cases, in doses of from fifteen to twenty-five minims every two hours. I have employed this remedy in nearly one hundred cases of idiopathic erysipelas of the face and head, and, with two exceptions, successfully. It not only cured the disease, but much shortened its duration, and prevented to a great degree its exhausting effects, as Mr. Bell has stated. One of the fatal cases was just recovering from severe rheumatic endo-pericarditis, when erysipelas occurred. The other was free from any complication, but was much exhausted when I first saw her, and probably took the tincture in too small doses, viz. fifteen minims. I consider the repetition of the dose (20 to 30 minims) every two hours very important, and have seen patients, who had taken the tincture for a week every four hours without benefit, immediately improve after taking it every two hours. I give it both in asthenic and sthenic cases, and find delirium no objection to its use. The only local application is hair powder or cotton wadding. To infants it may be given in doses of two drops and upwards. In various affections of the urino-genital organs it is frequently used with great success. Thus, in retention of urine, arising from spasmodic stricture, its effects are sometimes beneficial. It should be given in doses of ten minims every ten minutes. However, Mr. Lawrence, alluding to Mr. Cline's recommendation of it, says: 'I believe general experience has not led others to place any very great confidence in the use of this remedy.' In incontinence of urine in children, it is particularly serviceable in doses of from three to four minims. In gleet and leucorrhœa it is sometimes serviceable. I have found it occasionally successful, when given in conjunction with the tincture of cantharides, in the latter stage of gonorrhœa, after a variety of other remedies had failed. In passive hemorrhage from the kidneys, uterus, and bladder, it is employed with great benefit. It also greatly diminishes the disposition to worms in children.

Administration.—The dose of it is from ten to thirty minims, gradually increased to one or two drachms, and taken in some mild diluent.

Ferri Ammonio-Chloridum. *Ammonio-chloride of Iron.*

History.—This substance, which was known to Basil Valentine, has had various appellations; such as *flores salis ammoniaci martiales*, *ferrum ammoniacale*, or *ferrum ammoniatum.*

Preparation.—In the London Pharmacopœia it was directed to be prepared by dissolving peroxide of iron in hydrochloric acid and mixing the solution with sal ammoniac in such proportions as to obtain, on evaporating to dryness, a granular salt consisting of perchloride of iron fifteen parts and sal-ammoniac eighty-five parts.

The two salts are capable of crystallising together in cubes, but the combination does not appear to be definite.

TINCTURA FERRI AMMONIO-CHLORIDI. Tincture of Ammonio-chloride of Iron. *Lond.* 1851.

Take of

Ammonio-chloride of Iron . . .	1920 grains.
Proof Spirit }	of each $\frac{1}{2}$ pint
Distilled Water }	

Dissolve and filter.

[§ **Ferri Iodidum.** *Iodide of Iron.*

Iodide of iron FeI or **FeI$_2$** with about 18 per cent. of water of crystallisation and a little oxide of iron.

Take of

Fine Iron Wire	$1\frac{1}{2}$ ounce.
Iodine	3 ounces.
Distilled Water	15 fluid ounces.

Put the iodine, iron, and twelve ounces of the water into a flask, and having heated the mixture gently for about ten minutes, raise the heat and boil until the froth becomes white. Pass the solution as quickly as possible through a wetted calico filter into a dish of polished iron, washing the filter with the remainder of the water, and boil down until a drop of the solution taken out on the end of an iron wire solidifies on cooling. The liquid should now be poured out on a porcelain dish, and, as soon as it has solidified, should be broken into fragments, and enclosed in a stoppered bottle.]

A great excess of iron is here ordered, and in all the preparations of this salt, as it facilitates the action and ensures the rapid formation of the iodide.

[*Characters and Tests.*—Crystalline, green with a tinge of brown, inodorous, deliquescent, almost entirely soluble in water, forming a slightly green solution which gradually deposits a rust-coloured sediment, and acquires a red colour (from absorption of oxygen from the air). Its solution gives a copious blue precipitate with the red prussiate of potash (showing it to be a ferrous salt). Mixed with mucilage of starch, it acquires a blue colour on the addition of a minute quantity of solution of chlorine (indicating iodine).]

Properties.—Iodide of iron has a styptic taste. It is soluble in its own weight of water. By exposure to the air it is decomposed, and deposits a brown compound, the result of oxidation. It has been suggested to introduce into the solution a coil of iron wire as a remedy for this deteriorating action. This is, however, inadequate to prevent the change. When heated in the air, it first fuses, then absorbs oxygen, and is converted into peroxide of iron and iodine, which escapes in violet vapour.

Physiological Effects.—In *small and repeated doses* its effects are not very obvious, save that of blackening the stools. It sometimes sharpens the appetite and promotes digestion. It passes out of the system in the urine, and both of its constituents may be detected in this fluid. When it does not purge, it frequently acts as a diuretic. In *full doses*, as ten grains, it on one occasion caused uneasy sensation at the epigastrium, nausea, slight headache, copious black stool, and, in two hours, a larger quantity of urine, containing both iron and iodine. Its medicinal influence on the body seems to be stimulant, hematinic, tonic, and alterative or deobstruent. It possesses the combined properties of iron and iodine.

Therapeutics.—Iodide of iron is indicated as a tonic, hematinic, and resolvent in cases of debility accompanied with a soft and relaxed condition of the solids, and paleness of the skin. It is especially applicable in scrofulous and strumous affections of the glandular system, in which the use both of iodine and iron is indicated. In tabes mesenterica, and in swellings of the cervical lymphatic glands, it often proves highly advantageous. In chlorosis, and in atonic amenorrhœa, Dr. Thomson found it serviceable; and his testimony of its good effects has been supported by that of others. Its operation must be promoted by exercise and an invigorating diet. In secondary syphilis, occurring in debilitated and scrofulous subjects, it is in some cases, according to the testimony of both Drs. Thomson and Ricord, a valuable remedy. The last-mentioned writer employed it in the form of injection (composed of from thirty to sixty grains of iodide dissolved in eight ounces of water) in blenorrhœas, and in that of lotion in venereal and carious ulcers. Dr. Pierquin employed it internally and externally in leucorrhœa and amenorrhœa. It has also been used in incipient cancer and in atonic dyspepsia. Dr. Walsh considers it as specially appropriate in cases of cancer attended with anæmia.

Administration.—The *dose* of it is three grains gradually increased to eight, ten, or more. Ricord has given forty grains per day. It may be exhibited in the form of syrup, tincture, or of aqueous solution, flavoured with a little tincture of orange-peel. It must be remembered that acids, alkalies, and their carbonates, most metallic salts, all vegetable astringents, and many organic solutions, decompose it. Pierquin gave it in chocolate, Bourdeaux wine, distilled water, diluted spirit, or made into lozenges with saffron and sugar. In leucorrhœa and amenorrhœa, he employed an ointment (composed of sixty grains of iodine to an ounce of lard), by way of friction to the upper part of the thighs.

[§ **Syrupus Ferri Iodidi.** *Syrup of Iodide of Iron.*

Take of

Fine Iron Wire	1 ounce.
Iodine	2 ounces.
Refined Sugar	28 ounces.
Distilled Water	13 fluid ounces.

Prepare a syrup by dissolving the sugar in ten ounces of the water with the aid of heat. Digest the iodine and the iron wire in a flask, at a gentle heat, with the remaining three ounces of the water, till the froth becomes white; then filter the liquid while still hot into the syrup, and mix. The product should weigh two pounds eleven ounces, and should have the specific gravity 1·385. It contains 4·3 grains of iodide of iron in 1 fluid drachm.]

By filtering the solution of iodide of iron into a strong syrup, the oxidising action of the air is greatly impeded by the sugar. It has been sometimes found, however, that the syrup becomes coloured when it has been kept for some time, and several plans have been suggested for preventing this change. Heating the syrup for a short time, after the addition of the iodide of iron, has been found to render it more permanent, probably in consequence of a small portion of the cane sugar being thus converted into grape sugar. The application of heat to syrup that has become coloured from keeping will also in most instances restore it to a colourless condition. But the application of much or long-continued heat, either in making or decolourising the syrup, is to be avoided. The syrup should be kept in well-filled and well-stoppered bottles.

Dose, $\frac{1}{2}$ to 1 fluid drachm.

[§ **Pilula Ferri Iodidi.** *Pill of Iodide of Iron.*

Take of

Fine Iron Wire	40 grains.
Iodine	80 grains.
Refined Sugar, in powder . . .	70 grains.
Liquorice Root, in powder . . .	140 grains.
Distilled Water	50 minims.

Agitate the iron with the iodine and the water in a strong stoppered ounce phial until the froth becomes white. Pour the fluid upon the sugar in a mortar, triturate briskly, and gradually add the liquorice.

Dose, 3 to 8 grains.]

Three grains contain one of the iodide.

[§ **Liquor Ferri Pernitratis.** *Solution of Pernitrate of Iron.*]

Pernitrate of Iron, $Fe_2O_3,3NO_5$ or $\mathbf{Fe_26NO_3}$ in solution in water.

[§ Take of

Fine Iron Wire, free from rust .	1 ounce.
Nitric Acid	$4\frac{1}{2}$ fluid ounces.
Distilled Water	a sufficiency.

Dilute the nitric acid with sixteen ounces of the water, introduce the iron wire into the mixture, and leave them in contact until the metal is dissolved, taking care to moderate the action, should it become too violent, by the addition of a little more distilled water. Filter the solution, and add to it as much distilled water as will make its bulk one pint and a half.]

The iron is dissolved by the nitric acid, nitric oxide being given off with effervescence, and water at the same time produced, as shown by the following equation:—

$$\mathbf{Fe_2 + 8HNO_3 = Fe_26NO_3 + 4H_2O + 2NO.}$$

[§ *Characters and Tests.*—A clear solution of a reddish-brown colour, slightly acid and astringent to the taste; gives a blue precipitate with the yellow prussiate of potash. When to a little of it placed in a test-tube half its volume of pure sulphuric acid is added, and then a solution of sulphate of iron is poured on, the whole assumes a dark-brown colour (indicating a nitrate by the formation of **NO**, which is held in temporary solution by the sulphate of iron). Specific gravity 1·107. One fluid drachm treated with an excess of solution of ammonia gives a precipitate which, when washed, dried, and incinerated, weighs 2·6 grains. It gives no precipitate with red prussiate of potash (showing its freedom from protosalt).]

Physiological Effects.—They are those of a very powerful astringent and mild caustic. Mr. Kerr thinks that, in addition to the astringent quality, it possesses the property of diminishing the tenderness of the mucous membranes with which it comes in contact. Its remote effects are hematinic and tonic, like other chalybeates. Altogether, this preparation resembles in its medicinal properties the perchloride of iron.

Therapeutics.—Mr. Kerr introduced it as a valuable remedy for chronic diarrhœa both in children and adults, and whether accompanied with vomiting or not. With the exception of dysentery, he found it useful in almost every case of diarrhœa. He employed it both by the mouth and by the rectum. Dr. Graves has borne testimony to its beneficial effects; as has also Kopp, who states that he gave it with success in many cases which had resisted every approved remedy. Dr. Reynolds, of Brookville, U.S., confirms Mr. Kerr's observations on its efficacy, especially in arresting choleraic diarrhœa. Dr. T. C. Adams, of the United States, employed it not only in diarrhœa, but also in other mucous discharges, as leucorrhœa, in which he conjoined the local use of it with its internal administration. He also used it in aphthous sores, and toothache (Dunglison). Dr. J. W. Williams used it with success in the diarrhœa and alvine hemorrhage of typhoid fever.

It seems well adapted for hæmatemesis, hemorrhage from the bowels, and uterine hemorrhage, in pale, feeble, and languid constitutions. In such it may be employed to serve the double purpose of a topical astringent, and a tonic and hæmatinic. It has been used as a substitute for quinine in intermittent fever. The pernitrate has been used of late, like the perchloride, for injecting aneurismal sacs and nævi. In one case in which it was used for nævus, sloughing took place and the child died. In a concentrated state it has a powerful local action.

The *dose* of it is from ten minims to a fluid drachm. Mr. Kerr gave in some cases a teaspoonful three or four times a day; and he was acquainted with one case in which half an ounce was swallowed with no other effect than a considerable degree of costiveness. It may be given in plain water. Kopp gave it in gruel; but it is probable that it would prove less effective as a topical agent when administered in gruel than in simple water. To children it may be given in doses of a few drops according to their age. Mr. Kerr employed from nine to twelve drops, in warm water, in the form of enema for young children. Diluted with water, it has been employed, as an injection, in leucorrhœa and uterine hemorrhage.

[§ **Ferri Arsenias.** *Arseniate of Iron.*

Arseniate of iron, $3FeO,AsO_5$, or $\mathbf{Fe_3As_2O_8}$, partially oxidised.

Take of

Sulphate of Iron	9 ounces.
Arseniate of Soda, dried at 300° . .	4 ounces.
Acetate of Soda	3 ounces.
Boiling distilled Water . . .	a sufficiency.

Dissolve the arseniate and acetate of soda in two pints, and the sulphate of iron in three pints of the water, mix the two solutions, collect the white precipitate which forms, on a calico filter, and wash until the washings cease to be affected by a dilute solution of chloride of barium. Squeeze the washed precipitate between folds of strong linen in a screw press, and dry it on porous bricks in a warm air chamber whose temperature shall not exceed 100°.]

In preparing this salt by the employment of arseniate of soda and sulphate of iron alone a considerable quantity is held in solution, and so lost, in consequence of the formation of sulphuric acid.

$$2Na_2HAsO_4 + 3FeSO_4 = Fe_32AsO_4 + 2Na_2SO_4 + H_2SO_4.$$

By the introduction of acetate of soda it was intended to prevent this loss, on the assumption that arseniate of iron although soluble in sulphuric acid is insoluble in acetic acid, the acid which in this case is set free, as shown in the following equation :—

$$2Na_2HAsO_4 + 3FeSO_4 + 2NaC_2H_3O_2 = Fe_32AsO_4 3Na_2SO_4 + 2HC_2H_3O_2.$$

[§ *Characters and Tests.*—A tasteless amorphous powder of a green colour, insoluble in water, but readily dissolved by hydrochloric acid. This solution gives a copious light-blue precipitate with the yellow prussiate of potash, and a still more abundant one of a deeper colour with the red prussiate of potash. A small quantity boiled with an excess of caustic soda and filtered gives, when exactly neutralised by nitric acid, a brick-red precipitate on the addition of solution of nitrate of silver ($\mathbf{Fe_32AsO_4} + \mathbf{6NaHO}$ give $\mathbf{3Fe2HO} + \mathbf{2Na_3AsO_4}$. The arseniate of soda thus formed in the solution gives red arseniate of silver $\mathbf{Ag_3AsO_4}$; phosphate, under the same conditions, gives a yellow precipitate $\mathbf{Ag_3PO_4}$). The solution in hydrochloric acid when diluted gives no precipitate with chloride of barium (showing its freedom from sulphates). Twenty grains dissolved in an excess of hydrochloric acid diluted with water continue to give a blue precipitate with the red prussiate of potash until at least 170 grain-measures of the volumetric solution of bichromate of potash have been added. (This indicates the proportion of the compound existing as a ferrous salt.)]

Physiological Effects.—Its effects are similar to those of arsenious acid; topically it acts as a caustic. In about half an hour it excites uneasiness, which continues for several hours, and is followed by swelling, especially when it is used for ulcers of the face: in a few days a slough is formed. The employment of it, like that of other arsenical preparations, requires caution, as the arsenic becomes absorbed.

Therapeutics.—The therapeutical properties of the arseniate of iron in the treatment of herpetic and squamous diseases of the skin has been lately minutely investigated by M. Duchesne Dupare; and, in a memoir read before the French Academy, he advances the following propositions as the result of his researches:—1. Arseniate of iron possesses, in common with all other arsenical preparations, unquestionable remedial properties, applicable to the treatment and cure of herpetic and squamous affections of the skin. 2. The great advantage of this substance is, that it may be administered in sufficient doses without giving rise to any of the consequences with which various other arsenical preparations have been justly reproached. 3. The arseniate of iron, whether given singly or in combination with other substances, ought always to be administered in graduated doses, commencing from one-twentieth, one-tenth, or even one-fifth of a grain, according to the age, the constitution, and above all, the state of the digestive organs of the patient. 4. Numerous facts, accurately observed, authorise M. Dupare in concluding, that a daily dose of one-fifth of a grain of arseniate of iron, uninterruptedly repeated during the necessary time, is competent in the adult to effect the cure of an herpetic or squamous affection, however extensive or long established. Mr. Carmichael used it externally in ulcerated cancer. He applied from thirty to sixty grains as a dressing in cases of extensive ulceration. It has been used by Biett in lupus, elephantiasis, psoriasis, chronic eczema, and lichen.

Administration.—The *dose* of it is from $\frac{1}{16}$th to $\frac{1}{12}$th of a grain in the form of pill. It may be applied externally in the form of ointment composed of from 20 to 30 grains of the arseniate to 1 oz. of fat.

[§ **Ferri et Ammoniæ Citras.** *Citrate of Iron and Ammonia.*

Synonym.—Ferri ammonio-citras, *Lond.*, *Dubl.*

Take of

Solution of Persulphate of Iron .	8 fluid ounces.
Solution of Ammonia . . .	$19\frac{1}{2}$ fluid ounces.
Citric Acid	4 ounces.
Distilled Water	a sufficiency.

Mix fourteen fluid ounces of the solution of ammonia with two pints of distilled water, and to this add gradually the solution of persulphate of iron, previously diluted with two pints of distilled water, stirring them constantly and briskly. Let the mixture stand for two hours, stirring it occasionally, then put it on a calico filter, and when the liquid has drained away, wash the precipitate with distilled water until that which passes through the filter ceases to give a precipitate with chloride of barium. Dissolve the citric acid in eight ounces of distilled water, and having applied the heat of a water bath, add the oxide of iron, previously well drained, and stir them together until the whole or nearly the whole of the oxide has dissolved. Let the solution cool, then add five and a half fluid ounces of solution of ammonia. Filter through flannel; evaporate to the consistence of syrup, and dry it in thin layers on flat porcelain or glass plates at a temperature not exceeding 100°. Remove the dry salt in flakes, and keep it in a stoppered bottle.

Characters and Tests.—In thin transparent scales of a deep red colour, slightly sweetish and astringent in taste. It feebly reddens litmus paper, is soluble in water, but almost insoluble in rectified spirit. Heated with solution of potash, it evolves ammonia and deposits peroxide of iron. The alkaline solution from which the iron has separated does not, when slightly supersaturated with acetic acid, give any crystalline deposit (showing the absence of ~~potash~~ and tartaric acid). When incinerated with exposure to air it leaves not less than 27 per cent. of peroxide of iron, which is not alkaline to litmus.]

Physiological Effects.—The great advantages of this preparation, as a chalybeate, are: that it is devoid of any disagreeable flavour, so that it is readily taken by children and delicate persons; that it has no irritating properties, so that it is not apt to disturb the stomach; that it is readily soluble in water, forming a very agreeable solution; and that it may be given in conjunction with the alkaline carbonates, and many other salts often required when chalybeates are administered. On the other hand, it has its disadvantages: 1st, being devoid of astringent properties, it is unfitted for those cases in which the chalybeates are resorted to on account of their topical effects; 2ndly, it appears to me to operate on the general system more slowly and less powerfully as a hematinic than the perchloride or sulphate.

Therapeutics.—In ordinary cases of debility requiring a ferruginous tonic, especially where the stomach is irritable, or where the alkaline carbonates are required to be conjoined, and also in the various strumous affections of children, this salt is a valuable and useful preparation; but in extreme anæmia from violent hemorrhage, where an immediate and powerful hematinic is required, it is inferior to the perchloride and sulphate.

Administration.—It may be given in doses of from five to ten grains dissolved in water, flavoured with syrup of orange peel, or in infusion of gentian or calumba. If directed to be taken in an effervescing mixture of citrate of potash, it should be dissolved in the citric acid solution.

[§ **Vinum Ferri Citratis.** *Wine of Citrate of Iron.*

Take of

Citrate of Iron and Ammonia . .	160 grains.
Orange Wine	1 pint.

Dissolve and let the solution remain for three days in a closed vessel, shaking it occasionally; afterwards filter.]

Dose, 1 to 4 fluid drachms.

[§ **Ferri et Quiniæ Citras.** *Citrate of Iron and Quinia.*

Take of

Solution of Persulphate of Iron .	4½ fluid ounces.
Sulphate of Quinia . . .	1 ounce.
Diluted Sulphuric Acid . .	12 fluid drachms.
Citric Acid	3 ounces.
Solution of Ammonia, Distilled Water .	of each a sufficiency.

Mix eight fluid ounces of the solution of ammonia with two pints of distilled water, and to this add the solution of persulphate of iron previously diluted with two pints of distilled water, stirring them constantly and briskly. Let the mixture stand for two hours, stirring it occasionally, then put it on a calico filter, and when the liquid has drained away, wash the precipitate with distilled water until that which passes through the filter ceases to give a precipitate with chloride of barium.

Mix the sulphate of quinia with eight ounces of distilled water, add the diluted sulphuric acid, and when the salt is dissolved precipitate the quinia with a slight excess of solution of ammonia. Collect the precipitate on a filter, and wash it with a pint and a half of distilled water.

Dissolve the citric acid in five ounces of distilled water, and having applied the heat of a water bath, add the oxide of iron, previously well drained; stir them together, and when the oxide has dissolved, add the precipitated quinia, continuing the agitation until this also has dissolved. Let the solution cool, then add in small quantities at a time twelve fluid drachms of solution of ammonia diluted with two fluid ounces of distilled water, stirring the solution briskly, and allowing the quinia which separates with each addition of ammonia to dissolve before the next addition is made. Filter the solution, evaporate it to the consistence of a thin syrup, then dry it in thin layers on flat porcelain or glass plates at a temperature of 100°. Remove the dry salt in flakes and keep it in a stoppered bottle.

§ *Characters and Tests.*—Thin scales of a greenish golden-yellow colour, somewhat deliquescent, and entirely soluble in cold water. The solution is very slightly acid, and is precipitated reddish-brown by solution of soda (oxide of iron and quinia), white by solution of ammonia (quinia), blue by the yellow (ferric salt) and red prussiates of potash (ferrous salt), and greyish-black by tannic acid (tannate of iron and quinia). The taste is bitter as well as chalybeate. When burned with exposure to air, it leaves a residue which when moistened with water is not alkaline to test-paper (potash absent). Fifty grains dissolved in a fluid ounce of water and treated with a slight excess of ammonia give a white precipitate (quinia), which, when collected on a filter, and dried, weighs eight grains. The precipitate is almost entirely soluble in pure ether, and when burned leaves but a minute residue.]

Therapeutics.—This salt combines the effects of iron and quinia.

Administration.—It may be given in the form of a pill, or in solution, in doses of from three to ten grains, or more.

[§ **Ferrum Tartaratum.** *Tartarated Iron.*

Synonyms.—Ferri potassio-tartras, *Lond.* Ferrum tartarizatum, *Edin.*, *Dubl.*

Take of

Solution of Persulphate of Iron .	$5\frac{1}{2}$ fluid ounces.
Solution of Ammonia . . .	10 fluid ounces.
Acid Tartrate of Potash, in powder	2 ounces.
Distilled Water	a sufficiency.

Mix the solution of ammonia with three pints of distilled water, and to this add gradually the solution of persulphate of iron previously diluted with two pints of distilled water, stirring constantly and briskly. Let the mixture stand for two hours, stirring it occasionally, then put it on a calico filter, and when the liquid has drained away wash the precipitate with distilled water until that which passes through the filter, ceases to give a precipitate with chloride of barium. Mix the washed and drained precipitate intimately with the acid tartrate of potash in a porcelain dish and let the mixture stand for twenty-four hours; then, having applied a gentle heat, not exceeding 140°, add gradually a pint of distilled water and stir constantly until nothing more will dissolve. Filter; evaporate at a temperature not exceeding 140° to the consistence of syrup, and dry it in thin layers on flat porcelain or glass plates in a drying closet at 120°. Remove the dry salt in flakes, and keep it in stoppered bottles.

Characters and Tests.—Thin transparent scales of a deep garnet colour, slightly sweetish and astringent in taste. Soluble in water, and sparingly soluble in spirit. The aqueous solution, when acidulated with hydrochloric acid, gives a copious blue precipitate with the yellow, but none with the red, prussiate of potash. When the salt is boiled with solution of soda, peroxide of iron separates, but no ammonia is evolved, and the filtered solution when slightly acidulated by acetic acid gives, as it cools, a crystalline deposit (acid tartrate of potash). By incinerating fifty grains of it at a red heat, washing what is left with distilled water, and again incinerating, a residue of peroxide of iron is obtained, weighing fifteen grains.]

Dose, 5 to 10 grains.

[§ **Vinum Ferri.** *Wine of Iron.*

Take of

Fine Iron Wire (about No. 35)	1 ounce.
Sherry	1 pint.

Macerate for thirty days in a closed vessel, the iron being almost, but not quite, wholly immersed in the wine, and the vessel frequently shaken, and the stopper removed; then filter.]

The iron suffers oxidation by the united influence of air and water, and gives rise, by the aid of the acids of the wine, to soluble salts; chiefly the tartrate.

Dose, 1 to 4 fluid drachms.

Ferri et Ammoniæ Tartras. *Tartrate of Iron and Ammonia.*

Prepared in the same way as tartarated iron, but substituting acid tartrate of ammonia for the corresponding salt of potash. The acid tartrate of ammonia is made by neutralising a given weight of tartaric acid with ammonia, and then adding to the solution another equal weight of the acid.

It is in the form of shining brittle fragments of a deep-red colour: very soluble in water; the solution possessing a strongly saccharine flavour.

Dose, 5 to 10 grains.

[§ **Tinctura Ferri Acetatis.** *Tincture of Acetate of Iron.*

Take of

Solution of Persulphate of Iron .	$2\frac{1}{2}$ fluid ounces.
Acetate of Potash	2 ounces.
Rectified Spirit	a sufficiency.

Dissolve the acetate of potash in ten fluid ounces, and add the persulphate of iron to eight fluid ounces of the spirit, then mix the two solutions in a two-pint bottle and shake them well together, repeating the agitation several times during an hour. Put the tincture with the precipitated salt contained in it upon a filter, and when the liquid has ceased to run through put as much rectified spirit upon the filter as will make the filtered product measure one pint.]

The precipitated salt is sulphate of potash,

$$Fe_23SO_4 + 6KC_2H_3O_2 = Fe_26C_2H_3O_2 + 3K_2SO_4.$$

After the lapse of about three months, or less, this preparation is usually found to undergo decomposition; becoming gelatinous or semi-solid, in consequence of the separation of an insoluble basic acetate.

Dose, 5 to 30 minims.

[§ **Mistura Ferri Aromatica.** *Aromatic Mixture of Iron.*

Take of

Pale Cinchona Bark, in powder .	1 ounce.
Calumba Root, in coarse powder .	$\frac{1}{2}$ ounce.
Cloves, bruised	$\frac{1}{4}$ ounce.
Fine Iron Wire	$\frac{1}{2}$ ounce.
Compound Tincture of Cardamoms .	3 fluid ounces.
Tincture of Orange Peel . . .	$\frac{1}{2}$ fluid ounce.
Peppermint Water	a sufficiency.

Macerate the cinchona bark, calumba root, cloves, and iron with twelve fluid ounces of the peppermint water in a closed vessel for three days, agitating occasionally; then filter the liquid, adding as much peppermint water to the filter as will make the product measure twelve and a half fluid ounces; to this add the tinctures, and preserve the mixture in a well-stoppered bottle.

Dose, 1 to 2 fluid ounces.]

This preparation contains a small quantity of tannate of iron: according to Mr. Miller, less than one grain of iron in sixteen fluid ounces. It is a favourite chalybeate medicine in Ireland, and the formula here given was taken from the Dublin Pharmacopœia.

Ferri Valerianas. *Valerianate of Iron.*

$FeO,C_{10}H_9O_3$ or $\mathbf{Fe\,(C_5H_9O_2)_2}$.

Take of

Valerianate of Soda	258 grains.
Sulphate of Iron	288 grains.
Distilled Water	1 pint.

Let the sulphate of iron be converted into persulphate, as directed in the formula for *Liquor Ferri Persulphatis, Ph. Br.*, and let the solution of the persulphate so prepared measure eight ounces. Dissolve the valerianate of soda in ten ounces of the water, then mix the two solutions cold, and having placed the precipitate which forms upon a filter and washed it with the remainder of the water, dry it by placing it for some days rolled up in bibulous paper on a porous brick.

It combines the properties of iron and valerianic acid.

Dose, 1 to 3 grains.

Ferri Lactas. *Lactate of Iron.*

$FeO,C_6H_5O_5 3HO$ or $\mathbf{Fe2C_3H_5O_3 3H_2O}$.

Obtained by dissolving metallic iron in dilute lactic acid; or by mixing lactate of lime with a solution of an equivalent quantity of freshly-prepared protochloride of iron; lactate of iron crystallises out, leaving chloride of calcium in solution.

Lactate of iron is a greenish-white salt in small acicular or prismatic crystals, which have a sweetish chalybeate flavour. They are soluble in forty-eight parts of cold or twelve parts of boiling water; and they are nearly insoluble in alcohol.

This salt combines the properties of iron and lactic acid.

Dose, 1 to 5 grains.

COPPER (*Cuprum*). Cu=31·75 or **Cu** = 63·5.

History.—Cuprum, or copper, received its name from Κύπρος, the island of Cyprus, where it was first worked. The alchymists called it *Venus.* Copper is found in the metallic or reguline state; combined with oxygen, both as red oxide $\mathbf{Cu_2O}$, and *black* oxide, $\mathbf{CuO}$; combined with sulphur, as *glance copper*, $\mathbf{Cu_2S}$, and as *blue* or *indigo copper*, $\mathbf{Cu_2S}$; and also forming double sulphides (*variegated copper*, **FeCuS**, *copper pyrites*, $\mathbf{FeCuS_2}$, &c.) combined with selenium; with chlorine (*atacamite*); and as an oxysalt (*carbonate, phosphate, sulphate, silicate, vanadiate*, and *arseniate*).

Preparation.—The copper of commerce is usually prepared from *copper pyrites* (the double sulphide of copper and iron). The greater part of the ore raised in Cornwall is of this kind. It is roasted and then smelted, by which *coarse metal* is produced. This is calcined and again smelted, by which we obtain *fine metal*, or, when cast in sand, *blue metal.* By re-roasting and smelting, *coarse copper* is produced. These processes of roasting and smelting effect the expulsion of the sulphur and the oxidation of the iron. The copper thus produced is smelted and exposed to the air, to drive off any volatile matters, by which *blistered copper* is obtained. It is *refined* or *toughened* by melting it and stirring it with a birch pole.

Properties.—It is a brilliant red metal, crystallisable in regular octahedra and cubes, having a specific gravity of 8·86 to 8·894; malleable and ductile: it has a nauseous, styptic taste, and a peculiar and disagreeable smell. It fuses at 1996° Fah. (Daniell): at a higher temperature it may be volatilised. It is combustible, and is readily oxidised. Acid, alkaline, saline, and fatty bodies, when placed in contact with it in the air, promote its union with oxygen; and, by dissolving a portion of the newly-formed oxide, acquire poisonous properties. It is easily recognised by its communicating a green tinge to flame.

Characteristics of the salts of copper.—Copper dissolves in dilute nitric acid; the solution possesses the following properties:—It is blue, or greenish-blue: with potash or soda it yields a blue precipitate (*hydrate of copper*); a small quantity of ammonia produces with it a similar bluish-white precipitate, but an excess re-dissolves it, forming a deep blue liquid; ferrocyanide of potassium occasions in it a reddish-brown precipitate (*ferrocyanide of copper*); sulphuretted hydrogen and the hydrosulphides throw down a black precipitate (*sulphide of copper*); and lastly, a polished iron plate plunged into the liquid becomes coated with metallic copper;

$$\mathbf{Cu2NO_3 + Fe = Cu + Fe2NO_3}.$$

[§ **Cuprum.** *Copper.*

Fine copper wire, about No. 25.]

[§ **Copper Foil.** (Appendix I.)

Pure metallic copper, thin and bright.]
Used as a test for arsenic in hydrochloric acid.

[§ **Cupri Sulphas.** *Sulphate of Copper.*

$CuO,SO_3 + 5HO$ or $\mathbf{CuSO_4.5H_2O}$.]

History.—This substance was probably known to and employed by Hippocrates and Pliny. It has had various names, such as *blue vitriol*, *Cyprus vitriol*, *Roman vitriol*, *blue copperas*, *blue stone*. It occurs in copper mines, as those of Cornwall, and is formed by the joint action of air and water on sulphide of copper. The cupreous solutions of copper mines are termed *waters of cementation*.

Preparation.—For commercial purposes sulphate of copper is sometimes procured by the direct action of sulphuric acid upon copper scales, obtained from sheet copper which has undergone the process of annealing in a furnace or forge. These materials are placed in wooden troughs lined with lead; the operation being aided by steam blown in through a leaden pipe dipping to the bottom of the liquid. It is also produced by roasting copper-pyrites, lixiviating the residuum to dissolve the sulphate, and evaporating so as to obtain crystals; but in this case it will contain sulphate of iron.

[§ May be obtained by heating sulphuric acid and copper together, dissolving the soluble product in hot water, and evaporating the solution until crystallisation takes place on cooling.] By this process very pure sulphate of copper is obtained, but sulphuric acid and copper are wasted in consequence of the evolution of sulphurous acid gas and production of sulphide of copper by the action of this gas on part of the copper; $\mathbf{Cu} + 2\mathbf{H_2SO_4} = \mathbf{CuSO_4} + \mathbf{SO_2} + 2\mathbf{H_2O}$; then $2\mathbf{Cu} + 2\mathbf{SO_2} = \mathbf{CuSO_4} + \mathbf{CuS}$. It is better, therefore, to convert the metal into oxide by roasting previously in a muffle.

[§ *Characters and Tests.*—A blue crystalline salt, in oblique prisms, soluble in water, forming a pale blue solution which strongly reddens litmus. The aqueous solution gives with chloride of barium, a white precipitate insoluble in hydrochloric acid, and a maroon-red precipitate with yellow prussiate of potash. If an aqueous solution of the salt be mixed with twice its volume of solution of chlorine, and solution of ammonia be added, the precipitate formed by the first addition of the ammonia will be dissolved by a further and sufficient addition of the alkali, and a violet-blue solution will be produced, leaving nothing undissolved.]

Properties.—It dissolves in about four parts of water at 60°, and two parts of boiling water. It is insoluble in alcohol. It is known to be a salt of copper by sulphuretted hydrogen causing a black precipitate, ammonia in excess forming a dark purple blue-coloured liquid, and by the action of a polished iron plate upon which copper is precipitated by immersion. The commercial sulphate of copper frequently contains a small quantity of sulphate of iron. It may be detected as explained above.

Physiological Effects.—In *very small doses* it has no sensible operation on the body. In *larger doses* it is a safe and useful emetic, acting very speedily, and without exciting any great disorder of the general system. In *excessive doses* it becomes a poison, producing inflammation of the alimentary canal, and disordering the functions of the nervous system. In a case mentioned by Dr. Percival, 120 grains proved fatal; the patient was violently convulsed. In a more recent case there were vomiting and insensibility, but no convulsions or purging: the child died in four hours.

Its topical action is stimulant, astringent, styptic, and caustic. Its causticity depends on its union, either as a neutral or basic salt, with one or more of the constituents of the tissues.

Therapeutics.—Where speedy vomiting without much nausea is required, as in cases of narcotic poisoning, sulphate of copper is a tolerably sure and valuable *emetic.* It has also been employed, with success, to provoke vomiting in croup, and thereby to promote the expulsion of the false membrane.

As an *astringent* it has been used with great benefit in chronic diarrhœa and dysentery. It often succeeds when the ordinary vegetable astringents fail. It is also used as an astringent to check excessive secretion from the bronchial and urino-genital mucous membranes. Dr. Wright found it serviceable in dropsy.

As a *tonic* or *antispasmodic* it has been given in intermittent diseases, as the ague; and in some maladies of the nervous system (epilepsy and chorea).

As a *topical* agent, it has often been employed in substance as an application to ulcers, either for the purpose of repressing excessive soft and spongy granulations, commonly denominated 'proud flesh,' or of hastening the process of cicatrisation: and for either of these purposes it is one of the best agents we can employ. Solutions of it are frequently applied to mucous membranes to diminish excessive secretion: thus to the conjunctiva, in chronic ophthalmia, and the mucous lining of the vagina or urethra, in discharges from these parts. In superficial ulcerations of the mucous membranes (especially of the mouth), one or two applications of the sulphate of copper, in substance, are generally sufficient to heal them.

As a *styptic*, a solution of this salt is sometimes used to repress hemorrhages from a number of small vessels.

It may be used as a deodoriser to destroy the smell of sulphuretted hydrogen, or hydrosulphide of ammonia, evolved by putrefying substances. It acts by forming sulphide of copper.

Administration.—The *dose* of it, as an *emetic*, is from three or four grains to fifteen; as an *astringent*, or *tonic*, from a quarter of a grain to one, two, or more grains, given so as not to occasion vomiting. In chronic diarrhœa it should be given twice or thrice a day, combined with opium. Solutions used for external purposes vary considerably in their strength in different cases, but usually from one or two grains to eight or twelve, dissolved in an ounce of water, are employed.

Antidotes.—The chemical antidote for this salt is *albumen*; hence, the whites of eggs, and in the absence of these, milk, or even wheaten flour, should be employed. *Iron filings* have been proposed by some. The iron decomposes the cupreous salt, and precipitates the copper in the metallic (and, therefore, in an inert) state. The *ferrocyanide of potassium* is also said to be a good antidote; sugar has likewise been employed for the same purpose.

[§ SOLUTION OF AMMONIO-SULPHATE OF COPPER. (Appendix II.)

Take of

Sulphate of Copper, in crystals . .	$\frac{1}{2}$ ounce.
Solution of Ammonia	a sufficiency.
Distilled Water	a sufficiency.

Dissolve the sulphate of copper in eight fluid ounces of the water, and to the solution add the ammonia until the precipitate first formed is nearly dissolved. Clear the solution by filtration, and then add distilled water so that the bulk may be ten fluid ounces.]

Used as a test for the presence of sulphur in strong solution of ammonia, and for arsenious acid, with which it forms Scheele's green.

[§ **Sulphate of Copper, Anhydrous.** (Appendix I.)

CuO,SO_3 or $\mathbf{CuSO_4}$.

Sulphate of copper deprived of its water by a heat of 400°.

Characters.—A yellowish-white powder, which becomes blue when moistened with water (being converted into the ordinary crystalline salt).]

Use.—Employed as a test for the presence of water in absolute alcohol.

[§ **Subacetate of Copper of Commerce.** *Verdigris.* (Appendix I.)]

$Cu2C_2H_3O_2\text{-}CuO\text{-}6H_2O$.

History.—Hippocrates employed verdigris, which he terms χαλκοῦ ἰός, or rust of copper. The Romans called it *ærugo*, the term by which it was known in the London Pharmacopœia.

Preparation.—At Montpelier it is thus made:—The refuse of grapes is allowed to ferment with sour wine, and is then laid in alternate strata with plates of copper: acetous fermentation takes place, and the metal becomes oxidised by the combined influence of the air and acid. In about fifteen days the plates are covered with the acetate of copper: they are then wetted, and exposed for a month to the air: the acetate absorbs the water, and uniting with more oxide of copper, forms a subacetate, which is scraped off, and packed in leathern sacks for exportation. At Grenoble, verdigris is obtained by sprinkling plates of copper with ready-made vinegar. In this country it is prepared by exposing thin plates of copper to the action of acetic acid. The method now practised consists in alternating plates of copper with pieces of woollen cloth steeped in acetic acid: they gradually become corroded, and superficially covered with verdigris, which is from time to time removed, and the operation repeated as long as the plate lasts.

Properties—It occurs in masses or in powder. The taste is astringent and metallic; the odour is somewhat similar to, though more disagreeable than, acetic acid. Verdigris is insoluble in alcohol. Water resolves it into a soluble acetate and an insoluble basic acetate. When digested with strong sulphuric acid, it evolves acetic acid, which is readily distinguished by its odour. Heated in a glass tube it gives out acetic acid and acetone: the residue contains metallic copper. Chalk and sulphate of copper are employed to adulterate verdigris. The first effervesces with the mineral acids. The characteristics of the second have been already pointed out.

The neutral acetate of copper (*distilled verdigris*, *verditer*, &c.), is prepared by dissolving common verdigris in acetic acid, and crystallising. ($Cu2C_2H_3O_2.H_2O$.)

[§ Solution of Acetate of Copper. (Appendix II.)]

Acetate of Copper=CuO, $(C_4H_3O_3)+HO$ or **$Cu2C_2H_3O_2.H_2O$**.

[§ Take of

Subacetate of Copper of Commerce, in fine powder.	$\frac{1}{2}$ ounce.
Acetic Acid	1 fluid ounce.
Distilled Water	a sufficiency.

Dilute the acid with half a fluid ounce of the water; digest the subacetate of copper in the mixture at a temperature not exceeding 212° with repeated stirring, and continue the heat until a dry residue is obtained. Digest this in four ounces of boiling distilled water, and by the addition of more of the water make up the solution to five fluid ounces. Filter it.]

Used as a test for the presence of butyric acid in valerianate of zinc.

Linimentum Æruginis. *Liniment of Verdigris.*

Synonyms.—Oxymel Cupri Subacetatis; Mel Ægyptiacum; Unguentum Ægyptiacum; Oxymel Æruginis.

Take of

Verdigris powdered	1 ounce.
Vinegar	7 ounces.
Clarified Honey	14 ounces.

Dissolve the verdigris in the vinegar, and strain the solution through linen; afterwards, the honey being added, boil down to a proper consistence.

The verdigris is decomposed by the sugar, red suboxide of copper being formed which is precipitated, while the fluid portion containing the honey is darkened in colour.

[§ **HYDRARGYRUM.** *Mercury.*]

Hg = 100, or **Hg** = 200.

History.—Mercury was first employed medicinally by the Arabian physicians, Avicenna and Rhazes; but they only ventured to use it externally, against vermin and cutaneous diseases. We are indebted to that renowned empiric, Paracelsus, for its administration internally. It is comparatively a rare substance. It is found in the metallic state, either pure (*native* or *virgin mercury*) in the form of globules, in the cavities of the other ores of this metal, or combined with silver (*native amalgam*). Sulphide of mercury (*native cinnabar*) is the most important of the quicksilver ores, since the metal of commerce is chiefly obtained from it. The principal mines of it are those of Idria in Carniola, Almaden in Spain, and New Almaden in California.

Preparation.—The extraction of quicksilver is very simple. In some places the native cinnabar is mixed with caustic lime, and distilled in iron retorts. The products are sulphide of calcium, sulphate of lime, and mercury, which distils over;

$$4HgS + 4CaO = 3CaS + CaSO_4 + 4Hg.$$

At Almaden the ore is roasted, by which the sulphur is converted into sulphurous acid, and the mercury volatilised;

$$HgS + O_2 = Hg + SO_2.$$

At Idria a modification of this process is followed.

Quicksilver is imported in cylindrical wrought-iron bottles, holding from 60 lbs. to 1 cwt., the mouth of each being closed by an iron screw; and also in goat-skins, two or three times doubled.

The purity of this metal is ascertained by its brilliancy and great mobility. Mechanical impurities—such as adhering dirt or dust—are instantly detected, and may be separated by straining through flannel, or by filtering through a small hole in the apex of an inverted cone of paper. The presence of lead, tin, zinc, or bismuth, may be suspected by the rapidity with which the metal tarnishes in the air, and by its small globules *tailing*, instead of preserving a spherical form.

Mercury is readily purified by redistillation, or by adding to it a little strong solution of nitrate of mercury, agitating well, and after some time straining through flannel; the inferior metals, tin, &c., are oxidised, whilst metallic mercury is reduced from the nitrate.

[§ *Characters and Tests.*—A metal fluid at common temperatures, brilliantly lustrous, and easily divisible into spherical globules. Volatilises at a heat below that of visible redness, leaving no residue.] Faraday has shown that at common temperatures, and even when the air is present, mercury is surrounded by a mercurial atmosphere. It boils at 662° Fah. Its sp. gr. is 13·5 or 13·6.

Characteristics of the Compounds of Mercury.—Solutions of the protosalts of mercury yield with caustic potash or soda a black precipitate, (Hg_2O); the persalts give with the same a yellow precipitate (HgO), and with iodide of potassium a scarlet one (HgI_2), easily soluble in excess.

All mercurial compounds, when heated with carbonate of soda, give a sublimate consisting of globules of metallic mercury. Solutions containing mercury give a silvery stain to copper when that metal is boiled in them. When acidified, and mixed with excess of protochloride of tin, they give a greyish-black precipitate of metallic mercury.

Physiological Effects. 1. *Of Metallic Mercury.*—So long as mercury retains its *liquid form*, it is inert. It is notorious, that it has been repeatedly taken in doses of a pound or more in cases of obstruction of the bowels, without proving noxious. In the few instances in which it has acted injuriously, chiefly when it has been retained in the bowels for a considerable time, it has no doubt become oxidised in the bowels. Dr. Christison considers the question set at rest by the Berlin college of physicians, and that the metal is innocuous. But the injurious effects of *mercurial vapours*, when inhaled or otherwise applied to the body, have been long known. They are observed in water gilders, looking-glass silverers, barometer-makers, men employed in quicksilver mines, and in others exposed to mercurial emanations. In most instances an affection of the nervous system is brought on, which is indicated by shaking palsy, vertigo, loss of memory, and other cerebral disorders, which often terminate fatally. If the individual continue his business, other more dangerous symptoms come on, such as delirium, epilepsy, or apoplexy; and ultimately death takes place. A well-known instance of the effect of mercurial vapour, is afforded by the 'Triumph' man of war and 'Phipps' schooner, which received on board several tons of quicksilver saved from a wreck. In consequence of the rotting of the bags the mercury escaped, and the whole of the crew suffered more or less. In the space of three weeks 200 men were salivated, two died, and all the animals were destroyed.

2. *Of Mercurial Compounds.*—Probably all the mercurial compounds are more or less noxious. The only doubtful exception to the statement is in the case of the sulphides of this metal, which, according to Orfila, are inert. *Local Effects.*—For the most part the local effect of mercurial compounds is alterative and more or less irritant. Many of the preparations, as corrosive sublimate and the nitrate, are energetic caustics. *Remote Effects.*—In small and repeated doses the first obvious effect of mercurials is an increased activity in the secreting and exhaling apparatus. This is particularly observed in the digesting organs; the quantity of intestinal mucus, of bile, of saliva, of mucus of the mouth, and probably of pancreatic liquid being augmented. The alvine discharges become more liquid, and contain a larger proportion of bile. The operation of the medicine does not stop here; the pulmonary, urino-genital, and conjunctival membranes become moister, the urine is increased in quantity, the catamenial discharge is sometimes brought on, the skin becomes damper, and at the same time warmer, so that mercury seems to promote the excretions generally. The absorbent or lymphatic system seems also to be stimulated to increased activity, for we frequently observe that accumulations of fluid in the shut sacs (as the pleura, peritoneum, arachnoid and synovial membranes) diminish in quantity, and in some cases rapidly disappear, under the use of mercury. At the same time also, glandular swellings, enlargements, and indurations of various kinds are dispersed. When our object is to obtain the *sialogogue* operation of mercurials, we give them in somewhat larger or more frequent doses. To a certain extent the effects are the same as those already mentioned, but

more intense. Of all the secretions none are so uniformly and remarkably augmented as those of the mucous follicles of the mouth and salivary glands ; and the increased secretion is accompanied with more or less tenderness and inflammation of these parts, the whole constituting what is termed *salivation* or *ptyalism*. The first symptoms of this affection are slight tenderness and tumefaction of the gums, which acquire a pale rose colour, except at the edges surrounding the teeth, where they are deep red. Gradually the mouth becomes very sore, and the tongue much swollen, a coppery taste is perceived, and the breath becomes remarkably fetid. The salivary glands soon become tender and swollen : the saliva and the mucus of the mouth flow abundantly, sometimes to the extent of several pints in the twenty-four hours. During this state (unless abundance of suitable food be supplied), the fat is rapidly absorbed, and the patient becomes emaciated. The quantity of saliva and bursal mucus discharged by patients under the influence of mercury varies according to the quantity of medicine employed, and the susceptibility of the patient. When *large* or *poisonous doses* of some of the soluble salts of mercury have been swallowed, gastro-enteritis is produced. The patient complains of an acrid styptic taste in the mouth, a feeling of burning and tightness in the throat ; the face is usually flushed and sometimes swollen ; violent vomiting and purging, frequently of bloody matters, soon come on, the vomiting being increased by everything taken into the stomach ; oftentimes there is irritation of the urinary passages and sometimes suppression of urine ; the pulse is small, frequent, and contracted ; the respiration difficult, the extremities cold ; salivation sometimes occurs. These symptoms terminate in death ; and post-mortem examination discovers inflammation, and its consequences, of the gastro-intestinal membrane.

Absorption of Mercury.—By the external or internal use of mercury the metal becomes absorbed, and is subsequently either deposited in some of the solids of the body, or thrown out of the system by some of the excretories. Mercury has been detected in the blood, in the perspiration, the saliva, the gastro-intestinal secretion, the bile, and the urine. It has also been found, in the metallic state, in the bones, brain, liver, lungs, cellular tissue, &c.

Therapeutics. 1. *Of Metallic Mercury.*—Liquid mercury has been used as a *mechanical* agent to remove obstructions of the bowels : for example, intussusception, or intestinal invagination. But neither theory nor experience seems favourable to its use.

2. *Of the Preparations of Mercury.*—As *alteratives*, they are given in small doses in various chronic diseases ; such, for example, as dyspepsia, gout, chronic skin diseases, and scrofula. Calomel is said to be less beneficial as an alterative than blue pill, on account of its

more irritating action on the bowels. Mercury and chalk is an excellent alterative, especially for children.

Certain preparations of mercury (as blue pill, calomel, and mercury and chalk) are employed as *purgatives*. They promote secretion from the mucous follicles of the intestines, from the liver, and the pancreas. They are rarely, however, used alone; being, in general, either combined with, or followed by, other carthartics (as jalap, senna, colocynth, or the saline purgatives). Thus it is a common practice to exhibit a blue pill or calomel at night, and an aperient draught the following morning: the object being to allow the pill to remain as long as possible in the bowels, in order that it may the more effectually act on the liver. Mercurial purgatives are adminstered for various purposes; sometimes as anthelmintics, sometimes to assist in evacuating the contents of the alimentary canal, but more commonly with the view of promoting the secretions, particularly of the liver, or of producing counter-irritation, and thereby of relieving affections of other organs, as the skin or head. Dr. Prout, however, compares the stimulating effects of mercury to the stimulating effects of dram-drinking, and says that a liver, which has often been stimulated to perform its function by mercury, is seldom influenced by any milder remedy, so that the habit creates the necessity for its continuance. He therefore cautions persons against the abuse or wanton use of mercury, when milder means will suffice.

The great value of mercurials is experienced when they are given as *sialogogues*. Formerly it was supposed that the beneficial effects of mercury were proportionate to the degree of ptyalism; and thus, to eradicate particular affections, it was thought necessary to cause the evacuation of a given quantity of saliva. Modern experience has proved the incorrectness of this notion, and has shown that the good effect of mercurials may generally be gained by a very slight affection of the mouth, sometimes, indeed, without affecting the mouth at all. We now rarely find it necessary to excite a high degree of salivation; indeed, frequently it would be prejudicial, but we sometimes find it requisite to keep up a moderate effect for several weeks, particularly in diseases of a chronic character.

Production of sore mouth and salivation.—One of the most efficacious methods of putting the system under the influence of mercury is *friction* with the ointment of mercury; but the troublesome and unpleasant nature of the process is a strong objection to it in practice, more especially in venereal diseases, in which patients usually desire secrecy. *Fumigation*, as a means of affecting the general system, is an old method of treating venereal diseases. Turner employed for this purpose cinnabar; Lalouette, calomel; and the late Mr. Abernethy, the suboxide. Sir Benjamin Brodie, however, considered fumigation the least efficacious method, and Mr. Colles has frequently seen it fail in exciting salivation. He says, an easy method of fumigating any part is by using *mercurial candles*, composed of cinnabar or oxide of mercury, mixed with melted wax, with a wick, and burnt under a glass funnel. Upon the whole, the most convenient mode of producing salivation is by the *internal use of mercurials*, particularly of those preparations which are mild in their local action, as blue pill, calomel, and mercury and chalk.

Occasionally great difficulty is experienced in affecting the mouth —a circumstance which may arise from the irritable condition of the bowels: and when this is the case, inunction should be resorted to, or opium, or vegetable astringents conjoined. Sometimes, however, the system appears insusceptible to the influence of mercury, and this may arise from idiosyncrasy, or from the presence of some disease, particularly fever. Emetics and blood-letting are useful in these cases, as they promote absorption; and as the influence of the former depends on the state of nausea produced, tartarated antimony will be the best vomit, since it is the most powerful nauseant. Varying the mode of administering the mercury will also sometimes facilitate its operation upon the system: thus, if it have been employed internally, inunction should be tried, and *vice versa*. Children are salivated with difficulty, and old persons less easily than those of middle age. Salivation rarely occurs under two years of age. Dr. Graves attributes this to the salivary glands being most developed in middle age. Salivation is the ordinary indication in adults that the system is beginning to be influenced by mercury, because the salivary glands are usually first affected: but in young children the liver is first affected, and green stools afford the first indication. Some persons, again, are salivated by a single dose, say one or two grains of calomel, while others cannot be salivated at all. Even the external use of mercury (180 grains of mercurial ointment) has produced exfoliation of the jaw and death.

Treatment during Salivation.—During the time that the patient's mouth is sore, he should, if possible, confine himself to the house, use warm clothing, avoid exposure to cold, take light but nourishing food and regulate the state of his stomach and bowels. Mr. Hunter thought that during a mercurial course the manner of living need not be altered; but Mr. Colles has properly, I think, objected to this. If the discharge become excessive, or ulceration of the gums take place, the further use of mercury is of course to be stopped; and in order to moderate the effect already produced, the patient should be very freely exposed to a cold but dry air, use purgatives and opium, and wash his mouth with some astringent and stimulating liquid. I have generally employed, as a gargle, a solution of the chlorinated soda or lime; but in the absence of these, a solution of alum, or of sulphate of copper, may be used. Dr. Watson observes, that 'when the flow of saliva, and the soreness of the gums, form the chief part of the grievance, I have found nothing so generally useful as a gargle made of brandy and water, in the proportion of one part of brandy to four or five of water.' With regard to internal remedies, I have no confidence in any as having a specific power of stopping salivation, though iodine, sulphur, nitrate of potash, and other substances have been strongly recommended. Sometimes sulphate of quinia is administered with advantage. Dr. Farre says, 'I have rarely failed to stop, or at least to check, salivation by a grain of opium given every four or six hours.'

Fever.—It has been said that salivation diminishes the susceptibility to the contagion of fever, whether common or specific; but that it is not an absolute preventive is shown by the fact, that patients under the full influence of mercury have caught fever and died of it. I have several times used mercurials as sialogogues in fever; I believe, for the most part, with advantage. I have only used them when there was some marked local determination or inflammatory condition. I have seen several fatal cases of fever in which mercurials were used profusely without having any affect on the mouth; but in other instances, in which the mouth became affected, recovery took place. My experience, therefore, agrees with that of Dr. Copland, namely, that death, after salivation has been established, is very rare. Whether the recovery was the consequence of the mercurial action, or the salivation the result of the mitigation of the disorder, cannot be positively proved, though I think the first more probable. The great indisposition of the system in fever to take on the mercurial action, is frequently a most annoying circumstance. It may sometimes be overcome by the employment of mercurials both internally and externally. But it is a common and approved practice in the West Indies to give twenty grains of calomel, with or without a similar dose of sulphate of quinia, three times a day at the commencement of yellow fever, with the effect, never of salivating, but of causing the evacuation of thick black pitchy stools. In Germany also it is a common practice to give twenty grains of calomel on alternate nights during the first few days of fever: nor has this practice been without advocates in this country. (See *Lancet*, March 1843.)

The beneficial influence of mercurials has been more particularly experienced in the fevers of warm climates, especially those of the East Indies. It has been said by several writers, that in the yellow fever of the West Indies its beneficial effects are not equally evident.

Inflammation.—Of late years various forms of inflammation have been most successfully combated by the use of mercury. Hence this mineral is termed an *antiphlogistic.* It is principally valuable in adhesive inflammation, to stop, control, or prevent the effusion of coagulable lymph. On the other hand, it may prove injurious in erythematous, scrofulous, malignant, and gangrenous inflammation, as well as in inflammation accompanied with debility or great irritability of the nervous system. It is not equally serviceable in all inflammations. The *nature of the tissue*, the *structure of the organ affected*, and the *quality* or *kind* of inflammation, are points of considerable importance as affecting its use.

Thus it appears that inflammations of *membranous tissues* are those principally benefited by a mercurial plan of treatment; and more especially those in which there is a tendency to the exudation of coagulable lymph or of serous fluid,—as meningitis, pleuritis, pericarditis, and peritonitis (particularly of puerperal women). In inflammation of the lining membrane of the air-tube, but more especially in croup, or, as it is sometimes termed, plastic inflammation of the larynx, mercury is one of our most valuable remedies; and as this disease is one which terminates rapidly, no time should be lost in getting a sufficient quantity of mercury into the system. Calomel is usually employed; but when the bowels are very irritable mercury and chalk, or even mercurial inunction, may be resorted to. In inflammation of the tunics of the eye, particularly iritis, mercury (next to blood-letting) is the only remedy on which much confidence can be placed; and we use it not merely with a view of putting a stop to the inflammatory action, but also in order to cause the absorption of the effused lymph. In inflammation of the synovial membranes, mercury has been employed, and in some cases with manifest advantage. In dysentery, mercury has been extensively used, especially in warm climates. By some, calomel has been employed merely as a purgative; by others to produce its sialogogue effects. Mr. Annesley ('Diseases of India'), at the commencement of dysentery, gave twenty grains of calomel and a grain of opium. In this disease a large dose of calomel has often a sedative effect, allaying tenesmus, and diminishing the action of the bowels.

The *structure of the organ* influences the effect of mercury: at least, it is well known that this mineral is more beneficial in inflammation of certain organs (especially those of a glandular structure, as the liver) than of others; and we refer it to some peculiarity in the structure of the part affected. In hepatitis of either temperate or tropical climates (particularly of the latter), mercury is advantageously employed. Blood-letting, however, should be premised, particularly in the disease as usually met with in this country. In peripneumonia, more especially when hepatisation has taken place, the best effects have sometimes resulted from its use: of course after the employment of blood-letting. When hepatisation has taken place, Dr. Davies recommends the use of blue pill and opium. In acute cases I prefer calomel and opium. In inflammation of the substance of the brain, also, mercury may be advantageously resorted to after the usual depletives.

The *nature* or *quality of the inflammation* also influences the effects and thereby the uses of mercury. Thus in syphilitic inflammation, mercurials are of the greatest utility; less so in rheumatic inflammation; still less in scrofulous, and most decidedly objectionable in cancerous or scorbutic diseases. The treatment of rheumatism by calomel and opium was proposed by Dr. Hamilton, and has found many supporters; and undoubtedly, when the febrile action does not run too high, or when the pericardium becomes affected, calomel and opium, preceded by blood-letting, will be found serviceable. It appears to me best adapted to the fibrous or diffuse form of the disease, and to fail in the synovial. The scrofulous habit is, for the most part, unfavourable to the use of mercury given as a sialogogue, but there are cases in which it is not only admissible but serviceable,—as scrofulous ophthalmia, when of an acute kind. In all maladies of a malignant character (as cancers and fungoid diseases) mercurials are highly objectionable.

Venereal diseases.—It was formerly the opinion of surgeons that the symptoms of the venereal disease were progressive, and never disappeared until mercury was administered; but it has of late years been clearly proved that this notion is erroneous; and we are indebted to some of our army surgeons, for showing that the venereal disease, in all its forms, *may* be cured without an atom of mercury. Moreover it is fully established by the experience of almost every surgeon, that while in some instances mercury exercises a beneficial influence hardly to be observed with respect to any other disease or any other remedy, yet that in some cases it acts most injuriously; and it is generally supposed that many of the bad venereal cases formerly met with arose, in great part, from the improper use of mercury. It is a point, therefore, of considerable importance to determine what cases are best adapted for a mercurial, and what for a non-mercurial, method of treatment; for, in admitting the *possibility* of a cure without this agent, it is not to be inferred that the method is either *eligible* or *expedient*; nay, the very persons who have proved the possibility, admit that in some cases this mineral, given so as to excite moderate salivation, is advisable. One fact is, I think, tolerably well established, namely, that the cure of venereal diseases, without the aid of mercury, is much slower and less secure against relapses than by a mercurial treatment. It is not easy to lay down rules to guide us in the selection of the one or the other of these methods of treatment. Mr. Carmichael relies principally on the eruption, and next to this, on the appearance of the primary ulcer; and of the four forms of the venereal disease which he has described, namely, the *papular*, the *pustular*, the *phagedenic*, and the *scaly*, full courses of mercury are required, he says, in one only, namely the scaly; in which the primary sore is the Hunterian chancre or callous ulcer, and the eruption partakes of the characters of lepra or psoriasis. But it has been satisfactorily proved by experiments made in the military hospitals, that even this scaly form of the disease may get well without mercury; and on the other hand, in the pustular and papular forms, mercury is often a most valuable agent. Hennen, Rose, Guthrie, and Thompson, advise the employment of moderate quantities of mercury whenever the disease does not readily subside under the use of ordinary methods of treatment. But unless some special circumstances contraindicate the use of mercury, it is, I think, advisable to affect the mouth slightly in most forms of the disease.

The following circumstances also deserve attention, as affecting the use of mercury:—Some of the worst and most intractable forms of venereal disease occur in scrofulous subjects; and in such, mercury is in general prejudicial. I have seen numerous instances of its injurious effects. Another point deserving attention in deciding on the use of mercury, is the condition of the primary sore: if it be much inflamed, or of an irritable nature,—if it be of the kind called phagedenic, or at all disposed to slough,—mercury must be carefully avoided, as it increases the disposition to sloughing. In one case that fell under my notice, a gentleman lost his penis by the improper use of mercury, under the circumstances just mentioned.

Cholera.—Writers on the spasmodic cholera, both of this country and of India, speak for the most part favourably of the effects of mercury, especially in the form of calomel. I have met with no writers who attribute ill effects to it. Unfortunately those who advocate its use are not agreed as to the dose, or frequency of repetition: some advising it in small, others in large doses; some as a purgative, others as a sedative, in combination with opium; others, again, using it as a sialogogue. It is deserving of especial notice, that, when salivation takes place, the patient in general recovers.

Dropsy.—In this disease, mercurials may do either good or harm. Thus, when the dropsical effusion depends on inflammation, they may be employed with the best effects, as when hydrocephalus arises from meningitis, or hydrothorax from pleuritis. When ascites is occasioned by an enlarged liver, which compresses the vena portæ, and thereby gives rise to effusion, mercurials are sometimes beneficial. On the contrary, when dropsy occurs in old subjects, and when it depends on, or is accompanied by, general debility, salivation is almost always hurtful. In granular degeneration of the kidney, characterised by an albuminous condition of the urine, its use is highly objectionable. It is of no service to the primary disorder, while its effect on the mouth is often very violent and uncontrollable. When the effusion arises from mechanical causes not removable by mercury, as obliteration of any of the venous trunks, or pressure of malignant tumours, salivation is injurious. Occasionally dropsical effusion takes place without any appreciable cause, and then, of course, if mercury be employed, it must be in part on speculation. In such cases calomel is not unfrequently employed in combination with squills or digitalis.

In chronic diseases of the viscera, especially those arising from or connected with inflammation, mercury is frequently serviceable. Thus, in enlargement or induration of the liver, in hepatisation of the lungs, &c. In those diseases commonly termed malignant, as cancers and fungus hæmatodes, and also in diseases of a non-malignant character, but occurring in debilitated subjects, mercurials, given so as to excite salivation, are objectionable. In diseased spleen they are usually injurious.

In chronic diseases of the nervous system, mercury has been recommended in paralysis, and on some occasions has proved exceedingly efficacious. I have repeatedly seen hemiplegia with impaired vision and hearing, headache, and cramps of the extremities, recover under the use of mercury, after blood-letting and purgatives had failed. In one case the patient (a young man) was kept under the influence of the medicine for two months. Mr. Colles has likewise found it more efficacious in paralysis. In tetanus, mania, epilepsy, hysteria, tic douloureux, and other affections of the nervous system, mercury has been used with occasional benefit.

The foregoing are some of the most important diseases against which mercurials have been successfully administered as sialogogues.

[§ **Emplastrum Ammoniaci cum Hydrargyro.** *Ammoniacum and Mercury Plaster.*

Take of

Ammoniacum	12 ounces.
Mercury	3 ounces.
Olive Oil	1 fluid drachm.
Sublimed Sulphur	8 grains.

Heat the oil, and add the sulphur to it gradually, stirring till they unite. With this mixture triturate the mercury, until globules are no longer visible; and lastly, add the ammoniacum, previously liquefied, mixing the whole carefully.]

The presence of a small quantity of sulphur greatly facilitates the division of the mercury, probably by the formation of a little sulphide of mercury.

[§ **Emplastrum Hydrargyri.** *Mercurial Plaster.*

Take of

Mercury	3 ounces.
Olive Oil	1 fluid drachm.
Sublimed Sulphur	8 grains.
Lead Plaster	6 ounces.

Heat the oil and add the sulphur to it gradually, stirring until they unite; with this mixture triturate the mercury until globules are no longer visible, then add the lead plaster, previously liquefied, and mix the whole thoroughly.]

Therapeutics.—It is used as a discutient in glandular enlargements and other swellings, whether venereal or otherwise, and also to the region of the liver in hepatic complaints.

[§ **Hydrargyrum cum Creta.** *Mercury with Chalk.*

Take of

Mercury, by weight	1 ounce.
Prepared Chalk	2 ounces.

Rub the mercury and chalk in a porcelain mortar until metallic globules cease to be visible to the naked eye, and the mixture acquires a uniform grey colour.

Characters and Tests.—A powder of a light-grey colour; free from grittiness; insoluble in water; partly dissolved by diluted hydrochloric acid, leaving the mercury in a finely divided state. The solution formed with hydrochloric acid is not precipitated by the addition of chloride of tin.] Hydrochloric acid dissolves the chalk, leaving the mercury, and converting any suboxide into calomel. If red oxide of mercury were present, as sometimes happens in old or improperly prepared samples, it would form soluble perchloride, and this would be precipitated by the tin solution;

$$2HgCl_2 + SnCl_2 = 2HgCl + SnCl_4 \text{ and then}$$
$$2HgCl + SnCl_2 = 2Hg + SnCl_4.$$

This preparation, like the Dublin powder, contains one-third of its weight of mercury. The London and Edinburgh powders contained three parts in eight. If the powder be digested in acetic acid, the lime of the chalk is dissolved, and the carbonic acid escapes; but the greater part, if not the whole, of the mercury is insoluble in the acid, and hence it is not in the state of suboxide. If examined by a lens, the residue is found to consist of minute separate globules, which readily whiten silver and gold, showing they are in the metallic state. Hence it is evident that the quicksilver is mechanically divided only.

Therapeutics.—It is a valuable remedy in infantile syphilis. It is frequently employed to promote and improve the secretions of the liver, pancreas, and bowels, in various disordered conditions of the digestive organs accompanied by clay-coloured stools or purging. In strumous affections of children (especially enlarged mesenteric glands), and other chronic maladies, it is administered with great advantage as an alterative.

Administration.—To adults, it is given in doses of from five to twenty grains. It should be given in the form of powder. For children, the dose is two or three grains. Rhubarb, carbonate of soda, or, in some cases, powder of ipecacuan and opium may be conjoined with it.

[§ **Linimentum Hydrargyri.** *Liniment of Mercury.*

Take of

Ointment of Mercury	. . .	1 ounce.
Solution of Ammonia, Liniment of Camphor	of each . .	1 fluid ounce.

Liquefy the ointment of mercury in the liniment of camphor with a gentle heat; then add the solution of ammonia gradually, and mix with agitation.]

Therapeutics.—It is employed externally by means of friction in chronic tumours and in chronic affections of the joints where the object is to excite absorption. It is said to produce salivation more readily than the ointment of mercury, owing to the camphor and ammonia.

[§ **Pilula Hydrargyri.** *Mercurial Pill.*

Take of

Mercury	2 ounces.
Confection of Roses	3 ounces.
Liquorice Root, in fine powder . . .	1 ounce.

Rub the mercury with the confection of roses, until metallic globules are no longer visible, then add the liquorice, and mix the whole well together.]

The friction is usually effected by steam power. By trituration, the metal is reduced to a finely-divided state, and becomes intimately mixed with the confection and liquorice powder. It is a soft mass, of convenient consistence for making into pills, and has a dark-blue colour, from which it has acquired its popular name of *blue pill.* When rubbed on paper or glass it ought to present no globules. Three grains of this pill contain one grain of mercury.

Therapeutics.—The practice of giving a blue pill at night, and a senna draught the following morning, has become somewhat popular, in consequence of its being recommended by the late Mr. Abernethy, in various disorders of the chylopoietic viscera. In doses of five to fifteen grains it frequently acts as a purgative. As an alterative, in doses of two or three grains, blue pill is frequently resorted to. Lastly, it is one of the best internal agents for exciting salivation in the various diseases for which mercury is adapted.

Administration.—The usual form of exhibiting it is in the form of pill, in the dose already mentioned; but it may also be administered when suspended in a thick mucilaginous liquid. If the object be to excite salivation, we may give five grains in the morning, and from five to ten in the evening; and, to prevent purging, opium may be conjoined.

[§ **Unguentum Hydrargyri.** *Ointment of Mercury.*

Take of

Mercury	of each	1 pound.
Prepared Lard		
Prepared Suet		1 ounce.

Rub them together until metallic globules cease to be visible.]

The mercury in this ointment is in a finely-divided metallic state. Guibourt states that, by digesting ether on mercurial ointment, the fatty matter may be dissolved, and liquid mercury obtained in equal weight to that used in making the ointment. It is an unctuous fatty body, of a bluish-grey colour, and if properly prepared gives no traces of globules when rubbed on paper and examined with a magnifier of four powers. A powerful microscope, however, detects innumerable globules. It contains half its weight of mercury.

Therapeutics.—Applied *externally*, it is employed either as a local or constitutional remedy. Thus, as a *local* agent, it is used as a dressing to syphilitic sores, and is rubbed into tumours of various kinds (not those of a malignant nature, as cancer and fungus hæmatodes), with the view of causing their resolution. As a *means of affecting the constitution*, we use mercurial inunctions in syphilis, in inflammatory diseases, and, in fact, in all the cases (already noticed) in which our object is to set up the mercurial action in the system, more especially when the irritable condition of the digestive organs offers an objection to the internal employment of mercurials. It may be laid down as a general rule, that mercury may be used with more safety by the skin than by the stomach; but reasons of convenience, which I have already alluded to, frequently lead us to prefer its internal use.

Administration.—When the object is to excite very speedy salivation, thirty grains may be rubbed into the skin every hour, washing the part each time, and varying the seat of application. If, however, it be not desirable or necessary to produce such speedy effect, thirty grains, or more, rubbed in night and morning, will be sufficient. During the whole course of inunction, the patient should wear the same drawers night and day.

When the friction is performed by a second person, the hand should be enveloped with a soft oiled pig's bladder, turned inside out. Mercurial frictions ought not to be violent, but long continued, and had better be carried on near a fire, in order to promote the liquefaction and absorption of the ointment. In syphilis, and other diseases in which our sole object is the constitutional affection, it matters little to what part of the body the ointment is applied, provided the cuticle be thin (for this layer offers an impediment to absorption in proportion to its thickness). The internal parts of the thighs are therefore usually selected; but in liver complaints, the inunctions are made in the region of that organ. The occasional use of the warm bath promotes absorption when the ointment is applied to the skin.

[§ **Suppositoria Hydrargyri.** *Mercurial Suppositories.*

Take of

Ointment of Mercury	60 grains.
Benzoated Lard, White Wax, of each . . .	20 grains.
Oil of Theobroma	80 grains.

Melt the benzoated lard, wax, and oil of theobroma with a gentle heat, then add the ointment of mercury, and having mixed all the ingredients thoroughly, without applying more heat, immediately pour the mixture, before it has congealed, into suitable moulds of the capacity of fifteen grains; or the fluid mixture may be allowed to cool and then be divided into twelve equal parts, each of which shall be made into a conical or other convenient form for a suppository.]

Hydrargyri Suboxidum. *Suboxide of Mercury.* Hg_2O or $\mathbf{Hg_2O}$.

Synonyms.—Protoxide, grey or black oxide, of mercury (hydrargyri oxidum vel hyd. oxidum cinereum, seu hydr. oxid. nigrum). Mercurous oxide.

Preparation.—It may be prepared by rubbing finely levigated calomel with excess of lime water or solution of potash. In both processes double decomposition takes place; chloride of calcium or of potassium being formed in solution.

Characters.—Pure suboxide of mercury is black, or nearly so. The present preparation is frequently greyish, owing to the presence of some undecomposed calomel. It is readily decomposed by light, and is resolved into metallic mercury and the red oxide. By the action of hydrochloric acid it forms water and calomel; the solution when filtered should give no precipitate with potash nor with solution of chloride of tin. If any red oxide had been dissolved the potash would throw it down yellow and the tin solution black. It is a very unsatisfactory preparation, usually containing variable proportions of the more active and poisonous peroxide.

[§ **Lotio Hydrargyri Nigra.** *Black Mercurial Lotion.*

Take of

Subchloride of Mercury . .	30 grains.
Solution of Lime	10 fluid ounces.

Mix.]

Used as an application to venereal sores.

[§ **Hydrargyri Oxidum Rubrum.** *Red Oxide of Mercury.*
HgO or **HgO**.]

Synonyms.—Hydrargyri nitrico-oxidum, *Lond.* Peroxide or binoxide of mercury. Mercuric oxide. Red precipitate, &c.

History.—This preparation was known to Raymond Lully in the latter part of the thirteenth century. The old process consisted in keeping mercury heated to 600° in a convenient vessel for a considerable time.

Preparation.—[§ Take of

Mercury, by weight . . .	8 ounces.
Nitric Acid	$4\frac{1}{2}$ fluid ounces.
Water	2 fluid ounces.

Dissolve half the mercury in the nitric acid diluted with the water, evaporate the solution to dryness, and with the dry salt thus obtained triturate the remainder of the mercury until the two are uniformly blended together. Heat the mixture in a porcelain dish with repeated stirring, until acid vapours cease to be evolved; and when cold, enclose the product in a bottle.]

When mercury and diluted nitric acid are digested together, pernitrate of mercury is formed, while nitric oxide escapes, and this, combining with the oxygen of the air, becomes peroxide of nitrogen.

$$3Hg + 8HNO_3 = 3Hg2NO_3 + 2NO + 4H_2O.$$

When this is mixed with fresh mercury and heated, it is decomposed, peroxide of nitrogen given off, and red oxide of mercury remains. $Hg2NO_3 + Hg = 2HgO + 2NO_2$.

[§ *Characters and Tests.*—An orange-red powder readily dissolved by hydrochloric acid, yielding a solution which, with caustic potash added in excess, gives a yellow precipitate (oxide of mercury), and with solution of ammonia a white precipitate (ammoniated mercury). Entirely volatilised by a heat under redness, being at the same time decomposed into mercury and oxygen. If this be done in a test-tube no orange vapours are perceived (showing its freedom from undecomposed nitrate).] Dissolves without residue in hydrochloric acid (proving the absence of a lower oxide and of calomel).

Therapeutics.—As an external agent, it is used in the form of levigated powder or ointment; the latter is officinal. As a caustic, it is sprinkled over spongy excrescences, venereal warts, chancres, and indolent fungous ulcers.

[§ **Unguentum Hydrargyri Oxidi Rubri.** *Ointment of Red Oxide of Mercury.*

Synonym.—Unguentum hydrargyri nitrico-oxidi, *Lond.*

Take of

Red Oxide of Mercury, in very fine powder	62 grains.
Yellow Wax	$\frac{1}{4}$ ounce.
Oil of Almonds	$\frac{3}{4}$ ounce.

Melt the wax at a gentle heat, mix the oil with it, and when the mixture is nearly cold add the oxide of mercury, and mix the whole thoroughly together.]

This ointment, when made with white wax or with lard, becomes slate-coloured, in consequence of the partial reduction of the oxide of mercury.

Therapeutics.—It is a valuable stimulant, and as such is frequently applied to indolent sores and ulcers, when we require to increase the quantity and improve the quality of the discharge; also to inflamed eyelids, and chronic conjunctivitis.

[§ **Lotio Hydrargyri Flava.** *Yellow Mercurial Lotion.*

Take of

Perchloride of Mercury	18 grains.
Solution of Lime	10 fluid ounces.

Mix.]

[§ **Hydrargyri Sulphas.** *Sulphate of Mercury.*

HgO,SO_3 or $\mathbf{HgSO_4}$.

Take of

Mercury, by weight . . .	20 ounces.
Sulphuric Acid	12 fluid ounces.

Heat the mercury with the sulphuric acid in a porcelain vessel, stirring constantly until the metal disappears, then continue the heat until a dry white salt remains.]

The mercury decomposes the acid with evolution of sulphurous acid gas and vapour of water, and sulphate of mercury remains.

$$\mathbf{Hg + 2H_2SO_4 = HgSO_4 + 2H_2O + SO_2}.$$

[§ *Characters and Tests.*—A white crystalline heavy powder, rendered yellow by affusion of water (basic sulphate or turpeth mineral). Entirely volatilised by heat.]

Used in the production of calomel and corrosive sublimate.

Hydrargyri Subsulphas Flavus. *Yellow Subsulphate of Mercury.*

HgO,SO_3+2HgO or $\mathbf{HgSO_4.2HgO}$.

Synonym.—Turpeth or turbith mineral.

Take of

Sulphate of Mercury	1 ounce.
Boiling distilled Water	1 pint.

Triturate them together in an earthen mortar, and afterwards pour off the supernatant liquor. Wash the yellow powder that remains with distilled water several times repeated, and finally dry the powder.

Physiological effects.—It occasions nausea, vomiting, and ptyalism. Taken into the nostrils it excites sneezing.

Dose, as an alterative, $\frac{1}{2}$ grain to 1 grain; as an emetic, 3 to 5 grains; as an errhine, 1 grain mixed with 4 or 5 grains of starch or liquorice powder.

[§ **Hydrargyri Subchloridum.** *Subchloride of Mercury.*

Hg_2Cl or $\mathbf{HgCl}$.]

Synonyms.—Hydrargyri chloridum, *Lond.* Calomelas, 1864, *Edin.*, *Dubl.* Mercurous chloride. Protochloride of mercury, &c.

History.—Beguin in 1608 and Oswald Croll in 1609 are the first

Europeans who mention this compound. It is said to have been long known to the natives of Thibet. Its discoverer is unknown.

The term *calomel* (*calomelas*, from καλὸς, *good*, and μέλας, *black*) was first used by Sir Theodore Turquet de Mayenne (who died in 1655), in consequence, as some say, of his having had a favourite black servant who prepared it; or, according to others, because it was a *good* remedy for the *black* bile. *Drago mitigatus*, *aquila alba*, *manna metallorum* and *panchymagogum minerale*, are some of the older appellations for it. *Mercurius dulcis*, and *hydrargyrum muriaticum mite*, are some of the more modern synonyms of it.

Preparation.—[§ Take of

Sulphate of Mercury	10 ounces.
Mercury	7 ounces.
Chloride of Sodium, dried . . .	5 ounces.
Boiling distilled Water . . .	a sufficiency.

Moisten the sulphate of mercury with some of the water, and rub it and the mercury together until globules are no longer visible; add the chloride of sodium, and thoroughly mix the whole by continued trituration. Sublime by a suitable apparatus into a chamber of such size that the calomel, instead of adhering to its sides as a crystalline crust, shall fall as a fine powder on its floor. Wash this powder with boiling distilled water, until the washings cease to be darkened by a drop of sulphide of ammonium. Finally, dry at a heat not exceeding 212°, and preserve in a jar or bottle impervious to light.]

By the mutual action of sulphate of mercury, mercury, and chloride of sodium upon each other when heated, sulphate of soda is formed, and calomel rises in vapour;

$$HgSO_4 + Hg + 2NaCl = 2HgCl + Na_2SO_4.$$

A small quantity of corrosive sublimate ($HgCl_2$) may be also formed, which is removed by washing.

Calomel was formerly prepared by precipitation; as by mixing solutions of mercurous nitrate and chloride of sodium.

[§ *Characters and Tests.*—A dull-white, heavy, and nearly tasteless powder, rendered yellowish by trituration in a mortar: insoluble in water, spirit, or ether. Digested with solution of potash, it becomes black; and the clear solution, acidulated with nitric acid, gives a copious white precipitate with nitrate of silver. (Potash converts the calomel into suboxide, with the formation of chloride of potassium, with which nitrate of silver occasions a white precipitate of chloride of silver, insoluble in nitric acid.) Contact with hydrocyanic acid also darkens its colour. It is entirely volatilised by a sufficient heat. Warm ether which has been shaken with it in a bottle leaves, on evaporation, no residue (showing its freedom from earthy impurities, and from corrosive sublimate which is soluble in ether).] Mixed with carbonate of soda, and heated, it yields a sublimate of liquid globules of metallic mercury. Solution of chloride of tin decomposes it: the products are perchloride of tin and metallic mercury, $2HgCl + SnCl_2 + 2Hg + SnCl_4$.

Therapeutics.—Calomel is very frequently used as an *alterative* in glandular affections, chronic skin diseases, and disordered conditions of the digestive organs, more particularly in those cases which are connected with hepatic derangement. For this purpose it is usually taken in combination with other alteratives, as in the well-known Plummer's Pill, which will be presently noticed. It is very frequently employed as a *purgative*, though on account of the uncertainty of its cathartic effects it is seldom given alone; generally in combination with other drastic purgatives—such as jalap, scammony, or compound extract of colocynth, the activity of which it very much promotes. We employ it for this purpose when we are desirous of relieving affections of other organs, on the principle of counter-irritation. Thus in threatened apoplexy, in mental disorders, in dropsical affections, and in chronic diseases of the skin. In torpid conditions of the bowels, where it is necessary to use powerful cathartics to produce alvine evacuations, as in paralytic affections, it is advantageously combined with other purgatives. Sometimes we use it to promote the biliary secretion—as in jaundice and other affections of the liver, in chronic skin diseases, and in various disordered affections of the alimentary canal not accompanied by inflammation. Moreover, in the various diseases of children requiring the use of purgatives, it is generally considered to be very useful; and its being devoid of taste is of course an advantage. As a *sedative*, it has been administered in yellow fever, spasmodic or malignant cholera, dysentery and liver affections. As a *sialogogue*, it may be used in the cases in which I have already stated that mercurials generally are employed: with the view of preventing irritation of the alimentary canal, it is usually given in combination with opium, unless the existence of some affection of the nervous system contraindicates the use of narcotics. This combination is employed in peripneumonia, pleuritis, croup, laryngitis, hepatitis, enteritis, and other inflammatory diseases; in fever, syphilis, and chronic visceral diseases. Calomel is frequently combined with other medicines to increase their effects; as with squill, to produce *diuresis*, in dropsy; or with antimonials, to promote *diaphoresis*. As an *anthelmintic* it is in frequent use, and forms one of the active ingredients of many of the nostrums sold for worms.

Calomel is also used *locally*. It is sometimes suspended in thick mucilage, and used as a gargle in venereal sore-throat, or injected into the urethra in blennorrhœa. Now and then it is used as a substitute for cinnabar in fumigation. As a local application, in the form of ointment, calomel is one of the most useful remedies we possess for the cure of several forms of the chronic skin diseases.

Administration.—When used as an *alterative*, it is given in doses of from half a grain to a grain, frequently combined with sulphurated antimony (as in *Plummer's Pill*) or antimonial powder, and repeated every or every other night; a mild saline laxative being given the following morning. As a *purgative*, from two to five grains are given usually in combination with, or followed by, the use of other purgatives, especially jalap, senna, scammony, or colocynth. As a *sialogogue*, it is exhibited in doses of one to three or four grains, generally combined with opium or Dover's powder, twice or thrice a day. As a *sedative*, the dose is from twenty to thirty grains or more. The use of acids with calomel frequently occasions griping. Calomel is most extensively employed in the diseases of children, and may be given to them in as large or proportionately larger doses than to adults.

[§ **Pilula Hydrargyri Subchloridi Composita.** *Compound Pill of Subchloride of Mercury.*

Synonym.—Pilula calomelanos composita, 1864, *Edin. and Dubl.*

Take of

Subchloride of Mercury, Sulphurated Antimony	of each 1 ounce.
Guaiacum resin, in powder	2 ounces.
Castor Oil	1 fluid ounce, or a sufficiency.

Triturate the subchloride of mercury with the antimony, then add the guaiacum resin and castor oil, and beat the whole into a uniform mass.]

A little stronger than the London and Edinburgh pills, which contain one grain of calomel in six. This, like the Dublin, contains one grain in five.

Therapeutics.—This preparation is commonly known as *Plummer's Pill.* It is frequently employed as an alterative in chronic skin diseases, in the papular and pustular forms of the venereal disease, in chronic liver affections, and in various disordered conditions of the digestive organs.

Dose, from 5 to 10 grains.

[§ **Unguentum Hydrargyri Subchloridi.** *Ointment of Subchloride of Mercury.*

Synonym.—Unguentum calomelanos, 1864.

Take of

Subchloride of Mercury	80 grains.
Prepared Lard	1 ounce.

Mix thoroughly.]

Therapeutics.—This is a most valuable application in porrigo favosa, impetigo, herpes, and the scaly diseases (psoriasis and lepra). It might be also used as an inunction.

[§ **Hydrargyri Perchloridum.** *Perchloride of Mercury.* HgCl or $\mathbf{HgCl_2}$.

Synonyms.—Hydrargyrum corrosivum sublimatum, 1864. Hydrargyri bichloridum, *Lond.* Sublimatus corrosivus, *Edin.* Sublimatum corrosivum, *Dubl.* Corrosive sublimate.] Mercuric chloride.

History.—We have no account of the discovery of this preparation. Geber described the method of preparing it; but it is supposed to have been known long anterior to him.

[§ Take of

Sulphate of Mercury	20 ounces.
Chloride of Sodium, dried . . .	16 ounces.
Black Oxide of Manganese, in fine powder	1 ounce.

Reduce the sulphate of mercury and the chloride of sodium each to fine powder, and having mixed them and the oxide of manganese thoroughly by trituration in a mortar, put the mixture into an apparatus adapted for sublimation, and apply sufficient heat to cause vapours of perchloride of mercury to rise into the less heated part of the apparatus which has been arranged for their condensation.]

When sulphate of mercury and chloride of sodium are heated together double decomposition takes place, sulphate of soda being formed and corrosive sublimate rising in vapour, $\mathbf{HgSO_4} + 2\mathbf{NaCl} = \mathbf{HgCl_2} + \mathbf{Na_2SO_4}$. The oxide of manganese is added to prevent the formation of calomel by liberating a little chlorine.

[§ *Characters and Tests.*—In heavy colourless masses of prismatic crystals, possessing a highly acrid metallic taste; more soluble in alcohol, and still more so in ether, than in water. Its aqueous solution gives a yellow precipitate with caustic potash (oxide of mercury), a white precipitate with ammonia (ammoniated mercury), and a curdy white precipitate with nitrate of silver (chloride of silver). When heated it sublimes without decomposition or leaving any residue.]

Properties.—Albumen forms a white precipitate with an aqueous solution of corrosive sublimate. This precipitate is slightly soluble in water, especially when excess of albumen is present. Fibrin forms a similar white compound. When albuminous and fibrinous textures are immersed in a solution of this salt, combination takes place, the tissue contracts, increases in density, becomes whiter, and does not putrefy. Hence it is employed by the anatomist for hardening and preserving certain parts of the body, as the brain. Corrosive sublimate is soluble in fifteen parts of water and in seven of rectified spirit. The aqueous solution reddens litmus, and unites with the alkaline chlorides, forming double salts. Litmus, which has been reddened by a solution of corrosive sublimate, has its blue colour restored by chloride of sodium. Corrosive sublimate is recognised by the following characters. *Heated* in a tube, by a spirit lamp, with caustic, or the carbonated fixed alkalies, an alkaline chloride is formed, oxygen, and if a carbonate be used, carbonic acid gas is evolved, and metallic mercury is sublimed and condensed in the form of globules on the sides of the tube. The fused residue in the tube, if dry carbonate of soda be used, is chloride of sodium. This may be dissolved in water acidulated with nitric acid, and then tested by nitrate of silver. In this way the presence of chlorine as the combining ingredient of the mercury is established. *Iodide of potassium* occasions a scarlet precipitate (HgI_2) soluble in excess either of iodide of potassium or of corrosive sublimate; the precipitate frequently appears at first of a yellow colour, though it quickly becomes scarlet. *Chloride of tin* added in excess causes first a white precipitate (*calomel*),

$$2HgCl_2 + SnCl_2 = 2HgCl + SnCl_4,$$

and afterwards a greyish powder of mercury, which falls down in a finely-divided state. $2HgCl + SnCl_2 = 2Hg + SnCl_4$. *Sulphuretted hydrogen* in excess passed through a solution of corrosive sublimate occasions a black precipitate (HgS).

Galvanism.—Drop the suspected solution on a piece of gold as a sovereign, and apply a key so that it may touch simultaneously the gold and the solution; an electric current is immediately produced, the perchloride is decomposed, the mercury attaches itself to the negative electrode, namely, the gold, while the chlorine unites with the iron of the positive electrode or pole. The silvery stain left on the gold is readily removed by heat.

Physiological Effects.—In *small or therapeutic doses* it frequently exerts a beneficial effect on syphilitic and other diseases without producing any obvious alteration in the action of the different organs. Occasionally, especially when the stomach and bowels are in an irritable condition, it gives rise to a sensation of warmth in the epigastrium, and causes nausea, griping, and purging. In such cases it is best to diminish the dose and conjoin conium or opium. Continued use of it often causes diaphoresis if the skin is kept warm, while at other times the quantity of urine is increased. It may cause salivation, but corrosive sublimate has less tendency to produce this effect than the other preparations of mercury. *In somewhat larger doses, or by the long-continued use of small doses,* gastro-enteritis and all the usual constitutional effects of mercury are brought on, as heat and griping pain in the alimentary canal, particularly in the stomach and rectum, loss of appetite, nausea, vomiting, purging, and disordered digestion. The pulmonary organs also not unfrequently become affected, and the patient complains of dry cough, pain in the chest, disordered respiration, and bloody expectoration. These symptoms agree with the following results obtained by Dr. Christison in his experiments on animals. 'Corrosive sublimate causes, when swallowed, corrosion of the stomach; and in whatever way it obtains entrance into the body, irritation of that organ and of the rectum, inflammation of the lungs, depressed action, and perhaps, also, inflammation of the heart, oppression of the functions of the brain, and inflammation of the salivary glands.' *In very large doses* it acts as a caustic poison in virtue of its affinity for albumen fibrin and the other constituents of the tissues, and produces violent irritation of the alimentary canal, flushed countenance and a whitened condition of the epithelium of the mouth, often followed sooner or later by profuse salivation and ulceration of the mouth with great fetor of the breath.

Therapeutics.—Internally, it has been employed as a sialogogue, alterative, and diaphoretic. It has been employed with varying degrees of success as a remedy for *venereal diseases*; but the balance of evidence is decidedly favourable to the employment of corrosive sublimate in such cases. By its partisans, it has been asserted to be a safe and efficacious mercurial for the removal of venereal symptoms in a very short space of time, and without causing salivation, merely by exciting diaphoresis. Its opponents state, on the other hand, that other mercurials are quite as effectual and speedy; that the cure by corrosive sublimate is not permanent; and lastly, that its corrosive and irritant properties render its employment objectionable. During the time the patient is under its influence, he should adopt a sudorific regimen, and take decoction of sarsaparilla. In various *chronic diseases* it has been given as an *alterative* and *diaphoretic* with occasional success. Thus in rheumatism, diseases of the bones, periodical pains, skin diseases, scrofulous affections, and disorders of the nervous system. In such it should be associated with diaphoretics (as antimony or sarsaparilla) and warm clothing. Not unfrequently opiates should be combined with it. Corrosive sublimate is a valuable *sorbefacient* in old dropsical complaints, as those arising from diseased heart, liver, or lungs. Under its use I have repeatedly seen dropsical symptoms disappear.

As an *external* remedy, it has been employed as a *caustic* in substance. In onychia maligna, it is used with great advantage, mixed with an equal weight of sulphate of zinc, and sprinkled thickly upon the surface of the ulcer, which is then to be covered with a pledget of lint saturated with tincture of myrrh. A *solution* has been employed for various purposes: thus by Baumé for pediluvia, to produce salivation; as a lotion in chronic skin disease, as lepra, psoriasis, and scabies; as a wash to ulcers, particularly those of a venereal nature; as an injection in discharges from the urinary organs; as a collyrium in chronic diseases of the eye, especially those of a venereal nature; and as a gargle in ulcers of the tonsils. In obstinate gleet, where the constitution is not very irritable, an injection of a solution of corrosive sublimate is frequently very serviceable. I am informed that a most effective remedy for the contagious porrigo which spreads amongst children in schools, is an ointment composed of from half to two grains of corrosive sublimate to an ounce of lard.

Administration.—It may be used internally in substance or solution. The *dose* of it in substance is from one-sixteenth to one eighth of a grain. Some advise it to be given to the extent of one-fourth of a grain, but in this dose it is very apt to gripe and purge. In solution, it may be exhibited dissolved in water, alcohol, or ether.

For *external use*, a watery solution may be employed, containing from half a grain to two or three grains, dissolved in one ounce of distilled water. As an injection in gonorrhœa, from gr. $\frac{1}{8}$ to $\frac{1}{4}$ may be dissolved in an ounce of water.

Antidotes.—Several substances which decompose corrosive sublimate have been employed as antidotes; but the only efficacious antidotal treatment consists in the administration of albuminous substances. When corrosive sublimate is mixed with *albumen*, a compound is formed whose chemical action on the tissues is slight as compared with that of the corrosive sublimate itself. Hence the whites and yolks of eggs, milk, and a mixture of wheat-flour, oatmeal (or barley meal), and water, are used as antidotes. Baron Thénard, the celebrated chemist, inadvertently swallowed a concentrated solution of corrosive sublimate, but by the immediate use of whites of eggs suffered no material harm. Peschier states that one egg is required for every four grains of the poison. Albumen retards, but does not prevent the absorption of the poison, and consequently does not preclude the production of the constitutional effects of corrosive sublimate.

[§ **Liquor Hydrargyri Perchloridi.**
Solution of Perchloride of Mercury.

Synonym.—Liquor hydrargyri bichloridi, *Lond.*

Take of

Perchloride of Mercury, Chloride of Ammonium	of each . .	10 grains.
Distilled Water	. . . . .	1 pint.

Dissolve.

Dose, $\frac{1}{2}$ fluid drachm to 2 fluid drachms.]

[§ **Hydrargyrum Ammoniatum.** *Ammoniated Mercury.*
NH_2Hg_2Cl or $\mathbf{NH_2HgCl}$.]

Synonyms.—Hydrargyri ammonio-chloridum, *Lond.*, *Dubl.* Hydrargyri præcipitatum album, *Ed.* Ammonio-chloride of mercury. Amido-chloride of mercury. Chloride of mercur-ammonium.

History.—Discovered by Raymond Lully in the thirteenth century.

[§ Take of

Perchloride of Mercury . . .	3 ounces.
Solution of Ammonia . . .	4 fluid ounces.
Distilled Water	3 pints.

Dissolve the perchloride of mercury in the water with the aid of a moderate heat; mix the solution with the ammonia, constantly stirring; collect the precipitate on a filter, and wash it well with cold distilled water until the liquid which passes through ceases to give a precipitate when dropped into a solution of nitrate of silver, acidulated by nitric acid. Lastly, dry the product at a temperature not exceeding 212°.]

By the addition of ammonia to a solution of corrosive sublimate, a white precipitate of the ammoniated mercury is formed, while there remains in solution half the chlorine of the corrosive sublimate, combined with ammonium as chloride of ammonium, which is removed by washing.

$$HgCl_2 + 2NH_4HO = NH_2HgCl + NH_4Cl + 2H_2O.$$

[§ *Characters and Tests.*—An opaque white powder on which cold water, alcohol, and ether have no action. Digested with caustic potash, it evolves ammonia, acquiring a pale yellow colour (**HgO**), and the fluid, filtered, and acidulated with nitric acid, gives a white precipitate with nitrate of silver (in consequence of the formation of chloride of potassium). Boiled with a solution of chloride of tin it becomes grey, and affords globules of metallic mercury. Entirely volatilised at a heat under redness (evidencing its freedom from earthy fixed salts, &c.).]

This preparation is sometimes adulterated with chalk and carbonate of lead. Mr. Borland ('Ph. Journ.,' 2nd ser., vol. ix. p. 262), has also found in several specimens, that the *fusible* white precipitate, $\mathbf{N_2H_6Hg''Cl_2}$, prepared according to the process of the London Pharm. 1824, has been substituted for the officinal compound, from which it may be distinguished by the fact that on the application of heat it fuses before being volatilised. It contains less mercury.

Therapeutics.—It is employed as an external agent only; commonly in the form of an ointment. It is an efficacious application in various skin diseases—as porrigo, impetigo, herpes, and even scabies; also in ophthalmia tarsi. Among the lower classes it is commonly used to destroy pediculi.

Antidote.—Albumen. The speedy expulsion of the poison from the stomach.

[§ **Unguentum Hydrargyri Ammoniati.** *Ointment of Ammoniated Mercury.*

Synonym. — Unguentum hydrargyri ammonio-chloridi, *Lond.* Unguentum præcipitati albi, *Ed.*

Take of

Ammoniated Mercury	62 grains.
Simple Ointment	1 ounce.

Mix thoroughly.]

Therapeutics.—Stimulant, alterative, and detergent. It is used as already mentioned in various skin diseases.

Dr. Tilbury Fox considers the proportion of ammoniated mercury in this ointment much greater than is necessary or desirable. He considers five or six grains to the ounce sufficiently strong for nearly all purposes for which it is applied. When made with the smaller proportion of precipitate, it is advantageous to levigate it with a little oil before adding the ointment.

[§ **Hydrargyri Iodidum Viride.** *Green Iodide of Mercury.*

Synonym.—Hydrargyri iodidum, *Lond.*

Hg_2I or $\mathbf{HgI}$.

Take of

Mercury, by weight	1 ounce.
Iodine	278 grains.
Rectified Spirit	a sufficiency.

Rub the iodine and mercury in a porcelain mortar, occasionally moistening the mixture with a few drops of the spirit, and continue the trituration until metallic globules are no longer visible, and the whole assumes a green colour. The product thus obtained should be dried in a dark room, on filtering paper, by simple exposure to the air, and preserved in an opaque bottle.]

In this process the mercury and iodine enter into combination. Some red iodide is usually first produced, and is afterwards transformed into the green iodide by uniting with mercury. The spirit prevents the sudden and energetic action, attended with evolution of heat and dissipation of iodine, which would occur if the mercury and iodine were rubbed together alone.

[§ *Characters and Tests.*—A dull green powder insoluble in water, which darkens in colour upon exposure to light. When it is shaken in a tube with ether nothing is dissolved (showing its freedom from red iodide). Gradually heated in a test-tube, it yields a yellow sublimate, which upon friction, or after cooling, becomes red (red iodide of mercury), while globules of metallic mercury are left in the bottom of the tube ($\mathbf{2HgI = Hg + HgI_2}$).]

Mr. C. H. Wood has shown that the *green* iodide, prepared strictly according to the Pharmacopœia, invariably contains some proportion of the red iodide; and that true mercurous iodide, which may be obtained by continuing the trituration, has a yellow colour.

Therapeutics.—It has been used in syphilis and scrofula, especially when they occur in the same individual. Lugol employed an ointment of it in those forms of external scrofulous disease which resemble syphilis. Ricord gave it internally with good effect in syphilis infantum. Biett has successfully employed it in syphilitic ulceration and venereal eruptions. He considered it to be one of the most valuable preparations of mercury in the treatment of syphilis. The great objection to it however is, that it cannot be kept in a uniform and definite state, owing to its rapid conversion into red iodide and mercury.

Administration.—The *dose* of it for adults is from one grain gradually increased to three or four. Ricord gave from one-sixth to one-half of a grain to children of six months old. Biett employed it internally, and also externally, in the form of ointment, to the extent of twelve or fourteen grains daily, by way of friction.

[§ **Hydrargyri Iodidum Rubrum.** *Red Iodide of Mercury.*

Synonym.—Hydrargyri biniodidum, *Lond.* and *Edinb.*

$$HgI \text{ or } \mathbf{HgI_2}$$

Take of

Perchloride of Mercury	4 ounces.
Iodide of Potassium	5 ounces.
Boiling distilled Water	4 pints.

Dissolve the perchloride of mercury in three pints, and the iodide of potassium in the remainder of the water, and mix the two solutions. When the temperature of the mixture has fallen to that of the atmosphere, decant the supernatant liquor from the precipitate, and, having collected the latter on a filter, wash it twice with cold distilled water, and dry it at a temperature not exceeding 212°.]

A simple interchange of metals; $\mathbf{HgCl_2 + 2KI = HgI_2 + 2KCl}$. Red iodide of mercury being slightly soluble in hot water, it is necessary to allow the mixed solutions to cool before separating the precipitate.

[§ *Characters and Tests.*—A crystalline powder of a vermilion colour, becoming yellow when gently heated over a lamp on a sheet of paper; almost insoluble in water, dissolves sparingly in alcohol, but freely in ether, or in an aqueous solution of iodide of potassium. When digested with solution of soda it assumes a reddish-brown colour, and the fluid cleared by filtration and mixed with solution of starch gives a blue precipitate on being acidulated with nitric acid. Entirely volatilised by a heat under redness.]

By the action of soda on red iodide of mercury red oxide of mercury is formed, and iodide of sodium remains in solution,

$$\mathbf{HgI_2 + 2NaHO = HgO + 2NaI + H_2O,}$$

from which nitric acid eliminates free iodine,

$$\mathbf{6NaI + 8HNO_3 = 6NaNO_3 + 3I_2 + 4H_2O + 2NO.}$$

It should be remembered that the red iodide of mercury is easily dissolved by both iodide of potassium and corrosive sublimate, with formation of double salts. It is separable from the green iodide by its solubility in ether. Periodide of mercury is a dimorphous substance; its colour and crystalline form varying with the temperature. The yellow crystals of periodide belong to the right prismatic system; they are not permanent, but readily pass into the red octahedral variety.

Physiological Effects.—It is a powerful irritant and caustic, nearly as powerful as, or in the opinion of Rayer more powerful than, corrosive sublimate. Applied to ulcers in the form of ointment I have known it to cause excruciating pain. Left in contact with the skin for a while it induces, says Hayer, a most intense erysipelatous inflammation. It requires to be administered internally with great caution. Like other mercurial compounds, its repeated use causes salivation.

Therapeutics.—It has been employed in the same cases (i.e. syphilis and scrofula) as the green iodide of mercury, than which it is much more energetic. It has been employed by M. Cazenave in cases of lupus. Breschet applied it, in the form of ointment, with great success, in a case of obstinate ulceration (thought to have been carcinomatous) of the angle of the eye. In the form of the officinal ointment it has been used in opacity of the cornea. In obstinate ophthalmia tarsi, with thickening of the meibomian glands, it has also been successfully employed. It is most effective in bronchocele.

Administration.—It should be given in *doses* of one-sixteenth of a grain, gradually increased to one-fourth of a grain. It may be exhibited in the form of pills, or dissolved in alcohol or ether.

[§ **Unguentum Hydrargyri Iodidi Rubri.** *Ointment of Red Iodide of Mercury.*

Take of

Red Iodide of Mercury, in fine powder .	16 grains.
Simple Ointment	1 ounce.

Mix thoroughly.]

This ointment contains one-fourth as much red iodide of mercury as unguentum hydrargyri iodidi rubri, *Dubl.*

[§ **Liquor Hydrargyri Nitratis Acidus.** *Acid Solution of Nitrate of Mercury.*]

Mercuric nitrate, HgO,NO_5 or $\mathbf{Hg2NO_3}$, in solution in nitric acid.

[§ Take of

Mercury	4 ounces.
Nitric Acid	5 fluid ounces.
Distilled Water	$1\frac{1}{2}$ fluid ounce.

Mix the nitric acid with the water in a flask; and dissolve the mercury in the mixture without the application of heat. Boil gently for fifteen minutes, cool, and preserve the solution in a stoppered bottle.]

The mercury is dissolved by the nitric acid, with evolution of nitric oxide, $3Hg + 8HNO_3 = 3(Hg2NO_3) + 4H_2O + 2NO$. The acid solution is boiled in order to ensure the formation of the pernitrate, and also to get rid of the binoxide of nitrogen.

[§ *Characters and Tests.*—A colourless and strongly acid solution, which gives a yellow precipitate with solution of potash added in excess (mercuric oxide, HgO). If a crystal of sulphate of iron be dropped into it, in a little time the salt of iron, and the liquid in its vicinity, acquire a dark colour (owing to the formation and solution of binoxide of nitrogen, NO). Specific gravity 2·246. Does not give any precipitate when a little of it is dropped into hydrochloric acid diluted with twice its volume of water (showing its freedom from subnitrate).]

Therapeutics.—It is often employed in the Parisian hospitals as a caustic. Biett frequently employed it with success in lupus. It should be applied to the extent of a crown-piece, by means of a brush, to the ulcers, tubercles, and scars which remain soft or purple, and seem on the point of breaking: lint moistened with the solution is then to be applied to the cauterised surface. The parts immediately become white, a kind of erysipelatous inflammation is set up in the surrounding parts, and in a few days a yellow scab gradually falls off. This solution is also used for the cauterisation of the ulcerated cervix uteri. When the inflammation is intense, the ulceration large, and the granulations redundant or unhealthy, it exercises a very prompt and beneficial influence, generally cleansing and modifying the sore in one application. In very slight ulcerations, however, I think it is too powerful a remedy. It has been used by Recamier as a caustic in cancerous diseases. He thinks it acts specifically, and modifies the vital actions of the surrounding parts. The acute pain which its application causes is alleviated by a strong solution of opium. Godard employed it in herpes exedens. It has likewise been used with success in a great variety of other cases—as syphilitic and scrofulous ulcers, condyloma, obstinate lepra and psoriasis, and porrigo favosa. By its *local use* the constitutional effects of mercury have been produced. Breschet has seen salivation induced by one application of it to the ulcerated neck of the uterus. To prevent absorption, Mialhe recommends that the cauterised part should be washed immediately after the application of the caustic.

[§ **Unguentum Hydrargyri Nitratis.** *Ointment of Nitrate of Mercury.*

Synonym.—Unguentum citrinum, *Ed.*

Take of

Mercury, by weight	4 ounces.
Nitric Acid	12 fluid ounces.
Prepared Lard	15 ounces.
Olive Oil	32 fluid ounces.

Dissolve the mercury in the nitric acid with the aid of a gentle heat; melt the lard in the oil, by a steam or water bath, in a porcelain vessel capable of holding six times the quantity; and, while the mixture is hot (about 180°), add the solution of mercury, also hot, mixing them thoroughly. If the mixture do not froth up, increase the heat till this occurs. Keep it stirred until it is cold.]

By the action of concentrated nitric acid on mercury, pernitrate of mercury is produced,

$$3Hg + 8HNO_3 = 3(Hg2NO_3) + 4H_2O + 2NO,$$

which is dissolved in the excess of nitric acid used. When the solution is mixed with the lard and olive oil, a portion of elaïdine is produced by the action of nitrous or hyponitrous acid on the fat and oil, as well as a red viscid oil. Soubeiran says, that carbonic acid and nitric oxide gases are evolved. This ointment has a fine lemon-yellow colour, a butyraceous consistence, and a peculiar nitrous odour. It contains more acid than the London ointment, and the proportions of lard and oil are reversed. It also retains its buttery consistence better. It is very apt to become grey when mixed with other ointments, in consequence of their deoxidising powers; and to prevent this, a considerable excess of nitric acid is ordered. It should be spread with wooden or ivory spatulas. Elaïdine is a white saponifiable fat, fusible at 97° F., very soluble in ether, but requiring 200 times its weight of boiling alcohol to dissolve it. It has the same composition as oleine.

Therapeutics.—It is employed as a stimulant and alterative in *chronic diseases of the skin*, more particularly those affecting the hairy scalp, as the different forms of porrigo, in which it is exceedingly efficacious. It is also used as a dressing to *ulcers*, to stimulate and cleanse them—as in foul syphilitic sores, and phagedenic ulcers. Lastly, it is employed in *ophthalmic diseases*, more particularly ophthalmia tarsi, in which it is applied (mixed with its own weight of almond oil) by means of a camel's hair pencil to the lids, frequently with such advantage that some have regarded it as a specific in this complaint. More frequently, however, it is used recently mixed with seven parts of lard.

Hydrargyri Sulphidum. *Sulphide of Mercury.* HgS or **HgS.**

Synonyms.—Cinnabar. Vermilion. Mercuric sulphide.

History.—Crystallised or red sulphide of mercury was known in the most ancient times. *Vermilion* is mentioned twice in the Old Testament. It was formerly called *minium.* Cinnabar is found native but the greater part of the commercial article is manufactured.

Preparation.—Mercury six parts and sulphur one part are gently heated together until the mixture begins to swell up. The containing vessel is then covered to prevent the mixture taking fire. When the mass is cold it is powdered and sublimed.

Amorphous sulphide of mercury, that is, the compound obtained without sublimation with excess of sulphur (*hydrargyri sulphuretum cum sulphure*), is commonly called *Æthiops mineral.*

Physiological Effects.—According to Orfila sulphide of mercury is inert when administered by the stomach. Cinnabar is sometimes used in fumigations, and as in these cases the sulphide is decomposed, the vapour probably possesses efficacy.

Hydrargyri Cyanidum. *Cyanide of Mercury. Mercuric Cyanide.* HgC_2N or **Hg2CN.**

This salt was discovered by Scheele.

It may be prepared by dissolving red oxide of mercury in hydrocyanic acid, $\mathbf{HgO + 2HCN = Hg2CN + H_2O}$; or by boiling together equal parts of red oxide of mercury and Prussian blue,

$$\mathbf{Fe_4(FeCy_6)_3 + 9HgO = 2Fe_2O_3 + 3FeO + 9HgCy_2};$$

or two parts of sulphate of mercury and one part of ferrocyanide of potassium,

$$\mathbf{2K_4FeCy_6 + 7HgSO_4 = 6HgCy_2 + 4K_2SO_4 + Fe_23SO_4 + Hg}.$$

The filtered solution in either case deposits square prismatic crystals of cyanide of mercury. The dry salt when heated yields metallic mercury and cyanogen gas: the latter is known by the violet colour of its flame.

Therapeutics.—Used as a remedy in syphilis, and in such cases is preferred by some practitioners to corrosive sublimate, because it does not cause epigastric pain as the latter does, and is not decomposed by alkalies and organic substances.

Dose, $\frac{1}{16}$ to $\frac{1}{8}$ of a grain.

Potassii et Hydrargyri Iodo-cyanidum. *Iodo-cyanide of Potassium and Mercury.* $2HgC_2N,KI$ or $\mathbf{Hg2CN,KI}$.

Preparation.—Dissolve in a minimum quantity of warm water equivalent weights of cyanide of mercury and iodide of potassium.

If sufficiently saturated, colourless pearly scales separate on cooling. The solution of this salt is decomposed by all acids excepting the hydrocyanic, the red iodide of mercury being immediately produced;

$$2(\mathbf{HgCy_2KI}) + \mathbf{4HCl} = \mathbf{HgCl_2} + \mathbf{HgI_2} + \mathbf{4HCy} + \mathbf{2KCl}.$$

It is used as a test for detecting the presence of other acids in hydrocyanic acid.

ARGENTUM. *Silver.* Ag or **Ag**=108.

History.—Silver, like gold, has been known from the most remote periods of antiquity, being mentioned in the earliest books of the Old Testament. It was termed by the alchemists and astrologers *Diana* or *Luna.*

It is found in the mineral kingdom in various states; sometimes nearly pure, or alloyed with other metals (especially gold, antimony, arsenic, and copper): or combined with sulphur, iodine, bromine, or chlorine. Of these, *native silver*, and the sulphuret are by far the most abundant.

Silver is extracted from its ores by amalgamation, that is, solution in mercury; or by the cupellation of argentiferous galena. Lead which contains small quantities of silver is also profitably worked by melting, and allowing the pure lead to crystallise out from the melted metal. The process depends upon the fact that pure lead crystallises at a temperature at which the alloy of silver and lead is liquid.

[§ **Argentum Purificatum.** *Refined Silver.*

Pure metallic silver.]

Properties.—When pure, this metal is white, with a slight shade of yellow; inodorous and tasteless. It is moderately hard and elastic; very ductile and malleable: a single grain may be drawn out into 400 feet of wire, and leaf silver may be procured, whose thickness is only $\frac{1}{100000}$th of an inch. Its specific gravity is 10·474. It melts at a bright red heat (1873° F., according to Daniell). When exposed to the air it does not oxidate, but readily tarnishes by sulphur vapours.

[§ *Test.*—If ammonia be added in excess to a solution of the metal in nitric acid, the resulting fluid exhibits neither colour nor turbidity (showing its freedom from copper, lead, iron, &c.).]

The silver of the shops usually contains traces of gold and copper. The gold is left as a dark-coloured powder when the silver is dissolved in nitric acid.

Characteristics of the Salts of Silver.—With hydrochloric acid the soluble compounds give a white precipitate, insoluble in acids but readily dissolved by ammonia. With phosphate of soda a yellow precipitate, with chromates a red, and with potash or soda a dark-brown precipitate; all these are dissolved by both acids and ammonia.

[§ **Argenti Oxidum.** *Oxide of Silver.* AgO or $\mathbf{Ag_2O}$.

Take of

Nitrate of Silver, in crystals .	$\frac{1}{2}$ ounce.
Solution of Lime	$3\frac{1}{2}$ pints.
Distilled Water	10 fluid ounces.

Dissolve the nitrate of silver in four ounces of the distilled water, and having poured the solution into a bottle containing the solution of lime, shake the mixture well, and set it aside to allow the deposit to settle. Draw off the supernatant liquid, collect the deposit on a filter, wash it with the remainder of the distilled water, and dry it at a heat not exceeding 212°. Keep it in a stoppered bottle.]

The lime decomposes the nitrate of silver, forming nitrate of lime, while oxide of silver is precipitated,

$$\mathbf{2AgNO_3 + CaO = Ca2NO_3 + Ag_2O.}$$

[§ *Characters and Tests.*—An olive-brown powder, which at a low red heat gives off oxygen, and is reduced to the metallic state. It dissolves completely in nitric acid without the evolution of any gas, forming a solution which has the characters of nitrate of silver. Twenty-nine grains heated to redness leave twenty-seven grains of metallic silver.]

It is insoluble in the fixed alkalies, readily soluble in caustic ammonia, and very slightly soluble in water; the aqueous solution has an alkaline reaction and a metallic taste, and is rendered turbid by a small quantity of carbonic acid, but is dissolved by an excess of it.

Therapeutics.—Its uses are analogous to those of the nitrate. It is well adapted for painful (neuralgic) and irritable conditions of the stomach and intestines, especially those which are attended with augmented secretions. Thus in gastrodynia and enterodynia, in pyrosis and chronic diarrhœa, it has proved serviceable. In uterine diseases, especially where there are augmented discharges and great irritability, it has been beneficial, as in hysteralgia, menorrhagia, leucorrhœa, and dysmenorrhœa. It has also been used in epilepsy, syphilis, and cholera. Externally, it has been employed in the form both of powder and ointment; in irritable ulcers, both syphilitic and non-syphilitic, in ophthalmia, in sore nipples, and in gonorrhœa. In the latter complaint, it was used in the form of ointment applied to the urethral membrane by means of a bougie.

Administration.—The *dose* of it is from gr. $\frac{1}{2}$ to 2 gr. twice or thrice daily, in the form of powder or pill. It may be continued for five or six weeks with safety; but its prolonged employment is liable to be attended with permanent discoloration of the skin. For external use, it may be applied in the form of ointment composed of thirty grains of oxide to one ounce of lard.

[§ **Argenti Nitras.** *Nitrate of Silver.* AgO,NO_5 or $\mathbf{AgNO_3}$.]

History.—Geber describes the method of preparing the crystallised nitrate of silver.

Synonyms.—When fused,—*lunar caustic*; *lapis infernalis.* Silver nitrate. Argentic nitrate.

[§ Take of

Refined Silver	3 ounces.
Nitric Acid	$2\frac{1}{2}$ fluid ounces.
Distilled Water	5 ounces.

Add the nitric acid and the water to the silver in a flask, and apply a gentle heat till the metal is dissolved. Decant the clear liquor from any black powder which may be present, into a porcelain dish, evaporate, and set aside to crystallise; pour off the liquor, and again evaporate and crystallise. Let the crystals drain in a glass funnel, and dry them by exposure to the air, carefully avoiding the contact of all organic substances. To obtain the nitrate in rods, fuse the crystals in a capsule of platinum or thin porcelain, and pour the melted salt into proper moulds. Nitrate of silver must be preserved in bottles carefully stoppered.]

The silver decomposes the nitric acid with evolution of nitric oxide gas, which, coming into the air, produces red fumes.

$$3Ag_2 + 8\mathbf{H}\widehat{\mathbf{ON}}_3 = 6\mathbf{AgNO}_3 + 4\mathbf{H}_2\mathbf{O} + 2\mathbf{NO}.$$

In fusing, care must be taken not to overheat, and thereby to decompose the salt. The moulds should be warmed.

[§ *Characters and Tests.*—In colourless tabular crystals, the primary form of which is the right rhombic prism; or in white cylindrical rods; soluble in distilled water, and in rectified spirit. The solution gives with hydrochloric acid a curdy white precipitate (chloride of silver), which darkens by exposure to light, and is soluble in solution of ammonia. A small fragment heated on charcoal with the blowpipe, first melts, and then deflagrates, leaving behind a dull white metallic coating (Ag). Ten grains dissolved in two fluid drachms of distilled water give with hydrochloric acid a precipitate, which, when washed and thoroughly dried, weighs 8·44 grains (AgCl). The filtrate, when evaporated by a water bath, leaves no residue (proving the absence of impurities and adulterations, such as chlorate or nitrate of potash).]

It does not deliquesce: when exposed to the atmosphere and solar light it blackens, probably from the action of organic matter or sulphuretted hydrogen contained in the atmosphere. Mr. Scanlan found that nitrate of silver in a clean dry glass tube, hermetically sealed, undergoes no change of colour by exposure to solar light: the contact of organic matter, however, readily occasions it to become black. A solution of nitrate in pure distilled water is unchanged by exposure to solar light; but the presence of organic matter causes the liquid to become black or reddish. It forms with solutions of the alkaline carbonates, oxalates, and ferrocyanides, white precipitates (*carbonate*, *oxalate*, and *ferrocyanide of silver*). With a solution of phosphate of soda it yields a yellow precipitate, $\mathbf{Ag_3PO_4}$; with the alkaline arsenites, a yellow precipitate, $\mathbf{Ag_3AsO_3}$; with arseniates, a brick-red precipitate, $\mathbf{Ag_3AsO_4}$. Phosphorus and metallic copper immersed in it precipitate metallic silver, sulphuretted hydrogen occasions a black precipitate of sulphide of silver.

Physiological Effects.—The local action of nitrate of silver is that of a caustic or corrosive. Applied to the skin it produces first a white mark, owing to its union with the coagulated albumen of the cuticle. Gradually this becomes bluish-grey, purple, and ultimately black, owing to the partial reduction of the silver. If the integument be moistened, and the nitrate applied three or four times, it causes at the end of some hours vesication, which is usually attended with less pain than that produced by cantharides. In some cases, however, it excites acute pain. When applied to an ulcer, it produces a white film. This film in a few hours assumes a black colour, and ultimately forms a black eschar. This hardens and in a few days becomes corrugated, separates at the edges, and at length peels off altogether, leaving the surface of the sore beneath in a healed state. The intensity of the pain varies much in different cases, but it is on the whole very much less than might be imagined by those who have not tried this remedy. When applied to mucous surfaces a similar white compound of the nitrate with the animal matter of the secreted mucus is formed, and this defends the living tissue from the action of the caustic, so that the effects are not so violent as might be expected. In some cases it produces smarting pain, which lasts for several hours, but no serious effects have resulted from its use, and oftentimes it excites neither pain nor inflammation. Its application to the conjunctiva is attended with acute pain (especially when inflammation is going on), though in general this soon subsides. On all these surfaces it acts as an astringent. If continually administered *internally*, at first in small and afterwards in gradually-increased doses, it may be employed for a considerable period without producing any obvious changes in the corporeal functions, although it may be exercising a beneficial influence over the constitution, evinced by its amelioration of certain diseases. If the dose be too large, it occasions gastrodynia, sometimes nausea and vomiting, and occasionally purging. Taken in an excessive dose it acts as a corrosive poison. All the above-mentioned effects are referable to its local action; and from them we have no evidence of its absorption or of the nature of its influence over the general system; but the discoloration of the skin, which occasionally results from its use, fully proves that absorption does take place when the medicine is continued in small but long-continued doses. The blueness or slate-colour of the skin just alluded to has been produced in several patients who have continued the use of the nitrate during some months or years. In one instance the mucous membrane of the stomach and intestines was similarly tinted; and Wedemeyer relates a case in which all the internal viscera were more or less blue. The discoloration of the skin is usually regarded as permanent. In one person, whom I had an opportunity of observing, no perceptible diminution of the colour had occurred after several years; but in some cases it gradually fades in intensity.

Therapeutics.—Nitrate of silver has been employed *internally* in a very few cases only; and of these the principal and most important are epilepsy, chorea, and angina pectoris. Its liability to discolour the skin is a great drawback to its use: a medical man is not justified in risking the production of this effect without previously informing his patient of the possible result. In *epilepsy*, it has occasionally, perhaps more frequently than any other remedy, proved successful. Its *methodus medendi* is imperfectly understood. The cases which have been relieved by it are probably those termed by Dr. M. Hall eccentric. In the few instances in which I have seen this remedy tried, it has proved unsuccessful; but it was not continued long, on account of the apprehended discoloration of the skin. In *chorea* it has been successfully employed. In *angina pectoris* it has been administered in the intervals of the paroxysms with occasional success. In *chronic affections of the stomach* (especially morbid sensibility of the gastric and intestinal nerves) it has been favourably spoken of. It has been employed to ally chronic vomiting connected with disordered innervation, as well as with disease of the stomach (scirrhus and cancer), and to relieve gastrodynia. The foregoing are the most important of the diseases against which nitrate of silver has been administered internally. During the epidemic cholera of 1849, Mr. G. Ross gave the nitrate of silver, in grain doses, in seventy of the worst form of cases; i.e. in 70 cases out of 853, in which, other means having failed, the nitrate was employed as a last resource: of this number only 5 died. Nitrate of silver has also been used in the form of injection in cases of cholera, upon the indication of the necessity therein existing for the arrest of the destructive flow of saline matters from the bowels.

As an *external agent*, its uses are far more valuable, while they are free from the inconvenience of permanently staining the skin. It is employed sometimes as a *caustic*, and as such it has some advantages over caustic potash and the liquid corrosives. Thus, it does not liquefy by its application, and hence its action is confined to the parts with which it is placed in contact. It is used to remove and repress spongy granulations in wounds and ulcers, and to destroy warts, whether venereal or otherwise. It is applied to chancres on their first appearance, with the view of decomposing the syphilitic poison, and thereby of stopping its absorption, and preventing bubo or secondary symptoms. This practice has the sanction of Mr. Hunter. I have several times seen it fail, perhaps because it was not adopted sufficiently early. The nitrate should be scraped to a point, and applied to every part of the ulcer. M. Robin, of St. Etienne, states that an ointment of nitrate of silver, in the proportion of about one part to fifteen, is very efficacious in promoting the resolution of buboes, or in expediting the removal of thickening where the abscess has suppurated and been opened. The application of nitrate of silver to *punctured wounds* is often attended with most beneficial effects. It prevents or subdues inflammatory action in a very surprising manner. It is equally adapted for poisoned as for simple wounds. To promote the healing of *ulcers* it is a most valuable remedy. In large indolent ulcers, particularly those of a fistulous or callous kind, it acts as a most efficient stimulant. To small ulcers it may be applied so as to cause an eschar; and when at length this peels off, the sore is found to be healed.

Nitrate of silver was proposed by Mr. Higginbottom as a topical remedy for external inflammation. It may be applied with great advantage to subdue the inflammatory action of erythema, of paronychia or whitlow, and of inflamed absorbents. In some cases it is merely necessary to blacken the cuticle; in others, it may be used so as to induce vesication. M. Delvaux has found vesication of the surface very serviceable in pleurodynia and other neuralgic affections. Bretonneau and Serres recommend the *cauterisation of variolous pustules* by nitrate of silver, in order to cut short their progress. It is principally useful as a means of preventing pitting, and should be employed on the first or second day of the eruption.

In some diseases of the eye, nitrate of silver is a most valuable remedial agent. It is used in the solid state, in solution, and in ointment: the solution may be used as a wash or injection, or applied by a camel's hair pencil. In deep ulcers of the cornea, a cone of the solid nitrate should be applied; in superficial ones, a solution (of from four to ten grains of the salt to an ounce of distilled water) may be employed. There is one drawback to the use of this substance in ulcers of the cornea, as well as other affections of the eye: viz. the danger of producing dark specks in the cornea, or of staining the conjunctiva; but this occurrence is rare. In both acute and chronic ophthalmia, Mr. Guthrie employs this salt in the form of ointment (Arg. Nitr. gr. ij. ad gr. x.; Liq. Plumbi Subacet. min. xv.; Ung. Cetacei, gr. lx.). Of this, he directs a portion (varying in size from a large pin's head to that of a garden pea) to be introduced between the lids by the finger or a camel's hair pencil. It causes more or less pain, which sometimes lasts only half an hour, at others till next day. Warm anodyne fomentations are to be used, and the application of the ointment repeated every third day. In acute cases, two or three applications will arrest the disease.

In *inflammatory affections and ulcerations of the mucous membrane of the mouth and fauces*, nitrate of silver is sometimes a most valuable application. When the fibrinous exudation of croup commences on the surface of the tonsils and arches of the palate (diphtheria?), its further progress may be stopped, according to Mr. Mackenzie, by the application of a solution composed of twenty grains of nitrate of silver and an ounce of distilled water. The solid nitrate has been introduced through an aperture in the trachea, and applied to ulcers on the inner surface of the larynx in a case of phthisis laryngea, with apparent benefit. Nitrate of silver in solution, of the strength recommended by Dr. Green, of New York (viz. 60 grains to 1 fl. oz.), has been used with the most satisfactory results in inflammatory affections of the mucous membranes of the mouth, fauces, and pharynx. A case is related by Mr. Kesteven, in which severe inflammation of the epiglottis, with all its distressing symptoms, was immediately relieved by the application of a strong solution of this salt, and within twelve hours deglutition was completely restored. Dr. Lockwood has found a similar solution applied to the Schneiderian membrane a successful means of arresting catarrh in its early stages. Mr. J. D. Brown, of Haverfordwest, reports the good effects of a strong solution of nitrate of silver in quinsy. In some forms of *leucorrhœa*, the application of nitrate of silver, either in the solid state or in solution, is attended with beneficial effects. It is, I believe, most successful in cases dependent on local irritation or subacute inflammation, and not arising from constitutional debility. The solution may be applied by a piece of lint or sponge, or may be injected by means of a syringe with a curved pipe. Its strength must vary according to circumstances. Dr. Jewel generally employed three grains of the nitrate to an ounce of water; but in the Lock Hospital, solutions are sometimes used containing thirty, or even forty grains, to the ounce. In some cases the solid nitrate has been applied to the cervix uteri and vagina by means of a silver tube. In *gonorrhœa of the female*, a solution of the nitrate of silver, or even this caustic in the solid state, has been used with the best effects. In many cases the discharge ceased, never to return, in twenty-four hours. In *gonorrhœa of the male*, the introduction of a bougie smeared with an ointment of nitrate of silver, is occasionally a most effectual cure; but the practice is dangerous, as it is liable to cause urethritis. An aqueous solution of the salt has been successfully used in chronic gonorrhœa. It may also be employed at the commencement, before micturition becomes painful. Mr. William Reeves, of Carlisle, has, with satisfactory results, employed injections of nitrate of silver, twenty grains to the ounce of distilled water, in irritable bladder. In *fissured or excoriated nipples*, the application of the solid nitrate of silver is of great service. It should be insinuated into all the chaps or cracks, and the nipple afterwards washed with tepid milk and water. The application of solid nitrate of silver is a most effectual remedy for the different forms of *porrigo* which affect the heads of children. The caustic should be well rubbed into the parts. I have never known the practice to fail, or to cause the loss of hair. Where the greater portion of the scalp is involved the different spots should be cauterised successively at intervals of some days, for I have seen fever and delirium produced in a child from the too excessive use of this remedy. In *psoriasis*, the same medicine was found by Dr. Graves most effectual. An aqueous solution of the nitrate is also valuable as an astringent wash in other skin diseases, as *impetigo*. The solid nitrate is sometimes employed to stop the progress of irritative or erysipelatous inflammation, by applying it in a circular form around, and at a little distance from, the inflamed portion; but I have frequently observed the inflammation extend beyond the cauterised part. Mr. Higginbottom reports favourably of the effects of applying the nitrate to *burns* and *scalds*; and his observations have been confirmed by those of Mr. Cox. *In strictures of the urethra and œsophagus*, bougies armed with nitrate of silver, or lunar caustic on their point are occasionally employed with great advantage, at least in urethral stricture. Lunar caustic, fused round a platinum wire, has been employed by M. Chassaignac for operating with greater safety in cavities, where the fracture of the caustic might be dangerous. Notwithstanding that the application of nitrate of silver to stricture of the urethra has been repeatedly advocated, it is now but little employed; yet of its efficacy and safety in many obstinate cases, where the simple bougie fails, I am assured by repeated observation.

Administration.—Nitrate of silver may be exhibited in doses of one-sixth of a grain, gradually increased to three or four grains, three times a day. The usual mode of administering it is in the form of pills made of bread-crumb; but the chloride of sodium which it contains renders it objectionable: some mild vegetable powder with mucilage is preferable. Common salt or salted food should not be taken either immediately before or after swallowing these pills. It is deserving of especial notice that larger doses may be administered without inconveniencing the stomach, in the form of pill than in that of solution, in consequence, I presume, of the latter acting on a larger surface. Dr. Powell in some cases was able to give fifteen grains at a dose in the form of pills, while he rarely found stomachs that could bear more than five grains in solution. It is advisable not to continue the use of it beyond a month or six weeks at a time. The inhalation of nitrate of silver has been proposed by Dr. T. K. Chambers, in order to obtain its direct application to the air-passages. A light innocuous powder, such as the pollen of the lycopodium, or club-moss, is allowed to take up as much as it will of a saturated solution of the salt, and is then carefully dried and powdered. Two grains and a half of the powder thus prepared by Mr. Squire were found to contain one grain of nitrate. A glass funnel, or other apparatus for the especial purpose, serves for the introduction of the powder. Dr. Chambers observes, that its employment is attended with far less cough and spasm than the application of a sponge to the glottis. For external use, an aqueous solution is employed, of strengths varying from a quarter of a grain to forty grains, in an ounce of distilled water. The formula for Mr. Guthrie's ointment has already been given.

Antidote.—The antidote for nitrate of silver is common salt. When this comes in contact with lunar caustic, nitrate of soda and chloride of silver are produced: the latter compound is, according to the experiments of Orfila, innocuous. The contents of the stomach should be removed, and the inflammatory symptoms combated by demulcents, blood-letting, and the usual antiphlogistic means. When the local use of nitrate of silver causes excessive pain, relief may be gained by washing the parts with a solution of common salt. Pieces of caustic have been occasionally left in the vagina and urethra. Injections of a solution of common salt are the best means of preventing bad effects.

To diminish the slate-coloured tint of the skin arising from nitrate of silver, acids or the super-salts offer the most probable means of success. The external and internal use of dilute nitric acid, or the internal employment of the acid tartrate of potash, may be tried; the discoloration is said to have yielded to a steady course of the last-mentioned substance. Recent stains of the cuticle from the application of nitrate of silver may be removed by washing with a solution of common salt, followed by solution of ammonia, and stains of long standing by wetting them with the iodide and subsequently with the cyanide of potassium.

[§ VOLUMETRIC SOLUTION OF NITRATE OF SILVER. (Appendix III.)

Nitrate of Silver, AgO, NO_5 = 170 or **$AgNO_3$** = 170.

Take of

Nitrate of Silver	170 grains.
Distilled Water	a sufficiency.

Put the nitrate of silver into the 10,000 grain flask, and, having half-filled the flask with water, allow the salt to dissolve; then dilute the solution with more water until it has the exact bulk of 10,000 grain-measures. The solution should be kept in an opaque stoppered bottle. 1,000 grain-measures of this solution contain $\frac{1}{10}$ of an equivalent in grains of nitrate of silver (or 170 grains).

Grammes and cubic centimètres may be employed instead of grains and grain-measures, but for convenience $\frac{1}{10}$ of the numbers should be taken. One hundred cubic centimètres contain $\frac{1}{100}$ of an equivalent in grammes of nitrate of silver (or 1.7 gramme).]

It is used in testing hydrocyanic acid, bromide of potassium, arseniate of soda, and in estimating chlorides, iodides, &c.

[§ SOLUTION OF AMMONIO-NITRATE OF SILVER. (Appendix II.)

Take of

Nitrate of Silver, in crystals .	$\frac{1}{4}$ ounce.
Solution of Ammonia . .	$\frac{1}{2}$ fluid ounce, or a sufficiency.
Distilled Water . . .	a sufficiency.

Dissolve the nitrate of silver in eight fluid ounces of the water, and to the solution add the ammonia until the precipitate first formed is nearly dissolved. Clear the solution by filtration, and then add distilled water, so that the bulk may be ten fluid ounces.]

Used as a test for arsenious and phosphoric acids, whose silver salts are soluble in nitric acid, and cannot therefore be precipitated by the ordinary nitrate of silver.

GOLD (*Aurum*).

Au or **Au** = 196·5.

History.—Gold has been known from the most remote periods of antiquity. It was in common use 3,300 years since, and was probably the first mettal with which mankind was acquainted. The alchemists termed it *Sol* or *Rex Metallorum.* It is found only in the metallic state, commonly alloyed with other metals, especially with silver, copper, and iron. It occurs in veins in primitive rocks, and is also found in alluvial deposits in small lumps or particles, called *gold dust.*

[§ **Fine Gold.** (Appendix I.) Gold free from metallic impurities.]

Properties.—Pure gold has a rich yellow colour, a sp. gr. of 19·2 to 19·4; is soft, very ductile, and malleable; fuses at a bright red heat (2016° F., according to Daniell); and in the liquid state has a brilliant greenish colour.

It is unacted on by nitric acid, but is readily soluble in nitro-hydrochloric acid. The solution, which is yellow, stains organic matters (as the skin) purple.

Therapeutics.—Gold is but little used in medicine, especially in this country. It appears to act somewhat in the same way as mercury, but its action has not been well made out. It is used as a tonic, alterative, and deobstruent, in syphilitic, scrofulous, chronic cutaneous, and glandular affections. It sometimes causes salivation.

Preparations.—The only preparation of gold ordered in the Pharmacopœia is the perchloride in aqueous solution, which is used as a test. Powder of gold, peroxide of gold, chloride of gold and sodium, and iodide of gold, are preparations sometimes used in medicine.

Pulvis Auri. *Powder of Gold.*

This is obtained by rubbing gold leaf in a Wedgwood mortar with sulphate, or acid tartrate of potash, until it is completely disintegrated, and dissolving and removing the salt with boiling water. Or by rubbing the gold leaf with a little honey, and afterwards washing out the honey with water. Prepared in this way it retains the colour and appearance of the aggregated metal. It may also be obtained by adding a solution of sulphate of iron (ferrous sulphate) to solution of chloride of gold, when the gold is precipitated in a finely divided state as a dark brown powder.

Dose, $\frac{1}{10}$ to $\frac{1}{4}$ of a grain.

Auri Peroxidum. *Peroxide of Gold. Auric Acid.*

AuO_3 or $\mathbf{Au_2O_3}$.

Prepared by treating perchloride of gold with magnesia, washing the precipitate, then digesting it in diluted nitric acid, which abstracts the magnesia, and leaves the peroxide of gold. When dried it is a brown powder, insoluble in water, and decomposed by exposure to light.

Dose, $\frac{1}{10}$ to $\frac{1}{4}$ of a grain.

Auri Perchloridum. *Perchloride of Gold.*

Gold is dissolved in nitro-hydrochloric acid, aided by a gentle heat. Carefully evaporated the solution yields yellow crystals of the hydrochlorate of chloride of gold ($AuCl_3.2HCl.H_2O$). This is the salt commonly sold for photographic purposes, and a solution of which is the test solution of the Pharmacopœia. By the careful application of heat to the yellow crystals, hydrochloric aid is expelled, and the residue solidifies on cooling into a mass of red crystals, consisting of the perchloride of gold (**$AuCl_3$**).

In effecting the solution of the gold in nitro-hydrochloric acid, the following changes occur. By the mutual action of nitric and hydrochloric acids upon each other, free chlorine and chloronitric gas are produced,

$$6HCl + 2HNO_3 = Cl_2 + 2NOCl_2 + 4H_2O.$$

The gold combines with the free chlorine to form perchloride, which, with some unaltered hydrochloric acid and water, constitutes the yellow salt.

[§ ⁂ **Solution of Chloride of Gold.** (Appendix II.)

60 grains of fine gold dissolved in nitro-hydrochloric acid, excess of acid driven off by evaporation, and the residue mixed with 5 fluid ounces of distilled water.]

Used as a test for atropia.

Auri et Sodii Chloridum. *Chloride of Gold and Sodium.*

$AuCl_3.\ NaCl.\ 2H_2O.$

This salt is prepared by mixing in solution about five parts of chloride of gold and one part of chloride of sodium, and evaporating until the solution crystallises on cooling. It forms long four-sided prisms of a deep yellow colour. It is the form in which chloride of gold has generally been administered in medicine.

Dose, $\frac{1}{12}$ to $\frac{1}{4}$ of a grain.

Auri Iodidum. *Iodide of Gold.* **AuI.**

This salt may be prepared, by adding a solution of iodide of potassium to solution of perchloride of gold. Double decomposition takes place, and iodide of gold and free iodine are precipitated; $AuCl_3 + 3KI = AuI + 3KCl + I_2$. The precipitate should be collected on a filter, and washed with spirit to remove the free iodine adhering to it. It is a greenish-yellow powder, insoluble in cold, but slightly soluble in boiling water.

It has been employed internally in venereal affections, in doses of from $\frac{1}{15}$ to $\frac{1}{10}$ of a grain. Externally it has been applied in the form of ointment, to venereal ulcers.

PLATINUM. $Pt=98{\cdot}5$ or $\mathbf{Pt=197}$.

Natural History.—Platinum is found in the metallic state, in small grains, in Brazil and Peru; also in Antioquia (North America), and in considerable quantities in the Uralian mountains of Siberia.

[§ **Platinum Foil.** (Appendix I.)]

[§ **Platinum Black.** (Appendix I.)

Platinum in a state of minute division obtained by adding excess of carbonate of soda and some sugar to solution of perchloride of platinum, and boiling until a black precipitate is formed, which is washed and dried.] Alcohol or fousel oil dropped upon platinum black is oxidised to the corresponding, acetic or valerianic, acid.

Therapeutics.—The therapeutical effects of some of the compounds of platinum are said to resemble those of gold and mercury, but they are scarcely ever used, especially in this country.

Perchloride of Platinum. $PtCl_2$ or $\mathbf{PtCl_4}$.

Properties.—Perchloride of platinum may be obtained in prismatic crystals, having the composition, $\mathbf{PtCl_4 10H_2O}$. On heating these a dark reddish-brown, deliquescent, saline mass of anhydrous perchloride of platinum is obtained. It is soluble in water, alcohol, and ether. It forms a soluble double salt with chloride of sodium, which yields prismatic crystals of a deep orange colour on evaporation. With ammonia, in the presence of hydrochloric acid, it yields a very insoluble compound, $\mathbf{2NH_4Cl.PtCl_4}$, which, on being heated to redness, leaves the platinum in a spongy state.

[§ SOLUTION OF PERCHLORIDE OF PLATINUM. (Appendix II.)

Take of

Thin Platinum Foil	$\frac{1}{4}$ ounce.
Nitric Acid	a sufficiency.
Hydrochloric Acid	a sufficiency.
Distilled Water	7 fluid ounces.

Mix a fluid ounce of the nitric acid with four fluid ounces of the hydrochloric acid and two fluid ounces of the water; pour the mixture into a small flask containing the platinum, and digest at a gentle heat, adding more of the acids mixed in the same proportion, should this be necessary, until the metal is dissolved. Transfer the solution to a porcelain dish, add to it a fluid drachm of hydrochloric acid, and evaporate on a water bath until acid vapours cease to be given off. Let the residue be dissolved in the remaining five ounces of distilled water, filter, and preserve it in a stoppered bottle.]

The action here is precisely similar to that described under perchloride of gold, the action of the nitric upon the hydrochloric acid producing chlorine, which unites with the metallic platinum.

Used as a test for the presence or absence of potash and potash salts, with which, in the presence of hydrochloric acid, it forms a sparingly soluble double salt, $2KCl.PtCl_4$; also as an indication of nicotia, the active principle of tobacco.

Platini et Sodii Chloridum. *Chloride of Platinum and Sodium.*
$2NaCl.PtCl_4.6H_2O$.

Prepared by mixing 170 parts of perchloride of platinum and 59 parts of chloride of sodium, separately dissolved in water, and evaporating the mixed solutions until crystals are formed on cooling.

It has been used like the corresponding salt of gold in syphilitic affections.

Dose, $\frac{1}{8}$ to $\frac{1}{4}$ of a grain.

[§ ⁑ **Liquor Sodæ Effervescens.** *Effervescing Solution of Soda.*

Synonyms.—Aqua sodæ effervescens. Soda water.

Solution of bicarbonate of soda, 30 grains to a pint of water, with excess of carbonic acid gas.]

[§ ⁑ **Trochisci Sodæ Bicarbonatis.** *Bicarbonate of Soda Lozenges.*

Each lozenge contains 5 grains of bicarbonate of soda, made into a lozenge with sugar and gum.]

[§ * **Trochisci Potassæ Chloratis.** *Chlorate of Potash Lozenges.*

Each lozenge contains 5 grains of chlorate of potash, made into a lozenge with sugar and gum.]

[§ ⁑ **Unguentum Potassæ Sulphuratæ.** *Ointment of Sulphurated Potash.*

30 grains of sulphurated potash to an ounce of prepared lard.]

[§ ⁑ **Vapor Chlori.** *Inhalation of Chlorine.*

Inhale the vapour arising from 2 ounces of chlorinated lime moistened with cold water in a suitable apparatus.]

Group II.

VEGETABLE MATERIA MEDICA.

Under this head are included those vegetables with their educts and products (except those obtained as products of decomposition, which are treated of in Group I., among chemical compounds of definite composition), which are admitted into the British Pharmacopœia, together with such others as are usually employed in the treatment of disease. These are arranged as follows :—

VEGETABLE KINGDOM.

The Vegetable Kingdom is first divided into two sub-kingdoms, namely :—Cryptogamia, Flowerless, or Acotyledonous Plants ; and Phanerogamia, Flowering, or Cotyledonous Plants. The characters of these sub-kingdoms are as follows :—

Sub-kingdom 1. *Cryptogamia*, are those plants which have no flowers ; and which are propagated by spores, and are therefore acotyledonous.

Sub-kingdom 2. *Phanerogamia*, includes plants which have evident flowers; and which are propagated by seeds containing an embryo with one or more cotyledons.

The plants comprised in these sub-kingdoms are further divided into three classes, as follows :—

The Cryptogamia constitutes a class by itself, thus :—

Class 1. Acotyledones, are those plants which are propagated by spores, and are therefore acotyledonous, and have an indefinite or vague (heterorhizal) germination ; the stem is present or absent, in the former case, when woody, it is acrogenous ; the leaves are also either absent or present, in which latter case the veins are forked ; they have no true flowers. This has two sub-classes :—

Sub-class 1. *Thallogenæ.*—Plants with no distinction of stems and leaves ; stomata absent.

Sub-class 2. *Acrogenæ.*—Plants with the stems and leaves distinguishable ; and possessing stomata.

The Phanerogamia is divided into two classes, and other subdivisions, thus :—

Class 2. MONOCOTYLEDONES, in which the embryo is monocotyledonous; the germination endorhizal; the stem endogenous; the leaves usually with a parallel venation; and the flowers with a ternary arrangement. In this class we have three sub-classes :—

Sub-class 1. *Glumaceæ.*—Leaves parallel-veined, permanent; flowers glumaceous, that is, having no proper perianth, but consisting of imbricated bracts.

Sub-class 2. *Petaloideæ*, or *Floridæ.*—Leaves with a parallel venation, permanent; floral envelopes (perianth) verticillate and usually coloured, rarely scaly, sometimes absent.

Sub-class 3. *Dictyogenæ.*—Leaves with a reticulated venation, deciduous: rhizome and root with the wood arranged in a concentric manner; floral envelopes verticillate.

Class 3. DICOTYLEDONES, in which the embryo is dicotyledonous; the germination exorhizal; the stem exogenous; the leaves with a reticulated venation; and the flowers with a quinary or quaternary arrangement. In this class we have two divisions, thus :—

Division 1. *Gymnospermia*, in which the ovules are naked or not enclosed in an ovary, and are fertilized directly by the action of the pollen.

Division 2. *Angiospermia*, in which the ovules are enclosed in an ovary, and are fertilized indirectly by the action of the pollen on the stigma. In this division we have four sub-classes :—

Sub-class 1. *Monochlamydeæ*, or *Apetalæ.*—Flowers either having a calyx only, or without both calyx and corolla.

Sub-class 2. *Corollifloræ.*—Flowers having usually both a calyx and corolla, the latter with united petals; stamens inserted on the corolla or ovary, or free and arising from the thalamus.

Sub-class 3. *Calycifloræ.*—Flowers having usually both a calyx and corolla, the latter mostly with distinct petals, and inserted on the calyx; stamens either perigynous, or epigynous.

Sub-class 4. *Thalamifloræ.*—Flowers having usually both a calyx and corolla; the latter composed of distinct petals inserted on the thalamus; stamens hypogynous, or adherent to the sides of the ovary.

SUB-KINGDOM I.—*CRYPTOGAMIA, ACOTYLEDONES,* or *FLOWERLESS PLANTS.*

CLASS I.—ACOTYLEDONES.

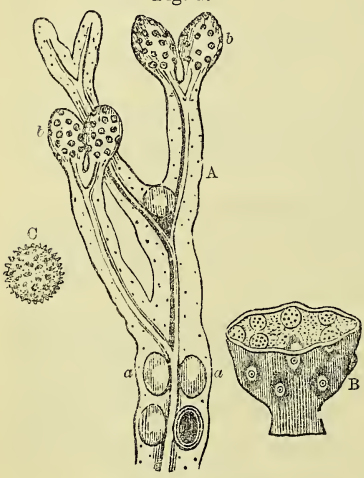
Sub-class I.—Thallogenæ.

ALGÆ, *Juss.* THE SEA-WEED ORDER.

FUCUS VESICULOSUS, *Linn.* **Sea Wrack or Bladder Wrack.**

Botanical Character.—Thallus (fig. 1, A), plane, linear, forked, leathery, entire at the margin; *air cavities* (fig. 1, A, *a a*), roundish-oval, in pairs. *Receptacles*, (fig. 1, A, *b b*, and B) mostly elliptical, terminating the branches, pierced by numerous pores, which communicate with enclosed spherical *conceptacles* (fig. 1, C), containing sporangia, antheridia, and paraphyses.

Fig. 1.



Fucus vesiculosus.

A. Upper part of the thallus, with air cavities, *a a*, and receptacles (fructification), *b b*.
B. Section of a receptacle.
C. Conceptacle.

Habitat.—Sea shores: very common.

Fucus. *Sea Wrack.*

The entire alga, Fucus vesiculosus, *Linn.*

(*Not official.*)

General Characters.—Its substance is thickish, flexible, and very tough. Its colour is dark olive-glossy-green, paler at the extremities, and becomes black by drying. Its odour is strong; its taste nauseous.

Composition.—The following are its principal constituents:—*Traces of iodine*, *mucilage* (carrageenin), *mannite*, *odorous oil*, *bitter matters*, and various *salts*. By combustion in the open air, this plant yields the ash called *kelp*; and by incineration in a covered crucible it forms a charcoal, termed *vegetable ethiops*.

Physiological Effects.—Its local action is detergent, and perhaps discutient. Its remote effects are probably analogous to those caused by small doses of iodine, modified by the influence of salts of sodium and calcium.

Therapeutics.—Frictions of the plant, with its contained mucilage, have been employed in glandular enlargements and other scrofulous tumours: the parts being afterwards washed with sea-water. The expressed juice has also been given in glandular affections. Of late years fucus has been much used as a remedy for obesity, and although it has been highly extolled by some, its virtues are by no means well established. Mr. Tamplin speaks highly of fucus or sea-weed wine as a remedy in diseases of the hip and other bones and joints of children.

Administration.—It may be administered in the form of decoction or liquid extract, the latter being preferable. This may be prepared by taking one pound of the freshly dried fucus, and after digesting this for seven days in six fluid ounces of rectified spirit, press, and filter. *Dose*, a teaspoonful. In the form of *vegetable ethiops* it has been exhibited in bronchocele and scrofulous maladies. This has been employed also as a dentifrice. The dose of it is from 10 to 120 grains. The remedial effects of fucus and its preparations are principally due to the presence of a small quantity of iodine.

CHONDRUS CRISPUS, *Grev.* Carrageen or Irish Moss.

Botanical Character.—*Thallus* (fig. 2, *a*) stalked, cartilaginous, flat or curled, dichotomously cleft, segments wedge-shaped, from two to twelve inches long; colour deep purple-brown, often tinged with purplish-red, paler at the summit, becoming greenish, and at length white in decay. *Tetraspores* collected in masses (*sori*) (fig. 2, *b*, *c*), and immersed in the substance of the thallus (fig. 2, *a*); *sori* elliptical or oblong, concave on one side (fig. 2, *b*). This Alga is liable to great variations of form, &c.; hence it has been said to be the Proteus of marine Algæ.

Habitat.—On rocks and stones on the sea-coast: very common.

Chondrus. *Carrageen Moss.*

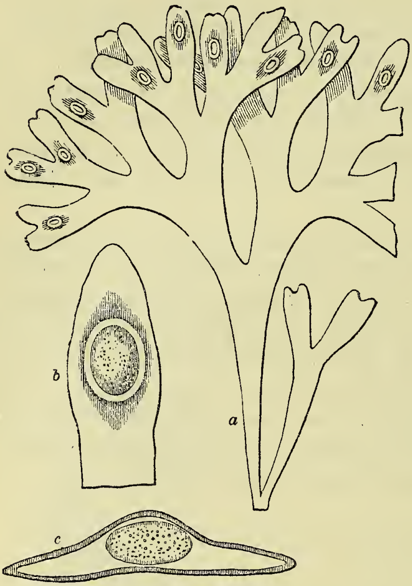
The entire alga, Chondrus crispus, *Grev.*

(*Not official.*)

Collection, &c.—It is chiefly collected on the west coasts of Ireland (especially in Clare); it is then washed, bleached (by exposure to the sun), and dried. Along with *Chondrus crispus*, other allied species, especially *Chondrus mamillosus* (fig. 3), are generally collected.

General Characters.—The carrageen or Irish moss of commerce consists of thalli (or fronds, as they are more commonly called), which are usually from two to three or four inches long, dry, crisp, mostly yellowish or dirty white, but intermixed with purplish-red portions, inodorous or nearly so, with a mucilaginous taste. In warm water, the dried commercial frond swells up, and, when boiled, almost entirely dissolves. *Chondrus mamillosus* is found in nearly all commercial samples of carrageen. The thallus of this plant is more or less channelled; but the species is best distinguished by the fructification, thus in *Chondrus crispus* the elliptical sori are imbedded in the thallus, producing a depression on the opposite side (fig. 2, *b*), while in *Chondrus mamillosus*, the spherical sori are scattered over the surface of the thallus, and are supported on little short stalks (fig. 3).

Fig. 2.



Chondrus crispus.

a. Thallus with sori (*natural size*); *b.* Segment with sorus; *c.* A segment and sorus vertically divided.

Composition.—Its principal constituent is *vegetable jelly* (carrageenin?). *Iodine* and *bromine* have also been detected in it.

Fig. 3.

Chondrus mamillosus.

Portion of the channelled thallus bearing the stalked sori.

Physiological Effects.—Carrageen moss is nutritive. It is generally regarded as being readily digestible. Medicinally, it is emollient and demulcent.

Therapeutics.—It is a popular remedy for pulmonary complaints (especially those of a phthisical character), chronic diarrhœa and dysentery, scrofula, rickets, enlarged mesenteric glands, irritation of bladder and kidneys, &c. As a culinary article it has been employed as a substitute for animal jelly, in the preparation of *blanc-mange*, jellies, white soup, &c. A thick mucilage of carrageen scented with some prepared spirit is sold as *bandoline* or *fixature* for stiffening the hair and keeping it in form.

Administration.—It is best exhibited in the form of decoction or jelly. The decoction is made by macerating half an ounce of carrageen in cold or warm water, during ten minutes; then boiling in three pints of water for a quarter of an hour, and straining through linen. Milk may be substituted for water when the decoction is required to be very nutritious. Sugar, lemon-juice, tincture of orange-peel, essence of lemon, or other aromatics, as cinnamon or nutmeg, may be employed as flavouring ingredients. Carrageen jelly may be prepared by adding sugar to the above decoction, and boiling down until the liquid is sufficiently concentrated to gelatinise on cooling; or by employing a larger quantity of carrageen. If milk be substituted for water, *carrageen blanc-mange* is obtained. Flavouring ingredients may be employed as above mentioned.

PLOCARIA CANDIDA, *Nees*. Ceylon Moss.

Synonym.—Gracilaria lichenoides, *Grev.*

Botanical Character.—*Thallus* cartilaginous, cylindrical, filiform, much and irregularly branched (fig. 4, *a*); branches smooth, spreading, acute. *Fructification* consisting of—1, hemispherical sessile scattered *coccidia* (fig. 4, *c*, *d*), containing oblong spores on a central axis; and, 2, oblong *tetraspores* imbedded in the surface.

Habitat.—Ceylon and the islands of the Indian Archipelago.

Plocaria. *Ceylon Moss.*

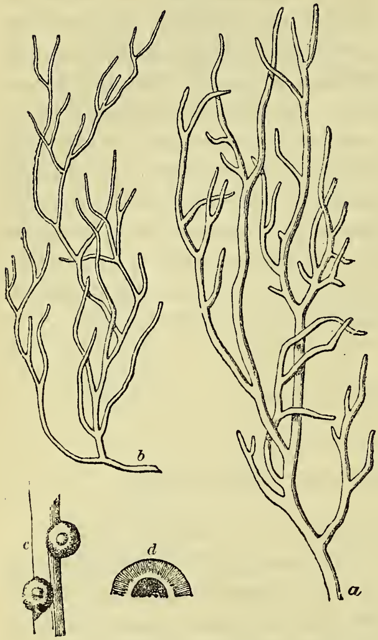
The entire alga, Plocaria candida, *Nees.*

(*Not official.*)

Commerce.—It is exported to China from the islands of the Indian Archipelago. The Ceylon moss of commerce usually consists of *Plocaria confervoides* (fig. 4, *b*), as well as *P. candida* (fig. 4, *a*). It would also appear that, under the name of Agar agar, or Ceylon moss, two very different articles are imported. Thus Professor Archer has shown that specimens received at Liverpool consisted of *Gigartina spinosa* (*Fucus spinosus*), and contained no portion of either species of *Plocaria.*

General Characters.—Ceylon moss is in whitish or yellowish-white ramifying filaments of several inches in length. At the base the largest fibres do not exceed in thickness a crowquill; the smallest fibres are about as thick as fine sewing thread. To the naked eye the filaments appear almost cylindrical and filiform; but, when examined by a microscope, they appear shrivelled and wrinkled. The branchings are sometimes dichotomous, at other times irregular. The coccidia are inconspicuous when dry, but when moist are readily seen. They are hemispherical, and about the size of a poppy-seed. The consistence of Ceylon moss is cartilaginous. Its flavour is that of sea-weed, with a feebly saline taste.

Fig. 4.



Plocaria candida.

a. Plocaria candida (natural size). *b.* Plocaria confervoides (natural size). *c.* Part of thallus with the coccidia (magnified). *d.* Section of coccidium.

Composition.—Its principal constituents are *mucilage* (carrageenin?), and *starchy matters.*

Physiological Effects.—These are similar to those of *Chondrus crispus.* Ceylon moss, therefore, may be denominated nutritive, emollient, and demulcent. By the continued use of it at the table, the saline constituents of the plant would not be without some influence on the system.

Therapeutics.—In the form of decoction or jelly, it is employed as a light and readily digestible article of food for invalids and children. The decoction or jelly of Ceylon moss may be employed in irritation of the mucous surfaces, and in phthisis. It is not apt to occasion thirst, sickness, flatulence, heartburn, acidity or diarrhœa.

Administration.—It may be administered in the form of decoction or jelly. Dr. O'Shaughnessy directs the moss to be first steeped for some hours in cold rain water, then dried in the sun, and ground to a fine powder. The decoction is prepared by boiling from $\frac{1}{4}$ to $\frac{1}{2}$ ounce of the Alga, prepared as above, in 1 pint of water, milk, or whey, and then straining. Milk, sugar, orange- or lemon-juice and peel, wine, cinnamon, or other aromatics, may be used to communicate flavour. This decoction may be taken *ad libitum.* Jelly may be prepared from this in a similar way to that directed for preparing carrageen jelly. It may then be flavoured according to taste.

PLOCARIA HELMINTHOCORTON, *Endl.* Corsican Moss.

(*Not official.*)

Synonym.—Gracilaria Helminthocorton, *Grev.*

Botanical Character.—Thallus (fig. 5, *a*) cartilaginous, cylindrical, tufted, entangled, filiform, creeping, branched in a somewhat dichotomous manner; branches setaceous with indistinct transverse markings. *Fructification* of two kinds—1, hemispherical *coccidia* containing oblong spores; and 2, oblong imbedded tetraspores.

Habitat.—The Mediterranean Sea, on the shores of Corsica.

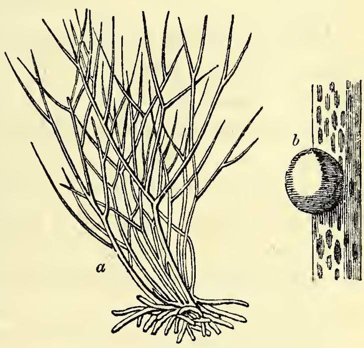
Plocaria Helminthocorton. *Corsican Moss.*

The entire alga, Plocaria Helminthocorton, *Endl.*

(*Not official.*)

General Characters.—Under the name of Corsican moss is sold in the shops a mixture of various marine vegetables and animals. The essential, though usually smaller, part of the mixture is the *Plocaria Helminthocorton*; the remainder consists of Corallines, Sertularias, and Ceramiums, to the number of twenty or more species. The thallus of *Plocaria Helminthocorton* has a consistence similar to that of the stems and leaf-stalks of some aquatic herbaceous phanerogamous plants, and having the appearance of articulations which do not actually exist. The fructification is scarcely ever seen. The plant has a reddish-grey colour externally, but is whitish internally. Its odour is strong, marine, and disagreeable: its taste is saline.

Fig. 5.



Plocaria Helminthocorton.

a. The plant (natural size).
b. A small stony coral attached to the thallus, and which may be readily mistaken for the fructification.

Composition.—It contains *vegetable jelly* [mucilage? carrageenin?], *chloride of sodium*, and *traces of iodine.*

Physiological Effects.—Its effects are not very obvious. The vegetable jelly (mucilage) must render it somewhat nutritive; the iodine and saline matters alterative. Mr. Farr says, that after using the decoction for six or seven days, it acts as a diuretic and diaphoretic, and occasionally produces nausea and giddiness:

and after some time the stools become darker, present greenish specks, and are sometimes slimy.

Therapeutics.—It has been principally celebrated as an anthelmintic against the large round worm (*Ascaris lumbricoides*). Its effect as an anthelmintic may be due to its action simply as a mechanical agent, like cowhage, from the fragments of numerous corallines mixed with it. It has also been used as a remedy for cancer, but experience does not warrant us in ascribing any benefit from its employment in this disease.

Administration.—In *powder*, it is given in doses of from 20 to 120 grains, mixed with honey or sugar; but the more usual mode of exhibiting it is in the form of *decoction*, prepared by boiling from one-half to three-quarters of an ounce of Corsican moss in a pint of water; of this the dose is a wine-glassful, three times daily.

FUNGI, *Juss.* The Mushroom Order.

CLAVICEPS PURPUREA, *Tulasne.* The Ergot Fungus.

[§ **Ergota.** *Ergot.*

The sclerotium (compact mycelium or spawn) of Claviceps purpurea, *Tulasne*, produced within the paleæ of the Common Rye, Secale cereale, *Linn.*]

Synonyms.—Secale cornutum. Spurred or Horned Rye. Ergot of Rye.

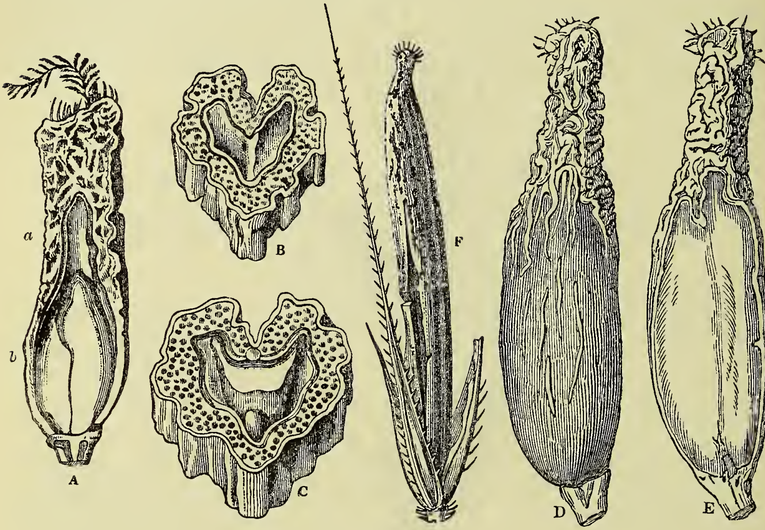
Cause and Development.—Ergot is not peculiar to rye, but the grains of wheat, oat, and a number of other species of Graminaceæ, and some Cyperaceæ, are also subject to it. Ergot is most prevalent in wet seasons and in species growing in damp places. The number of ergotised grains in each spikelet varies considerably: there may be one only, or the spikelet may be covered with them. Usually the number is from three to ten (fig. 6, *a a*). The observations and experiments of Léveillé, Wiggers, Smith, Quekett, Berkeley, Corda, and more recently of Tulasne, have proved that ergot is a disease of the grain associated with one or more parasitic fungi; but the real nature of the fungus which is the special exciting cause of the ergot has been only recently determined. Edwin Quekett, who most carefully examined the development of ergot, says that the first appearance of the ergot is observed by the young grain and its appendages becoming covered with a white coating composed of multitudes of spores mixed with minute cobweb-like filaments. This coating extends over all the other parts of the grain, cements the anthers and stigmas together, and gives the whole a mildewed appearance. If we examine the ergot at an early stage of its growth (fig. 7, A), we find it just beginning to show itself above the paleæ, and presenting a purplish-black colour. By this time it has lost in part its white coating, and the production of spores and filaments has nearly ceased. At the upper

Fig. 6.

Full-grown Ear (*spikelet*) *of Rye, strongly infected with ergot* (natural size).
a a. Mature ergots.

portion of the grain, the coating now presents a vermiform appearance, which Léveillé describes as constituting cerebriform undulations. These are beautifully depicted in Mr. Bauer's drawings (fig. 7, A, D, E). Edwin Quekett named this fungus, or ergot-mould, *Ergotœtia abortifaciens*; but both Link and Berkeley subsequently named it *Oidium abortifaciens.* This fungus was supposed by Quekett to be the cause of ergot: but though it is often found on ergotised grains, it also occurs on grasses which are not ergotised; and his statement that its spores are capable of infecting healthy grains of corn may be explained by their frequently accompanying the conidia of *Claviceps purpurea*, Tulasne, which is now ascertained to be the true parasitic cause of ergot. Tulasne has shown, beyond the possibility of a doubt, that ergot is induced by the mycelium of *Claviceps purpurea*. It appears that there are three phases in the development of ergot; first, the *sphacelium* or initial stage of the

Fig. 7.



Ergot of Rye.

A. A side view of a longitudinal section of an infected grain, soon after fecundation, when the disease makes its first external appearance; magnified eight times in diameter.
B. Front view of a section of the above infected grain, cut at letter *a*; magnified sixteen times in diameter.
C. Ditto, cut at letter *b*; magnified sixteen times in diameter.
D. Side view of an unripe but advanced ergotised grain, at the upper part of which is the tuberculated portion, having a vermiform appearance, and constituting the fungus (*Sphacelia segetum*) of Léveillé.
E. Longitudinal section of the grain.
F. A full-grown ergot, within its floret, magnified twice in diameter.

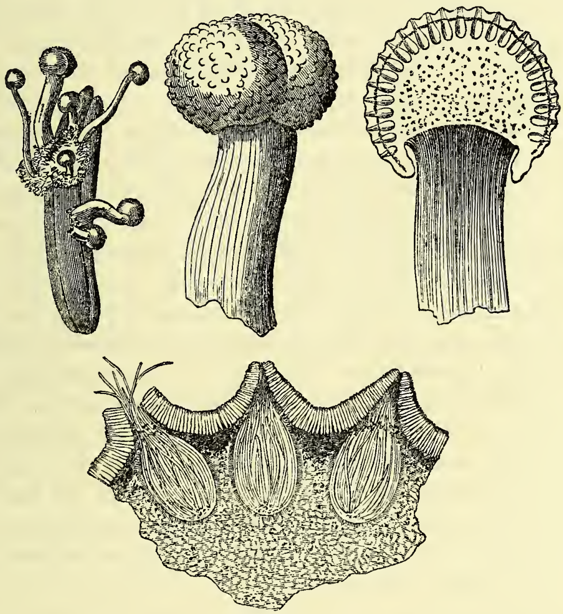
fungus, which soon spreads over the surface of the ovary, and after being covered with spores ultimately remains as decaying débris upon the surface of the second or sclerotial state of the ergot; second, the *sclerotium*, a hard and compact mycelium, which is developed under the sphacelium, and which constitutes what is commonly known as the ergot; and third, the *Claviceps purpurea*, which is developed upon ergots when placed in earth or under other favourable conditions, in the form of a fungus with a cylindrical stalk, and terminated by a round head which encloses the fructification (fig. 8, *a*, *b*, *c*, *d*).

Commerce.—Ergot is imported from Germany, France, and America.

General Characters.—Ergot consists of grains, which vary in length from a few lines to an inch, or even an inch and a half, and in

Fig. 8.

a *b*



d

Specimens of Claviceps purpurea, Tulasne.

a. An ergotised grain of rye, giving rise to a tuft of *Claviceps purpurea* (nat. size).
b. Upper part of a stem and head slightly magnified. The perithecia project in consequence of a slight contraction of the substance.
c. Section of the same, showing the perithecia.
d. A portion of the same more highly magnified, showing the structure of the same, and the asci in the perithecia.

breadth from half a line to four lines. Their form is cylindrical or obscurely triangular, with obtuse angles and extremities, curved somewhat like the spur of a cock, longitudinally furrowed on the concave side, and often irregularly cracked and fissured. The odour of a single grain is scarcely detectable, but of a large quantity is fishy, peculiar, and nauseous; and strong if the powder be triturated with solution of potash. The taste is not very marked, but is disagreeable, and very slightly acrid. The grains are externally violet-brown or black, more or less covered by a bloom, moderately brittle, the fractured surface being tolerably smooth, and whitish or pinkish-white.

Deterioration and Preservation.—The ergot of rye is fed on by a little acarus, which is about one-fourth the size of a cheese-mite. This animal destroys the interior of the ergot, leaves the grain as a mere shell, and produces much powdery excrementitious matter. In four months $7\frac{1}{2}$ ounces of this fæcal matter of the acari were formed in 7 pounds of ergot. According to our experience, if ergot be well dried at first, and afterwards kept in a warm and dry place, either exposed to the air or in hermetically-sealed bottles, it is not liable to change. It is advisable, however, not to use ergot which has been kept for more than two years.

Composition.—The chemistry of this subject is at present very imperfect; 102·20 gr. of ergot contain, according to Wiggers' analysis, 1·25 of *ergotin* and 35 of a *peculiar fixed oil.*—*Ergotin* was procured by digesting ergot with ether, to remove the fatty matter, and then in boiling alcohol. The alcoholic solution was evaporated, and the extract treated by water. The ergotin remained undissolved. It was brownish-red, with an acrid bitter taste, and, when warmed, had a peculiar but unpleasant odour. It was soluble in alcohol, but insoluble in water or ether. It is probable, therefore, that it is a resinoid colouring matter. It proved fatal to a hen. Nine grains of it were equal to an ounce and a half of ergot. It appears, then, that though a poisonous principle, it is probably not the agent which acts on the uterus; for the latter is soluble in water, whereas ergotin is not. It is possible, however, that it may be rendered soluble in water by combination with some other body. *Oil of Ergot.*—The liquid sold in the shops under the name of *oil of ergot* is obtained by submitting the ethereal tincture of ergot to evaporation by a very gentle heat. Its colour is reddish-brown. Its taste is oily and slightly acrid. It is lighter than water, and is soluble in alcohol and in solutions of the caustic alkalies. It is probably a mixture of several proximate principles. The oil has been supposed to possess the same influence over the uterus as that of the crude drug; that is, to occasion powerful uterine contractions. Winckler, however, considered it quite inoperative. The *tinctura ergotæ ætherea* of the last London Pharmacopœia was supposed to owe at least some, if not most, of its efficacy to this oil. The compilers, however, of the British Pharmacopœia have not only rejected this preparation, but in the preparation of liquid extract of ergot have first deprived the powdered ergot of its oil by passing ether through it. *Secalin.*—Winckler, after separating the fixed oil by means of ether, found in the watery extract of the residue, besides the ergotin of Wiggers, a volatile disagreeably-smelling nitrogenous substance, *secalin*, analogous to the volatile alkaloids. He regards ergotin as a nitrogenous acid, and considers that it forms with secalin a neutral compound, ergotate of secalin. Experiments, however, are still required to determine in which principle, or combination of principles, the efficacy of ergot resides.

Physiological Effects.—On the Uterine system.—The action of ergot on the uterus, *when labour has actually commenced*, is usually observed in from ten to twenty minutes after the medicine has been taken, and is manifested by an increase in the violence, the continuance, and the frequency of the pains, which usually never cease until the child is born; nay, they often continue for some minutes after, and promote the speedy separation of the placenta and the firm contraction of the uterus in a globular form. The contractions and pains caused by ergot are distinguished from those of natural labour by their continuance; scarcely any interval can be perceived between them, but a sensation is experienced of one continued forcing effort. If from any mechanical impediment (as distortion) the uterus cannot get rid of its contents, the violence of its contraction may cause its rupture. There is usually much less hemorrhage after delivery, when ergot has been employed, than where it has not been exhibited. Ergot has been charged with causing the death of the child; but the charge has been repelled by some experienced practitioners, as being devoid of the least foundation. It is not improbable, however, where the impediment to labour is very great, that the violent action of the uterus may have a deleterious influence on the fœtus. Dr. F. H. Ramsbotham has suggested that the poisonous influence of ergot may be extended from the mother to the fœtus, as in the case of opium. He also states that of 36 cases in which he induced premature labour by puncturing the membranes, 21 children were born alive; while in 26 cases of premature labour induced by ergot alone, 12 children *only* were born alive. This fact strongly favours the notion of the deleterious influence of the ergot on the fœtus. Given to excite abortion, or premature labour, ergot has sometimes failed to produce the desired effect. Hence many experienced accoucheurs have concluded, that for this medicine to have any effect on the uterus, it is necessary that the process of labour should have actually commenced. But while we admit that it sometimes fails, we have abundant evidence to prove that it frequently succeeds; and most practitioners are now satisfied that in a large number of cases it has the power of originating the process of accouchement. The action of ergot *on the unimpregnated uterus* is manifested by painful contractions, frequently denominated 'bearing-down pains,' and by the obvious influence which it exercises over various morbid conditions of this viscus; more particularly by its checking uterine hemorrhage, and expelling polypous masses. Tenderness of the uterus, and even actual metritis, are said to have been induced by it. *On the Cerebro-Spinal system.*—Weight and pain in the head, giddiness, delirium, dilatation of pupil, and stupor, are the principal symptoms which indicate the action of ergot of rye on the brain. *On the Circulatory system.*—Increased frequency and fulness of pulse, copious perspiration, and flushed countenance, sometimes follow the use of ergot during parturition. But in most instances the opposite effect has been induced: the patient has experienced great faintness, the pulse has been greatly diminished in both frequency and fulness, and the face has become pale or livid. *On the Digestive system.*—Nausea and vomiting are not uncommon consequences of the exhibition of ergot when the stomach is in an irritable condition.

Therapeutics.—Ergot seems to have been employed by women to promote labour-pains long before its powers were known to the profession. The following are the principal uses of it:—*To increase the expulsatory efforts of the womb in protracted or lingering labours.*—When the delay of delivery is ascribable solely to the feeble contractions of the uterus, ergot is admissible, provided, first, that there be a proper conformation of the pelvis and soft parts; secondly, that the os uteri, vagina, and os externum be dilated, or readily dilatable, and lubricated with a sufficient secretion; and, lastly, that the child be presenting naturally, or so that it shall form no great mechanical impediment to delivery. A natural position of the head is not, however, an absolute essential in all cases for the use of ergot, since this medicine is admissible in some cases of breech presentation. The circumstances which especially contraindicate or preclude the use of this medicine are those which create an unusual resistance to the passage of the child: such are, disproportion between the size of the head and the pelvis, great rigidity of the soft parts, and extraneous growths. Moreover, 'earliness of the stage' of labour is laid down by Dr. Bigelow as a circumstance contraindicating the use of ergot. The proper period for its exhibition is when the head of the child has passed the brim of the pelvis. Some practitioners assert that a dilated or lax condition of the os uteri is not an essential requisite for the exhibition of ergot. It has been contended that one of the valuable properties of this medicine is to cause the dilatation of the uterine orifice; and cases are not wanting to confirm these statements. *To hasten delivery when the life of the patient is endangered by some alarming symptoms.*—Thus, in serious hemorrhages occurring during labour, after the rupture of the membranes, and where the placenta is not situated over the os uteri, the ergot is especially indicated. It has also been employed to accelerate delivery in puerperal convulsions. But the narcotic operation of ergot presents a serious objection to its use in cerebral affections. *To provoke the expulsion of the placenta when its retention depends on a want of contraction of the uterus.*—In such cases ergot has often proved of great advantage. When the hemorrhage is excessive the ergot must not be regarded as a substitute for manual extraction, since, during the time required for its operation, the patient may die from loss of blood. In retention of the placenta from spasmodic or irregular contraction of the uterus, as well as from morbid adhesion, ergot is improper or useless. *To provoke the expulsion of sanguineous clots, hydatids, and polypi from the uterus.*—Coagula of blood collected within the womb after delivery may sometimes require the use of ergot to excite the uterus to expel them. Ergot is also valuable in promoting the expulsion of those remarkable formations called uterine hydatids. In uterine polypus, ergot has been exhibited with the view of hastening the descent of the tumour from the uterus into the vagina, so as to render it readily accessible for mechanical extirpation; for it is well known that until this is effected the patient is continually subject to hemorrhage, which in some cases proves fatal. In some instances ergot has caused the expulsion of a polypus. *To restrain uterine hemorrhage, whether puerperal or non-puerperal.*—The experience of physicians and surgeons in all parts of the civilised world has fully and incontestably established the efficacy of ergot as a remedy for uterine hemorrhage. In females subject to profuse uterine hemorrhages after delivery, ergot may be administered as a preventive, just before the birth of the child. Even in placenta presentations, a dose or two of ergot may be administered previously to the delivery being undertaken. To restrain excessive discharge of the lochia or catamenia, this remedy is sometimes most beneficial. *To provoke abortion, and to promote it when this process has commenced and is accompanied with hemorrhage.*—Under certain circumstances the practitioner finds it expedient to produce abortion: as in serious hemorrhage during pregnancy, and in deformed pelves which do not admit the passage of a full-grown fœtus. In such cases the ergot may be employed with great advantage. When abortion has already commenced, ergot may be employed to quicken the process and check hemorrhage. In *leucorrhœa* its efficacy has been attested by many practitioners.

Administration.—Ergot is given in the form of powder, infusion, liquid extract, or tincture. The powder is only to be prepared when required for use. The *dose* of it, for a woman in labour, is twenty grains, to be repeated, at intervals of half an hour, for three times; for other occasions (as leucorrhœa, hemorrhages, &c.) five to ten or fifteen grains, three times a day: its use should not be continued for any great length of time. It may be taken mixed with powdered sugar.

[§ **Extractum Ergotæ Liquidum.** *Liquid Extract of Ergot.*

Take of

Ergot, in coarse powder . . .	1 pound
Ether	1 pint, or a sufficiency.
Distilled Water	$3\frac{1}{2}$ pints.
Rectified Spirit	8 fluid ounces.

Shake the ether in a bottle with half a pint of the water, and after separation decant the ether. Place the ergot in a percolator, and free it from its oil by passing the washed ether through it. Remove the marc, and digest it in three pints of the water at 160° for twelve hours. Press out, strain, and evaporate the liquor by the heat of a water-bath to nine fluid ounces; when cold, add the spirit. Allow it to stand for an hour to coagulate, then filter. The product should measure sixteen fluid ounces.]

In this preparation, the ether is first washed with water to deprive it of the spirit which it contains, and which, if not removed, would dissolve out some of the active principles of the ergot. The washed ether is allowed to percolate through the ergot, which is thereby freed from its oil. The ergot then readily yields its soluble matters to water heated to 160°, a higher temperature being avoided to prevent coagulation before the active principles have been extracted. Spirit is added to the strained and evaporated liquor to preserve it, and the coagulated portion is filtered out. This preparation is said to be very efficacious. One fluid ounce of the extract is prepared from one ounce of the ergot, and is supposed to contain the whole of its active properties. The extract may therefore be administered in doses of from 10 to 30 minims.

[§ **Infusum Ergotæ.** *Infusion of Ergot.*

Take of

Ergot, in coarse powder	$\frac{1}{4}$ ounce.
Boiling Distilled Water	10 fluid ounces.

Infuse in a covered vessel, for half an hour, and strain.]

The *dose* for a woman in labour is from 1 to 2 fluid ounces, to be repeated at intervals of half an hour until the whole of the above infusion be taken. Sugar, aromatics (as nutmeg or cinnamon), or a little wine, or brandy, may be added to flavour it. The readiest and most efficient infusion is made in the following manner:—Place 20 grs. of powdered ergot in a teacup; pour upon it 2 or 3 fluid ounces of boiling water; cover the cup, infuse for a quarter of an hour; and let the whole be drunk *without straining.*

If the stomach does not retain this, the official infusion should be preferred.

[§ **Tinctura Ergotæ.** *Tincture of Ergot.*

Take of

Ergot, in coarse powder	5 ounces.
Proof Spirit	1 pint.

Macerate the ergot for forty-eight hours, in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.]

Dose.—It may be given in doses of 15 to 30 minims every four hours in cases of hemorrhage of a slight character, but in order to exert ecbolic effects it must be administered in doses of one fluid drachm every half-hour for three or four doses; and this quantity is also required if we use the preparation to check violent internal hemorrhage. One or two tea-spoonfuls of a tincture of ergot (prepared by digesting half an ounce of ergot in four fluid ounces of rectified spirit) mixed with water, has been recommended as an injection into the uterus in difficult labour. It is to be introduced between the head of the child and the neck of the uterus.

TORULA CEREVISIÆ, *Turpin.* The Yeast Fungus.

[§ **Cerevisiæ Fermentum.** *Beer Yeast.*

The ferment obtained in brewing beer.]

Botanical Source.—Yeast, or ferment, is generally considered (although there is some difference of opinion on this matter), to consist essentially of the sporules of *Torula Cerevisiæ*, whose vegetation is the immediate cause of the metamorphosis of the sugar. It is for this reason described amongst the Fungi, although it would otherwise come under the head of Products of Fermentation.

[§ *General Characters.*—Viscid, semi-fluid, frothy, exhibiting under the microscope numerous round or oval confervoid cells.]

Therapeutics.—As a medicine, yeast has been used both internally and externally. Internally it has been administered as a tonic and antiseptic in typhoid fevers. Dr. Stokes states that it usually acts as a mild laxative, improves the condition of the alvine evacuations, and is more effectual in removing petechiæ and black tongue than any other remedy. The dose of it is two table-spoonfuls every third hour, with an equal quantity of camphor water. Enemas of yeast and assafœtida are said by the same writer to be efficacious against typhoid tympany. Externally it is used in the form of poultice.

[§ **Cataplasma Fermenti.** *Yeast Poultice.*

Take of

Beer Yeast	6 fluid ounces.
Wheaten Flour	14 ounces.
Water, heated to 100° . . .	6 fluid ounces.

Mix the yeast with the water; and stir in the flour. Place the mass near the fire till it rises.]

It is applied, when cold, to fetid and sloughing sores as an antiseptic and stimulant; it destroys the fetor, often checks the sloughing, and assists the separation of the dead part. It should be renewed twice or thrice a day. I have frequently heard patients complain of the great pain it causes. The carbonic acid is supposed to be the active ingredient.

LICHENES, *Juss.* The Lichen Order.

CETRARIA ISLANDICA, *Ach.* Iceland Moss.

Botanical Character.—*Thallus* erect, 3 or 4 inches high, tufted and irregularly divided, foliaceous, and somewhat leathery, olive-brown on the upper or fertile surface, paler beneath; divisions channelled, lobed, and fringed (fig. 9). *Fructification* near the margin of the larger lobes consisting of flat brown plates (*apothecia*), (fig. 9, *a.*) with an elevated border. *Woodv.* pl. 205, p. 566 (*Lichen islandicus*); *Steph. and Church.* pl. 69.

Fig. 9.

Cetraria islandica.

a a a. The *apothecia* on the larger lobes of the thallus.

Habitat.—Dry mountainous districts of the new and old continents.

[§ **Cetraria.** *Iceland Moss.*

The entire lichen, Cetraria islandica, *Acharius, Lichenogr.* Native of the North of Europe.]

General Characters.—Iceland moss of commerce occurs in foliaceous, lobed, crisp, cartilaginous pieces of a brownish or greyish-white colour; the upper surface darker than the under surface, which is whitish, and marked with white spots lodged in little depressions of the thallus which have a chalky or mealy appearance, and when submitted to microscopic examination appear warty, pearl-white masses. Fructification is rather rare on the commercial lichen. When dry, the lichen is almost odourless. Its powder is whitish-grey. It swells up in cold water, to which it communicates some portion of bitterness, and a very little mucilage. A strong decoction gelatinises on cooling. If some tincture of iodine be dropped on the moistened thallus, the tissues become intensely blackish-blue.

Commerce.—It is imported from Hamburgh and Gottenburgh, and is said to be the produce of Norway and Iceland.

Composition.—Iceland moss contains about 80 per cent. of *amylaceous matters*, 3 of *cetraric acid*, a little *gum*, *uncrystallisable sugar*, and *extractive*. There are at least two kinds of amylaceous matter; namely, one which is coloured blue by iodine (*lichen starch*), and another which does not become blue with this agent (*inuline*). The *Cetraric Acid*, *Cetrarin*, or *Bitter Principle* resides in the cortical portion of the thallus. It exists there for the most part in the state of free cetraric acid, and not as a cetrarate. In the pure state the acid occurs in the form of shining minute acicular crystals. It is intensely bitter, not volatile, and is infusible without decomposition. It is almost insoluble in water, which, however, acquires a bitter taste when boiled with the acid. It is soluble in boiling alcohol, but crystallises in great part on cooling. It is slightly soluble in ether, and is quite insoluble in the fixed and volatile oils. It is dissolved both by the caustic and carbonated alkalies, and is precipitated from its solution by acids.

Physiological Effects.—It is a mucilaginous or demulcent tonic, without any trace of astringency. If the bitter matter and extractive be removed, it is nutritive, emollient, and demulcent, like ordinary starch, over which it has no advantage.

Therapeutics.—Iceland moss is well adapted to those cases requiring a nutritious and easily-digested aliment, and a mild tonic not liable to disorder the stomach. It has been principally recommended in chronic affections of the pulmonary and digestive organs, particularly phthisis, chronic catarrh, dyspepsia, chronic diarrhœa, and dysentery; but its efficacy has been much exaggerated.

Administration.—It is best exhibited in the form of decoction. When employed as an alimentary substance merely, the bitter matter should be extracted before ebullition. For this purpose the lichen should be heated once or twice in water up to about 180° F., by which it will be deprived of most of its bitterness. It is then to be boiled in water or milk. When the decoction is sufficiently concentrated it gelatinises on cooling. It may be flavoured with sugar, lemon-peel, white wine, or aromatics, and then forms an agreeable kind of diet.

[§ **Decoctum Cetrariæ.** *Decoction of Iceland Moss.*

Take of

Iceland Moss	1 ounce.
Distilled Water	1 pint.

Wash the moss in cold water, to remove impurities; boil it with the distilled water for ten minutes in a covered vessel, and strain, with gentle pressure, while hot; then pour distilled water over the contents of the strainer until the strained product measures a pint.

Dose.—1 to 4 fluid ounces.]

ROCCELLA, *Ach.*

Generic Character.—*Thallus* coriaceo-cartilaginous, rounded or plane, branched or laciniated. *Apothecia* orbicular, adnate with the thallus; the disk coloured, plano-convex, with a border at length thickened and elevated.

ROCCELLA TINCTORIA, *D.C.* Dyers' Orchella Weed.

Specific Character.—*Thallus* suffruticose, rounded, branched, somewhat erect, greyish-brown, bearing powdery warts [*soredia*]

Fig. 10.

Roccella tinctoria.

Fig. 11.

Roccella fuciformis.

a. Thallus with apothecia.

(fig. 10). *Apothecia* flat, almost black and pruinose, with a scarcely prominent border (fig. 10, *a*).

Habitat.—Maritime rocks of the eastern Atlantic islands (the Madeira Isles, the Azores, the Canaries, and the Cape de Verde Isles); and the western coast of South America.

ROCCELLA FUCIFORMIS, *D.C.* **Flat-leaved Orchella Weed.**

Specific Character.—*Thallus* (fig. 11) flat, branched, nearly upright, greyish-white, bearing powdery warts. *Apothecia* pruinose, bordered.

Habitat.—Angola, Madagascar, Madeira.

[§ **Litmus.** (Appendix I.)

A blue pigment prepared from various species of Roccella, *D.C.*]

Botanical Source.—A considerable number of lichens have been employed by man on account of the colouring matter which they yield him. Several species of *Roccella*, of *Lecanora*, of *Gyrophora*, &c., contain principles usually, if not in all cases, organic acids (e.g. *orsellic*, *erythric*, *lecanoric*, and *gyrophoric acids*), which are colourless while in the plant, but which, under the united influence of water, atmospheric oxygen, and alkalies, yield coloured products. *Purple* and *blue* colours are yielded by several lichens. In this country purple colours (*orchil* and *cudbear*) only are obtained from them; but in Holland a blue colour (*litmus*) is also prepared from the same lichens. It appears that any of the lichens which serve for the production of orchil may be used in the manufacture of litmus; but the best quality is prepared in Holland exclusively from *Roccella tinctoria*, while inferior sorts are made from species of *Variolaria*, *Lecanora*, and *Parmelia*. There are as many as nineteen sorts of litmus of varying quality kept by the Dutch manufacturers: some of these are more than six times the value of others, notwithstanding that, according to the observations of Hanbury, there is by no means a corresponding difference in richness or intensity of colour.

Preparation.—Dr. de Vry describes the manufacture of litmus as follows:—'Different species of Roccella from the Mediterranean, the Canary Islands, &c., are ground, and the powder mixed with weed ashes and water to make a pasty mixture, which is allowed to ferment. After some time, putrid urine and American potash are added to the mixture. When the paste has assumed a good blue colour, it is formed into quadrangular cakes, which are dried and sold, or when they are of an inferior quality are shaken with indigo or litmus-powder of superior quality. It is, however, very difficult to obtain accurate information about this manufacture, which is kept very secret.'

General Characters and Properties.—Litmus is imported from Holland in the form of small, rectangular, light, and friable cakes of an indigo-blue colour. The odour of the cakes is that of violets. The violet odour is acquired while the mixture is undergoing fermentation, and is common to all the tinctorial lichens. The colouring matter of litmus is soluble in both water and spirit, yielding a solution which, in the concentrated state, has a purple hue when viewed by transmitted light; but in the dilute state it is pure blue. Viewed by transmitted candlelight, it has a reddish colour. An aqueous infusion of litmus neither reddens turmeric paper nor occasions a precipitate with a solution of chloride of calcium. It contains, therefore, no free alkali or alkaline carbonate. It is reddened by acids and also by many of the metallic salts—as corrosive sublimate, sulphate of copper, sulphate of iron, &c. The infusion of litmus which has been reddened by acids has its blue colour restored by alkalies, alkaline earths, the alkaline and earthy sulphurets, the alkaline carbonates, the soluble borates, the tribasic phosphate of soda, and the alkaline cyanides. It is decolorised by chlorine and by the alkaline hypochlorites. Certain deoxidising agents also deprive it of colour; as sulphuretted hydrogen, hydrosulphuret of ammonia, sulphurous acid, the hyposulphites, nascent hydrogen (obtained by adding hydrochloric acid and zinc to an aqueous infusion of litmus), and the protosalts of iron. If an infusion of litmus be left in contact with sulphuretted hydrogen in a well-stoppered bottle for a few days, the liquid is decolorised, but reacquires its colour by exposure to the air or oxygen gas. The blue of litmus is distinguished from other vegetable blues by the action of acids and alkalies on it; for most vegetable blues and purples (as red-cabbage juice, syrup of violets, &c.) are changed to green by alkalies, whereas litmus-blue does not undergo this change. In the commoner varieties, however, of the litmus cakes of commerce, there is frequently found, besides the *litmus-blue*, another colouring matter, *indigo*, the existence of which was for some time entirely overlooked. Its presence is proved by the odour, the coppery lustre which they acquire when rubbed with the nail; by digesting them in oil of vitriol, by which a blue solution of sulphate of indigo is obtained; and by heating them in a watch-glass or platinum capsule, by which indigo vapour (characterised by its well-known odour and reddish-violet colour) and crystals of indigo are obtained.

Pharmaceutical Uses.—Litmus is employed as a test for acids and alkalies. The former communicate a red colour to blue litmus; the latter restore the blue colour of reddened litmus. If the litmus present be reddened by an unboiled, but not by a boiled, water, we may infer that the acid present is a volatile one; probably carbonic acid, or perhaps sulphuretted hydrogen.

[§ **Litmus Paper, Blue.** (Appendix I.)

Unsized white paper steeped in tincture of litmus, and dried by exposure to the air.]

Used to detect the presence of acids, and of salts which react as acids.

[§ **Litmus Paper, Red.** (Appendix I.)

Unsized white paper steeped in tincture of litmus which has been previously reddened by the addition of a very minute quantity of sulphuric acid, and dried by exposure to the air.]

Used as a test for alkalies, and salts which react as bases.

[§ **Litmus Tincture.** (Appendix I.)

Take of

Litmus, in powder . . .	1 ounce.
Proof Spirit	10 fluid ounces.

Macerate for two days in a closed vessel, and filter.]

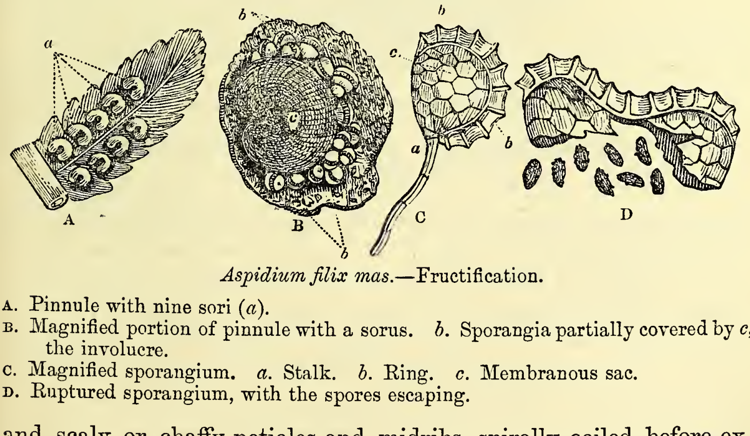
Sub-class II.—Acrogenæ.

FILICES, *Juss.* The Fern Order.

ASPIDIUM FILIX MAS, *Swartz.* **Male Fern.**

Botanical Character.—An herbaceous plant, with fronds 3–4 feet high, growing in a circle from a subterranean perennial scaly rhizome. *Fronds* bipinnate, with oblong obtuse serrated pinnules,

Fig. 12.



Aspidium filix mas.—Fructification.

A. Pinnule with nine sori (*a*).
B. Magnified portion of pinnule with a sorus. *b.* Sporangia partially covered by *c*, the involucre.
C. Magnified sporangium. *a.* Stalk. *b.* Ring. *c.* Membranous sac.
D. Ruptured sporangium, with the spores escaping.

and scaly or chaffy petioles and midribs, spirally coiled before expansion (fig. 13); *sori* round (fig. 12 A, B,) situated on the back of the frond, near the central vein; *involucre* reniform (fig. 12, B, *c*);

capsules (*sporangia*) (fig. 12, C, D), surrounded by a vertical ring, opening transversely.—*Woodv.* p. 136, pl. 271.

Habitat.—An indigenous plant, frequent in woods and on shady banks.

[§ **Filix Mas.** *Male Fern.*

The dried rhizome with the bases of the footstalks and portions of the root-fibres of Aspidium Filix mas, *Swartz.* Collected in summer.]

General Characters.—The rhizome (*fern root*), (fig. 13), varies in length and breath, according to its age. For medical purposes it

Fig. 13.

Aspidium Filix mas.—Fresh rhizome entire.

a. Spirally-coiled young frond. *b b b.* Footstalks of the older fronds. *c c.* Root-fibres or rootlets.

should be from three to six or more inches long, and from half an inch to an inch or more broad. It is almost completely enveloped by the thickened bases of the footstalks (*petioles*) of the fallen fronds. These are one or two inches long, curved, angular, brown, and furnished with numerous shining, reddish-yellow, thin, silky scales. The root-fibres (rootlets) arise from the rhizome between these footstalks. Internally, the rhizome and footstalks are, in the recent state, fleshy, and of a light yellowish-green colour; but in the dried state, yellowish or reddish-white. The dried rhizome has a disagreeable odour. Its taste is at first sweetish, then bitter and somewhat astringent, and subsequently nauseous, like rancid fat. The powder should be preserved in well-stoppered bottles. Both the entire rhizome and powder deteriorate by keeping.

Composition.—Fern rhizome contains a *green fatty oil*, *volatile oil*, and *tannic acid*. The presence of tannic acid in the aqueous decoction of male fern is shown by the persalts of iron producing a dark green colour (*tannate of iron*), and by a solution of gelatine causing a yellowish precipitate (*tannate of gelatine*).

Therapeutics.—Male fern has been long employed as an anthelmintic. 'It is an excellent remedy,' says Bremser, 'against *Bothriocephalus latus*, the tapeworm of the Swiss, but not against *Tænia Solium*, the tapeworm of this country; for though it evacuates some pieces of the latter, it does not destroy it.' Numerous practitioners have, however, testified to its value as a destroyer and expeller of tape-worm in this country.

Administration.—It may be administered in the form of powder, or of liquid extract. The dose of the recently prepared powder is from 50 to 150 grains.

[§ **Extractum Filicis Liquidum.** *Liquid Extract of Male Fern.*

Take of

Male Fern, in coarse powder . .	2 pounds.
Ether	4 pints, or a sufficiency.

Pack the male fern closely in a percolator, and pass the ether slowly through it until it passes colourless. Let the ether evaporate on a water-bath, or recover it by distillation, and preserve the oily extract.]

This ethereal extract is commonly termed oil of fern. A pound of the rhizome yielded Soubeiran an ounce and a half of thick black oil, having the odour of the fern. The anthelmintic property resides in the oil. The *dose* is from 15 to 30 minims or more in the form of electuary, emulsion, or pills; an hour afterwards, an ounce or an ounce and a half of castor oil should be exhibited to expel the destroyed worm.

Sub-kingdom II.—*PHANEROGAMIA; COTYLEDONES,* or *FLOWERING PLANTS.*

Class II.—MONOCOTYLEDONES.

Sub-class I.—Glumaceæ.

GRAMINACEÆ, *Lindley.* The Grass Order.

AVENA SATIVA, *Linn.* The Common Oat.

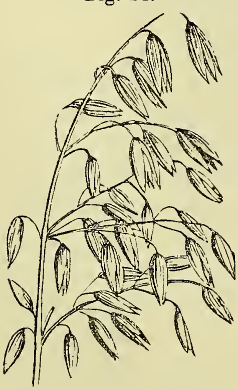
(*Not official.*)

Botanical Character.—*Panicle* (fig. 14) loose. *Spikelets* 3, 2-flowered; *flowers* remote, the upper one withered. *Glumes* 2, membranous, awnless. *Paleæ* 2, herbaceous; the lower one awned on the back, awn twisted; the upper one awnless. *Stamens* 3. *Ovary* hairy at the point. *Stigmas* 2, sessile, distant, with simple hairs. *Scales* 2-smooth, large. *Grain* (*caryopsis*) long, somewhat terete, internally marked by a longitudinal furrow, hairy at the point, covered by the paleæ.

Habitat.—Cultivated in Europe. A considerable number of varieties are cultivated; these are distinguished on account of their colours under the two heads of *white oats*, and *red*, *dun*, or *black oats.*

General Characters.—Oats are too well known to need more than a general notice. As found in commerce, the grains (the part used for medicinal and dietetical purposes) are usually enclosed in the paleæ or husk. When deprived of their integuments, they are called *groats*; these, when crushed, are denominated *Embden groats. Oatmeal* is prepared by grinding the grains. It is not so white as wheaten flour, and has a somewhat bitterish taste.

Fig. 14.



Avena sativa (the white variety.)

Composition.—The average composition of oats is:—*Starch*, 66; *gluten, albumen,* &c., 18; *sugar, gum, oil,* &c., 12; *salts,* &c., 4.

Therapeutics.—In medicine we employ *gruel*, prepared from groats or oatmeal, as a mild, nutritious, and, in most cases, easily digested article of food in fevers and inflammatory affections. It is also in general use after parturition; and is the basis of *caudle.* In poisoning by acrid substances, it is employed as an emollient and demulcent. It is frequently used, either alone or in conjunction with other agents, as an enema. Oatmeal is also used for making poultices.

HORDEUM DISTICHON, *Linn.* Two-rowed, or Long-eared Barley.

Botanical Character.—*Spikelets* spiked (fig. 15), 3 together, 2-flowered, the upper flower being rudimentary; the *lateral flowers* male, awnless; the *central ones* hermaphrodite, distichous, close-pressed to the stalk, awned. *Glumes* 2, collateral, awned. *Grain* (*caryopsis*) hairy at the summit, oblong, with a longitudinal furrow, adherent to the paleæ.

Fig. 15.

Hordeum distichon.

Habitat.—A native of Tartary, cultivated in Britain.

[§ **Hordeum Decorticatum.** *Pearl Barley.*

The husked seeds of Hordeum distichon, *Linn.* Cultivated in Britain.]

General Characters.—The grains, deprived of their husk by a mill, form *Scotch*, *hulled*, or *pot-barley*. When all the integuments of the grains are removed, and the seeds are polished, they constitute the *official* or *pearl-barley*. They are then white, rounded, and retaining a trace of the longitudinal furrow.

Composition.—The average composition of fine barley-meal is:—*Starch*, 68; *gluten*, *albumen*, &c., 14; *fatty matter*, 2; *saline matter* or *ash*, 2; *water*, 14=100.

Uses.—Barley is used in the form of decoction as a demulcent, and as a vehicle for more active medicines.

[§ **Decoctum Hordei.** *Decoction of Barley.*

Take of

Pearl Barley	2 ounces.
Distilled Water	$1\frac{1}{2}$ pint.

Wash the barley in cold water, and reject the washings; boil the washed barley with the distilled water for twenty minutes in a covered vessel, and strain.]

This is a valuable demulcent and emollient drink for the invalid in febrile cases and inflammatory disorders, especially of the chest and urinary organs. It is sometimes given to children as a slight laxative. It is usually flavoured with sugar, and frequently with some slices of lemon.

TRITICUM VULGARE, *Villars*. Common Wheat.

Botanical Character.—*Spikelets* generally 4-flowered. *Flowers* distichous; *glumes* 2, opposite, nearly equal, ribbed. *Paleæ* 2, ovate; the lower awnless, the upper bicarinate, keels ciliated. *Grain* (*caryopsis*) convex externally, free, marked with a deep furrow internally.

Fig. 16.

a. T. vulgare, var. æstivum.
b. T. vulgare, var. hybernum.

Var. æstivum (fig. 16, *a*), spring wheat; annual, glumes awned.

Var. hybernum (fig. 16, *b*), winter wheat; biennial, glumes almost awnless.

Habitat.—A native of Tartary. Widely cultivated in Europe.

[§ Farina Tritici. *Wheaten Flour.*

The grain of wheat, Triticum vulgare, *Villars*, ground and sifted.]

Composition.—The proportion of the organic constituents of wheaten flour is liable to considerable variation, according to soil, climate, variety of seed, mode of culture, time of cutting, and quality of manure.

The percentage composition of wheaten flour varies from 52 to 75 of *starch*, from 10 to 23 of *gluten* and *albumen*, and from 6 to 13 of *dextrine* and *glucose*. Wheat contains at least four different proteine compounds—namely, *albumen*, *vegetable fibrine*, *gluten*, and *caseine*. They have an analogous composition, and contain each about 16 per cent. of nitrogen. If wheaten dough be washed on a sieve by a stream of water, a milky liquid passes through, and a tenacious elastic mass is left behind, called *crude gluten*. The milky liquid holds in solution gum, sugar, and albumen; and in suspension, starch: the crude gluten contains vegetable fibrine, gluten, caseine, and oil. The cold decoction of wheaten flour forms with tincture of iodine the blue iodide of starch, and recently-prepared tincture of guaiacum forms a blue colour with its gluten.

Therapeutics.—Wheaten flour is used with great advantage as a dusting powder in burns and scalds. It cools the part, excludes the air, and absorbs the discharge, forming a crust which effectually protects the subjacent part. When the crust has become detached by the accumulation of purulent matter beneath, a poultice may be applied, and after its removal the exposed surface may be again dusted over with flour. A mixture of flour and water is used as a chemical antidote in poisoning by the salts of mercury, copper, zinc, silver, and tin, and by iodine.

Pharmaceutical Uses.—Wheaten flour is a constituent of the *yeast-poultice*, and is sometimes used in pharmacy for enveloping pills.

[§ **Amylum.** *Starch.*

The starch procured from the seeds of common wheat, Triticum vulgare, *Villars.*]

Preparation.—A mixture of coarsely ground wheat is steeped in water in a vat for one or two weeks (according to the state of the weather), by which acetous fermentation is established. The acid liquor called *sours* is drawn off, and the impure starch washed on sieves to separate the bran. What passes through is received in shallow vessels termed *frames*. Here the starch is deposited. The sour liquor is again drawn off, and the *slimes* removed from the surface of the starch, which is to be again washed, strained, and allowed to deposit. When, by these processes, the starch has become sufficiently pure, it is *boxed* ; that is, it is placed in wooden boxes perforated with holes and lined with canvas, where it drains. It is then cut into square lumps, placed on chalk stones or bricks, to absorb the moisture, and dried in a stove. By this process the blocks are *crusted.* The blocks are then scraped, papered, labelled, stamped, and returned to the stove. Here they split into columnar masses (like grain tin or basaltic columns), which are commonly called *races.*

General Characters and Tests.—In white columnar masses. When rubbed in a Wedgwood mortar with a little cold distilled water, it is neither acid nor alkaline to test paper, and the filtered liquid does not become blue on the addition of solution of iodine; mixed with boiling water and cooled, it gives a deep blue colour with iodine. In commerce there are two kinds of wheat starch—one *white*, the other *blue.* The *white* is the sort which should be employed for dietetical or medicinal purposes. When heated in a tray in an oven to 300° F., it acquires a buff colour, and is converted into dextrine or British gum. Boiled in water, wheat starch yields a mucilage, which, when sufficiently concentrated, forms, on cooling, a jelly. When submitted to prolonged ebullition in a large quantity of water, the granules of wheat starch almost entirely dissolve, and the decoction, on cooling, does not gelatinise.

Therapeutics.—Starch powder is used as a dusting powder to absorb acrid secretions and to prevent excoriation. Its decoction is used as an emollient and demulcent enema in inflammatory conditions of the large intestines, and as a vehicle for the formation of other more active enemas. Starch is an antidote for poisoning by iodine, and is sometimes given in combination with this substance to prevent its local action.

Pharmaceutical Uses.—It is an ingredient of compound powder of tragacanth.

[§ **Glycerinum Amyli.** *Glycerine of Starch.*

Take of

Starch	1 ounce.
Glycerine	8 fluid ounces.

Put them together until they are intimately mixed, then transfer the mixture to a porcelain dish, and apply a heat gradually raised to 240°, stirring it constantly until the starch particles are completely broken, and a translucent jelly is formed.]

This is intended to be used as an ointment, over the ordinary greasy forms of which it presents some advantages. It has been suggested that this gelatinised glycerine would be a good vehicle for the application of aconitia, atropia, &c.

[§ **Mucilago Amyli.** *Mucilage of Starch.*

Take of

Starch	120 grains.
Distilled Water	10 fluid ounces.

Triturate the starch with the water, gradually added, then boil for a few minutes, constantly stirring.]

It is sometimes used alone as an enema in dysentery, irritation of the rectum, &c. It is a constituent of all the official enemas except those of assafœtida and tobacco.

[§ **Mica Panis.** *Crumb of Bread.*

The soft part of bread made with wheat flour.]

The bread intended by the Pharmacopœia is probably the ordinary fermented loaf bread, the ingredients of which are wheat flour, salt, water, and yeast, to which a portion of potatoes is usually added by the baker, not for adulteration, but to assist fermentation, and to render the bread lighter. No directions, however, are given respecting its nature and composition, except that it shall be made with wheat flour.

Uses.—Fermented bread is employed both in medicine and pharmacy. Wheat flour, especially when baked, is rather constipating than purgative. In this it differs from both barley meal and oat meal. Infants who are fed on baked flour frequently suffer with constipation; and to relieve this it is sometimes found necessary to substitute a portion of barley meal for an equivalent weight of wheat flour. Wheat flour yields the finest, whitest, lightest, and most digestible kind of bread. It owes its superiority in these respects to the large quantity of tenacious gluten which it contains. Undressed wheat flour appears to act, by the bran which it contains, as a mechanical stimulant to the bowels; and hence brown bread is resorted to for the purpose of counteracting habitual constipation. It, however, frequently fails to produce the desired effect. In some forms of dyspepsia, fermented bread disagrees with the patient; and, in such, benefit is occasionally obtained by the substitution of unfermented bread. In diabetes ordinary bread is objectionable on account of its starch augmenting the saccharine condition of the urine; hence Bourchardat suggested, under such circumstances, the use of a *gluten bread* as a substitute for the ordinary wheaten bread. *Bran bread* is, however, in my opinion, the best for diabetic patients. The following formula yields a good bread of this kind, and has proved highly useful:—Take coarse *wheat bran*; wash it thoroughly with water on a sieve until the water passes through clear; then dry it in an oven, and grind to a fine powder by a mill. Then take 7 eggs, 1 pint of milk, $\frac{1}{4}$ lb. of butter, a few caraways or some ginger, and make into a paste with a sufficiency of the bran flour. Divide the mass into seven equal parts, and bake each separately, in a saucer, by rather a quick oven: the time required for baking is usually about twenty minutes. Some practitioners, however, much prefer the use of *gluten bread* to *bran bread*, for diabetic patients.

Crumb of bread is most valuable for the preparation of poultices. The *bread and water poultice* is prepared by covering some bread in a basin with hot water: after it has stood for ten minutes, pour off the excess of water, and spread the bread about one-third of an inch thick on soft linen, and apply it to the affected part. Sometimes lint dipped in oil is applied beneath the poultice. Decoction of poppy, or Goulard's water, may be substituted for common water. This is a valuble application to phlegmonous inflammation, and in the treatment of irritable ulcers.

Pharmaceutical Use.—It is an ingredient in charcoal poultice.

SECALE CEREALE, *Linn.* Common Rye.

Botanical Character.—*Spikelets* (fig. 17) 2-flowered. *Florets* sessile, distichous, with the linear rudiment of a third terminal one. *Glumes* 2, keeled, awned; *glumes* and *awns* scabrous. *Paleæ* 2, herbaceous, the lower one awned at the point, keeled, unequal sided, the upper shorter and bicarinate (fig. 17, *f f*). *Grain* (*caryopsis*), free, hairy at the point.

Habitat.—The Caucasian Caspian desert, cultivated in Europe, but little in England.

The grains are official when in a diseased state (see Ergota, p. 386).

Fig. 17.

Secale cereale. *e*, entire plant; *f f*, paleæ.

SACCHARUM OFFICINARUM, *Linn.* The Sugar Cane.

Botanical Character.—*Stem* six to twelve feet high, closely jointed, solid. *Leaves sheathing*, flat, long, and linear. *Panicle* terminal, from one to three feet long, spreading, of a grey colour from the long soft hairs that surround each flower. *Spikelets* all fertile, in pairs, the one sessile, the other stalked, articulated at the base, 2-flowered, the lower floret neuter, with 1 palea, the upper hermaphrodite, with 2 paleæ. *Glumes* 2, membranous, with very long hairs on the back. *Paleæ* rose-coloured, awnless, those of the hermaphrodite flower minute, unequal. *Ovary* smooth: *styles* 2, long; *stigmas* feathery. —*Nees. Plant. Med.* Plates 33, 34, 35. — *Steph. and Church.* plate 148.

Habitat.—It is cultivated in both Indies. Its native country is uncertain.

[§ **Saccharum Purificatum.** *Refined Sugar.*

$C_{24}H_{22}O_{22}$ or $\mathbf{C_{12}H_{22}O_{11}}$.

Pure cane sugar prepared from the juice of the stem of Saccharum officinarum, *Linn.* From plants cultivated in the West Indies and other tropical countries.]

Formation of Raw Sugar.—The canes, when ripe, are cut close to the ground, stripped of their leaves, and subjected to pressure between iron rollers. Cane juice contains from 18 to 20 per cent. of saccharine matter, which is all crystallisable, or true cane sugar; the uncrystallisable sugar, or molasses, which is obtained by evaporation from the juice, being the product of alterations effected in the crystallisable sugar by the operation. The clarification of cane juice is effected by the combined use of heat and lime. The heat serves to coagulate any vegetable albumen which may be present. The lime neutralises the free acid, and combines with a peculiar albuminous or proteine body not coagulable by heat or acids and readily putrifiable and forms with it a coagulum, the separation of which is promoted by the heat. Part of it rises to the top as a scum, and the remainder subsides as a thick muddy deposit. The clarified juice is then drawn off into the boiler, evaporated and skimmed. When it has acquired a proper tenacity and granular aspect, it is emptied into a cooler and allowed to crystallise or *grain*. The concrete sugar is then placed in casks perforated with holes in the bottom. Here the sugar is allowed to drain for three or four weeks. It is then packed in hogsheads and sent to this country under the name *muscovado* or *raw sugar*. The drainings, or uncrystallised portion of sugar, constitute *molasses*.

Sugar Refining.—Raw sugar is a mixture of crystallisable and uncrystallisable sugar, contaminated by various organic and mineral substances. It is dissolved in water by the aid of steam; the liquid heated with bullock's blood, and filtered through canvas bags; and the clear liquor allowed to percolate slowly through enormous cylinders containing coarse grained animal and fresh burnt charcoal. The filtered liquor, which is nearly colourless, is boiled by the aid of steam, under diminished atmospheric pressure, at a temperature of about 170° F. When the requisite degree of concentration has been attained, the syrup is transferred to conical moulds, whose orifices are closed; and when the contents have solidified, the stoppers are withdrawn, and the moulds placed in pots, in order to allow the *green syrups* or treacle to drain off. The loaves are then *sugared* by pouring on their base a saturated syrup, which slowly percolating through the mass carries with it the colouring matter and other impurities, but does not dissolve the crystallised sugar. The loaves are finally dried in a stove. 112 lbs. of raw sugar yield by the above process about 79 lbs. of refined sugar and 16 lbs. of treacle.

General Characters and Properties.—Refined sugar is in compact crystalline conical loaves, known in commerce as loaf sugar. The refined sugar of commerce is snow-white, dry, scentless, intensely and purely sweet, porous, friable, and made up of small crystalline grains. Common or cane sugar is the sweetest of all kinds of sugar. It is permanent in the air, and phosphorescent in the dark when struck or rubbed. When heated, it melts and soon becomes coloured. By this process its tendency to crystallise is diminished or destroyed. When it is subjected to a temperature of about 356° F. it melts: and, at a higher temperature, begins to give off water and to suffer decomposition. If the heat be gradually augmented it becomes brown, evolves a remarkable odour, loses its sweet taste and acquires a bitter one. In this condition it is called *caramel* or *burnt sugar.* It is very soluble in water, both hot and cold: is soluble in rectified spirit, but not in ether. Its watery solution, aided by heat, decomposes some of the metallic salts (as those of copper, mercury, gold, and silver); but several of them (as the subacetate of copper and nitrate of silver) require nearly a boiling temperature to change them. A dilute watery solution of sugar, with a little yeast, undergoes the vinous fermentation. Sugar promotes the solubility of lime in water, and forms both a soluble and an insoluble compound with oxide of lead. Cane sugar is capable of existing either in the crystallised or amorphous state. In this respect it resembles sulphur. By the slow cooling of a saturated aqueous solution of sugar we obtain the large and fine crystals which constitute the commercial *sugar candy.* These crystals are doubly oblique prisms.

Cane sugar is known by its susceptibility of undergoing the vinous fermentation; that is, of suffering a peculiar decomposition into alcohol and carbonic acid. For this purpose it is dissolved in water, and to the solution a small portion of yeast (dry yeast is to be preferred) is added, and the mixture exposed to a temperature of about 70° F. Effervescence soon takes place, carbonic acid is evolved, and a vinous or alcoholic liquor is produced. In this process the cane sugar ($C_{12}H_{22}O_{11}$) combines with water, and becomes grape sugar, $C_{12}H_{24}O_{12}$, which by fermentation is resolved into four molecules of carbonic acid, $4CO_2$, and four molecules of alcohol, $4C_2H_6O$. It is also distinguished by the following characters:—Its crystallisability in prismatic crystals, its very sweet taste, its ready solubility in water, its solution being charred and letting fall a brown or black powder when heated with a few drops of oil of vitriol, but being unchanged when treated in the same way with caustic potash, and by the difficulty with which it reduces the blue hydrated oxide of copper to the orange suboxide.

Therapeutics.—Sugar is but little used medicinally. In the form of lozenges, sugar candy, &c., it is slowly dissolved in the mouth to allay tickling cough. As a chemical antidote, it has been recommended in poisoning by arsenious acid, and by the salts of copper, mercury, silver, gold, and lead. But any advantage procured by its use in these cases is referable to its demulcent and emollient properties, and not to its chemical influence.

Pharmaceutical Uses.—Sugar serves to preserve, to give flavour, bulk, form, cohesiveness, and consistence; to subdivide, and to suspend oily substances in aqueous liquids. To fulfil one or more of these objects, it is a constituent of all the *syrups* and *lozenges*, some *mixtures*, *pills*, *powders*, and *other preparations* of the Pharmacopœia. It is also useful in preserving some inorganic compounds: thus it checks, though it does not absolutely prevent, the higher oxidation of some of the protosalts of iron: hence its use in the saccharated carbonate of iron, and the syrup of iodide of iron.

[§ **Syrupus.** *Syrup.*

Take of

Refined Sugar	5 pounds.
Distilled Water	2 pints.

Dissolve the sugar in the water with the aid of heat; and add, after cooling, as much distilled water as may be necessary to make the weight of the product seven pounds and a half. The specific gravity should be 1·330.]

Syrup is used in medicine to give flavour, cohesiveness, and consistence. It is a constituent in several preparations of the Pharmacopœia.

[§ **Theriaca.** *Treacle.*

Synonym.—Sacchari Fæx, *Lond.*

The uncrystallised residue of the refining of sugar.]

Molasses and Treacle.—These are viscid dark brown dense liquids, composed of amorphous or uncrystallisable sugar, crystallisable sugar, gum, extractive, various salts, and water. They are frequently confounded, but in trade are considered distinct. *Molasses* (more correctly *Melasses*, from *mel*, honey, because it is soft and sweet like honey) is the drainings from raw or Muscovado sugar. *Treacle* is the viscid dark brown uncrystallisable syrup which drains from refined sugar in the sugar moulds. It is thicker than molasses, has a somewhat different flavour, and contains, on an average, 75 per cent. of solid matter.

[§ *General Characters and Test.*—A thick brown fermentable syrup, very sweet; not crystallising by rest or evaporation. Specific gravity about 1·40. Nearly free from empyreumatic odour or flavour.]

Pharmaceutical Uses.—For making pills, treacle serves to give cohesiveness, to preserve the pill mass soft, to prevent mouldiness, and in some cases to check chemical changes. For these purposes it is a constituent of several official preparations.

Sub-class II.—Petaloideæ.

PALMACEÆ, *Lind.* The Palm Order.

SAGUS, *Gaertner.*

Generic Character.—*Flowers* hermaphrodite or polygamo-monœcious. *Spadix* much branched, sheathed by many incomplete spathes. *Bract* squamiform: *bractlets* very densely villose-bearded, connate like a cupule. *Perianth* in two whorls with three divisions in each whorl. *Stamens* 6: filaments subulate, connate at the base; *anthers* affixed by the back. *Ovary* subtrilocular: *stigmas* 3, connate in a pyramid. *Fruit* coated by reversed scales, 1-seeded. *Albumen* ruminated or uniform; *embryo* dorsal.

SAGUS LÆVIS, *Rumph.*

Specific Character.—*Stem* tallish. Petioles, rachides, and spathes *unarmed. Fruit* somewhat globose, and depressed on both sides.

Habitat.—Islands of the Indian Archipelago, Sumatra and Borneo, and the islands between them, growing spontaneously in low swampy lands.

SAGUS GENUINA, *Rumph.*

Specific Character.—*Stem* of middling height. Petioles, rachides and spathes *prickly*; the prickles scattered or confluent. *Fruit* somewhat globose, depressed on both sides.

Habitat.—Islands of the Indian Archipelago. Abounds in the Molucca islands, especially where the nutmeg and clove grow naturally.

SAGUERUS SACCHARIFER, *Blume.* The Gommuti Palm.

Botanical Character.—*Tree* 20–25 feet high. *Petioles* unarmed. *Flowers* monœcious by abortion, on separate spadices, sessile, the female ones between two males. *Spadices* simply branched; *branches* elongated, pendulous. *Spathes* many, incomplete. *Perianth* with 6 divisions in 2 whorls; the outer divisions imbricated, the inner valvate. MALES: *Stamens* numerous: *filaments* filiform: *anthers* linear, cuspidate. FEMALES: *Ovary* trilocular, with the *ovule* affixed at the bottom of the internal angle. *Stigmas* 3, acute, connivent. *Fruit* turbinate-globose 3- or, by abortion, 2-seeded. *Albumen* uniform; *embryo* dorsal.

Habitat.—Very common in the islands of the Indian Archipelago, the Moluccas, and the Philippines.

Sagus. *Sago.*

The starch obtained from the interior of the stems of the above and other species of Sagus, *Gaertner*, and of Saguerus saccharifer, *Blume.*

(*Not official.*)

Manufacture. a. Of Sago meal.—The mode of preparing sago meal varies somewhat in different localities. In the Moluccas it is obtained as follows:—When the tree is sufficiently mature, it is cut down near the root, and the trunk subdivided into portions of six or seven feet long, each of which is split into two parts. From these the medullary matter is extracted, and with an instrument of bamboo or hard wood is reduced to powder, like sawdust. To separate the starch from the accompanying bran and filaments, it is then mixed with water, and the mixture afterwards strained by a sieve. The strained liquor deposits the starch, which, after two or more edulcorations, is fit for use. This is *sago meal. b. Of Granulated Sago.*—To prepare this the meal is mixed with water and made into a paste, which is then granulated. Forrest says that in New Guinea granulated sago is made by mixing the sago meal with water and passing the paste through a sieve into a very shallow iron pot held over a fire, by which it is made to assume a globular form; so that, he adds, our grained sago is half baked and will keep long. This, according to Blume, is the process which is followed by the Chinese colony in Singapore; the meal being first repeatedly worked and dried. Blume adds, that during the heating process the grains are constantly turned, and that, though quite white at the commencement, they become hard and somewhat pellucid during the process.

General Characters, Varieties, and Commerce.—Sago occurs in commerce in two states,—in powder (*sago meal*), and in grains (*granulated sago*). It is brought to England from Singapore in boxes and bags, chiefly the former.

a. Sago meal.—This is imported in the form of a fine amylaceous powder. It is whitish with a buffy or reddish tint. Its odour is faint, but somewhat unpleasant and musty. Examined by the microscope, it is found to consist of irregularly elliptical, more or less ovate, usually isolated granules, which are often somewhat narrowed at one extremity. Owing to their mutual pressure, many of them appear as if truncated, either by a single plane perpendicular to the axis of the granule, in which case they are more or less mullar-shaped,—or by two inclined planes giving the granules a dihedral extremity. Some of them resemble in form a caoutchouc bottle cut off at the neck. From their strong lateral shading they are obviously convex. Many of the granules are more or less broken. Most of them have an irregular or tuberculated surface, as if eroded. The hilum, when perfect, is circular; but it is frequently cracked in the form of a single slit, or of a cross, or in a stellate manner. The surface of the granules presents the appearance of a series of concentric rings or annular striæ, which, however, are much less distinct than in potato starch. When examined by the polarising microscope, the granules show a black cross, the centre of which is the hilum.

b. Granulated Sago.—The grains are more or less rounded masses of variable size and colour. There are two kinds of granulated sago,—common or brown sago, and pearl sago.

α. Common or *Brown Sago* (*Borneo Sago*).—This is the only kind of sago which was known in English commerce prior to the introduction of pearl sago. It occurs in somewhat irregularly rounded or globular masses or grains, varying in size from a white mustard seed to that of a small pea, and which are whitish on one side, and greyish-brown on the other. Examined by the microscope, the grains of brown sago are found to consist of granules like those of sago meal, but somewhat more broken and less regular in their shape. Some of them present the appearance of containing in their interior a smaller granule, or rather perhaps an air cavity, which, when examined by polarised light, forms the centre of the black cross. Intermixed with the starch granules is a yellowish-brown substance, which gives colour to the sago.

β. Pearl Sago.—This is prepared by the Chinese of Malacca, and also at Singapore. Pearl sago occurs in pearl-like grains, which vary ordinarily in size from that of a poppy seed to a white mustard seed. The shape of the larger grains is more or less globular, that of the smaller ones being often much less regular. The surface of the larger grains is smooth, even, and regular; that of the small grains often rough, uneven, and somewhat tuberculated. Occasionally two or three of the smaller grains adhere together. Some samples are white, others brownish-yellow, pink, or roseate. The coloured grains are not of uniform tint over the whole of their surface; often being on one side white, and on the other coloured. By the aid of a solution of chloride of lime, the coloured kinds can be bleached and rendered perfectly white. When submitted to microscopic examination, pearl sago is found to consist of the same kind of starch granules as sago meal, but all more or less ruptured, and presenting indistinct traces of rings.

Composition.—Sago has not been analysed. The pure starch, of which it essentially consists, doubtless has the same composition as other amylaceous substances. Sago meal is contaminated with various impurities. Granulated sago contains some colouring matter. Sago possesses the general chemical characters of amylaceous substances.

Physiological Effects.—Sago is nutritive and easy of digestion, and is an important article of food in some parts of the East.

Uses.—Sago puddings are occasionally brought to table. But the principal use of sago is to yield a light, nutritious, easily digestible, and non-irritating article of food for the invalid in febrile and inflammatory cases. For this purpose it should be boiled in water (in some cases milk is preferred), the solution strained, and flavoured with sugar and spices, or even with a little white wine, when the use of this is not contraindicated.

MELANTHACEÆ, *R. Brown.* THE COLCHICUM ORDER.

COLCHICUM AUTUMNALE, *Linn.* Meadow Saffron.

Botanical Character.—*Root* fibrous. *Corm* ovate, fleshy, covered with a loose brown membrane (fig. 18, *a*). *Leaves* flat, broadly lanceolate, erect. *Flowers* several, lilac or pale purple, arising from the corm by a long narrow white tube; limb petaloid. *Stamens* 6, inserted into the throat of the tube. *Styles* 3, (fig. 18, *b*) filiform, long. *Capsule* 3-celled, opening through the dissepiments. *Seeds* small, spherical, with a rough brown testa. The flowers appear in September, and the leaves and fruit the following spring or summer.—*Woodv.* pl. 177, p. 483.

Habitat.—Moist rich meadows in many parts of England.

[§ **Colchici Cormus.** *Colchicum Corm.*

The fresh corm of Colchicum autumnale, *Linn.*; collected about the end of June; and the same stripped of its coats, sliced transversely, and dried at a temperature not exceeding 150°.]

Growth and Collection.—The corm is biennial. It first appears about the end of June or beginning of July: it flowers in the autumn, and produces its leaves in the spring, and its seeds in the June of the following year. It then begins to shrivel, becomes leathery, and finally disappears in the succeeding spring or summer. The activity of the corm varies at different seasons of the year. It is usually considered to be greatest when it is about a year old—that is, about the end of June or beginning of July, between the withering of the leaves and the sprouting forth of the flower of the young corm. At this period it is fully developed, and has not exhausted itself by the production of the young corm, and it is therefore now directed to be collected for use in medicine. The London market is principally supplied from Gloucestershire, but partly, also, from Hampshire and Oxfordshire.

Fig. 18.

Colchicum autumnale.
a. The flowering plant.
b. Stigmas, with a portion of the styles.
c. Leaves and fruit.

General Characters.—The fresh corm is about the size of a chestnut, flattened on one side, where it has an undeveloped bud; furnished with an outer brown and an inner reddish-yellow coat; internally white, solid, and fleshy; and yielding when cut a milky, acrid, and bitter juice. Before drying the corm, it should be cut transversely in thin slices, the coats being previously removed. The slices should be dried quickly in a dark airy place, at a temperature not exceeding 150° Fahr. The dried slices are about a line thick, moderately indented on one (rarely on both sides), firm, flat, whitish, amylaceous.

[§ **Colchici Semina.** *Colchicum Seeds.*

The fully ripe seeds of Colchicum autumnale, *Linn.*]

General Characters.—Colchicum seeds are brown or reddish-brown, nearly the size of white mustard seeds, and have a bitter acrid taste, but no odour.

Composition.—Both the corm and the seed contain *Colchicia.* Pelletier and Caventou found in the corm an alkaloid, which they supposed to be veratria, in combination with gallic acid. Geiger and Hesse subsequently obtained the same alkaloid from the seed, but, perceiving that it was new, named it Colchicia. The following are said to be its properties:—It is an alkaline substance, crystallising in slender needles, without odour, but having a bitter taste. Its hydrate is feebly alkaline, but neutralises acids, and forms crystallisable salts, having a bitter taste. It is soluble in water, and is precipitated by the solution of bichloride of platinum. Nitric acid colours colchicia deep violet, which passes into indigo blue, and quickly becomes, first green, and then yellow. Concentrated sulphuric acid colours it yellowish-brown. Colchicia is said to be distinguished from veratria by the following characteristics:—1st, it is soluble in water, whereas veratria is not; 2ndly, it is crystallisable, which is not the case with veratria; 3rdly, it does not possess the acridity of veratria; and 4thly, it differs from the latter in this, that it does not irritate the organ of smell, whereas the least portion of veratria occasions a most convulsive sneezing.

Physiological Effects.—Colchicum is acrid and sedative. Taken internally, *in small and repeated doses*, it promotes the action of the secreting organs, especially the intestinal mucous membrane. The kidneys, the skin, and the liver, are less certainly and obviously affected by it. The most constant effects observed from the use of *larger doses* are nausea, vomiting, and purging. Reduction of the frequency of the pulse is a common, though not an invariable effect. *In excessive doses* colchicum acts as a powerful poison. In one case two ounces of the wine of the seeds, in another three and a half drachms in divided doses, in a third an ounce and a half of the tincture, and in a fourth two drachms and a half of the tincture proved fatal; death being preceded in most of the cases by acute pain in the bowels, incessant vomiting, purging, tenesmus, and an imperceptible and intermitting pulse. Delirium, convulsions, and coma have also been observed. *Colchicia* is also a virulent poison. One-tenth of a grain, dissolved in weak spirit, killed a young cat in about twelve hours. The symptoms were salivation, diarrhœa, vomiting, a staggering gait, cries, convulsions, and death. The stomach and intestines were violently inflamed, and had extravasated blood throughout their whole course.

Therapeutics.—The following are the principal diseases in which colchicum has been employed:—*In Gout.*—The power of colchicum to alleviate a paroxysm of gout is admitted by all; but considerable difference of opinion exists as to the extent of this power, and the propriety of employing it. Sir Everard Home, from observation of its effects on his own person, regarded it as a specific in gout. Dr. Paris commends it in similar terms: 'As a specific in gout its efficacy has been fully ascertained: it allays pain, and cuts short the paroxysm.' But that alleviation is palliative, not curative. It has no tendency to prevent a speedy recurrence of the attack; nay, according to Sir Charles Scudamore, it renders the disposition to the disease much stronger in the system. Furthermore, by repetition its power over gouty paroxysms becomes diminished. The *modus medendi* of colchicum in gout is an interesting though not very satisfactory part of our inquiry. It has been already stated that some regard this remedy as a specific; that is, as operating by some unknown influence. Others, however, and with more propriety, refer its therapeutical uses to its known physiological effects. 'Colchicum,' says Dr. Barlow, 'purges, abates pain, and lowers the pulse. These effects are accounted for by assigning to it a cathartic and sedative operation; and it is this combination perhaps to which its peculiar virtues are to be ascribed.' Though purging is not essential to the therapeutical influence of colchicum, it is admitted by most that, in a large number of cases at least, it promotes the alleviation of the symptoms. Hence many practitioners recommend its combination with saline purgatives, as the sulphate of magnesia. *In Rheumatism.*—In acute rheumatism and other inflammatory affections, colchicum often affords relief, but its therapeutical effects in rheumatism are much less marked than in gout. *In Dropsy.*—Colchicum has been employed in dropsical cases with the twofold view of purging and promoting the action of the kidneys. Given in combination with saline purgatives, I have found it beneficial in some cases of anasarca of old persons. It is also sometimes given with advantage in obstinate diseases of the skin. *In Liver Complaints.*—Colchicum is also beneficial when combined with other purgatives as a cholagogue in cases of imperfect action of the liver.

Administration of the Corm.—The corm has been employed in powder, in *doses* of from two to eight grains. The following preparations of the corm are ordered in the Pharmacopœia.

[§ **Extractum Colchici.** *Extract of Colchicum.*

Take of

Fresh Colchicum Corms, deprived of their coats	7 pounds.

Crush the corms; press out the juice; allow the feculence to subside, and heat the clear liquor to 212°; then strain through flannel and evaporate by a water-bath at a temperature not exceeding 160° until the extract is of a suitable consistence for forming pills.

Dose.—$\frac{1}{2}$ grain to 2 grains.]

[§ **Extractum Colchici Aceticum.** *Acetic Extract of Colchicum.*

Take of

Fresh Colchicum Corms, deprived of their coats	7 pounds.
Acetic Acid	6 fluid ounces.

Crush the corms, add the acetic acid, and press out the juice; allow the feculence to subside, and heat the clear liquor to 212°; then strain through flannel, and evaporate by a water-bath at a temperature not exceeding 160°, to the consistence of a soft extract.

Dose.—$\frac{1}{2}$ grain to 2 grains.]

This compound contains the acetate of colchicia. It is a very favourite remedy in the treatment of gout and rheumatism, and was introduced into practice by Sir C. Scudamore. Dr. Paris observes that he has 'found it useful in promoting healthy discharges of bile.' He occasionally combined it with mercurial pill, calomel, or tartarated antimony. The use of the acetic acid is not very obvious, as it can scarcely modify the effect of the colchicia, which, as well as its salts, is soluble in water. The somewhat larger dose also in which it is generally prescribed does not indicate that it possesses greater activity than the simple extract. Both extracts are now prepared from the clear liquor *after the subsidence of the feculence*, and are therefore superior to the former extracts (*Lond. Ed.*) in which the starch was retained.

[§ **Vinum Colchici.** *Wine of Colchicum.*

Take of

Colchicum Corms, sliced, dried, and bruised .	4 ounces.
Sherry	1 pint.

Macerate the colchicum in the wine for seven days in a closed vessel with occasional agitation, press and strain through calico; then add sufficient sherry to make one pint.

Dose.—10 to 30 minims.]

Administration of the Seed.—The *dose* of the powdered seed is the same as that of the corm. The seed is to be preferred to the corm as being more uniform in its properties. It is usually given in the form of tincture, which is ordered in the Pharmacopœia to be prepared as follows :—

[§ **Tinctura Colchici Seminum.** *Tincture of Colchicum Seeds.*

Take of

Colchicum Seeds, bruised	$2\frac{1}{2}$ ounces.
Proof Spirit	1 pint.

Macerate the colchicum for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof-spirit to make one pint.]

Dose.—The average *dose* is from 10 to 30 minims. I have repeatedly given two fluid drachms at a dose without any violent effect. Dr. Barlow, who prefers this to the other preparations of colchicum, advises that in gout a fluid drachm, a drachm and a half, or two fluid drachms of the tincture, should be given at night, and repeated the following morning. If this quantity fail to purge briskly, a third dose may be administered the ensuing night. Externally, the tincture has been employed as a liniment, to relieve rheumatic, gouty, venereal, and other pains.

ASAGRÆA OFFICINALIS, *Lind.*

Botanical Character.—A bulbous plant with linear grass-like *leaves* 4 feet long and 3 lines broad (fig. 19), and small polygamous *flowers*, arranged in a dense straight *raceme*, a foot and a half long, on a *scape* about 6 feet high. *Perianth* 6-partite; segments linear, almost equal, with a nectariferous excavation at the base. *Stamens* 6, alternately shorter; *anthers* turned outward. *Fruit* capsular, consisting of 3 acuminate papery carpels, commonly called follicles. *Seeds* scimitar-shaped, corrugated, winged.—*Bot. Reg.* vol. xxv. pl. 33.

Fig. 19.

Asagræa officinalis.
a. Fruit-bearing stem.
b. Rootlets, bulb, and leaves.

Habitat.—Eastern side of the Mexican Andes.

[§ Sabadilla. *Cevadilla.*

The dried fruits of Asagræa officinalis, *Lind.* Imported from Mexico.]

General Characters.—The fruits are about half an inch long, consisting of three light-brown papyraceous acuminate carpels, each carpel (*follicle*) containing from one to three seeds, which are about a quarter of an inch long, scimitar-shaped, pointed, blackish-brown, shining, slightly winged, and having an intensely acrid bitter taste. The fruitstalk, and the remains of the dried and withered calyx, are usually present in the cevadilla of the shops. Internally the seeds are whitish and horny. They have little odour.

Composition.—Cevadilla seeds appear to consist of *veratria* combined with *gallic acid*, *fatty matter*, *wax*, *resin*, *extractive matter*, a *yellow colouring ingredient*, *veratric acid*, &c.

Pharmaceutical Use.—The principal use of cevadilla is for the preparation of veratria.

[§ Veratria. *Veratria.*

An alkaloid obtained from Cevadilla; not quite pure.

It may be obtained by the following process:—

Take of

Cevadilla		2 pounds.
Distilled Water .	of each . .	a sufficiency.
Rectified Spirit .		
Solution of Ammonia		
Hydrochloric Acid		
Purified Animal Charcoal . . .		60 grains.

Macerate the cevadilla with half its weight of boiling distilled water in a covered vessel for twenty-four hours. Remove the cevadilla, squeeze it, and dry it thoroughly with a gentle heat. Beat it now in a mortar, and separate the seeds from the capsules by brisk agitation in a deep narrow vessel, or by winnowing it gently on a table with a sheet of paper. Grind the seeds in a coffee mill, and form them into a thick paste with rectified spirit. Pack this firmly in a percolator, and pass rectified spirit through it till the spirit ceases to be coloured. Concentrate the spirituous solution by distillation, so long as no deposit forms, and pour the residue, while hot, into twelve times its volume of cold distilled water. Filter through calico, and wash the residue on the filter with distilled water, till the fluid ceases to precipitate with ammonia. To the united filtered liquids add the ammonia in slight excess, let the precipitate completely subside, pour off the supernatant fluid, collect the precipitate on a filter, and wash it with distilled water till the fluid passes colourless. Diffuse the moist precipitate through twelve fluid ounces of distilled water, and add gradually with diligent stirring sufficient hydrochloric acid to make the fluid feebly but persistently acid. Then add the animal charcoal, digest at a gentle heat for twenty minutes, filter, and allow the liquid to cool. Add ammonia in slight excess, and, when the precipitate has completely subsided, pour off the supernatant liquid, collect the precipitate on a filter, and wash it with cold distilled water till the washings cease to be affected by nitrate of silver acidulated with nitric acid. Lastly dry the precipitate first by imbibition, with filtering paper, and then by the action of a gentle heat.]

By the action of the cold water upon the concentrated spirituous solution the greater part of the resinous matter is precipitated, and on adding ammonia to the aqueous solution it unites with the organic acids and throws down impure veratria. This, by resolution in hydrochloric acid, decoloration by animal charcoal, and re-precipitation by ammonia, yields the official veratria.

[§ *Characters and Tests.*—Pale grey, amorphous, without smell, but, even in the most minute quantity, powerfully irritating the nostrils; strongly and persistently bitter, and highly acrid; insoluble in water, soluble in spirit, in ether, and in diluted acids, leaving traces of an insoluble brown resinoid matter. Heated with access of air it melts into a yellow liquid, and at length burns away, leaving no residue. An active poison.]

Therapeutics.—Veratria is chiefly employed externally. *In neuralgia* it has been used in the form of ointment. The frictions are to be continued until the heat and tingling caused by the veratria have acquired a considerable degree of intensity. Though, according to my own experience, it fails to give relief in a large majority of cases, yet in some few its effects are highly beneficial, and in none is it injurious. As a remedy for neuralgia, it is, however, far inferior to *Aconite* and its alkaloid *Aconitia*. *In rheumatism* it has also been employed in the form of ointment. It should not be applied while the inflammation is of an active kind. It would appear to be best adapted for the neuralgic forms of rheumatism. In *ptosis*, not arising from cerebral lesion, the ointment has been used with advantage. It is but rarely given internally, but it has been sometimes employed in gout and rheumatism, and as an anthelmintic, &c.

Administration.—Veratria should be administered cautiously in doses of $\frac{1}{8}$ or $\frac{1}{10}$ of a grain, in the form of a pill, three times a day.

[§ **Unguentum Veratriæ.** *Ointment of Veratria.*

Take of

Veratria	8 grains.
Prepared Lard	1 ounce.
Olive Oil	$\frac{1}{2}$ fluid drachm.

Rub the veratria and the oil together; then mix them thoroughly with the lard.]

VERATRUM.

Generic Character.—*Flowers* polygamous. *Perianth* 6-parted. *Stamens* 6, equal, inserted into the base of the segments; *filaments* subulate; *anthers* reniform. *Ovary* with 3 divaricating *stigmas*. *Capsule* 3-horned, separating into three many-seeded carpels. *Seeds* compressed, winged, at the apex.

Fig. 20.

Veratrum album.

VERATRUM ALBUM, *Linn.*

White Hellebore.

Specific Character.—*Root* composed of numerous fleshy brownish-white rootlets, arising from a perennial cylindrical fleshy *rhizome* (fig. 20). *Stem* 1 to 4 feet high. *Leaves* ovate-oblong, plaited. *Panicle* decompound. *Bracts* equalling the flowers. *Pedicels* pubescent. *Segments of the perianth* somewhat erect and obtuse, serrulate.

Habitat. — Mountainous regions of Europe. Abounds in the Alps and Pyrenees.

Veratri Albi Rhizoma. *White Hellebore Rhizome.*

The dried rhizome of Veratrum album, *Linn.*

(*Not official.*)

General Characters.—The *rhizome* (*white hellebore root*) is single-, double-, or many-headed, having the form of a cylinder, or, more frequently, of a truncated cone. It is from two to four inches long, and about one inch in diameter, rough, wrinkled, greyish or blackish-brown externally, whitish internally. Portions of the rootlets are usually attached to it, as well as some soft fine hair-like fibres. At the upper extremity of the rhizome we frequently observe the cut edges of numerous concentric woody or membranous scales: which are portions of the dried leaf-sheaths. The odour of the dried rhizome is feeble ; the taste is at first bitter, then acrid.

Composition.—The principal constituents are a *volatile* [cevadic ?] *acid*, *gallate of veratria*, *starch*, and a peculiar white crystalline alkaloid, called *jervine.*

Physiological Effects.—Its *local* action is that of a powerful acrid. Applied to the Schneiderian membrane, it excites violent sneezing. Its *remote* action is on the secretory apparatus, the stomach and intestines, and the nervous system. In *small* and *repeated doses* it promotes secretion from the mucous surfaces, the salivary glands, the kidneys and the uterus, and increases the cutaneous exhalation. In *larger doses* it causes vomiting, purging, pain in the abdomen, tenesmus, and occasionally bloody evacuations, and great prostration of strength. In its action on the system, white hellebore rhizome is more closely related to cevadilla and meadow saffron than to any other medicinal agents. In *excessive doses* it operates as a narcotico-acrid poison, producing gastro-intestinal inflammation and an affection of the nervous system.

Therapeutics.—It is but rarely employed, principally on account of the alleged uncertainty of its operation. But this uncertainty is probably much exaggerated, and chiefly referable to the varying lengths of time during which the rhizome has been kept, for, like colchicum, it deteriorates by keeping. The following are the principal cases in which it has been employed:—*In affections of the nervous system*, as melancholia, mania, and epilepsy. *In chronic skin diseases*, as herpes, the tincture has been given internally with benefit. As external applications, the decoction and ointment are used in scabies, tinea capitis, &c.; but their use is not quite free from danger. *In gout*, it has been given in combination with opium, as a substitute for, or in supposed imitation of, the once famous *Eau Médicinale.* But, according to Garrod, its action differs completely from that of colchicum, and produces no alleviation of the gouty symptoms. *In amaurosis* and *chronic affections of the brain* occurring in torpid habits, it is employed as an errhine or sternutatory. *To destroy pediculi*, the decoction is used as a wash.

Administration.—It may be administered in powder or in the form of a wine, made by macerating 8 ounces of white hellebore rhizome in 2 pints of sherry for seven days. The *dose* of the powder is from 2 to 8 grains; that of the wine from 10 to 20 minims. For external application in skin diseases, &c., the decoction (P. L. 1836); or the compound sulphur ointment of the London Pharmacopœia of 1851, into which it enters as an ingredient, may be employed.

VERATRUM VIRIDE, *Willd.* American or Green Hellebore.

Specific Character.—*Rhizome* perennial, thick, fleshy, truncated at top, the lower part solid and sending off numerous white or light yellow rootlets. *Stem* annual, from 2 to 3 feet high, pubescent. *Leaves* at base 6 inches to a foot long, broad, oval, ribbed, acuminate, of a deep green colour, and pubescent; those on the stem narrower, and, at the summit, bracteæform. *Flowers* in panicles, terminal, and of a greenish-yellow colour. *Perianth* of six divisions, ovate, acute. *Stamens* 6. *Fruit* 3-celled, many-seeded.

Habitat.—The plant is found in many parts of the United States, and Canada; inhabiting damp places in the neighbourhood of streams and meadows.

[§ **Veratri Viridis Radix.** *Green Hellebore Root.*

The dried rhizome of Veratrum viride, *Willd.* Collected in autumn in the United States and Canada.]

General Characters.—As found in commerce it occurs generally in small fragments or slices, or sometimes entire. When in the latter state the rhizome is from one to two inches in length, tapering upwards, of a compact texture; externally of a dark brown colour, and yellowish-white internally. The rootlets, which are numerous, are either loose and mixed with the rhizome, or attached to it. When separated from the rhizome, the latter is marked with the scars left by their breaking off. The rootlets are frequently several inches long, about the thickness ordinarily of a large knitting needle, or thicker, more or less shrivelled, of a yellowish colour, and closely marked by little depressions on their surface. The taste of both rhizome and rootlets is bitter and acrid, but they have no odour.

Composition.—It contains *gallate of veratria*, to which its properties are doubtless essentially due.

Therapeutics.—In its action it appears to resemble that of white hellebore rhizome, but it differs from it by not producing purging. It should be used with great care, as it frequently produces very distressing nausea and extreme depressing effects on the circulation and nervous system. In America it has been highly vaunted as a remedy in pneumonia, gout, rheumatism, typhoid fever, and various other affections, but at present little value is attached to its use by practitioners in this country.

Administration and Dose.—It may be given in the form of powder or the official tincture. The dose of the powdered rhizome is one to three grains or more.

[§ **Tinctura Veratri Viridis.** *Tincture of Green Hellebore.*

Take of

Green Hellebore Root, in coarse powder . .	4 ounces.
Rectified Spirit	1 pint.

Macerate the hellebore for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient rectified spirit to make one pint.

Dose.—5 to 20 minims.]

LILIACEÆ, *Lindl.* The Lily Order.

ALOE, *Linn.*

Generic Character.—Succulent plants, *Perianth* tubular, 6-cleft, nectariferous at the base. *Stamens* hypogynous, as long as the perianth, or even longer. *Capsule* membranous, scarious, 3-cornered, 3-celled, 3-valved, with a loculicidal dehiscence. *Seeds* numerous, in 2 rows.

ALOE VULGARIS, *Lam. Encycl.* **The Yellow-flowering Aloe.**

Specific Character.—A succulent plant, with a short woody simple cylindrical *stem*, and curved fleshy glaucous-green and slightly mottled lanceolate *leaves*, armed with hard distant reddish spines. *Scape* branched. *Spike* cylindrical-ovate. *Flowers* yellow, at first erect, then spreading, afterwards pendulous.—*Steph. and Church.* pl. 109.

Habitat.—East Indies, South of Europe, Barbadoes.

[§ **Aloe Barbadensis.** *Barbadoes Aloes.*

The inspissated juice of the leaf of Aloe vulgaris, *Lam. Encycl.* Imported from Barbadoes.]

Situation of the Aloe Juice.—The brownish-yellow, bitter, resinous juice, which by inspissation forms aloes, is contained in parallel greenish vessels placed beneath the epidermis of the leaves of this and other species of *Aloe*. When the leaf is first broken across, the juice which then exudes is nearly colourless, but it quickly acquires a brownish-yellow colour from exposure to the air.

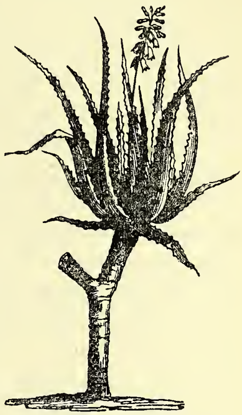
Preparation.—The finest kind of aloes is obtained by evaporating the juice which flows spontaneously from the transversely-cut leaves. The exudation of it is promoted by gravity, by dipping the leaves in hot water, and by making fresh sections of the leaves. But if pressure be employed the proper aloetic juice becomes mixed with the mucilaginous liquid of the leaves, and thus an inferior kind of aloes is obtained. A still inferior variety is procured by boiling the leaves, from which the juice has been previously allowed to escape, in water. In Barbadoes, the aloes is best obtained as follows:—'The leaves, being cut near the roots, are thrown into tubs with their broken ends downwards; and as the leaves are full of large longitudinal veins or vessels, they yield an easy passage to the juice to drip out. This being boiled for about five hours in a copper or kettle, the watery particles evaporate and the remainder comes to a consistency and thickening as sugar doth when sufficiently boiled. The way to know when it is enough boiled is to dip a stick in the liquor, and observe whether the aloe sticking to it, when cold, breaks short: if it doth, then it is boiled to perfection, and fit to be poured into gourds or calabashes, or other vessels, for use.' (Hughes, *Natural History of Barbadoes.*) The finest Barbadoes aloes is the inspissated juice, which is sometimes called *cold-drawn Barbadoes aloes*, to distinguish it from the extract of the decoction, which is of inferior quality.

General Characters.—Barbadoes aloes varies from a yellowish-brown or liver colour to a dark brown or black. It breaks with a dull or sometimes glossy or even resinous conchoidal fracture, has a bitter nauseous taste, and a strong disagreeable odour; dissolves almost entirely in proof spirit, and during solution exhibits under the microscope numerous crystals. Its powder is of a dull olive-yellow colour. Its odour is very characteristic. It is usually imported in gourds.

ALOE SOCOTRINA, *Lam.* The Socotrine Aloe.

Specific Character.—Stem woody, straight, one foot and a half or more high, naked below. *Leaves* amplexicaul, ascending, ensiform, green, curved inwards at the point, convex below, rather concave above, marked with numerous small white marginal serratures (fig. 21). *Raceme* cylindrical, unbranched. *Flowers* scarlet at the base, pale in the middle, green at the point. *Stamens* unequal, three of them longer than the flowers.—*Steph. and Church.* pl. 110.

Fig. 21.



Aloe socotrina.

Habitat.—Socotra. Lieut. Wellstead says that the hills on the west side of Socotra are covered for an extent of miles with aloe plants; and he observes that it is not likely, at any future period, that the whole quantity will be collected which might be required.

[§ Aloe Socotrina. *Socotrine Aloes.*

The inspissated juice of the leaf of one or more undetermined species of Aloe, *Linn.* Produced chiefly in Socotra, and shipped to Europe by way of Bombay.]

Botanical Source.—The aloes prepared in the island of Socotra is probably procured from *Aloe socotrina*, and perhaps also from *A. purpurascens.*

Preparation and Commerce.—In the island of Socotra the leaves are plucked at any period, and by anyone who chooses to take the trouble; and after being placed in a skin, the juice is allowed to exude from them. The following mode of preparing Socotrine aloes, as related by Hermann, was communicated to Ray by Dr. Palmer:—'When the leaves which have been pulled from the roots are gently compressed by the hand or an instrument, the juice drops from them into a receiving vessel; and being allowed to stand during a night, deposits the grosser parts. The next day it is transferred to another vessel, in which it is exposed to the sun that it may harden and become dry, when it acquires a brownish-yellow colour.' In reference to the above, Dr. F. Farre remarks that, 'About the year 1840 the island of Socotra was visited by Mr. Hunt, who brought thence a large quantity of Socotrine aloes, of which he gave me specimens. These varied much in quality, some being finer, other more or less impure. Mr. Hunt's account of the preparation of the drug corresponded with that previously given by

Lieut. Wellstead. No aloes is kept prepared for sale, but when any vessel stops at the island, and aloes is asked for, the leaves are cut and the juice allowed to drain out into a sack made of goats' skin. The sack with its contents is then put on board the vessel, and secured to the mast, or in some other place where it is constantly exposed to the sun, to facilitate evaporation. The vessels which touch at Socotra are mostly those which sail between Bombay and the eastern coast of Africa, or the Red Sea.' Sir Whitelaw Ainslie, however, says that the greater part of the extract sold under the name of Socotrine aloes is prepared in the kingdom of Melinda; and I am informed by an eminent drug-merchant, that both Socotrine and Hepatic aloes have been imported into London directly from Zanzibar. It comes over in skins, casks, kegs, and chests.

General Characters.—Socotrine aloes occurs in masses which vary in colour in different parts of the same mass; sometimes they are garnet-red, at other times much paler, and when quite dry are golden-red, and yield a golden-yellow powder. By exposure to the air the colour is deepened. The fracture of fine selected pieces is smooth, glassy, and conchoidal; but Socotrine aloes of excellent quality often breaks with a roughish fracture. Thin films of pure and hardened Socotrine aloes are usually translucent or nearly transparent. The odour of fresh-broken pieces (especially when breathed on) is very fragrant, and is much stronger in recent and soft specimens. The taste is very bitter. It dissolves entirely in proof spirit, and during solution exhibits under the microscope numerous minute crystals.

Socotrine Aloe Juice.—Some time since a large importation was made of what appears to me to be the raw or unboiled juice of the plant yielding what is known in commerce as Socotrine aloes; I propose to distinguish it from the ordinary soft Socotrine aloes by the name of '*Socotrine Aloe Juice.*' Messrs. Horner, the holders of the whole of this juice, informed me that it was purchased of the Arabs up the Red Sea by a merchant who was assured by the vendors that it was very fine aloe juice, and had not been boiled or otherwise altered. It was imported into London by way of Madras, in casks each containing six cwt. Its consistence is that of treacle or very thin honey; its colour deep orange or palm-oil yellow; its odour powerful, fragrant, and resembling that of fine Socotrine aloes. By standing it separates into two parts—an inferior, paler-coloured, opaque, finely granular portion, and a superior, darker-coloured, transparent liquid. The latter forms, however, a very small portion of the whole mass. When the granular portion is submitted to microscopic examination it is found that the opacity and granular appearance arise from myriads of beautiful prismatic crystals (fig. 23). If a temperature of 132° F. be applied to the juice, these crystals melt or dissolve, and the juice becomes deep red and transparent; and when the liquid becomes cold it retains its transparency, and does not deposit any crystals. By evaporation the juice yields a solid, transparent extract, having all the characters of fine Socotrine aloes, in which no trace of crystalline texture can be discovered. When the juice is mixed with cold distilled water it becomes opaque yellow, and renders the water turbid, but is not miscible with it. If, however, heat be applied, the juice dissolves in the water, forming an almost clear rich red liquid. As the solution cools, it at first becomes turbid, owing to the separation of an opaque yellow precipitate, which, apparently, is the crystalline principle in an amorphous form. This gradually separates from the liquid and collects as a clear resiniform mass (commonly called

Fig. 22.

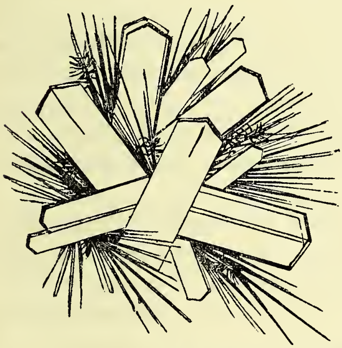
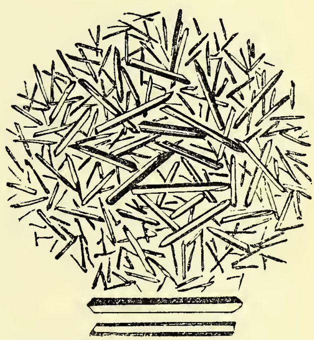


Fig. 23.



Microscopic Appearances of Crystals of Aloin.

Fig. 22. Aloin, prepared from Barbadoes aloes, by Messrs. Smith.
Fig. 23. Aloin contained in Socotrine aloe juice.
The magnifying power used was the same in both cases.

the *resin* of aloes) at the bottom of the vessel, leaving the supernatant liquid tolerably clear. If the juice be shaken up with rectified spirit of wine an uniform clear mixture is obtained, from which numerous yellow crystals rapidly fall to the bottom of the liquid. Similar results are obtained when we mix the juice with equal parts of rectified spirit and water. This crystalline constituent of Socotrine aloes is similar to the *aloin* formerly obtained from Barbadoes aloes (fig. 22), and described by Messrs. Smith, of Edinburgh, and by Dr. Stenhouse. I shall therefore term this crystalline principle the *aloin of Socotrine aloes* (fig. 23). On comparing it with a fine specimen of aloin kindly presented to me by Messrs. Smith, I find its crystals smaller and more tapering, the summits of the crystals being more acute. In drying, the crystals of the Socotrine aloin have a strong tendency to break up ; so that crystals which in the moist state are moderately large and regular, become small and pulverulent when dry. Like the aloin of Messrs. Smith, the crystals of Socotrine aloes strongly doubly-refract and depolarise light, and are, therefore, beautiful objects when viewed by the polarising microscope. The recent investigations of Dr. Flückiger show that there occurs in different varieties of aloes more than one crystalline principle. (See also Composition of Aloes.)

Varieties of Aloes.—Barbadoes and Socotrine aloes are alone official, but several other varieties are known in commerce, as Hepatic, Cape, Caballine, Mocha, Indian, Natal, &c.

Aloe Hepatica. *Hepatic Aloes.*

The inspissated juice of the leaf of one or more undetermined species of Aloe, *Linn.* It comes to Europe by way of Bombay.

(*Not official.*)

General Characters.—Hepatic aloes occurs in masses and resembles Socotrine aloes in odour, but is somewhat less fragrant. It is distinguished from the latter by its opacity and liver colour, and according to the author, it is obtained from the same plant. (See *Pharmaceutical Journal*, vol. xi. p. 439, 1st series.) The author concludes :—

1. That Hepatic aloes is the juice of the Socotrine aloes plant, which has been solidified without the aid of artificial heat. 2. That Hepatic aloes owes its opacity to the presence of minute crystals of aloin. 3. That the juice of Socotrine aloes, when evaporated by artificial heat, yields an extract possessing all the properties of commercial Socotrine aloes. According to the author, therefore, Socotrine aloes differs from Hepatic aloes in the circumstance of its having been prepared by the aid of artificial heat, by which its aloin constituent has become altered ; and this inference, he adds, is further substantiated, by the fact that after it has been melted, Hepatic aloes is found to have acquired the clearness and transparency of Socotrine aloes. Dr. F. Farre, in a former edition of this work, (see *Manual of Materia Medica and Therapeutics*, p. 200,) comments upon the above conclusions of the author, and gives several reasons for dissenting from them, and he adds, 'that the statements of Mr. Hunt and Lieut. Wellstead are directly opposed to the idea that Socotrine aloes is prepared by heat.' (See p. 429.) Mr. Hunt's specimens were, moreover, full of characteristic crystals, and did not at all resemble Hepatic aloes. Dr. Farre concludes by expressing his opinion, 'that Socotrine and Hepatic aloes are not obtained from the same plant.'

Aloe Capensis. *Cape Aloes.*

The inspissated juice of the leaf of Aloe spicata, *Thunb.* and other species.

(*Not official.*)

Commerce.—This kind of aloes is imported, as its name implies, from the Cape of Good Hope. It is brought over in chests and skins, the latter being preferred, as the aloes contained therein is usually purer and more glossy.

General Characters.—Cape Aloes has a shining resinous appearance, is of a deep brown colour, with a greenish tint, and has a glossy or resinous fracture; its edges, or thin laminæ, viewed by transmitted light, have a yellowish-red or ruby colour; its odour is stronger and more disagreeable than the Barbadoes aloes; its powder is greenish-yellow. Some of the commoner kinds of Cape aloes have a rough fracture.

The other varieties of aloes, known as *Caballine*, *Mocha*, *Indian*, *Natal*, &c., need no description in this work.

Composition.—The following appear to be the most important constituents of aloes:—*Aloetin, aloesin, amorphous aloin, bitter principle of aloes.*—This is the principal constituent of aloes, of which it forms about 60 per cent. It is contained in the cold infusion of aloes, and also in a decoction which has cooled; it may be obtained from either by evaporation. Thus procured, it is a brown and bitter mass, readily soluble in water, but difficultly so in spirit of wine. In pure alcohol or ether it is said to be insoluble, or nearly so. Its insolubility in ether distinguishes it from the bitter principle of rhubarb. It is probably a mixture or compound of various proximate principles. *Crystallised or hydrated Aloin. Aloin of Barbadoes Aloes.* $C_{34}H_{36}O_{14}, H_2O$ (Stenhouse).—Inodorous; taste at first sweetish, afterwards intensely bitter. Comparatively little soluble in cold water, but in warm water and in spirit of wine it dissolves with great facility; from a hot spirituous solution it deposits on cooling in tufts of yellow prismatic crystals, similar to those of fig. 22. The aqueous solution undergoes but little change upon exposure to the air, unless an alkali is present, when the liquid rapidly becomes brown, and loses its bitter taste. Nitric acid dropped upon the crystals, gives a rich crimson coloration which quickly fades to brownish-red. Bromine water added in excess to its aqueous solution gives a copious yellow precipitate, which dissolves in spirit and crystallises therefrom very readily. Ferric salts give with aqueous solutions of aloin an olive coloration. *Aloin of Socotrine Aloes.*—As already stated, this appears to be nearly identical with the foregoing (fig. 23). *Aloin from Natal Aloes.*

$C_{34}H_{38}O_{15}$ (Flückiger). This is readily distinguished from the two last by its very sparing solubility, requiring about seventy parts of spirit to dissolve it even with the aid of heat. It usually occurs in thin rectangular scales, one or more of the angles being frequently truncated. By the action of vapour of nitric acid upon its solution in oil of vitriol, it gives a fine green colour, quickly changing to red and *blue.* It gives no bromo-substitution compound analogous to that obtained from the aloin of Barbadoes Aloes. It is probable that, beside the above, analogous compounds exist in other varieties of aloes. *Aloe Resin.*—The substance which deposits from a decoction of aloes as it cools is usually denominated resin. It is transparent, brown, fusible, soluble in alcohol, ether, and alkaline solutions, from the latter of which it is thrown down by acids. By repeated treatment with water, it yields a considerable proportion of soluble matter, and loses its ordinary resinoid character. The alcoholic tincture of aloes does not become turbid when mixed with water. *Aloesic Acid.*—This is the acid which Trommsdorff supposed to be *gallic acid.* A solution of aloes reddens litmus, darkens ferruginous solutions, but does not precipitate gelatine; hence Trommsdorff assumed the presence of gallic acid. But while gallic acid causes a blue colour with the persalts of iron, infusion of aloes produces an olive-brown one. Furthermore, this cannot be regarded as evidence of the existence of such a compound, since the olive coloration is due to aloin and the products of its chemical alteration, and the acid reaction is probably solely to be ascribed to the aloetin alluded to above. Aloes, when heated with caustic potash or soda, yields an abundance of ammonia. This is derived from the vegetable albumen, of which a small quantity is always present. It is left insoluble when the drug is exhausted with rectified spirit.

Physiological Effects.—Taken internally *in small doses,* aloes acts as a tonic to the alimentary canal, assisting the digestive process, strengthening the muscular fibres and promoting the secretions, especially that of the liver, which organ it is thought specifically to influence. *In larger doses* it acts as a purgative. There are, however, some peculiarities attending its cathartic operation deserving of notice. In the first place, these effects are not so speedily produced as by some other purgatives; for eight, twelve, and sometimes twenty-four hours elapse before any action takes place. Secondly, it acts especially on the large intestines, and a full dose is in some persons apt to produce heat and irritation about the rectum, and tenesmus; and in those troubled with hemorrhoids it is said not unfrequently to increase, or even to bring on, the sanguineous discharge. The uterus, in common with all the pelvic viscera, is stimulated by aloes. A determination of blood towards these organs, and a fulness of the bloodvessels (especially of the veins), are produced, and thus uterine irritation and menorrhagia are apt to be increased by it, while in amenorrhœa and chlorosis it may occasionally act as an emmenagogue. Socotrine aloes has long been regarded as the best kind, though it is, I suspect, inferior in activity to Barbadoes aloes; the latter is always preferred by veterinarians. Perhaps it is most effectual as a purgative, while Socotrine is the best tonic and stomachic. As a purgative, aloes holds an intermediate rank between rhubarb and senna. From rhubarb it is distinguished by its more stimulant influence over the large intestines and the pelvic organs; from senna by its feebler action as a purgative, by its slow operation, and by its tonic influence when given in small doses. It irritates less powerfully than either jalap or scammony; and further, its influence over the bloodvessels of the pelvic viscera is greater than these.

Therapeutics.—The uses of aloes may be readily inferred from the remarks already made. It is evidently not adapted for those cases in which a speedy effect is required; and it is, therefore, useless to add it to purgatives to quicken their operation. It is well fitted for cases of costiveness where there is a scanty secretion of bile, and for torpid conditions of the large intestines, especially when attended with deficient uterine action. Some of the ill effects ascribed to the use of aloes are probably imaginary, and others are much exaggerated. It is, however, advisable to avoid the use of this purgative in inflammatory conditions and in organic diseases of the liver, in biliary calculi, in mechanical impediments to the passage of the blood through the branches of the portal veins, in hemorrhage from any of the pelvic organs (as the uterus and rectum), in irritation of the rectum, prostate gland, or bladder, in pregnancy, &c. The following are some of the cases in which the use of aloes has been advised:—*In loss of appetite and dyspepsia*, depending on a debilitated condition of the digestive organs, accompanied by costiveness, but unattended with any signs of local irritation, aloes may be given in small doses as a stomachic. *In habitual costiveness*, depending on deficiency of bile, or on a sluggish condition of the large intestines, particularly in hypochondriacal or studious persons, or in those whose habits or occupations are sedentary—aloes, given in sufficient doses to purge, will be found a very useful medicine. A torpid state of the colon, with large fæcal accumulation, is not unusual in females. In such the use of aloes is often attended with much benefit. *To excite the menstrual discharge* aloes is frequently successfully employed. But it often fails; indeed Dr. Cullen says that it rarely succeeds. *To reproduce the hemorrhoidal discharge* aloes has been frequently employed in large doses. Serious affections of the head, or of other parts, have sometimes disappeared on the occurrence of the hemorrhoidal flux; and therefore, in persons who have been subject to this discharge, but in whom it has stopped, it is advisable to attempt its re-establishment, with the view of relieving other more serious disorders. *To promote the secretion of bile* where a deficiency of this fluid does not arise from hepatic inflammation; as in some forms of jaundice which are unconnected with biliary calculi, inflammation, mechanical obstruction of the ducts, &c. *In cerebral affections* the compound decoction of aloes is a most valuable stimulating purgative for elderly persons in whom a tendency to apoplexy exists, especially in cold and phlegmatic habits. *As an anthelmintic,* a decoction of aloes, used as an enema, has been found efficacious in the small thread-worm (*Ascaris vermicularis*).

Administration.—On account of its nauseous taste aloes is frequently given in the form of pill. The ordinary dose is from three to five grains.

Official Preparations of Barbadoes Aloes.

[§ **Enema Aloes.** *Enema of Aloes.*

Take of

Aloes	40 grains.
Carbonate of Potash . . .	15 grains.
Mucilage of Starch	10 fluid ounces.

Mix and rub together.]

Either kind of aloes may be employed in this preparation, which is *used* to dislodge ascarides from the rectum.

[§ **Extractum Aloes Barbadensis.** *Extract of Barbadoes Aloes.*

Take of

Barbadoes Aloes, in small fragments . .	1 pound.
Boiling Distilled Water	1 gallon.

Add the aloes to the water, and stir well until they are thoroughly mixed. Set aside for twelve hours; then pour off the clear liquor, strain the remainder, and evaporate the mixed liquors by a water-bath or a current of warm air to a proper consistence.

Dose.—2 to 6 grains.]

The object of this preparation is to deprive the aloes of the substance called *resin*, on which its irritating and griping qualities have been supposed to depend. This, according to Winkler, it very imperfectly accomplishes. In reference to this, Dr. F. Farre states that: 'In order to ascertain the correctness of the above supposition, I gave, at different times, to about sixty hospital patients suffering from costiveness, three grains of crude aloes, of extract of aloes, and of the *resinous* deposit from the decoction of aloes. Most of them took the aloes in one or other of these states, several times. The result was remarkably uniform. The crude aloes and the watery extract produced from one to three evacuations from the bowels in twelve or eighteen hours. There was little difference in their action, and the crude drug *did not gripe* more than the extract. Perhaps the extract acted a little more speedily. The dried resinous deposit was almost inert. It did not gripe, and seldom produced any evacuation. It does not follow from the inertness of the resin when separated from the aloesin, that it is inert when combined with it; indeed, the equal activity in the above-mentioned experiments of the crude drug and the watery extract rather indicates the contrary; but I think that the griping effects of the resin have been somewhat over-estimated. A similar trial with Socotrine aloes, its watery extract, and its resin, gave similar results. Dr. Garrod, after a corresponding series of experiments with aloes, its watery extract, and its resin, arrived at the same conclusions.'

[§ **Pilula Aloes Barbadensis.** *Pill of Barbadoes Aloes.*

Take of

Barbadoes Aloes, in powder . . .	2 ounces.
Hard Soap, in powder	1 ounce.
Oil of Caraway	1 fluid drachm.
Confection of Roses	1 ounce.

Beat all together, until thoroughly mixed.

Dose.—5 to 10 grains.]

[§ **Pilula Aloes et Ferri.** *Pill of Aloes and Iron.*

Take of

Sulphate of Iron	1½ ounce.
Barbadoes Aloes, in powder . . .	2 ounces.
Compound Powder of Cinnamon . .	3 ounces.
Confection of Roses	4 ounces.

Reduce the sulphate of iron to powder, rub it with the aloes and compound powder of cinnamon, and adding the confection make the whole into a uniform mass.

Dose.—5 to 10 grains.]

Pharmaceutical Uses.—Barbadoes aloes is also an ingredient in the compound pill of gamboge, the compound pill of colocynth, and the pill of colocynth and hyoscyamus.

Official Preparations of Socotrine Aloes.

[§ **Decoctum Aloes Compositum.** *Compound Decoction of Aloes.*
Take of

Extract of Socotrine Aloes . .	120 grains.
Myrrh, Saffron } of each	90 grains.
Carbonate of Potash	60 grains.
Extract of Liquorice	1 ounce.
Compound Tincture of Cardamoms .	8 fluid ounces.
Distilled Water	a sufficiency.

Reduce the extract of aloes and myrrh to coarse powder, and put them together with the carbonate of potash and extract of liquorice into a suitable covered vessel with a pint of distilled water; boil gently for five minutes, then add the saffron. Let the vessel with its contents cool, then add the tincture of cardamoms, and covering the vessel closely, allow the ingredients to macerate for two hours; finally strain through flannel, pouring as much distilled water over the contents of the strainer as will make the strained product measure thirty fluid ounces.

This decoction contains 4 grains of extract of aloes in a fluid ounce, while that of the Pharmacopœia of 1864 contained 5·6 grains, and that of the London Pharmacopœia contained 3·3 grains.]

It is a mild cathartic, tonic, antacid, and emmenagogue, used in the before-mentioned cases in *doses* of $\frac{1}{2}$ to 2 fluid ounces. Acids, acidulous salts, and most metallic salts, are incompatible with it. If it be desirable to conjoin chalybeates with it, either the tartarated iron or the citrate of iron and ammonia may be added to the cold decoction without undergoing decomposition. The quality of the aloes used, the length of time the decoction is boiled, and the purity of the extract of liquorice, affect the transparency or turbidity of this decoction, which is never so bright as tincture of aloes.

Enema Aloes. (*See Official Preparations of Barbadoes Aloes.*)

[§ **Extractum Aloes Socotrinæ.** *Extract of Socotrine Aloes.*
Take of

Socotrine Aloes, in small fragments . .	1 pound.
Boiling Distilled Water	1 gallon.

Add the aloes to the water, and stir well until they are thoroughly mixed. Set aside for twelve hours; then pour off the clear liquor, strain the remainder, and evaporate the mixed liquors by a water-bath or a current of warm air to dryness.

Dose.—2 to 6 grains.]

[§ **Pilula Aloes et Assafœtidæ.** *Pill of Aloes and Assafœtida.*

Take of

Socotrine Aloes, in powder Assafœtida Hard Soap, in powder Confection of Roses	of each . .	1 ounce.

Beat all together, until thoroughly mixed.

Dose.—5 to 10 grains.]

Used in dyspepsia attended with flatulence and costiveness, and in the costiveness of hysterical women.

[§ **Pilula Aloes et Myrrhæ.** *Pill of Aloes and Myrrh.*

Take of

Socotrine Aloes	2 ounces.
Myrrh	1 ounce.
Saffron, dried	½ ounce.
Confection of Roses	2½ ounces.

Triturate the aloes, myrrh, and saffron together, and sift; then add the confection of roses, and beat together into an uniform mass.

Dose.—10 to 15 grains.]

Used as a purgative in chlorosis and amenorrhœa.

[§ **Pilula Aloes Socotrinæ.** *Pill of Socotrine Aloes.*

Take of

Socotrine Aloes, in powder . .	2 ounces.
Hard Soap, in powder . . .	1 ounce.
Volatile Oil of Nutmeg . . .	1 fluid drachm.
Confection of Roses . . .	1 ounce.

Beat all together, until thoroughly mixed.

Dose.—5 to 10 grains.]

This pill is a valuable purgative in habitual costiveness.

[§ **Tinctura Aloes.** *Tincture of Aloes.*

Take of

Socotrine Aloes, in coarse powder .	½ ounce.
Extract of Liquorice	1½ ounce.
Proof Spirit	a sufficiency.

Macerate the aloes and extract of liquorice in fifteen fluid ounces of the spirit for seven days, in a closed vessel, with occasional agitation, then filter, and add sufficient proof spirit to make one pint.

Dose.—1 to 2 fluid drachms.]

[§ **Vinum Aloes.** *Wine of Aloes.*

Take of

Socotrine Aloes		$1\frac{1}{2}$ ounce.
Cardamom Seeds, freed from the pericarps and bruised; Ginger, in coarse powder	of each .	80 grains.
Sherry		2 pints.

Macerate for seven days in a closed vessel, with occasional agitation; filter the liquor, and add sufficient sherry to make two pints.

Dose.—1 to 2 fluid drachms.]

Pharmaceutical Uses.—Socotrine aloes is also employed in the preparation of compound rhubarb pill, compound extract of colocynth, and compound tincture of benzoin.

URGINEA SCILLA, *Steinheil.* The Squill.

Botanical Character.—A bulbous plant with broad lanceolate *leaves*, 12 to 18 inches long, appearing after the flowers; and a *scape* from 2 to 4 feet high, terminated by a long dense *raceme. Bracts* long. *Perianth* white or pale yellowish-green, of 6 distinct spreading parts. *Stamens* 6, shorter than the perianth. *Ovary* 3-parted, glandular; *style* smooth, simple; *stigma* obscurely 3-lobed, papillose. *Capsule* rounded, 3-cornered, 3-celled. *Seeds* numerous, in two rows, flattened, winged, with a membranous testa.—*Woodv.* page 322, pl. 118 (*Scilla maritima*).

Habitat.—Shores of the Mediterranean, viz., Spain, France, Sicily, Africa, &c. In its native soil the plant flowers about August.

[§ **Scilla.** *Squill.*

The sliced and dried bulb of Urginea Scilla, *Steinheil.* From the Mediterranean coasts.]

General Characters and Varieties.—The fresh bulb is pear-shaped; it varies in size from that of the fist to a child's head; and in weight from half a pound to four pounds. It is composed of smooth scales, attenuated at their margins, closely applied over one another, and attached to a conical disc, which projects inferiorly, and gives origin to the rootlets, the remains of which are to be frequently found in the bulbs of commerce. The outer scales are membranous, brownish-red or white; the inner thick, whitish, fleshy, and juicy; their taste is mucilaginous, intensely and disagreeably bitter, and somewhat acrid. The *dried slices* are white or yellowish-white, slightly translucent, scentless, disagreeably bitter, brittle and easily pulverisable if very dry, but, if exposed to the air, readily recovering moisture and flexibility. Two varieties of squill are met with in commerce, viz. the *white* and the *red*, both of which are so called from the colour of their outer scales. The white is preferred in England. Squill is imported from the Mediterranean coasts, and also from St. Petersburg and Copenhagen. As the affinity of dried squill for moisture is great, it should be preserved in well-stoppered bottles, or in a very dry place.

Composition.—M. Mandet found in squill two principles, one *scillitine*, which is expectorant and diuretic, and not poisonous; the other *skuleine*, which is an irritant poison.

Physiological Effects.—In small doses squill acts as a stimulant to the excretory organs. Thus it promotes secretion from the mucous membranes (especially the bronchial and gastro-intestinal) and the kidneys. Its most marked effect is that of a diuretic. Its expectorant effects are less obvious and constant. Sometimes, when it fails to act on the kidneys, it increases cutaneous exhalation. *In full medicinal doses*, squill excites nausea and vomiting; purging, also, is not unfrequently produced. When it proves emetic or purgative its diuretic operation is much less obvious. *In excessive doses*, squill acts as a narcotico-acrid poison, and causes vomiting, purging, griping pain, strangury, bloody urine, convulsions, inflammation, and gangrene of the stomach and intestines. Twenty-four grains of the powder have proved fatal.

Therapeutics.—The principal uses of squill are those of an emetic, diuretic, and expectorant. *As a diuretic in dropsies*, it is applicable to those cases of dropsy requiring the use of stimulating or acrid diuretics, and is improper in inflammatory cases. It is an unfit remedy for dropsy complicated with granular kidney or vesical irritation; but when these conditions are not present, it is adapted for torpid leucophlegmatic subjects. Hence it is more serviceable in anasarca than in either ascites or hydrothorax. It should be given so as to excite a slight degree of nausea. By this means its absorption is promoted. The acetate or acid tartrate of potash may be conjoined. In hydrothorax mercurial pill squill and digitalis form a very efficient combination. *As an expectorant in chronic pulmonary affections*, admitting of the use of a substance stimulating the capillary vessels of the bronchial membrane, as chronic catarrh, humid asthma, and winter cough, it is often employed with considerable benefit. It is, of course, improper in all acute cases accompanied with inflammation or febrile disorder. In old persons it is often combined with the compound tincture of camphor, and with good effect. The syrup of squill may be given to relieve troublesome chronic coughs in children. *As an emetic*, it is occasionally used in affections of the organs of respiration requiring or admitting of the use of emetics. Thus the syrup may be given, with the view of creating sickness and promoting expectoration, to children affected with hooping-cough: and sometimes, though with less propriety, in mild cases of croup. The great objection to its use is the uncertainty of its operation; in one case it will hardly excite nausea, in another it causes violent vomiting. Furthermore, it is, of course, highly objectionable as an emetic for delicate children with irritable stomachs, on account of its acrid properties, and the irritation it is capable, in these cases, of setting up. It succeeds best as an emetic when combined with ipecacuanha.

Administration.—Powdered Squill.—The Dublin College formerly gave directions for the preparation of this as follows:—'Remove the membranous integuments from the bulb of the squill, cut it into slices, and dry at a temperature between 90° and 100° F.; then reduce them to powder, which ought to be kept in glass bottles with ground stoppers.' The bulb loses about four-fifths of its weight by drying: so that six grains of the dry powder are equal to thirty grains when fresh. Powdered squill readily attracts water from the atmosphere, and becomes soft and mouldy; hence the necessity of preserving it in stoppered bottles and in a dry place. Sometimes it becomes hard and massive like diachylon plaster. It is usually administered in the form of pill. The dose of the powder, as an emetic, is from 6 to 15 grains, 10 grains being the average. As an expectorant or diuretic we should commence with 1 grain, and gradually increase the dose until slight nausea is excited.

Pharmaceutical Use. — Squill is an ingredient of the pill of ipecacuanha with squill.

[§ **Acetum Scillæ.** *Vinegar of Squill.*

Take of

Squill, bruised	$2\frac{1}{2}$ ounces.
Diluted Acetic Acid . . .	1 pint.
Proof Spirit	$1\frac{1}{2}$ fluid ounce.

Macerate the squill in the acetic acid for seven days, then strain with expression, add the spirit to the strained liquor, and filter.

Dose.—15 to 40 minims.]

[§ **Oxymel Scillæ.** *Oxymel of Squill.*

Take of

Vinegar of Squill	1 pint.
Clarified Honey	2 pounds.

Mix and evaporate by a water-bath until the product when cold shall have a specific gravity of 1·32.

Dose.—½ to 1 fluid drachm.]

[§ **Pilula Scillæ Composita.** *Compound Squill Pill.*

Take of

Squill, in powder	. . .	1¼ ounce.
Ginger, in fine powder	of each	1 ounce.
Ammoniacum, in powder		
Hard Soap, in powder		
Treacle, by weight	. . .	2 ounces, or a sufficiency.

Mix the powders, add the treacle, and beat into an uniform mass.

Dose.—5 to 10 grains.]

This preparation contains nearly twice as much squill as the London and about one-third less than the Edinburgh pill. It is expectorant and diuretic. Principally used in chronic bronchial affections.

[§ **Syrupus Scillæ.** *Syrup of Squill.*

Take of

Vinegar of Squill	1 pint.
Refined Sugar	2½ pounds.

Dissolve with the aid of heat.

Dose.—½ to 1 fluid drachm.]

Used as an expectorant in chronic catarrh.

[§ **Tinctura Scillæ.** *Tincture of Squill.*

Take of

Squill, bruised	2½ ounces.
Proof Spirit	1 pint.

Macerate the squill for forty-eight hours in fifteen fluid ounces of the spirit in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards, subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

Dose.—10 to 30 minims.]

Used in chronic bronchial affections.

IRIDACEÆ, *Lindl.* The Iris Order.

CROCUS SATIVUS, *Linn.* The Saffron Crocus.

Botanical Character.—*Corm* roundish. *Leaves* linear, with a white central stripe, and surrounded at their base with long membranous sheaths. *Perianth* light purple, shorter than the leaves, with a slender tube twice as long as the limb; *limb* 6-partite, equal, erect. *Stamens* 3, inserted into the tube; *anthers* extrorse, sagittate, pale yellow. *Stigmas* deep orange-coloured. *Capsule* under ground, elevated by a short peduncle from the corm, which peduncle elongates after the decay of the flowers, and the capsules appear above ground.—*Steph. and Church.* pl. 101.

Habitat.—A native of Asia Minor; now naturalised and cultivated in France, Spain, and Italy. It flowers in September and October.

[§ Crocus. *Saffron.*

The dried stigma, and part of the style of Crocus sativus, *Linn.* Imported from Spain, France, and Italy.]

Preparation.—The flowers are gathered in the morning, and the stigmas, with a part of the style, plucked out for use, the rest of the flower being thrown away. The portion of styles and the attached stigmas are then dried on paper, either by means of portable kilns, or in a room by the sun. Saffron thus prepared was formerly called *Hay saffron*, to distinguish it from another kind in which the styles and stigmas, after being gathered, were dried between paper under the pressure of a thick board and weights, and then formed into cakes and termed *Cake saffron.*

General Characters.—*Hay saffron*, the only kind now found in the shops, consists of the dried parts of the styles, with their attached stigmas entangled together. Each part of which the saffron is composed is from an inch to an inch and a half long: the lower portion, which constitutes the part of the style, is narrow, capillary, yellowish; and the upper portion consists of three long deep orange-coloured stigmas which are expanded, and notched at their extremity. The odour of saffron is penetrating, aromatic, and, of large quantities, narcotic. The taste is bitter, and somewhat aromatic. When chewed, saffron tinges the mouth and saliva yellow; and when rubbed on the moistened finger it produces an intensely orange-yellow stain.

Varieties.—The principal varieties are Spanish, French, and Italian. *Spanish* is commonly regarded as the best kind. From the concurrent accounts of pharmacologists it would appear that formerly Spanish saffron was spoiled by being dipped in oil to preserve it. But the saffron now imported from Spain has not been subjected to this treatment. *French saffron* is usually considered in commerce to be second in quality. The *Italian* variety is rather more plump than the Spanish, but is hardly as valuable as it, or French saffron.

Adulterations.—It has been computed that upwards of 60,000 flowers are required to form a pound of saffron, hence saffron has always been liable to adulteration. Thus to give saffron flexibility and an appearance of freshness, as well as to augment its weight, it is sometimes damped or oiled. To detect either *water* or *oil*, a small portion of saffron should be subjected to pressure between folds of white blotting-paper; if this become either moistened or greased, the adulteration is obvious. Another adulteration practised on saffron is intermixing it with the florets of *safflower* (*Carthamus tinctorius*), which is sometimes called *bastard saffron.* The safflower readily escapes the eye of a superficial observer; but if rubbed with the moistened finger on paper, it produces a slightly yellow mark only, whereas genuine saffron causes an intense orange-yellow stain. The fraud may also be detected by carefully examining the suspected portion by a magnifying-lens; more especially if the saffron be previously macerated in hot water. Thus genuine saffron consists of a filiform style, divided at one extremity into three long convoluted deep orange stigmas, which are a little dilated upwards, and notched at the extremity. Safflower, on the other hand, is composed of florets, each consisting of a monopetalous tubular five-toothed red corolla inclosing five syngenesious stamens, and a style which is branched above, and bears two stigmas. Other florets or strips of petals artificially dyed to give them colour, and greased with oil to render them supple, have been also employed to adulterate saffron. But by attention to the above-mentioned characters of saffron, such frauds may be readily detected. Saffron from which the colouring matter has been extracted, is also sometimes found in commerce, but is easily recognised by the deficiency of colour when rubbed on the moistened finger. Fibres of smoked beef, it is said, have been also employed for adulterating saffron; and Professor Bentley has noticed within the last few years that saffron is much adulterated with the stamens of the *Saffron Crocus*; these may be readily detected by taking a small portion of the suspected specimen and diffusing it in a glass of warm water for about a minute, when, if adulterated in this way, the pale yellow-coloured twisted stamens may be readily distinguished from the orange-yellow stigmas and style which constitute genuine saffron. *Cake saffron*, as already noticed, was formerly prepared by drying the saffron under pressure. But the cakes now universally met with in this country are composed of safflower and gum-water, made into a paste, and rolled out into oval cakes, which are dried in a stove. They are shining, and of a brownish-red colour.

Therapeutics.—Hippocrates employed saffron in uterine and other maladies, but in the modern practice of medicine it is scarcely employed therapeutically.

Pharmaceutical Uses.—It is used as a colouring and flavouring ingredient in compound decoction of aloes, pill of aloes and myrrh, aromatic powder of chalk, compound tincture of cinchona, ammoniated tincture of opium, tincture of rhubarb, and in the following official preparation:—

[§ **Tinctura Croci.** *Tincture of Saffron.*

Take of

Saffron	1 ounce.
Proof Spirit	1 pint.

Macerate the saffron for forty-eight hours, in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.]

IRIS, *Linn.*

Generic Character.—*Perianth* tubular; *limb* petaloid with 6 divisions, the outer segments revolute, the inner erect and converging. *Stamens* 3, concealed beneath the segments of the style. *Style* 3-parted near the upper end, with petaloid segments. *Capsule*, 3-celled, 3-valved, coriaceous, with loculicidal dehiscence. *Seeds*, numerous, fleshy, flat or rounded.

Iridis Rhizoma. *Orris Rhizome.*

(*Not official.*)

Botanical Source.—The so-called *orris root* of commerce consists usually of the rhizomes of three species of Iris; namely, *Iris florentina*, *I. pallida*, and *I. germanica.* They are brought to us in the decorticated state, in casks, from Leghorn and Trieste.

General Characters.—Orris rhizome, or root, as it is frequently incorrectly termed, occurs in pieces, which are simple or branched, more or less knotty, and about the thickness of the thumb, flattened, of a whitish colour, a bitterish acrid taste, and a violet odour. This odour is acquired in the process of drying.

Composition.—Orris rhizome consists of *volatile oil*, *acrid resin*, *astringent extractive*, *gum*, *starch*, and *ligneous matter*. Raspail detected in it crystals, which he considered to be those of *oxalate of lime*. The starch of orris rhizome is made up of elliptical-shaped granules, which form interesting objects for the polarising microscope. Some of them consist of two mullar-shaped granules applied base to base. Most of them are cracked at the hilum, and even at their edges.

Effects and Uses.—Orris rhizome is an acrid substance, and in full doses causes vomiting and purging. It is principally used on account of its violet odour. Thus *hair* and *tooth powders*, *perfumed oils*, &c. are frequently scented with it. Issue peas have been made of it. During teething, infants are sometimes permitted to rub their gums with, and bite, the rhizome; but the practice is objectionable, since it is not unfrequently attended with irritation of the mouth, and disorder of the stomach and bowels. Furthermore, the danger of the rhizome getting into the œsophagus or trachea is not to be overlooked. One fatal case of this kind is recorded. Powdered orris rhizome is sometimes used as an errhine. A *tincture of orris rhizome*, prepared by digesting one part of powdered orris rhizome in eight parts of rectified spirit, is used as a scent, and is frequently sold as *essence of violets*.

MARANTACEÆ, *Lindl.*

MARANTA ARUNDINACEA, *Linn.* **The Maranta, or West Indian Arrow-root.**

Botanical Character.—*Rhizome* white, articulated, tuberous, placed horizontally in the earth, and giving origin to several tuberous jointed stolons, similar to itself, but covered with scales; these stolons are often more than a foot long, and curved, so that the points rise out of the earth and become new plants. *Stem* 2 to 3 feet high, branched, herbaceous. *Leaves* alternate, ovate-lanceolate, with long leafy hairy sheaths. *Peduncles* 2-flowered. *Flowers* white and small. *Corolla* unequal, one of the inner segments in the form of a lip. *Stamens* petaloid, with half an anther on their edge. *Style* hooded, adhering to the edge of a sterile filament. *Ovary* 3-celled, smooth: *ovules* solitary. *Fruit* even, dry, 1-seeded.

Habitat.—West Indies. It is cultivated both in the West and East Indies, Ceylon, Sierra Leone, &c.

Composition of the Root.—The principal constituent is *starch*, the average quantity of which is about 25 per cent.

Maranta. *West Indian Arrow-root, or Maranta Starch.*

The starch extracted from the rhizomes of Maranta arundinacea, *Linn.*

(*Not official.*)

Extraction.—The starch is extracted from the rhizomes when these are about ten or twelve months old. In Jamaica the following is the process adopted:—The rhizomes, or tubers as they are sometimes called, are dug up, well washed in water, and then beaten, in large deep wooden mortars, to a pulp. This is thrown into a large tub of clean water. The whole is then well stirred and the fibrous part wrung out by the hands and thrown away. The milky liquor being passed through a hair-sieve, or coarse cloth, is suffered to settle, and the clear water is then drained off. At the bottom of the vessel is a white mass, which is again mixed with clean water and drained; lastly, the mass is dried on sheets in the sun, and is pure starch. In Bermuda the rhizomes are first deprived of their paper-like scales, and then rasped by a kind of wheel-rasp (something like fig. 24, p. 450), and the starch well washed through sieves and carefully dried. In order to obtain the starch free from impurity, pure water must be used, and great care and attention paid in every step of the process. The drying is effected in pans covered by white gauze, to exclude dust and insects.

Commerce.—Arrow-root is brought in tin cases, and in barrels and boxes, from several of the West Indian Islands, Calcutta, Sierra Leone, &c. It is usually distinguished by the name of the island or place producing it; as *Bermuda Arrow-root*, *St. Vincent's Arrow-root*, *Jamaica Arrow-root*, *African or Sierra Leone Arrow-root*, &c. Bermuda Arrow-root is the most esteemed variety. In commerce the term *arrow-root* (which was originally applied to the starch of this plant, and derived from the employment of the mashed rhizomes by the native Indians as an application to wounds produced by poisoned arrows) is now frequently used to indicate other starches. The following are illustrations of its use in this way:—*Portland Arrow-root* is obtained from *Arum maculatum*. *East Indian Arrow-root* is the starch procured from *Curcuma angustifolia*. But as the West Indian plant (*Maranta arundinacea*) is also cultivated in the East Indies, and the starch obtained therefrom is exported, and might with equal propriety be called *East Indian Arrow-root*, to avoid confusion, the original West Indian Arrow-root is now commonly indicated as Maranta Starch, or Maranta Arrow-root. *Brazilian Arrow-root* is the starch of *Manihot utilissima*, and will be noticed hereafter. *Tahiti Arrow-root* is the starch of *Tacca oceanica*.

General Characters.—Maranta starch is white, odourless, and tasteless. It is in the form either of a light opaque white powder, or of small pulverulent masses. When passed between the fingers it feels firm, and when rubbed, produces a slight crackling noise. When viewed by a good pocket lens, it is found to consist of glistening granules. When examined by a microscope, these granules are seen to be convex, more or less elliptical, and moderately uniform in size. Their shape is more or less irregular, but often oblong, or usually somewhat ovate-oblong, frequently obscurely triangular, or oyster-shaped, or mussel-shaped. The rings are very evident, though fine. The nucleus or hilum, is usually most distinct, and generally placed towards one end of the granule ; it is normally circular, but frequently cracked in a linear, or stellate manner. When viewed by the polarising microscope the granules show very distinct crosses : the junction of the arms of the cross indicating the position of the hilum.

Substitutions, Impurities, and Adulterations.—The presence of accidental impurities (such as insects, dust, &c.) may be readily detected by alterations in the colour, odour, and flavour of the arrow-root. Other cheaper starches are sometimes substituted for, or mixed in variable preparations with, this kind of arrow-root, as sago-meal, potato-starch, rice-starch, Brazilian arrow-root, East Indian arrow-root, &c. These frauds may be detected by the microscope.

Physiological Effects.—By the Indians of South America, and even by some Europeans, the rhizomes have been supposed to possess alexipharmic properties. But their chief, if not their only real value, is that of yielding the starch called *Maranta starch*, which is a much-esteemed non-nitrogenised alimentary substance, and, like some other agents of this kind, is useful in the animal economy for the production of fatty and saccharine matters, lactic acid, and heat. Arrow-root is one of the most palatable and digestible of the starches.

Uses.—The mashed rhizomes have been used by the South American Indians to counteract the effects of wounds inflicted by poisoned arrows. The expressed juice of the rhizomes has also been lauded as an antidote to poisons taken into the stomach, and to the bites and stings of venomous insects and reptiles. But their more important, if not their only real use, is in furnishing the starch or *arrow-root* which is employed at the table as an article of food, in the form of puddings. It forms an agreeable, non-irritating diet for invalids and infants. In irritation of the alimentary canal, of the pulmonary organs, or of the urinary apparatus, it is especially valuable as a nutritive, emollient, and demulcent.

Administration.—To invalids and infants arrow-root is exhibited when boiled in water or milk and flavoured. Milk disagrees with some patients, and in such is of course to be avoided. The addition of sugar improves the flavour and increases the nutritive qualities. Spices, lemon-juice, or wine, may be employed according to circumstances.

CANNA EDULIS, *Ker.* Tous-les-Mois.

The rhizomes or tubers of this plant are supposed to yield the starch known in commerce as Tous-les-Mois, but it is just as probable that this is derived also from *C. glauca* and *C. Achiras.*

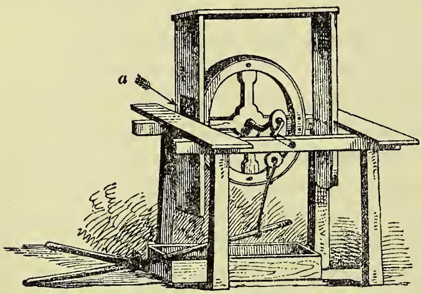
Tous-les-Mois.

The starch extracted from the rhizomes of one or more species of Canna, *Linn.* Imported from St. Kitts.

(*Not official.*)

Extraction. — In order to extract the starch, the rhizomes or tubers are rasped by means of a circular or wheel-rasp worked by a treddle. The rhizome is held against the edge of the rasp, at the point marked *a* in the accompanying figure. The starch is obtained from this pulp by the ordinary methods of washing, straining, decantation of the supernatant liquor, and desiccation of the deposited starch.

Fig. 24.



Wheel-rasp used for rasping the rhizomes of the Tous-les-Mois plant.

General Characters.—To the naked eye tous-les-mois greatly resembles potato-starch. On account of the large size of its granules it has a satiny or glistening appearance, and is devoid of that dead white or opaque appearance presented by Maranta starch. Examined by a pocket lens, the sparkling and glistening appearance of its granules is very obvious. When submitted to examination by means of the compound microscope, its granules are seen to be very large (in this respect exceeding those of all other starches), oval or somewhat ovate in form, to have a very distinct circular hilum, and concentric rings. The rings are numerous, regular, close, but somewhat unequally so. The hilum and the body of the granule are frequently cracked. Potato-starch is the only amylaceous substance which can be confounded with tous-les-mois. The two starches may, however, be readily distinguished by a careful attention to their relative sizes and forms, to the appearance of their rings, the position of the hilum, and the action of polarised light on them.

Composition.—The composition of tous-les-mois starch is assumed to be the same as that of other starches.

Uses.—In its dietetical qualities tous-les-mois resembles other starches. It yields agreeable articles of food for invalids and others, and is very readily digested.

ZINGIBERACEÆ, *Lindl.* The Ginger Order.

ZINGIBER OFFICINALE, *Roscoe.* The Narrow-leaved Ginger.

Botanical Character.—*Rhizome* biennial, creeping. *Stems* annual, erect, invested by the long smooth sheaths of the leaves; generally three or four feet high. *Leaves* linear-lanceolate, smooth. *Spike* radical, solitary, about 3–4 inches long, consisting of 1-flowered imbricated obovate bracts, with membranous margins. *Corolla* with the inner limb 3-parted, dark purple. *Anther* double, tapering into a simple incurved beak. *Stigma* funnel-shaped. *Capsule* roundish. *Seeds* numerous; mostly abortive.—*Woodv.* p. 31, pl. 11 (*Amomum Zingiber*).

Habitat.—Cultivated in the tropical regions of Asia and America, the West Indies, and Sierra Leone. Native soil doubtful, probably Asia.

[§ **Zingiber.** *Ginger.*

The scraped and dried rhizome of Zingiber officinale, *Roscoe.* From plants cultivated in the West Indies, India, and other countries.]

Preparation.—The dried rhizomes, called *ginger*, are prepared when the aerial stems are wholly withered, and the rhizomes about a year old. The rhizomes are then dug up and separately picked, washed, and scraped so as to remove their epidermis; and afterwards dried in the sun and open air. The product is the *uncoated* or *scraped* ginger of commerce. In some kinds of ginger the rhizomes are prepared in a nearly similar manner, but are not scraped. Hence such sorts are covered by a dry shrivelled epidermis, which is commonly called the coat, and are said to be *coated* or *unscraped.* The uncoated or scraped ginger is alone official.

General Characters.—Uncoated or scraped ginger occurs in flattish irregularly-branched pieces, called *races* or *hands*, three or four inches long, yellowish-white but not chalky on the surface, with a short mealy fracture, hot taste, and agreeable aroma. Powder yellowish-white.

Varieties.—Several kinds of ginger, distinguished partly by their place of growth, and partly by their quality, are known in English commerce. *Jamaica ginger* is an uncoated pale sort, and, when of fine quality, occurs in large plump bold fleshy races, which cut soft, bright, and pale-coloured. Inferior samples are in smaller races, darker-coloured, more or less flinty, and shrivelled. *Barbadoes ginger* is a coated sort, in short flat races, which are darker-coloured than Jamaica ginger, and are covered with a corrugated epidermis. *Malabar* and *Bengal gingers* occur both coated and uncoated, and vary in colour, consistence, and flavour, but are generally hard and dark. They are more liable to be worm-eaten than either the West Indian or African sorts. *Uncoated Malabar ginger*, *Tellicherry ginger*, *Calicut ginger*, or *Cochin ginger*, is a pale uncoated sort, which resembles Jamaica ginger, both in external appearance and flavour, but has externally more of a brownish tint. *Sierra Leone* or *African ginger*, is imported both coated and uncoated. The races are plump, smaller than those of Jamaica ginger, have a reddish-brown tint, and cut soft and bright. They are very warm in flavour, and, though low-priced, are sound and good. The external colour varies in these different varieties from pale or bright yellow to brown : the palest is the fine Jamaica ginger ; the darkest the Bengal old sort, and the other varieties being intermediate. The internal varies like the external colour; the best ginger is that which cuts pale but bright. The consistence of ginger, as ascertained by cutting, varies from soft to hard, or, as it is termed in trade, 'flinty,' the soft being preferred. *Washed Ginger ; Bleached Ginger.*—Ginger is sometimes washed in water, and then dried, by wholesale dealers, prior to its being offered for sale to the retailers. Some of the darker kinds are bleached by washing them in a solution of chloride of lime, and sometimes by exposing them to the fumes of burning sulphur. By this treatment the ginger acquires a chalky-white character, and is then often termed *white-washed* ginger.

Adulteration.—Powdered ginger is said to be mixed with flour and other amylaceous substances. The microscope would readily detect the adulteration, except in the case of East Indian arrowroot, the granules of which are similar in appearance to those of ginger starch.

Composition. — Ginger contains a *volatile oil*, *resin*, and *starch*. *Volatile Oil of Ginger* is pale yellow, very fluid, lighter than water ; odour that of ginger ; taste, at first mild, afterwards acrid and hot. *Resin.*—Obtained by digesting the alcoholic extract of ginger first in water, then in ether, and evaporating the ethereal tincture. The residual resin is yellowish-brown, soft, combustible, has an aromatic odour, and a burning aromatic taste, and is readily soluble in alcohol, ether, oil of turpentine, and hot almond oil. *Starch.*—Ginger-starch consists of thin flat discs, which resemble those of East Indian arrow-root derived from *Curcuma angustifolia.*

Physiological Effects.—Ginger is one of the aromatic stimulants, and possesses considerable pungency or acridity. The rhizome, chewed, is a powerful sialagogue. The powder, mixed with hot water and applied to the skin, causes a sensation of intense heat and tingling, and slight redness. When taken into the stomach, ginger operates as a stimulant—first to the alimentary canal; secondly, to the body generally, but especially to the organs of respiration. It is less acrid than pepper.

Therapeutics.—As a *stomachic* and *internal stimulant*, it serves several important purposes. Thus, in enfeebled and relaxed habits, especially of old and gouty individuals, it promotes digestion and relieves flatulency and spasm of the stomach and bowels. It checks or prevents nausea and griping, which are apt to be produced by some drastic purgatives. It covers the nauseous flavour of many medicines, and communicates cordial and carminative qualities to tonic and other agents. As a *sialagogue* it is sometimes chewed to relieve toothache, relaxed uvula, and paralytic affections of the tongue. As a *counter-irritant*, I have frequently known a ginger plaster (prepared by mixing together powdered ginger and warm water, and spreading the paste on paper or cloth), relieve violent headache when applied to the forehead.

Administration.—Powdered ginger may be administered, in doses of from ten to twenty grains or more, in the form of a pill.

Pharmaceutical Uses.—Ginger is an ingredient in confection of opium, confection of scammony, infusion of senna, compound squill pill, compound rhubarb powder, compound scammony powder, compound opium powder, compound jalap powder, compound cinnamon powder, syrup of buckthorn, and wine of aloes.

[§ **Syrupus Zingiberis.** *Syrup of Ginger.*

Take of

Strong Tincture of Ginger . .	6 fluid drachms.
Syrup	19 fluid ounces.

Mix with agitation.

Dose.—1 fluid drachm.]

It is used for flavouring, and for the same purposes as the tincture.

[§ **Tinctura Zingiberis.** *Tincture of Ginger.*

Take of

Ginger, in coarse powder . . .	$2\frac{1}{2}$ ounces.
Rectified Spirit	1 pint.

Macerate the ginger for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally ; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient rectified spirit to make one pint.]

This tincture is twice the strength of the London and Edinburgh tinctures, and rather more than half the strength of the Dublin tincture. It is a very valuable carminative, and is commonly employed as an adjunct to tonic, stimulant, and purgative mixtures. The tincture, if made with proof spirit, becomes turbid by keeping, in consequence of the mucilage it contains.

Dose.—15 minims to 1 fluid drachm.

[§ **Tinctura Zingiberis Fortior.** *Strong Tincture of Ginger.*

Synonym.—Essence of Ginger.

Take of

Ginger, in fine powder . . .	10 ounces.
Rectified Spirit	a sufficiency.

Pack the ginger tightly in a percolator, and pour over it carefully half a pint of the spirit. At the expiration of two hours add more spirit, and let it percolate slowly until one pint of tincture has been collected.

Dose.—5 to 20 minims.]

It is used in the preparation of Syrup of Ginger.

CURCUMA LONGA, *Linn.* The Long-rooted Turmeric.

Botanical Character.—*Rhizome* tuberous, with numerous long cylindrical branches, deep orange inside. *Leaves* radical, broadly lanceolate, with long sheathing petioles. *Scape* simple. *Spike* erect, somewhat imbricated at the base with bracts or saccate spathes. *Flowers* dull yellow, 3 to 5 together, surrounded by bractlets. Tube of the *corolla* gradually enlarged upwards; limb 2-lipped ; each 3-parted. *Filament* broad. *Anther* incumbent with two spurs at the base. *Style* capillary. *Capsule* 3-celled. *Seeds* numerous, arillate.

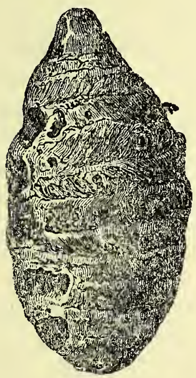
Habitat.—Much cultivated about Calcutta, and in all parts of Bengal, in Malabar, Madras, and Java, also in China and Cochin-China.

[§ **Turmeric.** (Appendix I.)

The rhizome of Curcuma longa, *Linn.*]

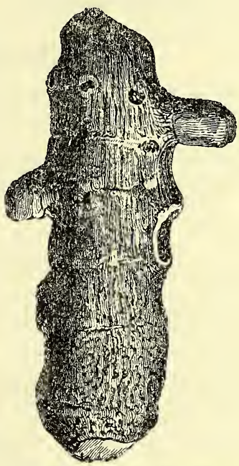
General Characters.—The *rhizomes* or *tubers*, called in the shops *turmeric*, are of two kinds; one *round* the other *long*, but both produced on the same plant. The first are round, oval, or ovate, from about one and a half to two inches long, and one inch in diameter, pointed at one end, and marked externally with numerous annular wrinkles. The second are cylindrical, not exceeding the thickness

Fig. 25.



China Round Turmeric.

Fig. 26.



China Long Turmeric.

of the little finger, two or three inches long, somewhat contorted, tuberculated. Both kinds are yellowish externally, and internally more or less orange-yellow, passing into reddish-brown. Their fractured surface has a waxy appearance. They have an aromatic taste and odour, somewhat analogous to ginger, but peculiar. When chewed, turmeric tinges the saliva yellow. Its powder is orange-yellow. The rhizomes are frequently worm-eaten.

Varieties.—Several varieties of turmeric are known in commerce, as China, Bengal, Madras, Malabar or Bombay, and Java. The China is regarded as the best.

Composition and Chemical Characteristics.—Turmeric owes its properties as a test (for which purpose it is much used), to the presence of a yellow colouring matter (*Curcumin*). If to tincture of turmeric boracic acid be added, and the mixture be evaporated to dryness, an orange-red residue is obtained, whereas, without the acid, the residue is yellow. By this test the yellow colouring matter of turmeric can be distinguished from that of rhubarb (see *Rheum*). Sulphate of copper causes a yellowish precipitate with an infusion of turmeric. A similar effect is produced by perchloride of iron.

Uses.—Used as a test to detect the presence of free alkalies, which change its yellow colour to a reddish-brown. But alkaline earths and the alkaline carbonates, borates, and sulphurets, as well as boracic, sulphuric, and hydrochloric acids, change the colour of turmeric from yellow to brown. Though not a very delicate test, it is often a very useful one. It is also employed as a condiment, and is a constituent of the well known *Curry powder*, and of many other articles of Indian cookery.

[§ **Turmeric Paper.** (Appendix I.)

Unsized white paper, steeped in tincture of turmeric, and dried by exposure to the air.]

Turmeric paper is employed as a test for alkalies, &c., which render it reddish or brownish.

[§ **Turmeric Tincture.** (Appendix I.)

Take of

Turmeric, bruised	1 ounce.
Rectified Spirit	6 fluid ounces.

Macerate for seven days in a closed vessel, and filter.]

It is employed for the preparation of turmeric paper. Diluted with water, it yields a slightly turbid yellow liquid, which is sometimes used as a test for alkalies, &c.

ELETTARIA CARDAMOMUM, *Maton.* **The Malabar Cardamom.**

Botanical Character.—A perennial plant, with a creeping *rhizome. Stems* perennial, erect, smooth, enveloped in the spongy sheaths of the leaves; from 6 to 9 feet high. *Leaves* in 2 rows, membranous, lanceolate, acuminate, pubescent above, silky beneath, 1 to 2 feet long. *Scapes* several (3 or 4) from the base of the stems, flexuose, jointed, branched, 1 to 2 feet long. *Racemes* alternate, one from each joint of the scape, sub-erect, 2 or 3 inches long. *Bracts* solitary, sheathing. *Flowers* alternate, short-stalked, solitary at each joint of the racemes. *Calyx* funnel-shaped, 3-toothed at the mouth, about three-quarters of an inch long, finely striated, permanent. Tube of *corolla* slender, as long as the calyx; limb double, exterior of 3 oblong, concave, nearly equal, pale greenish-white divisions; inner lip obovate, much larger than the exterior divisions, slightly 3-lobed, marked chiefly in the centre with purple-violet stripes. *Filament* short, erect; *anther* naked, 2-lobed, emarginate. *Ovary* oval, smooth; *style* slender; *stigma* funnel-shaped. *Capsule* oval, somewhat 3-sided, 3-celled, 3-valved. *Seeds* many, angular.—Maton, *Trans. Linn. Soc.* vol. x., pl. 4, 5.

Habitat.—Mountainous parts of the coast of Malabar.

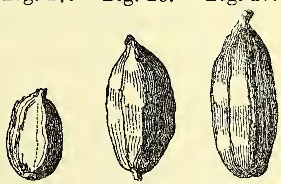
[§ **Cardamomum.** *Cardamoms.*

The dried seeds of the Malabar Cardamom, Elettaria Cardamomum, *Maton.* Cultivated in Malabar. The seeds are best kept in their pericarps, from which they should be separated when required for use, the pericarpial coats being rejected.]

General Characters.—Seeds obtusely angular, corrugated, reddish-brown externally, internally white; with a warm, aromatic, agreeable taste and odour; contained in ovate-oblong triangular pale brown coriaceous ribbed pericarps. One hundred parts of the fruit yield, on an average, seventy-four parts of seeds and twenty-six parts of pericarpial coats.

Varieties.—Three varieties of Malabar Cardamoms are distinguished in commerce; viz. *shorts*, *short-longs*, and *long-longs.* The two latter differ from each other in size merely. *Shorts;—Malabar cardamoms, properly so called.*—From 3 to 6 lines long, and from 2 to 3 lines broad; more coarsely ribbed, and of a browner colour, than the other varieties. This is the most esteemed kind. *Short-longs.* — Differs from the third variety in being somewhat shorter and less acuminate. *Long-longs.* — From 7 lines to an inch long, and from 2 to 3 lines broad, elongated, somewhat acuminate. This, as well as the last variety, is paler and more finely ribbed than the short variety. The seeds also are frequently paler and more shrivelled. The shorts are usually the dearest. The long-longs are seldom brought over.

Fig. 27. Fig. 28. Fig. 29.



Shorts. *Short-longs.* *Long-longs.*

Composition.—Good short cardamoms yield about 4·6 per cent. of *volatile oil.* This is colourless, has an agreeable odour, and a strong, aromatic, burning taste. Its sp. gr. is 0·943. It is very soluble in alcohol, ether, oils (both fixed and volatile), and acetic acid. It is insoluble in solution of potash. By keeping, it becomes yellow, viscid, and loses its peculiar taste and smell. It then detonates with iodine, and takes fire when placed in contact with concentrated nitric acid. On this oil depend the odour, flavour, and aromatic qualities of the seeds. Its composition is analogous to that of oil of turpentine.

Physiological Effects.—The effects of cardamoms are those of a very agreeable and grateful aromatic, devoid of all acridity.

Therapeutics.—Cardamoms are employed partly on account of their flavour, and partly for their cordial and stimulant properties. They are rarely administered alone, but generally either as adjuvants or correctives of other medicines, especially of stimulants, tonics, and purgatives.

Pharmaceutical Uses.—They are used in aromatic powder of chalk, compound cinnamon powder, compound extract of colocynth, compound tincture of gentian, tincture of rhubarb, and wine of aloes.

[§ **Tinctura Cardamomi Composita.** *Compound Tincture of Cardamoms.*

Take of

Cardamom Seeds, freed from their pericarps and bruised	$\frac{1}{4}$ ounce.
Caraway Fruit, bruised	$\frac{1}{4}$ ounce.
Raisins, freed from their seeds	2 ounces.
Cinnamon Bark, bruised	$\frac{1}{2}$ ounce.
Cochineal, in powder	60 grains.
Proof Spirit	1 pint.

Macerate the solid ingredients, for forty-eight hours, in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

About one-third stronger than the London, Edinburgh, and Dublin tinctures. It most resembles the latter, but differs from it in containing raisins. This compound is agreeably aromatic. It is used as an adjunct to cordial, tonic, and purgative mixtures; and its colour often renders it useful in prescribing. It is an ingredient in compound decoction of aloes, compound mixture of iron, compound mixture of senna, and compound tincture of chloroform.

AMOMUM MELEGUETA, *Roscoe.*

Grana Paradisi. *Grains of Paradise, or Guinea Grains.*

The seeds of Amomum Melegueta, *Roscoe.*

(*Not official.*)

Commerce.—Grains of paradise are imported, in casks, barrels, and puncheons, from the coast of Guinea.

General Characters.—These seeds are roundish or ovate, frequently bluntly angular, and somewhat cuneiform; shining golden-brown; minutely rough, from small warts and wrinkles; internally white. Their taste is aromatic, and vehemently hot or peppery; when crushed and rubbed between the fingers, their odour is feebly aromatic. Their greatest diameter rarely exceeds $1\frac{1}{4}$ line. The pungent taste resides in the seed-coats.

Composition.—Grains of paradise contain—among other substances —*volatile oil, two resins, extractive matter, starch, and salts.*

Physiological Effects.—Analogous to those of pepper. A very erroneous notion prevails that these seeds are highly injurious.

Uses.—Rarely employed as an aromatic. Esteemed in Africa as the most wholesome of spices, and generally used by the natives to season their food. Its principal consumption in this country is in veterinary medicine, and to give an artificial strength to spirits, wine, beer, and vinegar. (By 56 *Geo.* III. c. 58, no brewer or dealer in beer shall have in his possession or use grains of paradise, under a penalty of 200*l.* for each offence; and no druggist shall sell it to a brewer, under a penalty of 500*l.* for each offence.)

Sub-class III.—Dictyogenæ.

SMILACEÆ, *Lindl.* The Sarsaparilla Order.

SMILAX, *Linn.*

Generic Character.—*Diœcious. Perianth* 6-parted, nearly equal, spreading. Male flowers: *Stamens* 6; *anthers* erect. Female flowers: *Perianth* permanent. *Ovary* 3-celled, with 1 ovule in each cell; *style* very short; *stigmas* 3. *Fruit* baccate, 1- to 3-seeded. *Seeds* roundish; *albumen* cartilaginous; *embryo* remote from the hilum. (R. Brown, *Prodrom.* p. 293.)

Species.—Considerable uncertainty prevails as to the botanical source of the different commercial varieties of sarsaparilla. But from the following three species of Smilax, the greater part, at least, of this drug is obtained.

SMILAX OFFICINALIS, *H.B.K.*

Specific Character.—Stem twining, shrubby, prickly, quadrangular, smooth; the young shoots are unarmed, and almost round. *Leaves* ovate-oblong, acute, cordate, netted, 5- to 7-ribbed, coriaceous, smooth, a foot long, and 4–5 inches broad; the young ones are narrow, oblong, acuminate, and 3-ribbed. *Petioles* smooth, an inch long, bearing two tendrils above the base.

Habitat.—Grows in Central America, near the Chiriqui Lagoon, in the state of Costa Rica; and in New Granada, on the banks of the Magdalena, near Bajorque. It is the source of the Jamaica and Lima sarsaparillas; and probably, in part at least, of Caracas and Brazilian sarsaparillas.

SMILAX MEDICA, *Schlechtendal*, in *Linnæa*, vi. 47.

Specific Character. — *Stem* angular, armed at the joints with straight prickles, with a few hooked ones in the intervals. *Leaves* shortly acuminate, smooth, 5- to 7-ribbed; inferior ones cordate, auriculate-hastate; upper ones ovate-cordate. *Peduncle* axillary, smooth, about an inch long. *Inflorescence* an 8- to 12-flowered umbel. *Fruit* red, size of a small cherry; contains 1–3 reddish-brown *seeds*. *Embryo* cylindrical, lodged in horny albumen.

Habitat.—Grows on the eastern slope of the Mexican Andes. It is the source of Mexican or Vera Cruz (lean) sarsaparilla.

SMILAX PAPYRACEA, *Poiret.*

Specific Character.—Stem 4-cornered or plane-angular, polished, prickly. *Leaves* somewhat membranous, ovate-oblong, obtuse at both ends, or usually pointed at the apex, quite entire, unarmed, 5-ribbed. *Tendrils* inserted about the middle of the petiole. *Peduncles* axillary. *Fruit* baccate, about the size of a pea; 2–3-celled; 2–3-seeded. *Seeds* roundish.

Habitat.—Grows in the province of Rio Negro, and in Guatemala. It yields the greater part of Brazilian or Lisbon sarsaparilla; the whole of the Guatemala sarsaparilla of Bentley; and probably also Honduras sarsaparilla.

Sarsa or Sarsaparilla.

General Characters.—The *sarsaparilla*, *sarsa*, or *sarza* of commerce consists essentially of the *roots* of the before mentioned and perhaps also of other species of *Smilax*. In some varieties of sarsaparilla the roots are attached to a portion of the *rhizome*.

a. The *rhizome*, called by druggists the *chump*, is a tuberous subterranean stem, which in the living plant is placed horizontally or obliquely in the earth. It grows throwing out aerial stems and roots at the more pointed extremity, and gradually dies off at the thicker and older end. One or more *aerial stems* are frequently found attached to the rhizome of the shops; these are rounded or somewhat angular, and usually with prickles. If a transverse section be made of either the rhizome or aerial stem no distinction of bark, wood, and pith is perceptible.

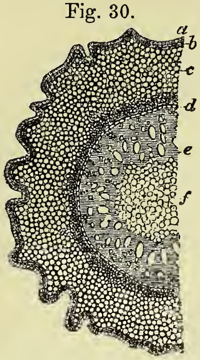
β. The *roots* (the parts used in medicine), are usually several feet long, and of variable thickness; on the average about that of a writing quill. The thin shrivelled roots are more or less wrinkled or furrowed longitudinally, and in trade are usually said to be *lean*; while the thick plump swollen ones, are described as being *gouty*. The latter usually abound in starch, and are said to be *mealy*. Frequently, especially in some varieties of sarsaparilla, the roots are said to be *bearded*; that is, they give off, more or less abundantly, rootlets, which are themselves often divided into smaller branches. The colour of the roots varies, being more or less red or brown, frequently with a greyish tint. The washed or unwashed condition, the greater or less care taken of them in drying, the time of year when they were collected, the colour and nature of the soil in which they grew, as well as the species of plant from which they are obtained, and many other circumstances, doubtless modify the colour. The taste of the root is mucilaginous and slightly acrid. The acridity is only perceived after chewing the root for a few minutes. The odour is somewhat earthy. If a transverse section be made the roots are seen to consist of a bark or rind (fig. 30, *a*, *b*, *c*); and a woody zone inclosing the pith, somewhat in the manner of an exogenous stem—the two together forming the ligneous cord or meditullium (fig. 30, *d*, *e*, *f*).

Varieties.—Several varieties of sarsaparilla are met with in commerce, and known under the names of *Caracas* or *gouty Vera Cruz*, *Honduras*, *Brazilian* or *Lisbon*, *Guatemala*, *lean Vera Cruz* or *Mexican*, *Lima*, and *Jamaica*. These differ from one another in the anatomical and other characters of their roots, in the manner in which they are folded and packed, and in the absence or presence and character of the attached rhizomes and stems. They may be arranged in two divisions: the first including those commonly termed mealy; the second, those which are non-mealy.

1. *Mealy Sarsaparillas.*

These are characterised by the mealy character of the inner cortical layers (fig. 30, *c*), which are also whitish or pale-coloured. The meal or starch is sometimes so abundant, that a shower of it, in the form of white dust, falls when we fracture the roots. The thickest mealy coat which I have measured was barely $\frac{1}{10}$th of an inch in thickness. Compared with the diameter of the meditullium or ligneous cord (fig. 30, *d*, *e*, *f*), the thickness of the mealy coat is sometimes nearly equal to it, but usually does not exceed the $\frac{1}{3}$ or $\frac{1}{2}$ of it. The thick mealy roots have a swollen appearance, and are technically called *gouty* by the dealers: the bark being brittle is frequently cracked transversely in rings, and readily falls off. The colour of the mealy coat varies from white to yellowish or pinkish. The medulla or pith (fig. 30, *f*) is frequently very amylaceous. If a drop of oil of vitriol be applied to a transverse section of the root of mealy sarsaparilla, the mealy coat is *but little altered in colour*; while the woody zone becomes dark purplish or almost black. Sometimes the pith also acquires a darkish tint. A decoction of mealy sarsaparilla, when cold, becomes dark blue on the addition of tincture of iodine. The aqueous extract of mealy sarsaparilla, when rubbed down with distilled water in a mortar, does not completely dissolve, but yields a turbid liquid, which becomes blue on the addition of iodine.

Fig. 30.



Magnified view of a section of a Mealy (Honduras) *Sarsaparilla.*

a. Epidermis.
b. Outer cortical layers.
c. Mealy coat, or inner cortical layers.
d. Cellular sheath (liber?).
e. Woody zone.
f. Medulla or pith.

This division includes four commercial varieties of sarsaparilla: namely, the *Brazilian*; the *Honduras*; the kind which by English dealers is commonly called *gouty* or *Vera Cruz*, but which, by Continental and American writers, is usually denominated *Caracas*; and *Guatemala.*

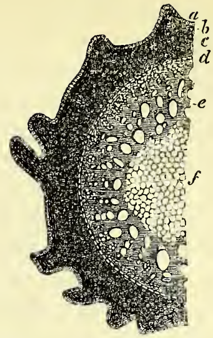
2. *Non-mealy Sarsaparillas.*

The sarsaparillas of this division are characterised by a deep-coloured usually non-mealy bark. The bark is red or brown, and much thinner than in the mealy sorts. Although by the microscope starch granules can be detected in the inner cortical layers, yet their number is comparatively small, and is quite insufficient to give the mealiness which characterises the sarsaparillas of the first division. The diameter of the meditullium or ligneous cord is much greater than in the mealy sarsaparillas, and is frequently six or more times greater than the thickness of the bark (fig. 31). The roots have never that swollen appearance called by dealers gouty, and which is frequently observed in the mealy sorts. Starch granules are usually recognisable in the pith by the microscope. If a drop of oil of vitriol be applied to a transverse section of the root of the non-mealy sarsaparillas, both bark and wood acquire a dark red or purplish tint. A decoction of non-mealy sarsaparilla, when cold, does not yield a blue colour when a solution of iodine is added to it.

This division includes the varieties known in commerce by the names of *Jamaica* and *Lima* sarsaparillas, as well as a variety which I have received as a *lean Vera Cruz* sarsaparilla.

The only official kind of sarsaparilla is the Jamaica sort.

Fig. 31.



Magnified view of a section of a Non-mealy (Jamaica) *Sarsaparilla.*

a. Epidermis.
b. Outer cortical layers.
c. Red inner cortical layers.
d. Cellular sheath (liber?).
e. Woody zone.
f. Medulla or pith.

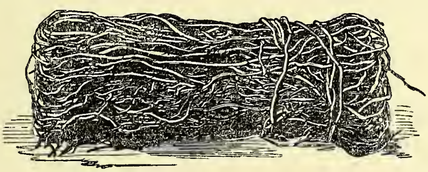
[§ **Sarsæ Radix.** *Jamaica Sarsaparilla.*

The dried root of Smilax officinalis, *Humb. and Bonpl.* Native of Central America, imported from Jamaica.]

Source.—As already noticed (see Smilax officinalis, p. 460), Jamaica sarsaparilla is not the produce of the island whose name it bears, but is imported into Jamaica from the eastern coast of Honduras, from Guatemala, Columbia, and New Granada.

General Characters.—The roots of *Jamaica*, or *Red-bearded Sarsaparilla* as it is also called, are folded and made up in bundles of

Fig. 32.



Bundle of Jamaica Sarsaparilla.

about twelve or eighteen inches long, and four or five or more inches broad (fig. 32). These bundles are neither trimmed nor closely packed. The roots are generally many feet in length, not thicker than a goose quill, slender, furnished with numerous small rootlets called the *beard.* The bark is reddish-brown, and when examined by the microscope is found to contain some starch granules. When chewed, Jamaica sarsaparilla tinges the saliva. Its taste is not remarkably mucilaginous, but slightly bitter, and after a few minutes feebly acrid. Its decoction is deepened in colour by a solution of iodine, but no blue tint is perceptible. Its powder is pale reddish-brown, and when rubbed with water and tincture of iodine becomes blue, but less intensely so than the powder of the Honduras variety. It yields a larger quantity of extract than the other varieties; its extract is perfectly soluble in cold water.

Therapeutical Value and Quality.—The relative therapeutical value of the different varieties of sarsaparilla is not easily determined, and at present we have no precise information, either chemical or clinical, which will allow us to speak positively on the matter; and to this want of precise information must be ascribed the different relative therapeutical values assigned to the various kinds in different countries. In the southern parts of Europe, where sarsaparilla has been the longest in use, the *thickest* and most *mealy* roots, irrespective of the country producing them, are preferred. It is, however, quite certain that starch is not the active principle of the root, but is regarded as being contemporaneous with it. I believe this opinion to be erroneous; for firstly, the mealy sarsaparillas give to the test of oil of vitriol slighter indications of the presence of smilacin than the non-mealy sorts; secondly, the mealy varieties are the least acrid to the taste; and thirdly, the largest quantity of extract is obtained from a non-mealy variety, viz. that brought *viâ* Jamaica. In England the non-mealy sarsaparillas are almost universally, and, as I believe, properly preferred; and of these the Jamaica variety, (the only official one,) is most esteemed, and next to this, that called the Lima. The *colour* of the root is not to be absolutely depended on as a test of goodness, but roots having a deep orange-red tint are preferred. *Taste*, perhaps is the best criterion: the more acrid and nauseous the taste, the better is the quality of the root. The *quantity of extract* yielded by a given weight of the root has been too much insisted upon as a test of goodness; for though a sarsaparilla which yields very little extract cannot be regarded as good, yet it does not follow, especially in the absence of comparative trials, that a sarsaparilla which yields the most abundant extract is necessarily the best, since the quantity may arise from the presence of mucilage and other inert matters. The *beard* is another criterion of goodness: the greater the quantity of rootlets (technically called *beard*), the better the sarsaparilla.

Composition.—Sarsaparilla contains a very small quantity of *volatile oil* and *smilacin*. *Volatile Oil.*—This is heavier than water, is soluble in rectified spirit, and has the dry odour and acrid taste of sarsaparilla. *Smilacin* is procured by decolorising a concentrated hot alcoholic tincture of sarsaparilla by animal charcoal. The tincture deposits, on cooling, impure smilacin, which may be purified by repeated solution and crystallisation. Smilacin is a white, crystallisable, odourless, and, in the anhydrous state, almost tasteless substance, very slightly soluble in cold water, more so in boiling water, and depositing from the latter as it cools. Its solution has the bitter acrid taste of sarsaparilla, and froths on agitation. It is soluble in alcohol, ether, and oils. It does not combine with acids to form salts. Strong sulphuric acid colours it red, then violet, and lastly yellow.

Physiological Effects.—Diaphoresis is by far the most common effect of its internal use. In some conditions of system, especially those of a cachectic kind, sarsaparilla acts as a powerful and valuable alterative tonic. Its continued use is often attended with improvement of appetite and digestion, augmentation of strength, increase of flesh, and the palliation, or, in some cases, complete disappearance, of various morbid symptoms, as eruptions, ulcerations, and pains of a rheumatic character. Sarsaparilla differs in several respects from the bitter vegetable tonics. Though it is not devoid of, yet it does not, as they do, abound in a bitter principle. It is not adapted for the cure of intermittents, or of simple debility. But its best effects are seen in those depraved conditions of system which the public, and even some medical men, ascribe to the presence of a morbid poison, or to a deranged condition of the fluids. Hence it is frequently denominated *a purifier of the blood.* Those who do not adopt the pathological notion here referred to call it an *alterative.*

Therapeutics.—Sarsaparilla has been found especially serviceable in the following maladies:—*In inveterate venereal disease.*—It is beneficial principally when the malady is of long continuance, and the constitution is enfeebled and emaciated, either by the repeated attacks of the disease or by the use of mercury. When the disease resists, or is aggravated by, the use of mercury, sarsaparilla evinces its most salutary powers. It is given to relieve venereal pains of a rheumatic character; to remove venereal eruptions; to promote the healing of ulcers of the throat; and to assist in the cure when the bones are affected. In recent chancre, or bubo, it is of little use; nor does it appear to possess the least power of preventing secondary symptoms. Sarsaparilla is sometimes given alone, but more frequently with other remedies, as with stimulating diaphoretics (mezereon, sassafras, and guaiacum). *In chronic rheumatism* sarsaparilla is often advantageously conjoined with powerful sudorifics and anodynes (as opium or hyoscyamus), especially when any suspicion exists as to the venereal origin of the disease. *In obstinate skin diseases* benefit is frequently obtained by the use of sarsaparilla. Its employment is not confined to cutaneous affections of one particular elementary form, since it is given with good effect in papular, vesicular, pustular, and tubercular skin diseases of a chronic kind, when they occur in enfeebled and emaciated constitutions. Though, in these cases, its value principally depends on its tonic and alterative effects, its diaphoretic operation is to be encouraged by the use of diluents and warm clothing. *In cachectic conditions of the system generally* sarsaparilla may be given, often with the best effects, and never with any ill consequences, save that of producing slight nausea. Indeed, one of the great advantages of sarsaparilla over many other alteratives and tonics is that, although it may fail in doing good, it never does any harm beyond that of now and then causing slight disorder of the stomach. In chronic abscesses, attended with profuse discharge, diseases of the bones, obstinate ulcers, chronic pulmonary affections accompanied with great wasting of the body, enlarged glands, and various other maladies connected with a depraved state of the system, sarsaparilla is often a very useful medicine.

[§ **Decoctum Sarsæ.** *Decoction of Sarsaparilla.*

Take of

Jamaica Sarsaparilla, cut transversely .	$2\frac{1}{2}$ ounces.
Boiling Distilled Water . . .	$1\frac{1}{2}$ pint.

Digest the sarsaparilla in the water for an hour; boil for ten minutes in a covered vessel, cool and strain, pouring distilled water, if required, over the contents of the strainer, or otherwise making the strained product measure a pint.

Dose.—2 to 10 fluid ounces.]

Half a pint less water is used for this than for the London decoction, and hence that quantity less has to be boiled off. Decoction of Jamaica sarsaparilla usually produces little or no blue colour with tincture of iodine; whereas the corresponding preparations of Honduras sarsaparilla become bluish-black on the addition of a solution of iodine.

[§ **Decoctum Sarsæ Compositum.** *Compound Decoction of Sarsaparilla.*

Take of

Jamaica Sarsaparilla, cut transversely . .	$2\frac{1}{2}$ ounces.
Sassafras Root, in chips . } each . .	$\frac{1}{4}$ ounce.
Guaiacum Wood turnings . } each . .	$\frac{1}{4}$ ounce.
Fresh Liquorice Root, bruised } each . .	$\frac{1}{4}$ ounce.
Mezereon Bark	60 grains.
Boiling Distilled Water	$1\frac{1}{2}$ pint.

Digest the solid ingredients in the water for an hour; then boil for ten minutes in a covered vessel; cool and strain; pouring distilled water, if required, over the contents of the strainer, or otherwise making the strained product measure a pint.

Dose.—2 to 10 fluid ounces.]

This preparation is an imitation of the celebrated *Lisbon Diet Drink.* The extract is usually conjoined with it. During its use the skin should be kept warm.

[§ **Extractum Sarsæ Liquidum.** *Liquid Extract of Sarsaparilla.*

Take of

Jamaica Sarsaparilla, cut transversely	. 1 pound.
Distilled Water, at 160° F. . . .	. 14 pints.
Rectified Spirit	. 1 fluid ounce.

Digest the sarsaparilla in one-half of the water for six hours, and decant the liquor. Digest the residue in the remainder of the water for the same time, express and filter the mixed liquors, and evaporate them by a water bath to seven fluid ounces, or until the specific gravity of the liquid is 1·13. When cold, add the spirit. The specific gravity should be about 1·095.

Dose.—2 to 4 fluid drachms.]

Extract of sarsaparilla is declared by many writers to be an inert and useless preparation. I have extensively used it, and believe that when properly prepared from Jamaica sarsaparilla, it is a most valuable and efficient remedy; and the enormous quantity of it which is consumed by the profession generally (including some of the most eminent of its members) is a proof that many others entertain a similar opinion. Alkalies render its flavour somewhat disagreeable, though they frequently increase greatly its remedial powers.

Class III.—DICOTYLEDONES.

Division I.—Gymnospermia.

CONIFERÆ, *Linn.* The Pine Order.

PINUS, *D.C.*

Generic Character.—Hardy evergreen trees. *Leaves* 2 or many, in the same sheath. *Flowers* monœcious. *Males: Catkins* racemose, compact and terminal, squamose; the *scales* staminiferous at the apex. *Stamens* 2; *anthers* 1-celled. *Females: Catkins* simple, imbricated with acuminate scales. *Ovules* 2, naked, inverted, collateral, situated at the base of each of the scales. *Scales* of the *cone* oblong, club-shaped, woody. *Seeds* in pairs, covered with a sharp-pointed membrane. *Cotyledons* digitato-partite.

PINUS PALUSTRIS, *Miller.* The Swamp Pine.

Specific Character.—A large *tree* 60 or 70 feet high, the trunk being about 15 or 18 inches in diameter for two-thirds of this height. *Leaves* in threes, about a foot long, of a brilliant green colour. *Stipules* pinnatifid, ragged, persistent. *Cones* very long, sub-cylindrical, armed with sharp prickles.—*Lambert, Pinus*, vol. i. pl. 20.

Habitat.—Grows in dry sandy soil, from the southern parts of Virginia to the Gulf of Mexico.

It furnishes by far the greater proportion of *turpentine, tar*, &c., consumed in the United States, or sent from that to other countries.

PINUS TÆDA, *Linn.* The Frankincense Pine.

Specific Character.—A large *tree*, 70 or 80 feet in height. *Leaves* in threes, elongated, rigid, with long sheaths. *Cones* often in pairs, oblong-pyramidal, 3–4 inches long, somewhat truncate at the apex; *scales* with short incurved prickles.—*Lambert, Pinus*, vol. i. pl. 16.

Habitat.—Abundant in Virginia.

Yields *common turpentine*, but of a less fluid quality than that which flows from the preceding species.

PINUS PINASTER, *Aiton.* The Cluster Pine.

A large *tree.* *Leaves* twin, very long, rigid, pungent, furnished at the base with a reflexed scale. *Cones* oblong-conical, obtuse, very smooth, bright, shorter than the leaves. *Scales* bristly.—*Lambert, Pinus*, vol. i. pl. 9, 10.

Habitat.—Southern maritime parts of Europe. Very abundant in the neighbourhood of Bordeaux, and between that town and Bayonne.

It yields a small portion of the turpentine known as *Bordeaux turpentine* and *tar.*

[§ Oleum Terebinthinæ. *Oil of Turpentine.*

The oil distilled from the oleo-resin (turpentine) obtained from Pinus palustris, *Miller's Dict.*, Pinus Tæda, *Linn.*, and sometimes Pinus Pinaster, *Aiton.*]

Nature and Preparation of Turpentine.—The term *Turpentine* is applied to the liquid or soft solid oleo-resinous juice of the above-mentioned official and some other coniferous plants. When submitted to distillation, these oleo-resins are resolved into *volatile oil* and *resin*. At first they are liquid, but by age and exposure to the air they become, more or less speedily solid, partly by the volatilisation, and partly by the resinification, of the volatile oil. They have a certain general similarity in taste and odour. They soften and become very fluid by heat, readily take fire in the air, and burn with a white flame, and, if the supply of air be limited, with the copious deposition of finely divided carbon (*lamp black*). They are almost completely soluble in alcohol and ether. Water acquires a terebinthinate flavour when digested with them; and by the aid of the yolk or the white of egg, or still better by that of vegetable mucilage, forms an emulsion with them.

Varieties and Commerce.—Turpentine is imported from America and France. *American* or *white turpentine* is procured chiefly from *Pinus palustris*, partly also from *Pinus Tæda*, and perhaps some other species growing in the Southern States. The method of procuring this turpentine is as follows :—A hollow is cut in the tree a few inches from the ground, and the bark removed for the space of about 18 inches above it. The turpentine runs into this excavation and is transferred thence into casks. When imported from New York it is yellowish-white, translucent or opaque, with an aromatic odour, and a warm, pungent, bitterish taste. Its consistence varies, being semifluid, or, in cold weather, that of a soft solid. It contains various impurities (leaves, twigs, chips, &c.). That got from the first tappings is the best, and is called *virgin turpentine*. American turpentine is melted and strained, and in this state it is sometimes called *refined turpentine*. *Bordeaux turpentine* is obtained from Pinus Pinaster, which grows abundantly on the Landes, and is brought from Bordeaux, Bayonne, and Dax.

Preparation of the Oil of Turpentine.—This is obtained by submitting to distillation a mixture of American turpentine (which has been melted and strained) and water in due proportions, in the ordinary copper still, with a naked fire. The distilled product is found to consist of oil of turpentine swimming on water; the residue in the still is resin. If no water be employed, a much higher temperature is required to effect the distillation, and danger is thereby incurred of causing empyreuma. The average quantity of oil yielded by American turpentine is from 14 to 16 per cent. The oil obtained in a similar way from the Bordeaux turpentine has a more disagreeable odour and the resin is of inferior quality. The common or unrectified oil of turpentine, sold in the shops under the name of *turps*, contains resin, and is, in consequence, denser and more viscid than the rectified oil. Its sp. gr. varies from 0·87 to 0·884. To deprive it of all traces of resinous and acid matters, oil of turpentine should be re-distilled from a solution of potash. Oil of turpentine is frequently though erroneously called *spirits or essence of turpentine.*

General Characters.—Pure oil of turpentine is limpid, colourless, with a strong peculiar odour, and pungent and bitter taste. It is a volatile, very inflammable fluid, burning with a very sooty flame. Its composition is $C_{10}H_{16}$. When pure, it is neutral to test-paper. Its sp. gr. is 0·86 at about 70° F. It boils at about 314° F.; the density of its vapour is 4·76. It evaporates without leaving any greasy stain on paper. It is almost insoluble in water, and very slightly soluble in weak alcohol; but 100 parts of alcohol, of sp. gr. 0·840, dissolve 13 or 14 parts of it, and absolute alcohol takes up a still larger proportion. The oil is also soluble in ether. It readily mixes with and is soluble in the fixed and volatile oils. Exposed to the air, it absorbs oxygen, becomes yellowish and somewhat denser, owing to the formation of resin (*pinic* and *sylvic acids*). This resinification is accompanied with the production of a small quantity of formic acid. Oil of turpentine has the power of rotating the ray of plane-polarised light; but the direction of rotation is different in the English oil (obtained by distillation from American turpentine), and the French oil (obtained by distillation from Bordeaux turpentine)—in the former being right-handed, in the latter left-handed.

Physiological Effects.—In *small doses* (as six or eight drops to a fluid drachm) it creates a sensation of warmth in the stomach and bowels, becomes absorbed, circulates with the blood, and in this way affects the capillary vessels, and is thrown out of the system by the different excretories, on the secerning vessels of which it acts in its passage through them. The exhalations of the skin and bronchial membranes acquire a marked terebinthinate odour, while the urine obtains the smell of violets. By its influence on the renal vessels it proves diuretic. By the same kind of local influence on the cutaneous vessels it proves sudorific. It appears to have an astringent effect on the capillary vessels of the mucous membranes, for, under its use, catarrhal affections of, and hemorrhages from, these parts are frequently checked, and often are completely stopped. Its continued use sometimes brings on irritation of the urinary organs, or, when this state pre-existed, it is often aggravated by the use of turpentine. In a *medium dose* of one or two fluid drachms, its effects are not constant; but, in general, we may expect, from a medium dose, a feeling of heat in the stomach and bowels, accelerated peristaltic motion, increased frequency of pulse, diaphoresis, diuresis, and sometimes irritation of the urinary organs. Occasionally it provokes the catamenia. In *a large* or *maximum dose* of half a fluid ounce to two fluid ounces its affects are not constant. It usually causes a sensation of abdominal heat, sometimes nauseates, and in general operates as a tolerably active purgative, without causing any unpleasant effects. Applied *externally* it is rubefacient.

Therapeutics.—The following are the principal uses of the oil of turpentine:—*As an anthelmintic.*—It is the most effectual remedy for *tape-worm* we possess. It both causes the death of, and expels the parasite from the body. To adults it should be given in doses of an ounce at least. To prevent any disorder of the cerebral functions, an oleaginous purgative should be either conjoined with it, or given at an interval of four or five hours after it. An excellent and safe method of employing it is to combine it with a castor-oil emulsion. A very effectual remedy for the *small thread-worm* is the turpentine enema. *In mucous discharges.*—In small doses oil of turpentine sometimes checks or stops profuse chronic discharges from the mucous membranes. In gonorrhœa and gleet it is frequently, and in leucorrhœa occasionally, used with success. In chronic pulmonary catarrh, and in chronic diarrhœa and dysentery, it has proved advantageous. In the two latter diseases it has a direct local action on the affected part, besides exerting its influence over this in common with other mucous membranes after its absorption. *In hemorrhages.*—In sanguineous exhalations, called hemorrhages, from the mucous surfaces, oil of turpentine may, under some circumstances, act efficaciously. But it is only admissible in cases of a passive or a tonic character, in the absence of plethora and acute inflammation, or a disposition thereto. Its benefit is most obvious in hemorrhage from the stomach or bowels, in which case it acts locally as well as after absorption. *In puerperal fever.*—The use of the oil of turpentine as a specific in this disease was introduced by Dr. Brenan of Dublin, and strong testimony was subsequently borne to its efficacy. Dr. Brenan gave one or two tablespoonfuls of the oil every three or four hours, in cold water, sweetened: and applied flannel soaked in the heated oil to the abdomen. But the apparent improbability of a stimulant like turpentine curing an inflammatory disease has prevented many practitioners placing any faith in it, or even giving it a trial. Lastly, it has failed, in the hands of some of our most accurate observers, to produce the good effects which have been ascribed to it, and in some instances has appeared to aggravate the malady. These reasons have been conclusive against its employment in the way advised by Dr. Brenan. Dr. F. Farre remarks in reference to this:—'Small doses, however, as ten minims, are not liable to the same objections, and are employed at the present time, as they were thirty or forty years ago, with probably more success than any other remedy.' At all events there are two valuable uses which may be made of turpentine in puerperal fever: it may be given in the form of an enema to relieve a tympanitic condition of the intestines, and for this purpose no remedy perhaps is superior to it; secondly, flannel soaked in the hot oil, as recommended by Dr. Brenan, may be applied to the abdomen, to cause rubefaction, as a substitute for a blister, to the employment of which several objections exist. *In tympanites and constipation.*—To relieve flatulent distension of the stomach and bowels, and the colic thereby induced, both in infants and adults, oil of turpentine is a most valuable remedy. It should be given in full doses so as to act as a purgative; or when, from any circumstance, it cannot be exhibited by the mouth, it may be employed in the form of an enema. Dr. Ramsbotham speaks in the highest terms of the efficacy of the oil of turpentine in acute tympanites of the puerperal state, and thinks that most of the cases of the so-called puerperal fever which yielded to this oil were in fact cases of acute tympanites; and in this opinion he is supported by Dr. Marshall Hall. In a case of *obstinate constipation*, with a tympanitic condition of the intestines, Dr. Kinglake found oil of turpentine a successful cathartic, after the ordinary means of treating these cases had been assiduously tried in vain. Dr. Paris also speaks highly of it in obstinate constipation, depending on affections of the brain. *In suppression of urine.*—I have seen oil of turpentine succeed in reproducing the urinary secretion when other powerful diuretics had failed. *In dropsy.*—Oil of turpentine has occasionally proved serviceable in the chronic forms of this disease. It is contra-indicated in dropsies attended with irritation of the urinary organs; but in the atonic forms of dropsy, especially in leucophlegmatic subjects, attended with deficient secretion of the skin and kidneys, it is calculated to be of benefit. *In rheumatism.*—In chronic rheumatism oil of turpentine has long been celebrated. Its beneficial influence depends on its stimulant and diaphoretic operation, and is more likely to be evinced in old and debilitated persons. It has sometimes succeeded admirably, mostly in medium doses, in rheumatic inflammation of the iris and choroid. *In sciatica and other neuralgic affections.*—Oil of turpentine has been used as a remedy for sciatica with great success, as well as in various other neuralgias.

As an external remedy.—Oil of turpentine is employed externally, as a *rubefacient*, in numerous diseases, on the principle of counter-irritation. Thus, in the form of liniment, it is used, either hot or cold, in chronic rheumatism, sprains, sore-throat, neuralgic affections of the extremities, &c. In the form of fomentation the hot oil is applied to produce redness of the skin in puerperal peritonitis and pleuro-pneumonia. As a powerful local *stimulant*, it was recommended by Dr. Kentish as an application to burns and scalds, his object being to restore the part gradually to its natural state, as in the treatment of a case of frostbite. The practice is most successful when the local injury is accompanied with great constitutional depression. In that form of gangrene which is not preceded by inflammation, and is called *dry* or *chronic*, oil of turpentine may occasionally prove serviceable, especially when the disease affects the toes and feet of old people.

Administration and Dose.—When given as a diuretic, and to affect the capillary and secerning vessels (in catarrhal affections of the mucous membranes, dropsy, suppression of urine, hemorrhage, &c.), the dose is from six or eight minims to a fluid drachm; as a general stimulant (in chronic rheumatism, &c.), or to produce a change in the condition of the intestinal coats (in chronic dysentery), from one to two fluid drachms; as an anthelmintic (in tape-worm), or as a revulsive (in apoplexy, in epilepsy previous to an expected paroxysm, &c.), from half a fluid ounce to two fluid ounces. It may be taken floating on some aromatic water to which some hot aromatic tincture, as *tincture of capsicum*, has been added; or it may be diffused through water by the aid of mucilage or an emulsion; or it may be made into a confection with honey or some aromatic syrup, as in confection of turpentine. The readiest mode of using it as a fomentation is to dip a flannel into water as hot as the hands can bear, and having then wrung out the water, to sprinkle the warm oil freely on the surface and apply the flannel.

[§ **Confectio Terebinthinæ.** *Confection of Turpentine.*

Take of

Oil of Turpentine	1 fluid ounce.
Liquorice Root, in powder . .	1 ounce.
Clarified Honey	2 ounces.

Rub the oil of turpentine with the liquorice, add the honey, and mix to a uniform consistence.

Dose.—60 to 120 grains.]

Useful in those cases where oil of turpentine is required for internal administration. Under some circumstances, however, the dose given in the Pharmacopœia, as quoted above, is too small.

[§ **Enema Terebinthinæ.** *Enema of Turpentine.*

Take of

Oil of Turpentine	1 fluid ounce.
Mucilage of Starch	15 fluid ounces.

Mix.]

Used as an anthelmintic in ascarides; as an antispasmodic and purgative in colic, obstinate constipation, tympanites, and hysteria.

[§ **Linimentum Terebinthinæ.** *Liniment of Turpentine.*

Take of

Soft Soap	2 ounces.
Camphor	1 ounce.
Oil of Turpentine	16 fluid ounces.

Dissolve the camphor in the oil of turpentine, then add the soap, rubbing them together until they are thoroughly mixed.]

This liniment is used as a dressing for burns and scalds. The parts being first bathed with warm oil of turpentine, alcohol, or camphorated spirit, are to be covered with pledgets of lint thickly spread with this liniment. When the inflammation, excited by the fire, has subsided, milder applications are then to be resorted to. This liniment may also be used in any other cases requiring the employment of a more stimulant application than the ordinary soap liniment.

[§ **Linimentum Terebinthinæ Aceticum.** *Liniment of Turpentine and Acetic Acid.*

Take of

Oil of Turpentine .	of each . .	1 fluid ounce.
Acetic Acid . .		
Liniment of Camphor		

Mix.]

A useful, and rather powerful, counter-irritant.

[§ **Unguentum Terebinthinæ.** *Ointment of Turpentine.*

Take of

Oil of Turpentine		1 fluid ounce.
Resin, in coarse powder . . .		60 grains.
Yellow Wax	of each . . .	½ an ounce.
Prepared Lard		

Melt the ingredients together by the heat of a steam or water bath. Remove the vessel, and stir the mixture constantly while it cools.]

A warm stimulating ointment, which may be employed as a dressing for burns, scalds, &c.

[§ **Thus Americanum.** *Common Frankincense.*

The concrete turpentine of Pinus palustris, *Miller's Dict.*, and Pinus Tæda, *Linn.* From the Southern States of North America.]

Until the appearance of the British Pharmacopœia in 1864, the official Thus was alway referred to *Abies excelsa*, of which it was stated to be a spontaneous exudation. There is no doubt that this is a correct description of the original Thus, but this has, however, long ceased to be imported under the name of Thus, though it still comes to us, after being melted and strained, as Burgundy pitch. The old Thus may, therefore, still be procured in its purified form, under the name of Burgundy pitch. But the article which is now known as Thus in the London market, and which has entirely superseded the original crude Thus, is concrete American turpentine. This is now official, and is distinguished from the European Thus by the epithet *Americanum*.

General Characters.—A softish bright-yellow opaque solid, resinous but tough, having the odour of American turpentine. The appearance of this oleo-resin, mixed with numerous pieces of adherent bark, indicates that it has concreted spontaneously on the tree. The finer and more recent pieces are of a bright lemon-yellow colour, but older pieces are amber-coloured and even brown.

Pharmaceutical Use.—It is only used to improve the consistence and colour of pitch plaster.

[§ **Resina.** *Resin.*

The residue of the distillation of the turpentines from various species of Pinus, *Linn.* and Abies, *Lam.*]

Preparation.—Resin or *Rosin* is the residue of the process for obtaining oil of turpentine. It is run, while liquid, into metallic receivers coated with whiting to prevent adhesion, and from these is ladled into wooden moulds or casks. When the distillation is not carried too far, the product contains a little water, and is the official resin.

General Characters.—Resin is compact and solid, translucent, brittle, pulverisable; fracture shining; odour and taste faintly terebinthinate. It is easily fusible, and burns with a dense yellow flame and much smoke. It is insoluble in water, but soluble in alcohol, ether, and the volatile oils. With wax and the fixed oils, it unites by fusion; with the caustic alkalies it forms a *resinous soap*. The official resin (*yellow resin*) is semi-opaque and of a yellow, or yellowish-white colour. Its opacity is owing to water, with which it is incorporated. By continued fusion this is got rid of, and the resin then becomes transparent (*transparent resin*).

Varieties.—Since the abolition of the duty, a good deal of American resin has been brought to this market. It is very much purer than the English, and the difference, independently of colour, is distinguished by the naked eye. On looking through moderately sized pieces, the English resin shows little specks (impurities), while the American is free from them. The latter usually fetches from 25 to 100 per cent. more than the former.

Composition.—Resin is a compound or mixture of *pinic acid*, *colophonic acid*, and *sylvic acid*.

Pharmaceutical Uses.—The principal value of resin is in the formation of plasters and ointments, to which it communicates great adhesiveness, and some slightly stimulant properties. It is an ingredient of blistering paper, ointment of turpentine, and several of the official plasters.

[§ **Emplastrum Resinæ.** *Resin Plaster.*

Take of

Resin	4 ounces.
Lead Plaster	2 pounds.
Hard Soap	2 ounces.

To the lead plaster, previously melted with a gentle heat, add the resin and soap, first liquefied, and stir them until they are thoroughly mixed.]

This is the Dublin resin plaster, which differed from the London and Edinburgh plasters in containing soap, and a smaller proportion of resin. It is commonly known as *adhesive plaster*, and is kept in the shops ready spread. It is employed to retain the lips of wounds in contact; as in cuts, surgical operations, &c. It is more adhesive than lead plaster, but at the same time somewhat more irritating; and it occasionally causes excoriation. It is an ingredient in several of the official plasters.

[§ **Unguentum Resinæ.** *Ointment of Resin.*

Synonym.—Ceratum Resinæ, *Lond.*

Take of

Resin, in coarse Powder	8 ounces.
Yellow Wax	4 ounces.
Simple Ointment	16 ounces.

Melt with a gentle heat, strain the mixture while hot, through flannel, and stir constantly while it cools.]

A mildly stimulant, digestive, and detergent application to ulcers which follow burns, or which are of a foul and indolent character, and to blistered surfaces to promote a discharge.

PINUS SYLVESTRIS, *Linn.* Scotch Fir.

Specific Character.—A tall, straight *tree. Leaves* in pairs, rigid. *Cones* ovate-conical, acute; young ones stalked, recurved, as long as the leaves; generally in pairs. Crest of the *anthers* very small. *Embryo* 5-lobed.

Habitat.—Highlands of Scotland, Denmark, Norway, and other northern countries of Europe.

[§ **Pix Liquida.** *Tar.*

A bituminous liquid, obtained from the wood of Pinus sylvestris, *Linn.*, and other pines, by destructive distillation.]

Preparation and Varieties.—Two kinds of *tar* are known in commerce, *mineral tar* and *wood tar.* Mineral tar is either a natural production, as *petroleum* (e.g. Barbadoes tar, which was formerly official), or an artificial product, as *coal tar*, which is obtained in the destructive distillation of coal. Of wood tar there are also two sorts; one obtained as a secondary product in the manufacture of pyroligneous acid and gunpowder charcoal; the other procured by the destructive distillation of fir timber, in the northern parts of Europe and in America, and known in commerce as *Stockholm tar*, *Archangel tar*, *American tar*, &c. The last of these is the kind used in medicine. That which is procured from *Pinus sylvestris* in the northern parts of Europe is considered to be much superior to American tar. The process now followed is a kind of *destillatio per descensum* of the roots and other woody parts of old pines. As now carried on in Bothnia, it is thus described by Dr. Clarke:—'The situation most favourable to the process is in a forest near to a marsh or bog, because the roots of the fir, from which tar is principally extracted, are always most productive in such places. A conical cavity is then made in the ground (generally in the side of a bank or sloping hill); and the roots of the fir, together with logs and billets of the same, being neatly trussed in a stack of the same conical shape, are let into this cavity. To prevent the volatile parts from being dissipated, the whole is then covered with turf, which, by means of a heavy wooden mallet and wooden stamper, worked separately by two men, is beaten down, and rendered as firm as possible about the wood. The stack of billets is then kindled, and a slow combustion of the fir takes place, without flame, as in working charcoal. During this combustion the tar exudes, and a cast-iron pan being at the bottom of the funnel, with a spout which projects through the side of the bank, barrels are placed beneath this spout to collect the fluid as it comes away. As fast as the barrels are filled they are bunged, and ready for immediate exportation.'

Commerce.—Tar is imported into this country chiefly from the northern parts of Europe (Russia, Sweden, Norway, Denmark, and North Germany), but partly from the United States of America. Tar is also produced in this country.

General Characters.—Tar is a viscid, semi-liquid, brownish-black substance, which preserves during a long period its softness. Its viscidity is destroyed by heat. It has a well-known peculiar aromatic odour. It is soluble in alcohol, ether, and the oils both fixed and volatile. Water agitated with it acquires a pale brown colour, sharp empyreumatic taste, and acid reaction. Submitted to distillation it yields an aqueous acid liquor (*pyroligneous acid*), and a volatile oily matter (*oil of tar*); the residuum in the still is *pitch.* The vapour of tar is highly inflammable.

Composition.—Tar is a very complex substance. It consists principally of *pyrogenous resin*, *pyrogenous oil*, *acetic acid*, and *water.* The tar obtained from coniferous woods contains, in addition, *resin* and *oil of turpentine.*

Physiological Effects.—The effects of tar are analogous to those of oil of turpentine, but modified by the presence of acetic acid and the pyrogenous products. Locally it acts as a stimulant; and when applied to chronic skin diseases and indolent ulcers, it frequently induces a salutary change in the action of the capillary and secerning vessels, evinced by the improved quality of the secretions, and the rapid healing of the sores. In such cases it is termed detergent, digestive, or cicatrisant.

Therapeutics.—Tar is rarely employed *internally.* Applied *externally*, it is used in lepra and other obstinate skin diseases, especially those which affect the scalp.

[§ **Ungentum Picis Liquidæ.** *Ointment of Tar.*

Take of

Tar	5 ounces.
Yellow Wax	2 ounces.

Melt the wax with a gentle heat, add the tar, and stir the mixture briskly while it cools.]

Used as an application in obstinate skin diseases, especially to ring-worm and other cutaneous affections of the scalp. It is also sometimes applied to foul ulcers.

Pix Nigra. *Black Pitch.*

The residuum in the still after the distillation of tar.

(*Not official.*)

General Characters.—At ordinary temperatures pitch is a black solid, having a brilliant fracture. It softens at 99° F., and melts in boiling water. It dissolves in alcohol, and in solutions of the alkalies and of the alkaline carbonates.

Physiological Effects.—Made into pills with flour or any farinaceous substance, pitch may be taken to a great extent, not only without injury, but with advantage to the general health. It affords one of the most effectual means of controlling a languid circulation, and an inert and arid condition of the skin. As a local remedy it possesses great adhesiveness, and when applied to wounds and ulcers acts as a stimulant and digestive.

Therapeutics.—It has been employed as an internal remedy in *ichthyosis* and in other obstinate skin diseases. But the principal use of pitch is in the form of ointment, as an application to cutaneous affections of the scalp.

Administration.—Dose from 10 to 60 grains made into pills with flour. The unpleasant pitchy flavour of the pills is materially diminished by keeping them for some time.

ABIES, *D.C.*

Generic Character.—*Flowers* monœcious. *Males: Catkins* solitary, not racemose; *scales* staminiferous at the apex. *Stamens* two; *anthers* 1-celled. *Females: Catkins* simple. *Ovules* 2, at the base of the scales. *Scales* of the *cone* imbricated, thin at the apex, rounded, neither thickened, angular, nor umbilicated, on the back. *Leaves* solitary in each sheath.

ABIES EXCELSA, *D.C.* The Norway Spruce Fir.

Specific Character.—A very lofty *tree*, growing sometimes to the height of 150 feet. *Leaves* tetragonal. *Cones* cylindrical; the *scales* rhomboid, flattened, jagged, and bent backward at the margin.—*Woodv.* p. 573, pl. 208 (*Pinus Abies*).

Habitat.—A native of Germany, Russia, Norway, and other parts of Europe, and of the northern parts of Asia. Commonly cultivated in England.

[§ **Pix Burgundica.** *Burgundy Pitch.*

A resinous exudation from the stem of the Spruce Fir, Abies excelsa, *D.C.* Melted and strained; imported from Switzerland.]

Collection.—Although the authors of the British Pharmacopœia mention Burgundy pitch as the produce of Switzerland, Hanbury, on the authority of Dr. Flückiger of Bern, states that no terebinthinate resins are collected in Switzerland for commercial purposes; but that Burgundy pitch is produced on a large scale in Finland, and also of fine quality in Baden, and in Austria.

Preparation.—True Burgundy pitch is prepared by melting the original frankincense (or the resinous exudation of the spruce fir) in hot water, and straining through a coarse cloth. (See *Thus Americanum*, p. 474.) By this process part of the volatile oil and the impurities are got rid of.

General Characters.—True Burgundy pitch has been described by Hanbury as follows:—'Colour, dull yellowish-brown; fracture shining, conchoidal; translucent; some samples contain much water and are opaque, and of a dull grey colour, and require straining to free them from impurities. Odour peculiarly aromatic. Not wholly soluble in alcohol of ·838, but leaves a small amount of fine white flocculent matter. Placed in contact with double its weight of glacial acetic acid in a vial, is dissolved, with the exception of a small amount of flocculent matter.' The characters as given in the Pharmacopœia are as follows:—'Hard and brittle, yet gradually taking the form of the vessel in which it is kept; opaque, varying in colour but generally dull reddish-brown; of a peculiar somewhat empyreumatic perfumed odour, and aromatic taste, without bitterness; free from vesicles; gives off no water when heated.'

Adulteration and Substitution.—But little true Burgundy pitch is found in this country or on the Continent, an artificial compound being usually sold in lieu of it. The characters of this artificial Burgundy pitch are thus described by Hanbury:—'Colour, usually more brilliant than that of the true Burgundy pitch; its odour is weak and hardly aromatic. It is still less completely soluble in alcohol of ·838, and similarly treated with glacial acetic acid as true Burgundy pitch, it forms a turbid mixture, which soon separates into two layers, a thick oily liquid above, and a bright solution below.' The principal constituent of spurious Burgundy pitch is resin, rendered opaque by the incorporation of water, and usually coloured by palm oil.

Composition.—Consists of *resin* principally, and a small quantity of *volatile oil.*

Physiological Effects.—Its local action is that of a mild irritant. In some persons it excites a troublesome vesiculo-pustular inflammation.

Therapeutics.—It is employed as an external agent only, spread on leather, forming the well-known (*Burgundy*) *pitch plaster*, which is applied to the chest in chronic pulmonary complaints, to the loins in lumbago, to the joints in chronic articular affections, and to other parts to relieve local pains of a rheumatic character. It acts as a counter-irritant or revulsive.

Pharmaceutical Use.—It is a constituent of chalybeate plaster.

[§ **Emplastrum Picis.** *Pitch Plaster.*

Take of

Burgundy Pitch	26 ounces.
Common Frankincense	13 ounces.
Resin, Yellow Wax, of each	$4\frac{1}{2}$ ounces.
Expressed Oil of Nutmeg	1 ounce.
Olive Oil, Water, of each	2 fluid ounces.

Add the oils and the water to the frankincense, Burgundy pitch, resin, and wax, previously melted together; then, constantly stirring, evaporate to a proper consistence.]

It is stimulant and rubefacient.

ABIES BALSAMEA, *Aiton.* Balm of Gilead Fir.

Specific Character.—An elegant tree, seldom rising more than 40 feet high. *Leaves* solitary, flat, emarginate, sub-pectinate, sub-erect above. *Scales* of the flowering cone acuminate, reflexed. *Lambert, Pinus*, pl. 31 (*Pinus balsamea*).

Habitat.—Native of Canada, Nova Scotia, Maine, Virginia, and Carolina.

[§ Terebinthina Canadensis. *Canada Balsam.*

The turpentine, obtained by incision from the stem of Abies balsamea, *Aiton.* From Canada.]

Production.—*Canada balsam* is obtained in Canada and the State of Maine. Between the bark and wood of the trunk and branches of this tree are receptacles containing this oleo-resin, which exudes when they are broken, and is received in a bottle. It is imported in barrels containing each from $\frac{3}{4}$ to $1\frac{1}{2}$ cwt.

General Characters.—[§ A pale yellow ductile oleo-resin, of the consistence of thin honey, with a peculiar agreeable odour, and a slightly bitter feebly acrid taste; by exposure drying very slowly into a transparent adhesive varnish; solidifying when mixed with a sixth of its weight of magnesia.] When mixed with magnesia the acid resins combine with the magnesia, and form solid compounds, which absorb the volatile oil. Canada balsam, however, will not in general solidify with the quantity of magnesia stated in the Pharmacopœia until some hours have elapsed. It is imperfectly soluble in alcohol.

Composition.—It contains *resin* principally, and about 18·6 per cent. of *volatile oil.*

Therapeutics.—It is, with some exceptions, applicable to the same purposes as oil of turpentine. The following are the principal cases in which it is employed:—*In mucous discharges from the urino-genital organs*; as gonorrhœa, gleet, leucorrhœa, and chronic cystirrhœa. *In chronic catarrh, both mucous and pituitous*, occurring in old persons of a lax fibre and lymphatic temperament. *In chronic rheumatism*, especially sciatica and lumbago.

Pharmaceutical and other Uses.—It is used as an ingredient in blistering paper and flexible collodion. Besides its use in medicine, it is employed by varnish makers, by opticians as a cement, and by microscopists as a medium for mounting objects.

Administration.—The dose of Canada balsam is from 20 to 30 grains. It is best given in the form of *pill.*

ABIES (LARIX) EUROPÆA, *Lamb.* Common Larch.

Terebinthina Veneta. *Larch or Venice Turpentine.*

(*Not official.*)

Production.—Obtained from *Abies* (*Larix*) *europœa*, by boring the trunks of the trees, and adapting to each hole a wooden gutter, which conveys the juice into a tub or trough, from which it is afterwards withdrawn for filtration. It is imported from Switzerland, Italy, and the Alps. It is commonly sold in Paris as *Strasburgh turpentine.*

General Characters.—It is a thick and consistent fluid, flowing with difficulty; is sometimes transparent, but more frequently cloudy; has a yellow or greenish-yellow tint; an odour which is peculiar, not very agreeable, weaker than that of either Strasburgh or common turpentine, but less disagreeable than the latter; and an acrid, very bitter taste. It has little or no tendency to concrete by keeping; a property which distinguishes it from common turpentine.

Composition.—It consists principally of *resin* and *volatile oil.*

Substitution.—A factitious substance is usually sold in London for Venice turpentine. This is prepared by melting together oil of turpentine and black resin.

ABIES PICEA, *Linn.* Silver Fir.

Strasburgh Turpentine.

(*Not official.*)

Production.—The peasantry in the vicinity of the Alps collect it by puncturing the receptacles adhering to the bark with sharp-pointed hooks, and receiving the juice in a bottle. It is afterwards filtered through a rude kind of bark funnel.

General Characters.—Strasburgh turpentine is very fluid, transparent, of a yellowish colour, has a very agreeable odour of citron, and a taste moderately acrid and bitter.

Composition.—It consists principally of *volatile oil, resin,* and *abietic acid.*

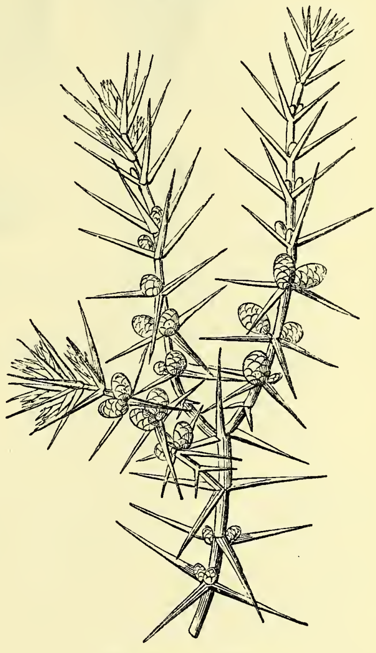
JUNIPERUS, *Linn.*

Generic Character.—Diœcious, rarely monœcious. *Flowers* in small axillary catkins (figs. 33 and 34).—*Males: Anther-cells*, 4–7, attached to the lower edge of a broad scale.—*Females*: Lower scales of catkin dry and empty (fig. 34, *a*, *b*); upper 3 fleshy, coalescing, having each at their base an erect ovule (fig. 34, *c*). *Fruit* a *galbulus*, consisting of three united fleshy *scales*, and containing 3 triquetrous osseous *seeds*.

JUNIPERUS COMMUNIS, *Linn.* Common Juniper.

Specific Character.—A bushy *shrub*. *Leaves* evergreen, numerous, 3 in each whorl, spreading, linear-subulate, keeled, mucronate (fig. 33). *Flowers* diœcious, axillary, sessile. *Fruit* commonly called a *berry*, but properly a *galbulus*, purplish-black, covered with bloom, and scarcely more than half the length of the leaves. It requires two seasons to arrive at maturity.—*Woodv.* fasc. v., pl. 95, p. 259.

Fig. 33.



Juniperus communis.
Branch with male flowers.

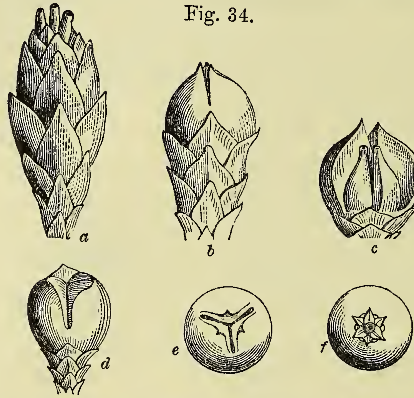
Habitat.—North of Europe. Indigenous, growing on hills and heathy downs, especially where the soil is chalky.

Products of the Juniper Plant.—*Juniper berries*, as the dried fruit of the shops is commonly termed, are about the size of a pea, of a blackish-purple colour, and covered by a glaucous bloom. They are marked superiorly with a tri-radiate groove, indicating the adhesion of the succulent scales; and inferiorly with the bracteal scales, which assume a stellate form (see fig. 34, *d*, and *f*). They contain three seeds. Their taste is sweetish, with a terebinthinate flavour; their odour agreeable and balsamic. *Juniper tops* have a bitter terebinthinate flavour and a balsamic odour. *Juniper wood* is obtained either from the stem or root; it evolves a balsamic odour in burning, and, by distillation with water, yields a volatile oil. On old stems there is sometimes found a resinous substance. This is not, however, the resin known in commerce as *sandarach*, *juniper resin*, or *gum juniper*, which is the produce of *Callitris quadrivalvis*, Vent., and is imported from Mogadore. Sandarach is not employed in medicine. It is used in the manufacture of varnishes. Its powder is commonly known under the name of *pounce*.

Composition.—Juniper berries principally contain *volatile oil*, *resin*, *sugar*, *gum*, and *water*.

Physiological Effects.—Juniper berries and tops are analogous in their operation to the terebinthinate substances. They operate on the urinary organs, promoting the secretion of urine, to which they

Fig. 34.



Female Flower and Fruit of Juniperus communis.

a. Female catkin (magnified).
b. Ditto, at a later stage of evolution (magnified).
c. Two fleshy scales of the female catkin; the third having been removed to expose the ovules.
d. Fruit approaching maturity.
e. Ripe galbulus, seen from above.
f. Ditto, seen from below.

communicate a somewhat violet odour. In large doses they occasion irritation of the bladder and heat in the urinary passages. They promote sweat, relieve flatulency, and provoke the catamenia. Their activity is principally dependent on the volatile oil.

Therapeutics.—Juniper berries or oil may be employed, either alone or as adjuncts to other diuretic medicines, *in dropsical disorders*, indicating the employment of renal stimuli. *In some affections of the urino-genital apparatus* juniper may be employed with advantage. Thus, in mucous discharges (as gonorrhœa, gleet, leucorrhœa, and cystirrhœa), it may be used under the same regulations that govern the employment of copaiva and the terebinthinates.

Administration.—The dose of the *berries* is from 60 to 120 grains, triturated with sugar. The oil is the best form of exhibiting juniper, and is *alone official.* (See *Oleum Juniperi.*)

[§ **Oleum Juniperi.** *Oil of Juniper.*

The oil distilled in Britain from the unripe fruit of Juniperus communis, *Linn.*]

Preparation.—Oil of juniper is obtained by submitting the fruit to distillation with water. The full grown green fruit yields more than the ripe fruit, for in the act of ripening a portion of the oil becomes converted into resin.

General Characters.—Colourless or pale greenish-yellow, of a sweetish odour and warm aromatic taste. It is limpid, transparent, and lighter than water, and causes the left-handed rotation of polarised light—in this respect agreeing with French oil of turpentine. It has the odour of the fruit. It dissolves with difficulty in alcohol. It is a carburet of hydrogen, $\mathbf{C_{10}H_{16}}$, and isomeric with oil of turpentine. Its density is 0·839.

Substitution.—The foreign oil is frequently distilled from the tops and wood, and scarcely differs from oil of turpentine.

Physiological Effects and Therapeutics. (See *Juniperus communis.*)

Administration.—The dose of the oil is from 2 to 6 minims, either in the form of pill or of spirit of juniper. Hollands gin owes its flavour and diuretic properties to oil of juniper.

[§ **Spiritus Juniperi.** *Spirit of Juniper.*

Take of

Oil of Juniper	1 fluid ounce.
Rectified Spirit	49 fluid ounces.

Dissolve.

Dose.—$\frac{1}{2}$ to 1 fluid drachm.]

It is used as an adjunct to diuretic mixtures. It enters into the composition of Creasote mixture.

JUNIPERUS OXYCEDRUS, *Linn.* Brown-berried Juniper.

Oleum Cadinum. *Oil of Cade.*

(*Not official.*)

Preparation.—By the dry distillation of the wood of *Juniperus Oxycedrus*, in France and Germany, a tarry oil called *huile de cade*, or *oleum empyreumaticum juniperi*, is obtained.

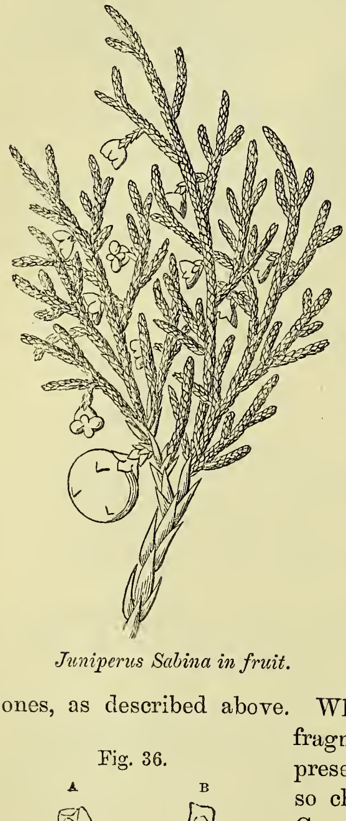
General Characters.—It is a brownish, inflammable liquid, having a strong empyreumatic and resinous odour, and an acrid caustic taste.

Effects and Uses.—It is employed in veterinary medicine,—to cure ulcers in horses, and, formerly, to cure the itch in sheep. Oil of tar, which is often substituted for it, is considered to be inferior. It has also been used in the human subject, both externally and internally, — in obstinate skin diseases, worms, and toothache. *Dose*, a few minims. It is most efficient when used as an external application, either in the form of an ointment prepared by mixing it in equal parts with some fatty matters, or made into a soap, or diluted with spirit as a lotion.

JUNIPERUS SABINA, *Linn.* Common Savin.

Specific Character.—A small bushy *shrub*. *Branches* closely invested by the very small leaves (fig. 35). *Leaves* small, ovate, convex, densely imbricated, erect, decurrent, opposite, glandular. *Galbulus* round, purple, somewhat smaller than that of juniper (fig. 35).—*Woodv.* pl. 94, p. 256.

Fig. 35.



Juniperus Sabina in fruit.

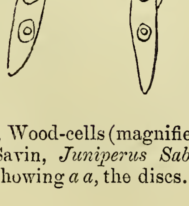
Habitat.—Midland and southern parts of Europe and Asiatic Russia. Cultivated in gardens in this country.

[§ Sabinæ Cacumina. *Savin Tops.*

The fresh and dried tops of Juniperus Sabina, *Linn.* Collected in spring, from plants cultivated in Britain.]

General Characters. — [§ Twigs densely covered with minute imbricated adpressed leaves in four rows: odour strong, peculiar, and unpleasant; taste acrid, bitter, resinous, and disagreeable.] The dried tops are yellowish-green, and less odorous than that of the fresh ones, as described above. When in very coarse powder, or in fragments, the microscope shows the presence of the circular discs (fig. 36) so characteristic of the wood-cells of the Gymnospermia; and as savin is sometimes given for criminal purposes, the microscope may afford important aid in detecting it under such circumstances.

Fig. 36.



A B, Wood-cells (magnified) of Savin, *Juniperus Sabina*; showing *a a*, the discs.

Composition. — The principal constituents are *volatile oil*, *resin*, *gallic acid*, and *extractive*.

Physiological Effects.—Oil of savin, the active principle of the tops, is a powerful local irritant. When applied to the skin, it acts as a rubefacient and vesicant. On wounds and ulcers its operation is that of an acrid (not chemical) caustic. Swallowed in large doses, it occasions vomiting, purging, and other symptoms of gastro-intestinal inflammation. The emmenagogue power of savin is fully established.

Therapeutics.—Savin is not much used internally; but in cases of amenorrhœa and chlorosis depending on or accompanied by a torpid condition or deficient action of the uterine vessels, it may be given as a powerful uterine stimulant. In such cases it proves a most efficient remedy. According to my own observation, it is the most certain and powerful emmenagogue of the whole materia medica. Its use is contra-indicated where irritation of the uterus, or indeed of any of the pelvic viscera, exists, or when the female is in a pregnant state. As a topical agent, savin is frequently employed, mostly in the form of the ointment, to make *perpetual blisters.* Equal parts of savin and verdigris, in powder, form one of the most efficacious applications for the removal of venereal warts.

Administration.—By drying, savin loses part of its volatile oil, and hence the *powder* is not the best form for administering it. It is, however, sometimes given in doses of from five to fifteen grains.

[§ **Tinctura Sabinæ.** *Tincture of Savin.*

Take of

Savin Tops, dried and coarsely powdered	$2\frac{1}{2}$ ounces.
Proof Spirit	1 pint.

Macerate the savin for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.]

This preparation is intended for internal use. One fluid drachm should be equivalent to six or seven grains of dried savin. It may, therefore, be given as an emmenagogue in doses of from twenty minims to one fluid drachm, but the oil would be more certain in its action.

[§ **Unguentum Sabinæ.** *Ointment of Savin.*

Synonym.—Ceratum Sabinæ, *Edin.*

Take of

Fresh Savin Tops, bruised	8 ounces.
Yellow Wax	3 ounces.
Prepared Lard	16 ounces.

Melt the lard and the wax together on a water-bath, add the savin, and digest for twenty minutes. Then remove the mixture, and express through calico.]

The ingredients and proportions ordered by the London and Edinburgh colleges are retained, except that the savin is a little increased. Fresh savin is used, not dried as in the Dublin Pharmacopœia, and the boiling ordered by the Edinburgh college is omitted. The colour of this ointment should be a fine green, and its odour that of the plant; the former property depends on chlorophyll, and the latter on the presence of oil of savin. Savin ointment is used as a dressing to blistered surfaces, to produce what is termed a *perpetual blister.* It is preferred to the ointment of cantharides, as being less acrid, and not liable to cause strangury. It is sometimes applied to seton tapes, to increase the discharge from setons.

[§ **Oleum Sabinæ.** *Oil of Savin.*

The oil distilled in Britain from fresh savin, Juniperus Sabina, *Linn.*]

Preparation.—Oil of savin is obtained by submitting the fresh tops to distillation with water. The tops yield about 3 per cent. of the oil.

General Characters.—It is a limpid, colourless or pale yellow liquid, having the unpleasant odour of the plant, and a bitter acrid taste. Its specific gravity is 0·915. Its boiling point is 315°. Its composition is isomeric with that of oil of turpentine. It is very soluble in ether, but forms a turbid mixture with rectified spirit. The odour is the best and the most characteristic test.

Physiological Effects and Therapeutics. (See *Sabinæ Cacumina.*)

Administration.—The *oil* is by far the most convenient and certain preparation of savin. The *dose* of oil of savin, as an emmenagogue, is from 1 to 5 minims, diffused in a mucilaginous or oleaginous mixture.

Division II.—ANGIOSPERMIA.

Sub-class I.—Monochlamydeæ.

LIQUIDAMBARACEÆ, *Richard.* The Liquidambar Order.

LIQUIDAMBAR ORIENTALE, *Miller.* The Storax Plant.

Botanical Character.—A *tree*, 20 to 60 feet high. *Leaves* palmately 5-cleft, rarely 3- or 7-cleft, smooth, truncate or subcordate at the base, lobes ovate-lancelote, serrated mostly irregularly; with 1–3 lateral lobes. *Flowers* unisexual: *female flowers* in globular catkins. *Fruit* 2-celled 2-lobed, many-seeded. *Seeds* winged, albuminous.—Plate, *Pharm. Journ.* vol. xvi. p. 462.

Habitat.—South-west of Asia Minor, forests near Melasso and

Moughla, in the district of Giova and Ulla, and opposite Rhodes. Also in Cyprus, where it is called *Xylon Effendi*, the wood of Our Lord.

[§ **Styrax Præparatus.** *Prepared Storax.*

A balsam, obtained from the bark of Liquidambar orientale, *Miller's Dict.* Purified by means of rectified spirit and straining.]

Extraction and Commerce.—Hanbury has given the following information respecting the mode adopted for obtaining liquid storax, derived from Mr. Maltass of Smyrna, Lieutenant Campbell of Rhodes, and Dr. McCraith of Smyrna. The outer bark of the tree being removed, the inner bark is then stripped off and thrown into pits, until a sufficient quantity is obtained. Mr. Maltass states that it is then packed in strong horse hair bags, and submitted to pressure in a wooden press. After removal from the press, hot water is thrown on the bags, and they are pressed a second time, after which the greater part of the balsam will have been extracted. According to Lieutenant Campbell and Dr. McCraith, the bark is first boiled over a brisk fire, and the balsam which separates removed. The residual bark is afterwards pressed, to yield an additional quantity. The product is the opaque semi-fluid substance called *Liquid Storax*, which is forwarded to Alexandria, Smyrna, and Constantinople. From Smyrna it is shipped mostly to Trieste. The whole, both of the balsam and the residual bark, was formerly bought by the merchants of Rhodes. The latter is known to pharmacologists as Cortex Thymiamatis, Cortex Thuris, and Storax Bark. The balsam occasionally finds its way from Rhodes to Bombay, by way of Alexandria and the Red Sea, under the name of Rose Malloes or Rosa Mallas. Hanbury adds that the original storax, produced by *Styrax officinale*, always scarce and valuable, has in modern times wholly disappeared from commerce.

Common or Opaque Liquid Storax, obtained as above, is imported from Trieste. It is opaque, of a grey colour, has the consistence of birdlime, and the odour of storax, frequently accompanied with a feeble odour of benzol or naphthalin. It is commonly adulterated by the admixture of sand and ashes.

Preparation.—The official or prepared storax is directed to be obtained from liquid storax by means of rectified spirit and straining. It is, however, commonly prepared by heating it until the water with which it is usually mixed is evaporated, and then straining it. During the process it evolves a very fragrant odour.

General Characters.—[§ A semitransparent brownish-yellow semifluid balsam, of the consistence of thick honey, with a strong agreeable fragrance, and aromatic bland taste. Heated in a test tube on the vapour bath it becomes more liquid, but gives off no moisture; boiled with solution of bichromate of potash and sulphuric acid, it evolves the odour of hydride of benzoyle.]

Composition.—Simon found liquid storax to consist of a *volatile oil* (*styrol*), *cinnamic acid*, *styracine* and *resins*. *Volatile Oil, Styrol*, C_8H_8.—A colourless, extremely volatile, transparent liquid, which has a burning taste and a peculiar aromatic odour, resembling a mixture of benzol and naphthalin. Sp. gr. 0·924. It is soluble in alcohol and ether, burns with a sooty flame, and boils at about 295° F. *Cinnamic Acid*, $HC_9H_7O_2$.—This acid is also a constituent of the balsams of Peru and Tolu, and is likewise formed by the oxidation of oil of cinnamon. It is a colourless crystalline acid, having a feebly aromatic acrid taste; sparingly soluble in cold water, but readily soluble in alcohol. It fuses at 250°, and boils at 560° F. It has some resemblance to benzoic acid, for which it was formerly mistaken, but it may be distinguished by boiling it with a solution of chromic acid, when it gives rise to the production of oil of bitter almonds, of which benzoic acid does not yield a trace. *Styracine.*—This is found in the still after the distillation of styrol. It is a crystallisable substance, soluble in boiling alcohol and in ether but insoluble in water. The *resins* are two, hard and soft.

Physiological Effects.—Storax is a stimulant expectorant, closely allied in its operation to balsam of Tolu and Benzoin, but is less powerful than the latter.

Therapeutics.—In chronic bronchial affections admitting of the use of stimulants, it may be used as an expectorant. It is best exhibited in the form of pill, in doses of from 10 to 20 grains.

Pharmaceutical Use.—Prepared storax is an ingredient of compound tincture of benzoin.

Styrax Calamita. *Common Storax.*

(*Not official.*)

Besides the official storax as just described, an inferior kind is known in England as *Styrax calamita*, but it is not now employed in medicine. It is imported, like the former, from Trieste.

General Characters.—*Styrax calamita* occurs in large round cakes of a brown or reddish-brown colour, and fragrant odour. It is brittle and friable, being very easily rubbed into a coarse kind of powder; yet it is soft and unctuous. When exposed to the air it becomes covered with an efflorescence (cinnamic acid) which, to the superficial observer, looks like a whitish kind of mouldiness, and falls to powder. When pure, it consists of liquid storax mixed with the residual liquidambar bark, called *Cortex Thymiamatis* (see p. 489), reduced to coarse powder; or when the bark is scarce common sawdust is substituted for it. Boiled with rectified spirit, it yields a reddish solution, which becomes milky on the addition of water. The insoluble residue is a reddish sawdust.

Composition, &c.—It contains similar constituents to liquid storax, and possesses analogous properties.

CUPULIFERÆ, *Richard*. The Oak Order.

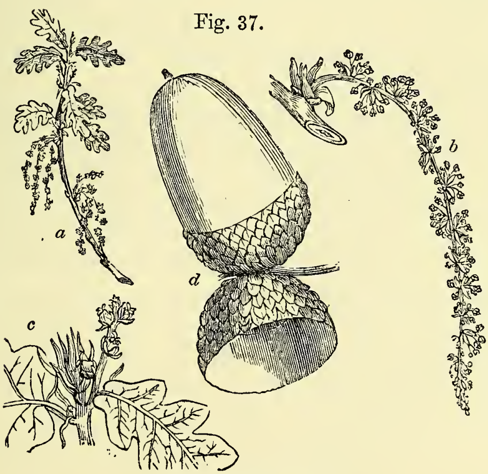
QUERCUS.

Generic Character.—Monœcious: *Male Flowers* (fig. 37, *a b*): *Catkins* long, lax, and pendulous. *Calyx* 5–7 parted. *Stamens* 5 to 10. *Female Flowers* (fig. 37, *c*): *Involucre* scaly; the *scales* numerous, imbricated; combined below into a coriaceous hemispherical *cupule*. *Calyx* 6-lobed, adhering to the ovary. *Ovary* 3-celled. *Stigmas* 3. *Fruit* (nut) 1-celled, 1-seeded, surrounded at the base by the enlarged cup-shaped involucre (*cupule*) (fig. 37, *d*).

QUERCUS PEDUNCULATA, *Willd*. The Common British Oak.

Specific Character.—A large and handsome *tree*, remarkable for its longevity. *Leaves* deciduous, shortly-stalked, oblong-obovate,

Fig. 37.



Quercus pedunculata.

a. Branch with male flowers. *c*. Branch with female flowers.
b. A male catkin. *d*. Nut (acorn), and cupule.

deeply sinuate, with obtuse lobes. *Fruits* (fig. 37, *d*) 2 or 3 upon a long peduncle.—*Woodv*. p. 344, pl. 126. (*Q. Robur*.)

Habitat.—Indigenous, growing in woods and hedges. It is found in most European countries.

[§ **Quercus Cortex.** *Oak Bark.*

The dried bark of the small branches and young stems of Quercus pedunculata, *Willd.* Collected in spring, from trees growing in Britain.]

Collection and Preparation.—In the spring the barks of trees contain more astringent matter, and are more readily separated from the wood than at other seasons. The usual time for barking the oak is from the beginning of May to the commencement of July. The barkers make a longitudinal incision with a mallet furnished with a sharp edge, and a circular incision by means of a barking bill. The bark is then removed by the peeling-irons; the separation being promoted, when necessary, by beating the bark with the square end of the mallet. The bark is then carefully dried in the air, and is afterwards stacked.

General Characters.—Oak bark consists of pieces of from one to two feet long, which vary in their appearance according to the age of the stem or branch from which they have been taken. The bark of young stems is thin, moderately smooth, covered externally with a silvery or ash-grey epiphlœum, and is frequently beset with lichens. Internally it is, in the fresh state, whitish; but when dried, it is cinnamon-coloured or brownish-red, fibrous, brittle, and strongly astringent. This young bark is *alone official.* The bark of old stems is thick, very rough externally, cracked and wrinkled, and is of inferior quality.

Composition.—According to Braconnot, oak bark contains *tannic acid*, *tannates of lime*, *magnesia*, *potash*, and *gallic acid.* The quantity of *tannic acid* obtained by Davy from 100 parts of oak bark is as follows:—Entire bark of oak, cut in spring, 6·0; entire bark, cut in autumn, 4·4; white interior cortical layers, 15·0. Decoction of oak bark reddens litmus, and becomes dark blue or purple on the addition of perchloride of iron (*tannate of iron*). A solution of gelatine causes a precipitate with it (*tannate of gelatine*). A solution of tartarated antimony causes no precipitate with the decoction.

Physiological Effects.—The effects of oak bark are similar to those of other vegetable astringents containing tannic acid.

Therapeutics.—The principle value of oak bark in medicine arises from its astringent property. Thus we employ a decoction of it as a gargle in relaxed conditions of the uvula, and in chronic inflammatory affections of the throat; as a wash in flabby, ill-conditioned, or bleeding ulcers; as an injection in leucorrhœa, in piles, or in prolapsus of the uterus or rectum; as an internal astringent in old diarrhœas, in the last stage of dysentery, and in alvine hemorrhages. As a tonic, oak bark has been employed in medicine, but it is very much inferior in this respect to cinchona.

[§ **Decoctum Quercus.** *Decoction of Oak Bark.*

Take of

Oak Bark, bruised	$1\frac{1}{4}$ ounce.
Distilled Water	1 pint.

Boil for ten minutes in a covered vessel, then strain, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint.]

Used as a local astringent for various purposes, in the form of gargle, injection, or lotion. Administered in *doses* of from 2 to 6 ounces.

QUERCUS INFECTORIA, *Olivier.* The Gall, or Dyers' Oak.

Specific Character.—A small *tree* or *shrub*, from 4 to 8 feet high. *Stem* crooked. *Leaves* ovate-oblong, sinuate-dentate, very smooth, deciduous, on short petioles, with a few short mucronate teeth on each side. *Fruit* solitary, sessile, obtuse, very long, 2 or 3 times the length of the cupule.—*Steph. and Church.* pl. 152.

Habitat.—Asia Minor, from the Bosphorus to Syria, and from the Archipelago to the frontiers of Persia.

[§ **Galla.** *Galls.*

Excrescences on Quercus infectoria, *Olivier*, caused by the punctures and deposited ova of Diplolepis Gallæ tinctoriæ, *Latr.*]

Production.—The *galls* (or nut-galls) of commerce are produced by the insect as follows:—On the sides and at the ends of the branches and shoots of this tree the female makes a puncture with her ovipositor and deposits her ova. An excrescence or gall is soon formed, within which the larva is developed. As soon as the perfect insect is produced, it eats its way out. If we examine those galls from which the animal has escaped we observe externally a circular hole, of about a line in diameter, leading to a small canal which passes to the centre of the gall. But in those galls in which the insect has not put off its pupa state we find neither an external hole nor an internal canal.

General Characters.—[§ Hard heavy globular bodies, varying in size from half an inch to three-fourths of an inch in diameter, tuberculated on the surface, the tubercles and intervening spaces smooth; of a bluish-green colour on the surface, yellowish-white within, with a small central cavity; intensely astringent.]

Varieties and Commerce.—The galls of different countries vary in their size, shape, weight, and character of surface. *Levant galls* are the ordinary galls of commerce. They are in general about the size of a hazel-nut, somewhat round, and tuberculated or warty. They are imported from Syria, Smyrna, and Constantinople. The most esteemed *Syrian galls* are the produce of Mosul on the Tigris; these are the *Mosul galls.* The *Aleppo galls* usually pass for Mosul galls. *Tripoli galls* come from Tripoli, and are inferior to the Aleppo galls. The *Turkey galls* usually come from Constantinople or Smyrna; they are the produce of Anatolia. *Smyrna galls* are not so heavy, are lighter-coloured, and may be ranked with Tripoli galls, which are now rarely met with, and contain a larger admixture of white galls than those brought from Aleppo. The galls brought from Bombay (*East India galls*) are probably the produce of Persia or neighbouring parts. They are heavy, but less sightly than those from the Levant. In commerce three kinds of Levant galls are distinguished—viz. *black* or *blue*, *green*, and *white*; but there is no essential distinction between the two first. *Black* or *blue galls*, *green galls.*—These are gathered before the insect has escaped. They vary from the size of a pea to that of a hazel-nut, and have a greyish colour. The smallest have a blackish-blue tint, and are distinguished by the name of *black* or *blue galls*; while the larger and greener varieties are called *green galls.* Externally they are frequently tuberculated, but the surface of the tubercles and of the intervening spaces is usually smooth. Their texture is compact but fragile. They have no odour, but a styptic and powerfully astringent taste. These are the official galls, and are those described above under the head of General Characters. *White galls.*—These are for the most part gathered after the insect has escaped; and hence they are perforated with a circular hole. They are larger, lighter-coloured (being yellowish or whitish), less compact, less heavy, and less astringent. They are of inferior value.

Composition.—Sir H. Davy found in 100 parts of good Aleppo galls *tannic acid* 26, *gallic acid* with a little *extractive* 6·2. Pelouze found *tannic acid* 40, *gallic acid* 3·5. Infusion of nutgalls reddens litmus paper, forms an inky compound on the addition of a persalt of iron (*tanno-gallate of iron*), and a yellowish-white precipitate with a solution of gelatine (*tannate of gelatine*). If a piece of skin, depilated by lime, be immersed in the infusion, and agitated with it from time to time, all the tannic acid is absorbed, the filtered liquor striking a blue colour with the persalts of iron (*gallate of iron*), but giving no precipitate with a solution of gelatine.

Physiological Effects.—As galls contain a larger portion of tannic acid than any other known vegetable production, they possess in the highest degree the properties of an astringent.

Therapeutics.—The following are the principal uses of galls:—*As an astringent in hemorrhages*, especially passive alvine hemorrhages. *In chronic mucous discharges*, as old diarrhœas. *As a* *chemical antidote*, galls may be given in poisoning by ipecacuanha, emetina, the organic alkaloids generally, and those vegetable productions the activity of which depends on an organic alkaloid, as opium, colchicum, and nux-vomica, &c. Their efficacy arises from the tannic acid, which combines with the vegetable alkaloid to form a tannate possessing less activity than the other salts of these bases; perhaps because of its slight solubility. Galls have been also recommended as an antidote in cases of poisoning by tartarated antimony. *As a topical astringent.*—Galls are applicable in any cases requiring the topical use of a powerful vegetable astringent. Thus, in the form of gargle, in relaxation of the uvula; as an injection, in gleet and leucorrhœa; as a wash, in flabby ulcers, with profuse discharge, and in prolapsus of the rectum or vagina; and in the form of ointment, in piles.

Administration.—The *dose* of the *powder* is from 10 to 20 grains. Galls are also used in the form of *ointment* and *tincture.*

Pharmaceutical Uses.—It is used for the preparation of gallic acid, and tannic acid.

[§ **Tinctura Gallæ.** *Tincture of Galls.*

Take of

Galls, in coarse powder	$2\frac{1}{2}$ ounces.
Proof Spirit	1 pint.

Macerate the galls for forty-eight hours, in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation, with the remaining 5 ounces of the spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make 1 pint.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

A powerful astringent. Diluted with water, it forms a very useful and convenient astringent gargle and wash. Its principal use is as a chemical test, especially for the persalts of iron, gelatine, and the vegetable alkaloids. After it has been kept for some time its tannic acid becomes converted into gallic acid, and it then ceases to occasion precipitates in solutions of gelatine and of the vegetable alkaloids, although it still serves to detect iron. Paper impregnated with it serves as a portable test for solutions of iron.

[§ **Unguentum Gallæ.** *Ointment of Galls.*

Take of

Galls, in fine powder	80 grains.
Benzoated Lard	1 ounce.

Mix thoroughly.]

Astringent. Mixed with zinc ointment, it is applied to piles after the inflammatory stage is passed. Mr. B. Bell recommends an ointment composed of equal parts of powdered galls and hog's lard or butter, in external hemorrhoidal swellings.

[§ **Unguentum Gallæ cum Opio.** *Ointment of Galls and Opium.*

Take of

Ointment of Galls	1 ounce.
Opium, in powder	32 grains.

Mix thoroughly.]

The ointment is intermediate in strength between the London and Edinburgh ointments, being about twice as strong as the former.—An excellent astringent application to *blind piles* (i.e. piles without hemorrhage) and prolapsus ani. The opium diminishes the pain which the galls might otherwise occasion, when the hemorrhoidal tumours are very sensible. From 20 to 30 grains of camphor are frequently added to this ointment. Dr. Carson remarks that a smoother ointment, and one which leaves no gritty or rough deposit on irritable surfaces, is prepared by adding 60 grains of an aqueous extract of galls to 1 ounce of simple ointment.

[§ **Acidum Tannicum.** *Tannic Acid.*

$C_{54}H_{22}O_{34}$ or $C_{27}H_{22}O_{17}$.

An acid extracted from galls.

It may be obtained by the following process:—

Take of

Galls, in powder . .	of each a sufficient quantity.
Ether	

Expose the powdered galls to a damp atmosphere for two or three days, and afterwards add sufficient ether to form a soft paste. Let this stand in a well closed vessel for twenty-four hours, then, having quickly enveloped it in a linen cloth, submit it to strong pressure in a suitable press, so as to separate the liquid portion. Reduce the pressed cake to powder, mix it with sufficient ether, to which one-sixteenth of its bulk of water has been added, to form again a soft paste, and press this as before. Mix the expressed liquids, and expose the mixture to spontaneous evaporation until, by the aid subsequently of a little heat, it has acquired the consistence of a soft extract; then place it on earthen plates or dishes, and dry it in a hot-air chamber at a temperature not exceeding 212°.]

Conflicting statements have been made with reference to the action of ether in extracting tannic acid from galls. The thick syrupy liquid obtained when galls are treated with washed ether, has been sometimes represented as a solution of tannic acid in ether, and at other times as a solution of the acid in the water separated from the washed ether. In support of the latter statement reference has been made to the fact that the liquid obtained by percolation or expression often forms two strata, the upper one consisting of ether with very little tannic acid, while the lower one has been described as a strong solution of the acid in water. That the lower syrupy liquid is merely an aqueous solution has, however, been denied. Bolley says it is a solution of tannic acid in, or a compound of the acid with, equal parts of ether and water. Anhydrous ether is known to be capable of dissolving only a very small quantity of tannic acid; and Bolley found that ether saturated with water was not a good solvent of pure tannin.

[§ *Characters and Tests.*—In pale yellow vesicular masses or thin glistening scales, with a strongly astringent taste, and an acid reaction; readily soluble in water and rectified spirit, very sparingly soluble in ether. The aqueous solution precipitates solution of gelatine yellowish-white, and the persalts of iron of a bluish-black colour. It leaves no residue when burned with free access of air.]

Properties.—The aqueous solution, when boiled, becomes turbid. Provided it be not exposed to air, but kept in a bottle quite full, the aqueous solution may be preserved for a long time without undergoing chemical change. If exposed to air, it becomes dark-coloured, mouldy, and loses its property of precipitating gelatine; but it does not appear that there is any production of gallic acid when the tannic acid is pure. The conversion of tannic acid into gallic acid appears to depend on a species of fermentation, from the presence of some nitrogenous matter, of the same nature as ordinary ferment, contained in the crude gall. The conversion to gallic acid is prevented by all those substances which destroy the fermenting properties of yeast. It has been hitherto considered that the access of oxygen is necessary to this change; but, according to Regnault, oxygen or air is not required; and in this respect the gallic resembles the alcoholic fermentation. Regnault states that gallic acid is a result of the decomposition of an extract of galls, even in a vessel hermetically sealed. Tannic acid when boiled with diluted sulphuric acid is resolved into gallic acid and glucose, hence it is represented as a glucoside.

$$\underset{\text{Tannic acid.}}{C_{27}H_{22}O_{17}} + \underset{\text{Water.}}{4H_2O} = \underset{\text{Gallic acid.}}{3(C_7H_6O_5)} + \underset{\text{Glucose.}}{C_6H_{12}O_6}$$

A similar reaction takes place when tannic acid is treated with a concentrated solution of potash, but in this case the glucose is further converted into glucic acid. In the production of gallic acid in the usual way by mixing powdered nutgalls with water and allowing the mixture to become mouldy, an albuminous constituent of the galls acts as a ferment inducing alcoholic fermentation of the glucose, and setting the tannic acid free. It is said that the production of gallic acid may be in some cases increased by the addition of ordinary ferment (yeast), as it is often procured with difficulty and only in small quantities from common galls.

Chemical Characteristics.—The following are other chemical characteristics of this substance in addition to those already given:—It produces with solutions of the vegetable alkaloids, white precipitates (*tannates*), slightly soluble in water, but very soluble in acetic acid. The mineral acids also cause precipitates with concentrated solutions of tannic acid, as do the alkalies and their carbonates. The carbonates are decomposed by a strong solution of it. The diluted sulphuric or hydrochloric acid, on boiling, converts it into gallic acid. Gelatinous alumina rapidly absorbs tannic acid from its solution, and forms an insoluble compound with it. When a few drops of a solution of this acid are added to a glass of lime-water, a dense white precipitate is formed (*tannate of lime*), acquiring rapidly a grey and a dingy green colour. It thence passes through various shades to a dark purple-brown colour. Tannic acid is dissolved by strong sulphuric acid, forming a dingy purple-brown solution, almost black. It does not produce the red or crimson colour of gallic acid under the same circumstances, and there is a black deposit when it is added to water.

Physiological Effects.—Tannic acid is a powerful astringent. As a *topical* remedy, it is probably the most powerful of all vegetable astringents or styptics. Its chemical action on fibrin, albumen, and gelatine explains this. It is the active principle of a very large proportion of vegetable astringents. Tannic acid operates as a constipating agent, when given in a sufficient dose and frequently repeated. The *remote* effects of tannic acid are not so obvious, but they appear to be astringent, though in a much feebler degree. As the tannic acid becomes changed into gallic acid during its passage through the system, it is probably the latter agent which operates on remote parts as an astringent when tannic acid is administered. If this opinion be correct, tannic acid would act, as Dr. Garrod has suggested, less powerfully, as a remote astringent than an equal weight of gallic acid. But, as a topical astringent, tannic is far more powerful than gallic acid; because its chemical reaction on albumen, gelatine, and fibrin is energetic, while gallic acid exerts no action on these principles.

Therapeutics.—Tannic acid is used as an astringent chiefly in hemorrhages and profuse secretions; and also to constringe relaxed fibres. In hemorrhages it has been used both topically as a styptic (in bleeding gums, piles, and uterine hemorrhage), and remotely as an astringent (in hemorrhage from the lungs, stomach, bowels, kidneys, and uterus). In chronic fluxes it has likewise been employed both as a topical and a remote remedy: topically in gonorrhœa, gleet, leucorrhœa, and ophthalmia; remotely in pulmonary catarrh, diarrhœa, dysentery, leucorrhœa, gonorrhœa, and cystirrhœa. It has been also recommended to restrain the phthisical sweating. To constringe fibres, it is applied to spongy gums and prolapsed bowel. It has likewise been given as an antidote to check excessive vomiting from ipecacuanha or emetina.

Administration.—Tannic acid may be administered in doses of from two to ten or more grains, in powder, pill, or solution. When we employ it as a remote agent, the pill-form seems to be the most appropriate mode of exhibition. As a lotion or injection, it may be used in the form of aqueous solution, containing from four to six or more grains in the fluid ounce. It has also been employed in the form of ointment, composed of a quarter of an ounce of tannic acid dissolved in a quarter of an ounce of distilled water, and mixed with an ounce and a half of lard.

Uses.—In addition to its therapeutic uses tannic acid is employed as a reagent or test. Its solution should be recently made when used, and preserved in a bottle kept full.

[§ **Glycerinum Acidi Tannici.** *Glycerine of Tannic Acid.*

Take of

Tannic acid	1 ounce.
Glycerine	4 fluid ounces.

Rub them together in a mortar, then transfer the mixture to a porcelain dish, and apply a gentle heat until complete solution is effected.]

This is a convenient form in which to keep tannic acid in solution. The proportions are 1 part in 5 by weight, or $4\frac{1}{2}$ parts by measure of the solution contain 1 part by weight of the acid.

[§ **Suppositoria Acidi Tannici.** *Tannic Acid Suppositories.*

Take of

Tannic Acid	36 grains.
Benzoated Lard	44 grains.
White Wax	10 grains.
Oil of Theobroma	90 grains.

Melt the wax and oil of theobroma with a gentle heat, then add the tannic acid and benzoated lard previously rubbed together in a mortar, and mix all the ingredients thoroughly. Pour the mixture while it is fluid into suitable moulds of the capacity of fifteen grains; or the fluid mixture may be allowed to cool, and then be divided into twelve equal parts, each of which shall be made into a conical or other convenient form for a suppository.]

To be used as a local astringent in diarrhœa.

[§ **Trochisci Acidi Tannici.** *Tannic Acid Lozenges.*

Take of

Tannic Acid	360 grains.
Tincture of Tolu	$\frac{1}{2}$ fluid ounce.
Refined Sugar, in powder . . .	25 ounces.
Gum Acacia, in powder . . .	1 ounce.
Mucilage of Gum Acacia . . .	2 fluid ounces.
Distilled Water	1 fluid ounce.

Dissolve the tannic acid in the water; add, first, the tincture of tolu, previously mixed with the mucilage; then, the gum and the sugar, also previously well mixed. Form the whole into a proper mass; divide it into 720 lozenges, and dry these in a hot-air chamber with a moderate heat. Each lozenge contains half a grain of tannic acid.

Dose.—1 to 6 lozenges.]

This is a convenient and very effectual mode of employing tannic acid in relaxed sore throat and loss of voice, the astringent substance being applied slowly and continuously to the relaxed part.

[§ **Acidum Gallicum.** *Gallic Acid.*

$3HO,C_{14}H_3O_7+2HO$, or $\mathbf{H_3C_7H_3O_5.H_2O}$.

A crystalline acid prepared from galls.

It may be obtained by the following process:—

Take of

Galls, in coarse powder . . .	1 pound
Distilled Water	a sufficiency.

Place the powder of galls in a porcelain dish, pour on as much of the water as will convert it into a thick paste, and keep it in this moistened condition for six weeks, at a temperature of between 60° and 70°, adding distilled water from time to time to supply what is lost by evaporation. At the end of that time boil the paste for twenty minutes with forty-five fluid ounces of the water, strain through calico, and, when the fluid has cooled, collect on a filter the crystalline deposit which has formed, and let it drain. Press it strongly between folds of filtering paper, and redissolve in ten ounces of boiling distilled water. When the fluid has cooled to 80° pour it off from the crystals which have formed, wash these with three ounces of ice-cold distilled water, and dry them, first by filtering paper, and finally at a temperature not exceeding 100°.

By boiling the undissolved portion of the galls with forty-five additional ounces of water, filtering into a dish containing the liquor decanted from the crystals in the preceding process, evaporating to the bulk of ten ounces, and cooling to 80°, an additional quantity of acid may be obtained, which, however, is usually a little darker in colour than the product of the previous crystallisation.

Characters and Tests.—Crystalline in acicular prisms or silky needles, sometimes nearly white, but generally of a pale fawn-colour. It requires about 100 parts of cold water for its solution, but dissolves in 3 parts of boiling water. Soluble also in rectified spirit. The aqueous solution gives no precipitate with solution of isinglass. It gives a bluish-black precipitate with a persalt of iron. The crystalline acid when dried at 212° loses 9·5 per cent. of its weight. It leaves no residue when burned with free access of air.]

Properties and Chemical Characteristics.—Pure gallic acid has an acidulous and styptic taste. Its solutions in water, alcohol, and ether, have a strongly acid reaction. It produces a deep blue colour with the salts of the peroxide of iron, in which circumstance it agrees with tannic acid; but it differs from the latter acid in not precipitating solutions of gelatine, albumen, or the salts of the alkaloids. To detect gallic acid mixed with tannic acid, the latter may be previously removed from its solution by precipitation with a solution of gelatine. The gallic acid may then be detected by the salts of the peroxide of iron. It does not occasion any precipitate with the salts of the pure protoxide of iron. Gallic acid, when in excess, forms stable salts with alkaline bases; but when the alkali predominates, oxygen is absorbed, and the liquid undergoes various changes of colour. Solutions of potash and ammonia poured on crystals of gallic acid produce a rich red-coloured solution. A small quantity of a solution of gallic acid added to a glass of lime-water produces at first a white precipitate (*gallate of lime*), which rapidly becomes blue, and passes through a violet tint to a dark purple colour. The crystals dissolved in boiling concentrated sulphuric acid produce a rich crimson-red solution, and when poured into cold water a red crystalline precipitate is formed. It deoxidises nitric acid, producing a red colour like that caused by morphia. When a solution of gallic acid is added to a solution of nitrate of silver, there is no precipitate, but the silver is slowly reduced. If the mixture be warmed, the reduction of the metal is instantaneous. On account of this property, gallic acid is much used in photography. Gallic acid equally reduces the solutions of gold.

Physiological Effects.—Gallic acid acts principally as a remote astringent: as a topical agent it is greatly inferior to tannic acid. Unlike tannic acid, it causes precipitates neither in gelatinous nor in albuminous solutions ; and a piece of skin does not absorb gallic acid from its aqueous solution, as it does tannic acid from its solution. Its chemical action on the constituents of the animal tissues is thus much weaker than that of tannic acid. No obvious effects result from the introduction of a few grains into the stomach. For reasons already stated, it is probable that, in equal doses, it is more powerful as a remote astringent than tannic acid.

Therapeutics.—Dr. Todd says that in all cases of hemorrhage—whether hæmoptysis, hæmatemesis, hæmaturia, or any other form dependent on hemorrhagic tendency—he considers gallic acid to be the best styptic we possess. It is now very frequently used to restrain internal hemorrhage, though its power is scarcely equal to that of acetate of lead. In acute and even in chronic renal dropsy, and the dropsy of scarlatina, it has been found by Dr. F. Farre very serviceable in diminishing the albumen. In cases of acute tonsillitis and scarlatinal sore throat, great benefit is said to be derived from the use of the following gargle :—℞ Acidi Gallici, gr. xl.; Liq. Sodæ Chloratæ, fl. drs. ij.; Aquæ destillatæ calidæ, fl. oz. viij. M. This gargle assumes a dark olive-brown colour, owing to the action of the excess of alkali in the chlorinated soda upon the gallic acid, but the taste is said not to be unpleasant.

Administration.—The *dose* of gallic acid is from two to ten grains or more three or four times a day. It may be used in the same forms as tannic acid.

[§ **Glycerinum Acidi Gallici.** *Glycerine of Gallic Acid.*

Take of

Gallic Acid	1 ounce.
Glycerine	4 fluid ounces.

Rub them together in a mortar, then transfer the mixture to a porcelain dish and apply a gentle heat until complete solution is effected.]

This is a convenient form in which to keep gallic acid in solution. It is suitable for use where a strong solution is required, and as it keeps well it affords a ready means of introducing the acid in the liquid state. The proportions are 1 part to 5 by weight, or $4\frac{1}{2}$ parts by measure of the solution contain 1 part by weight of the acid.

ULMACEÆ, *Mirbel.* The Elm Order.

ULMUS CAMPESTRIS, *Linn.* The Broad-leaved Elm.

Botanical Character.—A large *tree*, with a *rugged* bark. *Leaves* alternate, broadly ovate, very unequal at the base, acuminate, doubly-serrate, usually rough. *Flowers* hermaphrodite, reddish-brown, in dense clusters. *Calyx* campanulate, 4–5-toothed. *Stamens* 5. *Ovary* superior, compressed, 2-celled; with one *ovule* in each cell. *Styles* 2, diverging. *Fruit* green and leaf-like, broadly ovate or orbicular, slightly notched, with a broad membranous margin; 1-seeded.—*Woodv.* pl. 197, p. 540.

Habitat.—Southern parts of England.

[§ **Ulmi Cortex.** *Elm Bark.*

The dried inner bark of Ulmus campestris, *Linn.* From trees indigenous to and cultivated in Britain.]

Preparation.—To obtain the bark it should be separated from the tree in spring, and after the external bark has been removed, the inner bark (liber) should be quickly dried.

General Characters.—[§ A tough brownish-yellow bark, about half a line thick, without smell; taste mucilaginous, slightly bitter and astringent. Its decoction is turned green by perchloride of iron, and precipitates with a solution of gelatine.]

Composition.—Elm bark contains about 20 per cent. of *gum* and *ulmin*, and 3 per cent. of *tannic acid*, and a little *resin*.

Therapeutics.—A decoction has been recommended in cutaneous, especially scaly, eruptions. Dr. Lettsom found it successful in ichthyosis. It has been employed as a cheap substitute for sarsaparilla.

[§ **Decoctum Ulmi.** *Decoction of Elm Bark.*

Take of

Elm Bark, cut in small pieces . .	$2\frac{1}{2}$ ounces.
Distilled Water	1 pint.

Boil for ten minutes in a covered vessel, then strain and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint.

Dose.—2 to 4 fluid ounces.]

Formerly given in skin diseases; but now almost fallen into disuse.

CANNABINACEÆ, *Lindl.* The Hemp Order.

CANNABIS SATIVA, *Linn.* Common Hemp.

Botanical Character.—Annual. *Stem* 3 to 6 feet high, erect, branched, angular. *Leaves* on long weak petioles, digitate, serrate, roughish. *Stipules* subulate. *Flowers* axillary, diœcious. *Males: Flowers* racemose. *Calyx* 5-parted, imbricated. *Stamens* 5. *Females: Flowers* in spikes. *Calyx* (bract?) 1-leaved, acuminate, rolled round the ovary. *Ovary* roundish. *Style* short. *Stigmas* 2, filiform, pubescent. *Fruit* 1-celled, 2-valved. The whole plant has a clammy feel.—*Rheede, Hort. Malab.* pl. 61, vol. x.

Fig. 38.

Cannabis sativa.

Habitat.—Cultivated in India. The plant which grows in India and has been described by some botanists under the name of *Cannabis indica*, or *Indian hemp*, does not appear to possess any specific differences from the common hemp. Roxburgh and most other botanists have accordingly considered it identical with the *Cannabis sativa, Linn.*

[§ **Cannabis Indica.** *Indian Hemp.*

The dried flowering tops of the female plants of Cannabis sativa, *Linn.* For medicinal use that which is grown in India, and from which the resin has not been removed, is alone to be employed.]

General Characters.—The dried hemp plant which has flowered, and from which the resin has not been removed, is sold, under the name of Gunjah, in the Calcutta bazaars, for smoking chiefly, in bundles of about two feet long and three inches in diameter, each containing twenty-four plants. That which I have received from Dr. O'Shaughnessy, and also found in commerce, consists of cylindrical or fusiform masses (about the size and shape of the fingers) of a greyish or greenish-brown colour, and composed of stems, leaves, and petioles pressed together. It has a faint odour and feeble bitterish taste. The more abundant resinous secretion of the Indian plant is easily accounted for by its exposure to greater light and heat. The resinous exudation removed from the leaves, slender stems, and flowers, is called *churrus.* It is collected in India, Herat, and Persia, and is employed for its intoxicating effects in the East, but is not official in this country. The following are the characters of Indian hemp as given in the Pharmacopœia :—

[§ Tops consisting of one or more alternate branches, bearing the remains of the flowers and smaller leaves and a few ripe fruits, pressed together in masses which are about two inches long, harsh, of a dusky-green colour and a characteristic odour.]

Composition.—Besides the *resin* (*cannabin*); which appears to be the active ingredient, hemp contains some *gum*, *extractive*, and a little *ethereal oil*, about twelve minims in twenty-eight ounces (Fronmuller), but there is no evidence at present that this oil possesses any activity.

Physiological Effects.—Indian hemp owes its celebrity chiefly to its exhilarating and inebriating effects on orientals. In these the inebriation or delirium produced by it is usually of an agreeable or cheerful character, exciting the individual to laugh, dance, and sing, and to commit various extravagances,—acting as an aphrodisiac, and augmenting the appetite for food. In some it occasions a kind of reverie. It renders others excitable and quarrelsome, and disposes to acts of violence. It may also produce a cataleptic condition, in which the muscles are moderately contracted, but flexible and pliant, and the limbs retain any position or attitude in which they may be placed. In Europeans I have never heard of a cataleptic state being produced by this drug. In a case of tetanus under my care in the London Hospital, and which was carefully watched by Dr. O'Shaughnessy and myself, the resinous extract of hemp was given in increasing doses up to twenty grains. It caused stupor and cessation of spasms, but no perfectly cataleptic state. The only tendency to this condition which was observed was when the arm of the patient was lifted and then cautiously let go: it fell slowly and gradually, not quickly, as it would have done under ordinary conditions: the patient was at this time quite insensible. The exhilarating effect so constantly experienced by Asiatics, appears to be almost equally unknown in this country. The cause of this may be in great part due to the difference in the European and Asiatic temperaments; but probably the hemp loses some of its properties during its transmission; for in the author's large work are described by Drs. Taylor and Rees its inebriating and phantasmatic effects on Mr. B. Taylor while at Damascus; which are not surpassed by any of the extravagances to which it gives rise in Asiatics. Dr. Fronmuller thinks it probable that the Indian hemp contains some ethereal ingredient which is dissipated on the passage. (See *Composition.*) Dr. O'Shaughnessy, when in England, satisfied himself of the difference of the effect of Indian hemp in this country and in Bengal; and he observes, that while in India he had seen marked effects from half a grain of the extract, or even less, and had been accustomed to consider one grain and a half a large dose; in England he had given ten or twelve or more grains to produce the desired effect. Dr. Fronmuller, who has used it in 1,000 cases, considers eight grains of the extract the smallest dose. By internal use it acts as a *mydriatic*, causing preternatural dilatation of the pupil. But Dr. Lawrie states that when applied round the eye it does not cause dilatation of the pupil. Indian hemp does not appear much to affect the secretions. It neither excites nausea nor lessens the appetite. It neither causes dryness of the tongue nor constipation of the bowels. It does not appear to check or otherwise affect the bronchial secretions.

Therapeutics.—Indian hemp is chiefly employed as a medicine for its hypnotic, anodyne, and antispasmodic properties; occasionally, also, as a phrenic. As a *hypnotic*, I have used it with advantage in spirit-drinkers, and have succeeded in one or two cases in producing sleep with it where large doses of morphia had failed. Dr. Fronmuller ranks it next to opium. As an *anodyne* it is, I think, in general, decidedly inferior to opium; but in acute and subacute rheumatism, in gout, and in neuralgia, it frequently alleviates the pain. As an *anæsthetic*, Mr. Donovan found that under its influence his sense of touch and feeling gradually became obtuse, until at length he lost all feeling unless he pinched himself severely. As an *antispasmodic*, it has been employed with occasional success in tetanus, and also in hydrophobia and chorea. In chorea I have found it serviceable, sometimes as an antispasmodic, at others as a hypnotic; and the same be said of its use in hysteria. As a *phrenic*, or medicinal agent affecting the mental functions, Indian hemp has also been employed. Dr. Clendinning speaks favourably of its use as a nervine stimulant, in removing languor and anxiety, and raising the pulse and spirits; and Dr. Conolly thinks that it may be useful in some chronic forms of mania.

[§ **Extractum Cannabis Indicæ.** *Extract of Indian Hemp.*

Take of

Indian Hemp, in coarse powder . .	1 pound.
Rectified Spirit	4 pints.

Macerate the hemp in the spirit for seven days, and press out the tincture. Distil off the greater part of the spirit, and evaporate what remains by a water-bath to the consistence of a soft extract.]

Dose.—The *dose* of this extract is from $\frac{1}{4}$ to 1 grain or more. I have usually found one grain to act as a narcotic. In a case of tetanus under my care in the London Hospital, the dose of the extract (supplied by Dr. O'Shaughnessy, who watched the case with me) was gradually increased to twenty grains. It has been already stated that Dr. O'Shaughnessy considered that ten or twelve grains are required in England to produce the effects which follow one grain in India, and that Dr. Fronmuller considers eight grains of the extract *the smallest* dose. It may be administered in the form of pill; or better, by diffusion through an emulsion (prepared by rubbing the extract with olive oil, in a warm mortar, and gradually adding mucilage, and afterwards water).

[§ **Tinctura Cannabis Indicæ.** *Tincture of Indian Hemp.*

Take of

Extract of Indian Hemp	1 ounce.
Rectified Spirit	1 pint.

Dissolve the extract of hemp in the spirit.]

The tincture is prepared from the extract instead of from the herb, to secure greater uniformity of strength, as the latter varies much in the quantity of resinous secretion. The proportions are those directed to be used by Dr. O'Shaughnessy. The tincture may be administered in an emulsion or mucilaginous mixture, or in water sweetened with sugar. It should be swallowed soon after it has been added to the aqueous liquid, as the resin is precipitated, and is apt to adhere to the side of the vessel.

Dose.—The ordinary dose is from 5 to 20 minims. Dr. O'Shaughnessy, however, gives in tetanus as much as a fluid drachm every half hour until the paroxysms cease or catalepsy is induced; in cholera, ten minims every half hour. Dr. F. Farre remarks, 'If, however, we adopt the doses of the extract recommended for Europeans by Dr. Fronmuller, we shall probably find it necessary to give somewhat larger doses of the tincture, as one fluid drachm is only equivalent to two and a half grains of the extract. I have found one-drachm doses well borne in chorea by children twelve or fourteen years of age.'

HUMULUS LUPULUS, *Linn.* The Hop.

Botanical Character.—A perennial plant. *Stems* annual, long, weak, twining, scabrous. *Leaves* opposite, petiolate, 3–5-lobed, serrate, rough. *Flowers* diœcious, greenish-yellow. *Male flowers* in loose *panicles* (fig. 39, *a*). *Calyx* of 5 segments. *Stamens* 5. *Female flowers* in ovoid or globular catkins (*strobiles*), consisting of large persistent imbricated *bracts*, each having a flower in its axil (fig. 39, *b*). *Calyx* a solitary obtuse sepal, infolding the ovary. *Ovary* 1.

Styles 2. *Fruit* (*achenium*) small, hard, nearly globular.—*Steph. and Church.* pl. 41.

Fig. 39.

Humulus Lupulus.

a. Branch of the male plant.
b. Branch of the female plant.

Habitat.—Thickets and hedges in many parts of Europe. Indigenous. The female plant is cultivated in several counties in England, especially Kent, Sussex, Surrey, Worcestershire, and Herefordshire.

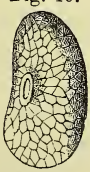
[§ **Lupulus.** *Hop.*

The dried strobiles of the female plant of Humulus Lupulus, *Linn.* Cultivated in England.]

Collection and Preparation.—The *gathering* or *picking*, takes place in September. The strobiles are dried in kilns, and are then packed in hempen sacks called bags or pockets.

General Characters.—The strobiles (or catkins as they are improperly called), and which in commerce are termed *hops*, consist of scales (bracts), nuts (achenes), and lupulinic glands or grains. The *scales* are the enlarged and persistent bracts, which enclose the nuts; they are ovate, membranous, of a greenish-yellow colour, and glandular at their base. The *nuts* or *achenes*, are covered with aromatic, superficial, round glands. These *lupulinic glands* or *grains* (commonly termed *yellow powder* or *lupuline*), are the most important parts of the strobiles. Dr. Ives procured fourteen ounces of glands from six pounds of hops, and he therefore concluded that dry hops would yield about a sixth part of their weight of these glands. They are rounded, of a cellular texture, golden-yellow, and somewhat transparent. They are sessile, or nearly so. The common centre, around which the cells are arranged, has been called the *hilum*. By drying, they lose their spherical form (fig. 40). Placed in water, they give out an immense number of minute globules. Under other circumstances they become ruptured, and allow an inner envelope to escape. Hops have an agreeable aromatic odour, and a bitter taste. The odour entirely depends upon, and the bitter taste principally, on the lupulinic glands.

Fig. 40.



Dried Lupulinic gland, with its hilum (magnified).

Composition.—According to Payen, the lupulinic glands contain 2 per cent. of *volatile oil*, 10·30 of *bitter principle*, and 50 to 55 of *resin.*

The scales also contain *tannic acid.* *Volatile Oil of Hops* resides in the lupulinic glands. It is obtained by submitting these, or hops which contain them, to distillation with water. Its colour is yellowish, its odour that of hops, its taste acrid. It is soluble in water, but still more so in alcohol and ether. Its specific gravity is 0·910. By keeping, it becomes resinified. It is said to act on the system as a narcotic. The water which comes over, in distillation, with the oil, contains acetate of ammonia, and blackens silver, from which circumstance the presence of sulphur is inferred. *Bitter Principle of Hops, Lupulite,* is procured by treating the aqueous extract of the lupulinic glands, united with a little lime, with alcohol. The alcoholic tincture is to be evaporated to dryness, the residue treated with water, and the solution evaporated. The residue, when washed with ether, is lupulite. It is neutral, uncrystallisable, yellowish-white, very bitter, soluble in twenty parts of water, very soluble in alcohol, and slightly so in ether. The aqueous solution froths by agitation; it forms no precipitate with either tincture of galls or acetate of lead. Lupulite contains no nitrogen. It is devoid of the narcotic property of the oil. *Tannic Acid, Tannin.*—In the manufacture of beer, this principle precipitates the nitrogenised or albuminous matter of the barley, and therefore serves for clarification. All genuine beer, however, contains tannic acid. The *resin* is of a golden-yellow colour, and becomes orange-yellow by exposure to the air. It is soluble in both alcohol and ether. It appears to be the oil changed into resin, partly by oxidisement. A decoction of hops reddens litmus, owing to the presence of free acid, sulphuric acid having been formed in the common process of drying hops with the vapour of burning sulphur, mixed with coke or charcoal. Perchloride of iron strikes an olive-green colour (*tannate of iron*). A solution of gelatine renders the filtered decoction turbid (*tannate of gelatine*).

Physiological Effects.—The odorous emanations of hops (vapour of the volatile oil) possess narcotic properties. Hence, a pillow of hops promotes sleep, as I have several times witnessed. Moreover we are told that stupor has occasionally been induced in persons who have remained for a considerable time in hop warehouses. The lupulinic glands are aromatic and tonic. They appear also to possess soothing, tranquillising, and, in a slight degree, sedative and soporific properties. But the existence of any narcotic quality has been strongly denied by Dr. Bigsby, Magendie, and others. Dr. Maton found that they allayed pain, produced sleep, and reduced the frequency of the pulse from ninety-six to sixty in twenty-four hours. Both infusion and tincture of hops are mild but agreeable aromatic tonics. Their sedative, soporific, and anodyne properties are very uncertain.

Therapeutics.—A pillow of hops is occasionally employed in mania, and other cases in which inquietude and restlessness prevail, and in which the use of opium is considered objectionable. In hop countries it is a popular remedy for want of sleep. Hops are given internally to relieve restlessness consequent upon exhaustion and fatigue, and to induce sleep in the watchfulness of mania and of other maladies; to calm nervous irritation, and to relieve pain in gout, arthritic rheumatism, and after accouchement. Though they sometimes produce the desired effect, they frequently fail to give relief. Dr. Maton used hops with good effect, as an anodyne in rheumatism. As a tonic, hops are applicable in dyspepsia. Dr. J. R. Farre found both the tincture and extract very useful in gouty spasm of the stomach.

Administration.—The *Yellow Powder*, *Lupulinic Glands*, or *Lupuline*, may be taken in the form of powder or pills. This is the best preparation of hops for internal use. *Dose.*—6 to 12 grains.

[§ **Extractum Lupuli.** *Extract of Hop.*

Take of

Hop	1 pound.
Rectified Spirit	$1\frac{1}{2}$ pint.
Distilled Water	1 gallon.

Macerate the hop in the spirit for seven days, press out the tincture, filter, and distil off the spirit, leaving a soft extract. Boil the residual hop with the water for one hour, press out the liquor, strain, and evaporate by a water-bath to the consistence of a soft extract. Mix the two extracts, and evaporate at a temperature not exceeding 140° until it has acquired a suitable consistence for forming pills.

Dose.—5 to 15 grains.]

This extract differs from the London and Edinburgh extracts in being prepared with spirit as well as with water. Hence it will contain the resin as well as the bitter principle and some of the volatile oil.

[§ **Infusum Lupuli.** *Infusion of Hop.*

Take of

Hop	$\frac{1}{2}$ ounce.
Boiling Distilled Water . . .	10 fluid ounces.

Infuse in a covered vessel, for two hours, and strain.

Dose.—1 to 2 fluid ounces.]

[§ **Tinctura Lupuli.** *Tincture of Hop.*

Take of

Hop	$2\frac{1}{2}$ ounces.
Proof Spirit	1 pint.

Macerate the hop for forty-eight hours, in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

MORACEÆ, *Lindl.* The Mulberry Order.

MORUS NIGRA, *Linn.* The Mulberry.

Botanical Character.—A small *tree* with rugged bark. *Leaves* cordate-ovate, lobed or unequally dentate, rough and thickish (fig. 41). *Flowers* greenish, monœcious. *Catkins* unisexual. *Calyx* 4-lobed; the lobes concave. *Stamens* 4, alternate with the segments of the calyx. *Ovary* free. *Stigmas* 2. *Fruit* (*sorosis*) dark purple, consisting of the female flowers, become fleshy and coherent, and inclosing a dry membranous pericarp.—*Steph. and Church.* pl. 39.

Habitat.—Native of Persia and China. Cultivated in Britain.

Fig. 41.

Morus nigra.

[§ **Mori Succus.** *Mulberry Juice.*

The juice of the ripe fruit of Morus nigra, *Linn.*]

General Characters.—The fruit has a faint agreeable odour; and its taste is pleasant, acidulous, and sweet. The juice is dark violet-red.

Composition.—The juice has not been analysed. Its principal constituents are, *violet-red colouring matter*, *tartaric acid*, and *sugar*.

Uses.—Mulberry juice is employed for its colour and flavour.

[§ **Syrupus Mori.** *Syrup of Mulberries.*

Take of

Mulberry Juice	1 pint.
Refined Sugar	2 pounds.
Rectified Spirit	$2\frac{1}{2}$ fluid ounces.

Heat the mulberry juice to the boiling point, and when it has cooled filter it. Dissolve the sugar in the filtered liquid with a gentle heat, and add the spirit. The product should weigh three pounds six ounces, and should have the specific gravity 1·33.

Dose.—1 fluid drachm.]

Used as a colouring and flavouring substance. Its acidity prevents its being used with alkalies, earths, or their carbonates.

FICUS CARICA, *Linn.* The Fig.

Botanical Character.— A small *tree. Leaves* (fig. 42) cordate, palmate, scabrous above, pubescent beneath. *Flowers* monœcious, numerous, pedicellated, inclosed within a green fleshy hollow receptacle (fig. 43, B), which is umbilicated, and nearly closed at the apex. At the base of each receptacle are (fig. 43, A, *a a*) two or three bracteal scales. *Calyx* 3–5-lobed; lobes acuminate. *Male flowers* (fig. 43, E) near the umbilicus (fig. 43, A, *b*). *Stamens* 3–5. *Female flowers* (fig. 43, C, D): *Style* 1. *Stigmas* 2. *Achenium* 1-seeded, sunk into the pulpy receptacle. *Pericarp* fragile, crustaceous. — *Steph. and Church.* pl. 154.

Fig. 42.

Ficus Carica.

Habitat.—Native of Asia and South of Europe.

[§ Ficus. *Fig.*

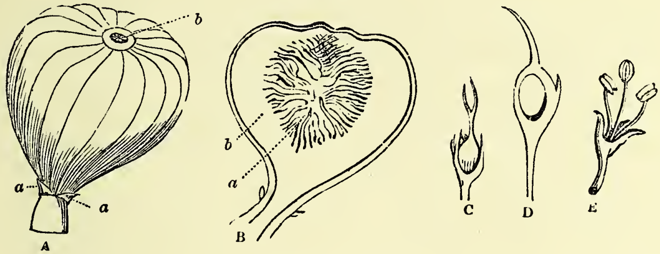
The dried fruit of Ficus Carica, *Linn.* Imported from Smyrna.]

General Characters and Varieties.—Figs constitute that kind of collective fruit called a *syconus.* They consist of fleshy, hollow, pear-shaped receptacles, within which are numerous small seed-like fruits (*achenia*). In the unripe state they contain an acrid and bitter juice, but which when they are ripe, is replaced by sugar. Ripe figs are dried in the sun, or in ovens, and are afterwards placed in drums and baskets in which they are imported. Dried figs are compressed, soft but tough, have a brownish or yellowish colour, are somewhat translucent, covered with a saccharine efflorescence, and containing a viscid sweet pulp, and numerous small hard achenia. They have a peculiar and agreeable odour. *Turkey* or *Smyrna figs* are the largest, most juicy, and sweetest; hence they are sometimes termed *fat figs*: they are distinguished into *pulled* and *flat*. They come from the provinces of Aiden and Erbeli. The finest are termed *Eleme figs*, i.e. *choice*.

Physiological Effects.—Figs are emollient, demulcent, and laxative.

Uses.—In the Old Testament we are informed that Hezekiah (who lived 600 years before Christ) used figs (probably the fresh fruit) as a topical application to a boil.

Fig. 43.



Ficus Carica.

A. Receptacle:—*a a*, bracteal scales; *b*, umbilicus.
B. Longitudinal section of receptacle:—*a*, flowers seated on *b*, the inner side of the receptacle.
C. Female flower. D. Section of female flower. E. Male flower.

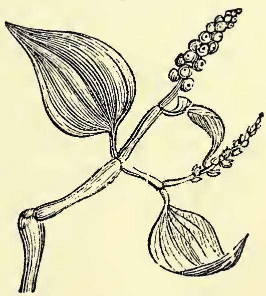
Pharmaceutical Use.—Dried figs enter into the composition of confection of senna.

PIPERACEÆ, *D.C.* THE PEPPER ORDER.

PIPER NIGRUM, *Linn.* The Black Pepper.

Botanical Character.—*Stem* shrubby, round, climbing, 8–12 feet long, jointed (fig. 44), swollen and rooting at the joints, dichotomous. *Leaves* ovate or elliptical, acuminate, subcordate, 5–7-ribbed, coriaceous, smooth, recurved at the margin. *Spikes* opposite the leaves, shortly pedunculated, pendulous, covered with flowers on all sides. *Flowers* unisexual or hermaphrodite. *Fruits* distinct, baccate, sessile, 1-seeded, at first green, then red, afterwards black.—*Woodv.* pl. 187, p. 513.

Fig. 44.



Piper nigrum.

Habitat.—Cultivated in various parts of India and its islands, and also in the West Indies.

[§ **Piper Nigrum.** *Black Pepper.*

The dried unripe berries of Piper nigrum, *Linn.* Imported from the East Indies.]

Preparation.—When any of the berries on a spike change from green to red, the whole are considered fit for gathering; for if they are allowed to become fully ripe, they are somewhat less pungent, and moreover, easily drop off. At this period therefore, they are collected, then spread out and dried in the sun, and the stalks separated by hand-rubbing. They are afterwards winnowed. These dried unripe berries constitute *black pepper.*

General Characters and Varieties.—*Black pepper*, (which is alone official,) is round, and covered externally with a brownish-black corrugated layer. Each fruit contains a hard, whitish, spherical, smooth seed, which is horny externally, but farinaceous internally. The taste of both seed and covering is pungent and somewhat bitter; the odour is aromatic. Amongst wholesale dealers three kinds of black pepper are distinguished:—*Malabar pepper* is the most valuable: it is *brownish-black*, free from stalks, and nearly free from dust. *Sumatra*, and *Penang* or *Batavia* peppers are of inferior quality. They are black or earthy-coloured, and generally contain from one to ten per cent. of dust and occasionally stalks. The grains of Penang pepper are large. The heavier the pepper is, the more it is esteemed in the market. The heaviest of all, being hard and smooth, is called *shot pepper.*

White pepper is prepared from the best and soundest fruits, gathered when quite ripe. These being soaked in water, swell and burst their outer covering, which is afterwards carefully separated by drying in the sun, hand-rubbing and winnowing. Hence white pepper is the fruit deprived of the external portion of the pericarp; in fact, it is but little more than the seed. The grains (as they are then called), are spherical, whitish, smooth, and horny externally; and internally they are farinaceous or hollow in the centre. White pepper is less pungent than black pepper. It is *not official.* There are four sorts of white pepper distinguished in commerce:—*Tellicherry* (the best), *Penang*, *Batavia*, and *Singapore.* All white peppers are bleached before they are forwarded for consumption; and an attempt has been made to convert the black to white pepper, by depriving it of the outer portion of the pericarp by mechanical trituration. The pepper formerly distinguished as *Fulton's decorticated pepper* was thus prepared, but the loss in weight is so great, and the article, when made, is so inferior in quality, that the process is not now carried on.

Composition.—Black pepper contains *acrid soft resin, volatile oil,* and *piperin.* *Resin of Pepper.*—This is a very acrid substance, soluble in alcohol and ether, but not so in volatile oils. It possesses, in high perfection, the acrid properties of pepper. In the museum of the Pharmaceutical Society are two kinds of pepper resin: one called the 'green resin,' the other the 'red resin.' *Volatile Oil of Pepper*, $\mathbf{C_{10}H_{16}}$.—When pure, this is colourless; it has the odour and taste of pepper. Its specific gravity is 0·9932. *Piperin*, $\mathbf{C_{17}H_{19}NO_3}$.—This is a crystalline substance, the crystals being rhombic prisms, with inclined bases. It fuses at 212° F., is insoluble in cold water, and is only very slightly soluble in boiling water. Its best solvent is alcohol: the solution throws down piperin when water is added to it. Ether dissolves it, but not so readily as alcohol. Acetic acid is likewise a solvent for it. Piperin, when pure, is white: but as met with in commerce it is usually straw-yellow. It is tasteless and inodorous. With strong sulphuric acid it forms a blood-red liquid. Nitric acid colours it first greenish-yellow, then orange, and afterwards red. The action of hydrochloric acid is similar.

Physiological Effects.—The great acridity of pepper is recognised when we apply it to the tongue. On the skin it acts as a rubefacient and vesicant. Swallowed, it stimulates the stomach, creates a sensation of warmth in this viscus, and when used in small doses, assists the digestive functions, but if given in large quantities induces an inflammatory condition. On the vascular and secreting systems pepper acts as a stimulant. It accelerates the frequency of the pulse, promotes diaphoresis, and acts as an excitant to the mucous surfaces. It has long been regarded as a stimulant to the urino-genital apparatus. This opinion is supported by the well-known influence of the peppers over certain morbid conditions of these organs. Moreover the beneficial effect of pepper in some affections of the rectum leads us to suspect that this viscus is also influenced by it.

Therapeutics.—Pepper is employed as a condiment partly for its flavour, and partly for its stimulant influence over the stomach, by which it assists digestion. As a gastric stimulant it is a useful addition to difficultly digestible foods, as fatty and mucilaginous matters, especially for persons who suffer in consequence of a torpid or atonic condition of the stomach. Infused in brandy it is a popular remedy for preventing the return of the paroxysms of intermittent fevers, given shortly before the expected attack. The febrifuge power of pepper has been fully proved, in numerous cases. In relaxed uvula, paralysis of the tongue, and other affections of the mouth or throat requiring the use of a powerful acrid, pepper may be employed as a masticatory. Mixed with mustard it is employed to increase the acridity of sinapisms.

Administration.—The *dose* of black pepper is from 5 to 15 grains; the powder may be given in the form of pills.

Pharmaceutical Uses.—It is an ingredient of confection of opium and compound opium powder.

[§ **Confectio Piperis.** *Confection of Pepper.*

Synonym.—Electuarium Piperis, *Edin.*

Take of

Black Pepper, in fine powder . . .	2 ounces.
Caraway Fruit, in fine powder . .	3 ounces.
Clarified Honey	15 ounces.

Rub them well together in a mortar.]

The elecampane (*Lond.*) and the liquorice root (*Edinb.*, *Dub.*) are omitted, and caraway is substituted for fennel. No sugar is used, and the honey is mixed at once with the other ingredients, as in the Edinburgh and Dublin preparations. This confection is intended to be a substitute for a medicine called '*Ward's Paste*,' which has obtained some celebrity as a remedy for fistula, piles, and ulcers about the rectum. Its efficacy doubtless depends on the gentle stimulus it gives to the affected parts. Sir B. Brodie observes, that severe cases of piles are sometimes cured by it; and he thinks that it acts on them topically, the greater part of the paste passing into the colon, and becoming blended with the fæces, and in this way coming in contact with the piles, on which it operates as a local application, much as wine of opium acts on the vessels of the conjunctiva in chronic ophthalmia. In confirmation of this view, he mentions the case of a patient attended by Sir Everard Home, who was cured by the introduction of the paste into the rectum. Confection of pepper is adapted for weak and leucophlegmatic habits, and is objectionable where much irritation or inflammation is present. As it is apt to accumulate in and distend the colon, gentle aperients should be exhibited occasionally during the time the patient is taking the confection.

Dose.—60 to 180 grains twice or thrice a day. 'It is of no use,' says Sir B. Brodie, 'to take this remedy for a week, a fortnight, or a month; it must be persevered in for two, three, or four months.'

CHAVICA ROXBURGHII, *Miquel.* Long Pepper.

Botanical Character.—Stem woody, rather hairy. *Lower leaves* roundish-ovate, 7-ribbed. *Spikes* solitary, opposite to the leaves. *Female spikes* cylindrical, about as long as their peduncles. *Flowers* sessile, diœcious. *Bracts* with short stalks, nearly rhomboid in shape, peltate. *Style* very short or 0. *Berries* sessile, united with the permanent bracts, and the thickened rachis of the spike. *Seeds* oblong, or almost lenticular, with a crustaceous finely scrobiculate testa, and a mealy albumen.

Habitat.—India. Found wild among bushes on the banks of watercourses up towards the Circar mountains. It is cultivated in Bengal, and in the valleys amongst the Circar mountains.

Piper Longum. *Long Pepper.*

The dried unripe spikes of fruit of Chavica Roxburghii, *Miquel.*

(*Not official.*)

Botanical Source.—The long pepper imported from our possessions in India is the produce of *Chavica Roxburghii*, Miq. But that which is brought to Europe and America from the Dutch colonies is the produce of *Chavica officinarum*, Miq.

Preparation and Commerce.—When fully grown, but yet unripe, the spikes are gathered and dried by exposure to the sun. They are then packed in bags for sale. The best long pepper comes from Singapore and Batavia.

General Characters.—As met with in commerce, *long pepper* is greyish-brown, cylindrical, an inch or more in length, having a mild aromatic odour, but a violent pungent taste. In its natural state its colour is brown, but it usually receives a slight coating of lime.

Composition.—Acrid fatty matter (resin ?), volatile oil, piperin, nitrogenous extractive, gum, bassorin, starch, malates and other salts.

Physiological Effects and Uses.—The effects of long pepper are analogous to those of black pepper. Cullen and Bergius consider it less powerful; but most other pharmacologists are agreed on its being more acrid. Medicinally it may be employed in similar cases. It is used principally in pickling, and for culinary purposes.

CUBEBA OFFICINALIS, *Miq.* The Cubeb Pepper.

Botanical Character.—A climbing shrub. *Leaves* stalked, smooth; the lower ones unequal, somewhat cordate at the base, ovate, acute; the upper ones more oblong-ovate, with rounded base, and smaller; those of the male plant 5-ribbed, of the female plant 5–9-ribbed. *Spike* solitary, opposite the leaves. *Flowers* diœcious. *Fruit* baccate, stalked, shorter than the stalk. *Seed* roundish, with mealy albumen.—*Steph. and Church.* pl. 175.

Habitat.—Grows wild in Bantam, the western part of Java; also on some of the neighbouring islands. Cultivated in the lower parts of Java.

[§ **Cubeba.** *Cubebs.*

The dried unripe fruit of Cubeba officinalis, *Miquel.* Cultivated in Java.]

General Characters.—In size and appearance cubebs resemble black pepper, except that they are lighter-coloured, and are each furnished with a stalk two or three lines long, from which circumstance they have received the name of *tailed pepper.* They are globular, wrinkled, and each fruit contains a hard spherical seed, which is whitish and oily. The taste of cubebs is acrid, peppery, and camphoraceous; the odour is peculiar and aromatic.

Composition.—Cubebs contain *volatile oil, resin,* and *cubebin. Volatile Oil of Cubebs.*—(See *Oleum Cubebæ.*) *Resin of Cubebs.*—Vauquelin has described two resins of cubebs; one is green, liquid, acrid, and analogous, both in colour and taste, to copaiva; the other is brown, solid, acrid, and insoluble in ether. *Cubebin.*—From cubebs is obtained a principle to which the term *cubebin* has been applied. It crystallises in small needles and is very analogous to piperin. Cassola, a Neapolitan chemist, says it is distinguished from the latter principle by the fine crimson colour which it produces with sulphuric acid, and which remains unaltered for twenty or twenty-four hours. According to Monheim, cubebin is identical with piperin, and he asserts that it is combined with a soft acrid resin. In this state it is soluble in ether, alcohol, the fixed oils, and acetic acid: but it is insoluble in oil of turpentine and dilute sulphuric acid. It fuses at 248° F.

Physiological Effects.—Cubebs belong to the class of acrid substances. Their sensible operation is very analogous to that of black pepper. Taken in moderate doses, they stimulate the stomach, augment the appetite, and promote the digestive process. In larger quantities, or taken when the stomach is in an irritated or inflammatory condition, they cause nausea, vomiting, burning pain, griping, and even purging. These are their local effects. The constitutional effects are those resulting from the operation of an excitant,—namely, increased frequency and fulness of pulse, thirst, and augmented heat. They probably stimulate all the mucous surfaces, but unequally so. In some instances cubebs give rise to an eruption on the skin like urticaria. Cubebs appear to exercise a specific influence over the urino-genital apparatus. Thus they frequently act as diuretics, and at the same time deepen the colour of, and communicate a peculiar aromatic odour to the urine.

Therapeutics.—The principal use of cubebs is in the treatment of gonorrhœa. They should be given in as large doses as the stomach can bear, in the earlier part of the disease ; for experience has fully proved that in proportion to the length of time gonorrhœa has existed, the less amenable is it to the influence of cubebs. In some instances an immediate stop is put to the progress of the malady. In others the violent symptoms only are palliated; while in many cases no obvious influence over the disease is manifested. The presence of active inflammation of the urethra does not positively preclude the use of cubebs, though I have more than once seen them aggravate the symptoms. Mr. Jeffreys thinks the greatest success is met with in the more inflammatory forms of the disease. Cubebs have been charged with inducing swelled testicle ; but I have not observed this affection to be more frequent after the use of cubebs, than when they were not employed. Mr. Broughton gave them to fifty patients, and in forty-five they proved successful. Of these only two had swelled testicle. The explanation of the *methodus medendi* is unsatisfactory. Sir A. Cooper thinks that cubebs produce a specific inflammation of their own on the urethra, which has the effect of superseding the gonorrhœal inflammation. The occasional occurrence of a cutaneous eruption from the use of cubebs deserves especial attention, as I have known it create a suspicion of secondary symptoms. In abscess of the prostate gland, twenty or thirty grains of cubebs, taken three times a day, have in many cases appeared to do good. They seemed to give a gentle stimulus to the parts, and to influence the disease much in the same way that Ward's Paste operates on abscesses, fistulæ, and ulcers of the rectum. In cystirrhœa also they have occasionally proved serviceable in small doses. The efficacy of cubebs in mucous discharges is not confined to the urino-genital mucous membrane. In catarrhal affections of the membrane lining the air-passages, it proves exceedingly useful, especially when the secretion is copious and the system relaxed.

Administration.—Cubebs, in the form of *powder*, are given in doses varying from ten grains to one hundred and fifty. In affections of the bladder and prostate gland, the dose is from ten grains to thirty grains. In gonorrhœa, on the other hand, they should be administered in large doses.

[§ **Tinctura Cubebæ.** *Tincture of Cubebs.*

Take of

Cubebs, in powder	$2\frac{1}{2}$ ounces.
Rectified Spirit	1 pint.

Macerate the cubebs for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient rectified spirit to make one pint.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

[§ **Oleum Cubebæ.** *Oil of Cubebs.*

The oil distilled in Britain from cubebs.]

Preparation, Characters, and Composition.—The oil is prepared by grinding the fruit, and distilling with water. By distillation, cubebs yield about 10·5 per cent. of a transparent, slightly-coloured, or when pure colourless, volatile oil, which is lighter than water (sp. gr. 0·929), and has the cubeb odour, and a hot, aromatic, bitter taste. Its formula is $\mathbf{C_{15}H_{24}}$. By keeping, it sometimes deposits crystals (*cubeb stearoptene* or *cubeb camphor*), the primary form of which is the rhombic octahedron. These crystals are a hydrate whose composition is $\mathbf{C_{15}H_{24}H_2O}$. Their odour is that of cubebs; their taste, at first, that of cubebs and camphor, afterwards cooling. They are fusible at 156° F., soluble in alcohol, ether, and oils, but insoluble in water.

Administration.—The *dose*, at the commencement of its use, is from 5 to 20 minims. This quantity is to be gradually increased as long as the stomach will bear it. In some instances I have given it to the extent of a fluid drachm for a dose. It may be taken suspended in water by means of mucilage, or dropped on sugar, or in the form of *gelatine capsules of cubebs*. A combination of oil of cubebs and oil of copaiva forms a very useful medicine in some cases of gonorrhœa. Oil of cubebs is an excellent and most convenient substitute for the powder.

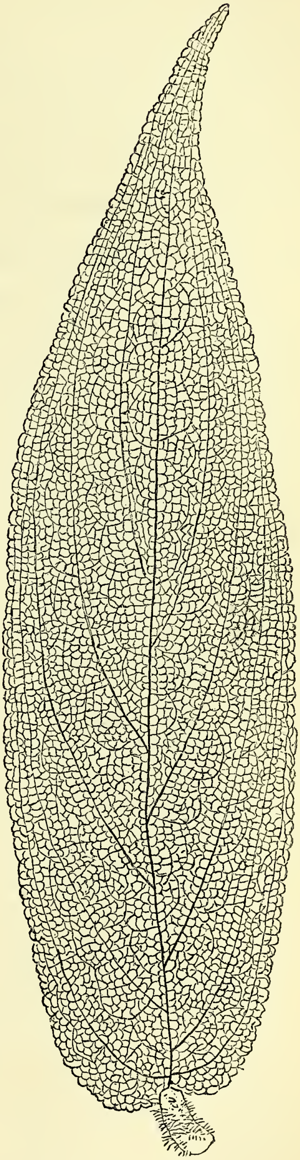
ARTANTHE ELONGATA, *Miquel.* The Matico Plant.

Synonym.—Piper angustifolium, *Ruiz and Pavon.*

Botanical Character.—A *shrub* of about twelve feet high, with jointed stem and branches. *Leaves* harsh, short-stalked, oblong-lanceolate, acuminate, pubescent beneath, tessellated or rough on the upper side, on account of the sunken veins. *Spikes* solitary, ylindrical, and opposite the leaves. *Bracts* peltate. *Flowers* hermaphrodite. *Style* 0.—*Ruiz and Pavon, Flor. Peruv.* pl. 57 (*Pip angustifolium*).

Habitat.—It grows at Huanuco and elsewhere in Peru.

Fig. 45.



Leaf of Artanthe elongata.

[§ **Maticæ Folia.** *Matico Leaves.*

The dried leaves of Artanthe elongata, *Miquel.* Imported from Peru.]

History.—Under the name of *matico*, the leaves of several plants are employed by the inhabitants of Central and South America, for arresting both external and internal hemorrhages, and for other purposes. A nearly similar story is told throughout America, as to the discovery of the styptic property of each kind of matico. It is said that a Spanish soldier named Matico, when desperately wounded, dragged himself into the shade of the plants near him, and in his agony plucked some of their leaves, and applied them accidentally to his wound, when to his great surprise and delight, he found in a short time that the bleeding was arrested, and the wound soon healed. From this circumstance Matico has received the Spanish names of 'Yerba soldado,' and 'Palo del soldado,' signifying 'Soldier's herb,' and 'Soldier's tree.' Three plants have been especially mentioned by authors as having received the name of Matico, or Soldier's herb, namely, *Artanthe elongata*, Miq.; *Eupatorium glutinosum*, Kunth; and *Walteria glomerata*, Presl. The former is alone official; it was introduced into this country as an internal styptic in 1839; but until 1864 it was only admitted into the Dublin Pharmacopœia.

General Characters.—Matico, as imported, consists of the dried leaves, stalks, and spikes (some unripe, others ripe), more or less compressed into a lump, which has a greenish colour. The leaves are from two to eight inches long, veined and tessellated on the upper surface, downy beneath, with an aromatic slightly astringent warm taste, and an agreeable aromatic odour.

Substitution.—In 1863, during the last American War, and just before the issue of the British Pharmacopœia, matico was very scarce in this country ; and the leaves and spikes of fruit of another plant were imported and sold under the same name. This matico was examined by Professor Bentley, and pronounced by him to be derived from *Artanthe adunca.* A similar kind of matico has recently also appeared in commerce. It may be at once distinguished from the official matico by being in a less compressed state, by the upper surface of its leaves not being so tessellated or rough, and by the almost entire abscence of pubescence on the under surface of the leaves.

Composition.—Matico contains *an aromatic volatile oil*, *a bitter principle*, and *a soft dark green resin. Oil of matico* has a light green colour, and, when recent, the consistence of good castor oil, but becomes thick and crystalline on keeping. The *bitter principle*, called *maticine*, is soluble in alcohol and water, but not in ether. The existence, however, of maticine has been denied, and the soft resin has been found by Mr. Stell ruby-red, the green colour being attributed to chlorophyll. Infusion of matico yields a dark greenish colour and precipitate with the perchloride of iron, but undergoes no change on the addition of solution of gelatine, tartarated antimony, or corrosive sublimate. It therefore contains little or no tannic acid. Both acetate of lead and infusion of galls occasion copious coloured precipitates. According to Mr. Stell the medicinal properties of matico are due to the volatile oil and resin.

Physiological and Therapeutical Effects.—Matico is an aromatic bitter stimulant. As an *internal* remedy, it is applicable as a substitute for cubebs, in discharges from the mucous surfaces, as leucorrhœa and gonorrhœa, and in catarrh of the bladder. It has been greatly lauded, especially in the United States, as an internal styptic or astringent in internal hemorrhages. But the botanical, chemical, and sensible qualities of matico are opposed to the idea of its astringent properties. If matico have any styptic power, it is derived, not from tannic or gallic acids, but from the volatile oil which the plant contains ; and in that case the oils of pepper, cubebs, or turpentine, would be much more energetic and preferable. The latter, indeed, is decidedly efficacious as an internal remedy for hemorrhage. But matico is more decidedly useful (like lint, felt, or cobweb) as a topical application for staunching blood from slight cuts and other wounds of the face and gums, or from leechbites. It acts mechanically as a styptic by the structure of its leaf, which divides the blood and promotes its coagulation.

Administration.—Matico is administered in the form of powder and infusion. The *dose* of the *powder* is from 30 to 60 grains.

[§ **Infusum Maticæ.** *Infusion of Matico.*

Take of

Matico Leaves, cut small	. .	$\frac{1}{2}$ ounce.
Boiling Distilled Water .	. .	10 fluid ounces.

Infuse in a covered vessel, for half an hour, and strain.

Dose.—1 to 4 fluid ounces.]

EUPHORBIACEÆ, *Juss.* The Spurge Order.

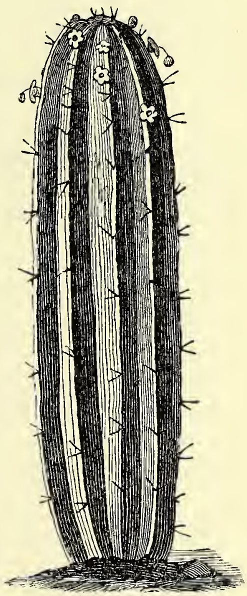
EUPHORBIA OFFICINARUM, *Linn.* The Acrid Spurge.

Euphorbium. *Euphorbium.*

An acrid resin, obtained from Euphorbia officinarum, *Linn.*, and probably other species of Euphorbia, *Linn.* Imported from Western Africa.

(*Not official.*)

Fig. 46.



Euphorbia officinarum.

Extraction. — Euphorbium is thus procured:—The inhabitants of the lower regions of the Atlas range make incisions in the branches of the plant, and from these a milky juice exudes, which is so acrid that it excoriates the fingers when applied to them. This exuded juice hardens by the heat of the sun, and forms a whitish-yellow solid, which drops off in the month of September, and forms the euphorbium of commerce.

General Characters.— Euphorbium (commonly called Gum euphorbium) consists of irregular yellowish, slightly friable tears, usually pierced with one or two holes, united at the base, and in which we find the remains of a double spine. These tears are almost odourless; but their dust, applied to the olfactory membrane, acts as a powerful sternutatory. Their taste is at first slight, afterwards acrid and burning. When heated, euphorbium melts, swells up imperfectly, evolves an odour somewhat like that of benzoic acid vapour, takes fire, and burns with a pale flame. Alcohol, ether, and oil of turpentine, are its best solvents; water dissolves only a small portion of it.

Composition.—Euphorbium contains about 60 per cent. of a reddish-brown hard brittle *resin*; which is intensely acrid. This resin is the active constituent of euphorbium.

Therapeutics.—It is now but rarely employed in medicine. It was formerly used as an *emetic* and *drastic purgative* in dropsies; but the violence and danger of its operation have led to its disuse. Sometimes it is employed as an *errhine* in chronic affections of the eyes, ears, or brain; but its local action is so violent that we can only apply it when largely diluted with some mild powder, as starch or flour. Mixed with turpentine, Burgundy pitch, or resin, it is employed in the form of plaster, as a *rubefacient*, in chronic affections of the joints. As a *vesicant*, it is rarely employed. But farriers sometimes employ it as a substitute for cantharides, for blistering horses.

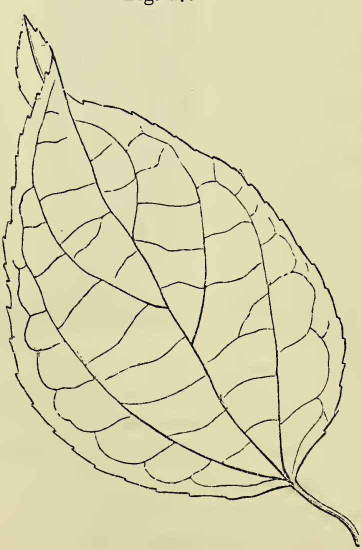
CROTON, *Linn.*

Generic Character.—*Flowers* monœcious, or very rarely diœcious. *Calyx* 5-parted. *Males*: *Petals* 5. *Stamens* 10 or more, distinct. *Females*: *Petals* 0. *Ovary* superior; *styles* 3, each divided into two or more partitions. *Capsule* tricoccous, with one seed in each cell. *Seeds* albuminous.

CROTON TIGLIUM, *Linn.* The Croton Oil Plant.

Specific Character.—A small *tree*, from 15 to 20 feet high; *bark* smooth, ash-coloured. *Leaves* petiolate, thin and membranous, oblong-ovate (fig. 47), sometimes cordate, acuminate, slightly serrate, with two flat round glands at their base; when young, covered on both surfaces, but especially the lower one, with minute stellate hairs. *Raceme* terminal, erect, simple. *Petals* white. *Stamens* 15, distinct. Each cell of the fruit filled by the seed.—*Steph. and Church.* pl. 4.

Fig. 47.



Leaf of Croton Tiglium.

Habitat.—Continent of India, islands forming the Indian Archipelago, and Ceylon.

Crotonis Semina. *Croton Seeds.*

The seeds of Croton Tiglium, *Linn.*

(*Not official.*)

General Characters. — Croton seeds are oval, about 6 lines in length, and 3 or 4 lines in breadth:

the testa is dark brown or blackish; within which is a thin pale internal seed-coat, and a yellowish oily albumen, which envelopes the embryo, whose cotyledons are foliaceous or membranous. 100 parts by weight of the seeds consist of about thirty-six parts of seed-coats, and sixty-four of kernel. The seeds are without odour; their taste is at first mild and oleaginous, afterwards acrid and burning. When heated, they evolve an acrid vapour.

Composition.—Croton seeds contain a *volatile oil*, *fixed oil* (see *Oleum Crotonis*), *crotonic acid*, *crotonin*, *resin*, and other unimportant ingredients.

Physiological Effects and Uses.—Croton seeds are powerful local irritants, causing inflammation in those living parts with which they are placed in contact. A grain of croton seed will frequently act as a powerful purgative. Croton seeds from their poisonous character are rarely or never used in this country. Their powder, may, however, be given in doses of a grain or two.

[§ **Oleum Crotonis.** *Croton Oil.*

The oil expressed from the seeds of Croton Tiglium, *Linn.*]

Commerce.—Croton oil is occasionally imported from India and Ceylon; but the oil now found in the London market is generally expressed in this country.

General Characters and Varieties.—English croton oil varies in colour from brownish-yellow to dark reddish-brown, like the deepest-coloured sherry. Its consistence is unctuous, and increases with age. It has an unpleasant but marked odour, and an acrid taste, and leaves behind an acrid sensation in the fauces. It reddens litmus, and is soluble in ether and in the fixed and volatile oils. The difference of colour depends chiefly on the condition of the seeds; sound and fresh seeds yielding the palest oil. English croton oil, viewed by reflected light, has a greenish tinge, and affords a good example of the phenomenon termed fluorescence. *Foreign* or *East Indian croton oil* is paler than London expressed oil. Some samples are very transparent and pale yellow, like Canada balsam. Others (the more usual sort) are of a pale amber colour. The two oils differ in their relations to alcohol, thus:—If equal volumes of East Indian oil and alcohol (sp. gr. 0·796) be shaken together, an opaque milky mixture is obtained; but if the heat of a spirit-lamp be applied, the mixture becomes transparent and uniform. But if equal volumes of alcohol (sp. gr. 0·796) and English croton oil be shaken together at ordinary temperatures, they form an uniform transparent mixture, and no separation takes place on standing for many weeks, unless the mixture be exposed to a low temperature. The action of alcohol upon croton oil is, however, so much modified by temperature, age of the oil, &c., that it cannot be relied upon as a means of distinguishing the two oils, as stated in the British Pharmacopœia of 1864.

Composition.—The official croton oil is a mixture of fixed oil, crotonic acid, and other constituents of the seeds.

Physiological Effects.—*Rubbed on the skin*, it causes rubefaction and a pustular or vesicular eruption, with sometimes an erysipelatous swelling of the surrounding parts. When rubbed on the abdomen, it sometimes, but not invariably, purges. *Swallowed in doses* of one or two minims, it usually causes an acrid burning taste in the mouth and throat, and acts as a drastic purgative, giving rise to watery stools, and frequently increasing the urinary secretion. Its operation is very speedy. Frequently it causes evacuations in half an hour; yet it is somewhat uncertain, sometimes 6, 8, or even 10 minims having been given at a dose without affecting the bowels. In comparing croton oil with other violently acrid purgatives, we find it distinguished by its speedy operation, the great depression of the vascular system as well as the general feeling of debility which it produces, and by the uncertainty of its action.

Therapeutics.—The value of croton oil as an internal remedial agent depends principally on two circumstances—first, its powerful and speedy action as a drastic cathartic, by which it is adapted for obviating constipation, or for operating on the bowels as a counter-irritant; and secondly on the smallness of the dose, which in practice presents many advantages. These circumstances render it peculiarly applicable in cases requiring powerful and speedy catharsis, and in which the patient cannot swallow, or does so with extreme difficulty, as in *trismus*, *coma*, and *some affections of the throat*; or where he will not swallow, as in *mania*. In all such cases the oil may be dropped on the tongue. *In obstinate constipation*, whether from the poison of lead or from other causes, it has sometimes succeeded where other powerful cathartics had been tried in vain. It is especially serviceable where the stomach is irritable, and rejects more voluminous purgatives. *In torpid conditions of the intestinal canal*, *in tendency to apoplexy*, *in dropsy* unconnected with inflammation, *in paralysis*,—in a word, in any cases in which a powerful and speedy intestinal irritant is required, either for the purpose of evacuating the canal merely, or for acting as a revulsive or counter-irritant, and thereby relieving distant parts, croton oil is a very useful, and, on many occasions, most valuable cathartic. In employing it, two cautions are necessary: it must be avoided, or at least used with great caution, in extreme debility; and it is improper in inflammatory affections of the digestive organs. The great drawback to its use is its uncertainty. In one case it acts with extreme violence, in another it scarcely produces any effect. *In the diseases of children*, when a powerful purgative is required, croton oil has been administered, on account of the minuteness of the dose and the facility of its exhibition. In hydrocephalus, and other head-affections of children, I have several times used it where other cathartics had failed, or where extreme difficulty was experienced in inducing the patients to swallow the more ordinary remedies of this class. *Rubbed on the skin*, croton oil has been employed to produce rubefaction and a pustular eruption, and thereby to relieve diseases of internal organs, on the principle of counter-irritation. *Inflammation of the mucous membrane lining the air passages*, *peripneumonia*, *glandular swellings*, *rheumatism*, *gout*, and *neuralgia*, are some of the diseases against which it has been applied in this way, and doubtless frequently with benefit. It is sometimes used in the undiluted form, but more commonly with twice or thrice its volume of olive oil, oil of turpentine, soap liniment, alcohol, ether, or some other convenient vehicle. But in all the cases just enumerated it has never appeared to me to present any advantage over many other counter-irritants in common use, as tartarated antimony; while the chance of causing purging is, in some cases, an objection to its use. Frictions with it on the abdomen have been used to promote alvine evacuations, but it frequently fails to produce the desired effect. To promote the absorption of the oil in these cases, it should be dissolved in olive oil, oil of turpentine, ether, or alcohol, and the frictions should be assiduously made.

Administration.—The ordinary dose of croton oil is from $\frac{1}{3}$ to 1 minim. In some instances it is simply placed on the tongue, as in coma, tetanus, and mania; or it may be taken in a tea spoonful of syrup. These methods of administering it are, however, objectionable, on account of the acrid taste produced. The usual mode of employing it is in the form of pill, made with confection of roses or bread crumb. Some have employed it in the form of emulsion, flavoured with a carminative oil or a balsamic substance; but the burning of the mouth and throat to which it gives rise is an objection to its use in this form.

Antidotes.—In case of poisoning by croton seeds or croton oil, the first object is to evacuate the stomach. Mild, demulcent, and emollient drinks are then to be given. Alkaline substances have been recommended as chemical antidotes, but their efficacy is not proved. Full doses of opium will be requisite to check the diarrhœa. To relieve a failing circulation, ammonia and brandy may be given, and the warm-bath employed.

[§ **Linimentum Crotonis.** *Liniment of Croton Oil.*

Take of

Croton Oil	. . . . . .	1 fluid ounce.
Oil of Cajuput, Rectified Spirit	of each . .	$3\frac{1}{2}$ fluid ounces.

Mix.]

Rubbed repeatedly on the skin, this liniment should occasion redness and a pustular eruption. It is used as a counter-irritant.

CROTON ELUTERIA, *Bennett.* Sweet-wood Bark, or Bahama Cascarilla.

Specific Character.—A small compact *shrub*, 3–5 feet in height, or occasionally a small *tree*. *Stem* erect, unbranched below; *bark* marked irregularly with greyish stains, and various, mostly crustaceous, lichens. *Leaves* scanty, alternate, 2 or 3 inches in length, petiolate, slightly cordate, acuminate, obtuse, pale or greyish-green, with a few peltate scales above, and a dense clothing of shining silvery scales beneath. *Flowers* monœcious, white, numerous, small, closely set, and shortly pedunculate, in terminal or axillary spikes, very fragrant. *Fruit* a small roundish-oblong lobed capsule, about the size of a pea, covered with silvery peltate scales, 3-celled, each cell containing a dark-brown oblong shining *seed.*—Plate *Pharm. Journ.* 2nd ser. vol. iv. p. 150.

Habitat.—Tolerably abundant in the larger Bahama islands, from one of which, Elutheria, its specific name has been derived, owing to the great supply of bark it formerly yielded.

[§ Cascarillæ Cortex. *Cascarilla Bark.*

The bark of Croton Eluteria, *Bennett.* From the Bahama Islands.]

Commerce.—It is imported from Nassau in New Providence, one of the Bahama Islands; but it frequently comes *viâ* New York.

General Characters.—*Cascarilla bark* is in the form of fragments, or quills about one or two, more rarely three or four, inches long; the fragments being thin, and usually curved transversely, and the quills varying in size from that of a writing-pen to that of the little finger. The bark is compact, hard, moderately heavy, and has a short resinous fracture. Its colour is naturally dull brown, but it is more or less covered with white crustaceous lichens, which give it a corresponding silvery or greyish appearance. The cortical layers are of a dull brown colour. The taste is warm and bitterish; its odour is peculiar, but agreeable, especially when burned. As the absence of adulteration cannot be easily determined when the bark occurs in small fragments, the Pharmacopœia orders the quills.

Composition.—Cascarilla bark contains *volatile oil*, *resin*, and *extractive*. *Volatile Oil.*—This possesses the odour and taste of the bark. Its specific gravity is 0·938. Its colour is variable, sometimes being greenish, at others yellow or blue. It consists of two oils, one boiling at 344°, which contains no oxygen; the other less volatile and oxygenated. Nitric acid converts it into a yellow, pleasant-smelling resin. By distillation with water the bark yields about 1-120th of its weight of this oil. *Resin.*—Separated from the alcoholic tincture of the cascarilla, by the addition of water. It is reddish-brown; has a balsamic, slightly bitter, not astringent taste; and when thrown on hot coals, evolves an agreeable odour. *Extractive.*—Has a bitter, but not balsamic taste. Its watery solution reddens litmus, and is unchanged by either ferruginous solutions or tincture of galls. The perchloride of iron deepens the colour of the infusion of cascarilla. The tincture of galls causes turbidity, and at the end of twenty-four hours a very slight precipitate.

Physiological Effects.—Cascarilla bark belongs to the *aromatic bitters*; that is, it produces the combined effect of an aromatic and of a moderately powerful tonic; but it does not possess any astringency. Some pharmacologists place it with aromatics, others with tonics.

Therapeutics.—Cascarilla bark has been employed as a substitute for cinchona; and, although it is inferior to the latter in tonic and febrifuge properties, its aromatic quality frequently enables it to sit easily on the stomach, without causing either vomiting or purging, which, in irritable affections of the alimentary canal, cinchona is apt to produce. In this country it is principally employed in those forms of dyspepsia requiring an aromatic stimulant and tonic; and in chronic bronchial affections, to check excessive secretion of mucus.

Administration.—The *powder* may be given in doses of from 10 to 30 grains; but it is a less agreeable form than the infusion.

[§ **Infusum Cascarillæ.** *Infusion of Cascarilla.*

Take of

Cascarilla Bark, in coarse powder .	1 ounce.
Boiling Distilled Water . . .	10 fluid ounces.

Infuse in a covered vessel, for one hour, and strain.

Dose.—1 to 2 fluid ounces.]

This is the Dublin formula, which was rather stronger than the infusions of London and Edinburgh. It is a light and aromatic bitter tonic. It is a good vehicle for acids and alkalies. The tincture of cascarilla is usually joined with it, as this preparation quickly spoils.

[§ **Tinctura Cascarillæ.** *Tincture of Cascarilla.*

Take of

Cascarilla Bark, bruised	$2\frac{1}{2}$ ounces.
Proof Spirit	1 pint.

Macerate the cascarilla for forty-eight hours, in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

It is generally employed as an adjunct to tonic and stomachic infusions.

RICINUS COMMUNIS, *Linn.* The Castor Oil Plant.

Botanical Character.—*Stem* perennial, arborescent, sometimes attaining a height of twenty feet or more; younger branches pruinose.

Fig. 48.

Ricinus communis.

a. Stamens. *b.* Anther. *c.* Style and Stigmas. *d.* Transverse section of capsule (regma). *e.* Seed. *f.* Embryo.

Leaves alternate, peltato-palmatifid, 7–10 lobed, the lobes lanceolate, serrated (fig. 48); *petiole* with glands at the apex. *Flowers* in terminal glaucous panicles; the lower male, the upper female. *Calyx*

3–5-parted, valvate. *Petals* 0. *Males: Filaments* numerous, irregularly united into several branches. *Females: Style* short; *stigmas* 3, deeply bi-partite, feathery. *Fruit* prickly, capsular, tricoccous, with one seed in each cell.—*Bot. Mag.* pl. 2,209.

Habitat.—Cultivated all over India; and in other temperate and tropical regions in both hemispheres. The castor oil plant grown in this country is usually an annual, four or five feet high, or sometimes as much as ten feet; but in India, Crete, Sicily, and Spain, it is woody and long-lived, and forms a stem as thick or thicker than a man's thigh, and attains a height of twenty feet or more.

History.—Hippocrates employed the root in medicine. This plant was termed κρότων by the Greeks, and *ricinus* by the Romans, on account of the resemblance of its seeds to a little insect bearing these names, which infests dogs and other animals, and whose common name in English is the *tick.*

Ricini Semina et Folia. *Castor Seeds and Leaves.*

The seeds and leaves of Ricinus communis, *Linn.*

(*Not official.*)

General Characters and Varieties of the Seeds.—The seeds are oval, somewhat compressed, about four lines long, three lines broad, and a line and a half thick; externally they are pale grey, but marbled with yellowish-brown spots and stripes. 100 parts of these seeds contain, exclusive of moisture, 23·82 parts of seed-coats, and 69·09 of kernel or nucleus. The *seed-coats* consist of a hard thick testa and an internal membrane. A fleshy tumid body termed the *caruncule* or *strophiole* is situated at one end of the seed. The *nucleus* of the seed consists of oily *albumen* and an *embryo*, the cotyledons of which are membranous or foliaceous; its taste is sweetish and somewhat almond-like, followed by slight acrimony. Two varieties of the seed are known—the large and the small. The latter yields the most oil.

Composition and Effects.—The nucleus of the seeds, in addition to the *fixed oil*, contains an *acrid principle*, probably of a resinous nature, which resides both in the albumen and the embryo. The residual cake left after the expression of the oil from the seeds excites vomiting when given in doses of about eight grains. A single seed has caused violent and long-continued vomiting and purging; and a girl eighteen years of age died of gastro-enteritis after eating about twenty seeds.

Of the Leaves.—According to Dr. M'William, the leaves are used by the women of Western Africa *to increase the secretion of milk.* They are employed in the form of a decoction, made by boiling a handful of leaves in about a gallon of water, and bathing the breasts with it for fifteen or eighteen minutes, and also by spreading part of the boiled leaves over the breasts. Dr. Tyler Smith verified this statement, but in the hands of other practitioners it has had no effect. The decoction is also reputed to act as an *emmenagogue* and *lactagogue* when administered internally.

[§ **Oleum Ricini.** *Castor Oil.*

The oil expressed from the seeds of Ricinus communis, *Linn.* Imported chiefly from Calcutta.]

Preparation.—Castor oil may be obtained from the seeds by expression or decoction. The chief part if not the whole of the oil consumed in England, whether imported or of home extraction, is procured by expression. Soubeiran considers all processes in which heat is employed as objectionable, as a quantity of fatty acids is produced which render the oil acrid. In America, on the contrary, heat is considered useful by expelling a volatile acrid principle. It cannot be doubted, however, that too high a temperature developes an acrid matter. In England the oil is expressed, either by Bramah's hydraulic press or by the common screw-press, in a room artificially heated. It is afterwards purified by rest, decantation, and filtration ; and then bleached by exposure to light on the tops of houses. The oil expressed in Calcutta is first heated with water in a tin boiler until the water boils, by which the mucilage or albumen is separated as a scum. The oil is then strained through flannel and put into oblong tins. The best East Indian castor oil is sold in London as cold drawn. Much of the American castor oil is prepared by mere expression, rest, and decantation ; but the following are the outlines of the process usually employed in the United States by those who prepare it on the large scale :—The seeds, cleansed from the dust and fragments of the capsules, are placed in a shallow iron reservoir, where they are submitted to a gentle heat insufficient to scorch or decompose them, and not greater than can be readily borne by the hand. The object of this step is to render the oil sufficiently liquid for easy expression. The seeds are then introduced into a powerful screw-press, and submitted to pressure, by which a whitish oily liquid is obtained ; this is then boiled with a considerable quantity of water in clean iron boilers, and the impurities skimmed off as they rise to the surface. The water dissolves the mucilage and starch, and the heat coagulates the albumen, which forms a whitish layer between the oil and water. The clear oil is now removed, and boiled with a minute portion of water until aqueous vapour ceases to arise, and till a small portion of the liquid taken out in a phial preserves a perfect transparency when it cools. The effect of this operation is to clarify the oil, and to render it less irritating by driving off the volatile acrid matter. But much care is requisite not to push the heat too far, lest the oil acquire a brownish hue, and an acrid peppery taste similar to the West Indian oil, which is obtained by decoction, but none of which is imported into this country. In America the seeds yield about 25 per cent. of the best oil.

General Characters.—Castor oil, when fresh and pure, is viscid, and is colourless or pale straw-yellow; it has a mild, somewhat acrid taste, and a slightly nauseous odour. It is lighter than water, its specific gravity being, according to Saussure, 0·969 at 55° F. When cooled down to about 0°, it congeals into a transparent yellow mass. By exposure to the air it becomes rancid, thick, and ultimately congeals, without becoming opaque; and hence it is called a *drying oil.* When heated to a little more than 500° F. it begins to decompose. Castor oil is remarkable for its ready solubility in alcohol. Strictly speaking, castor oil and alcohol exercise a mutual solvent action on each other. When they are shaken together, a homogeneous transparent mixture is obtained. Rectified spirit of wine may be substituted frequently with a similar result; but with some samples of genuine oil the mixture with rectified spirit does not become clear until heat be applied; and, moreover, by standing a separation takes place into two strata, an upper spirituous one, holding oil in solution; and an inferior oleaginous one, containing spirit. In one experiment 65 volumes of oil and 65 volumes of rectified spirit were mixed, and by shaking a transparent uniform mixture was obtained: after several weeks a separation had taken place: the upper stratum measured 12 volumes, the lower one 118 volumes. In the Pharmacopœia castor oil is said to be entirely soluble in one volume of alcohol, and in two volumes of rectified spirit. Ether readily dissolves castor oil.

Varieties and Commerce.—In the London market there are chiefly four sorts of castor oil, namely, the oil expressed in London from imported seeds, East Indian oil, American, and Italian. *English Castor Oil.*—By this is meant castor oil drawn in England from imported seeds. It differs somewhat from the imported oil. I am informed that it is not bleached so completely by exposure to light as the East Indian oil. This is usually ascribed to the seeds having suffered some change before they are pressed. But something is probably due to the mode of preparation, for in England the oil is not heated in boiling water, as it is in Calcutta. *East Indian Castor Oil* is the principal kind employed in this country. It is imported chiefly from Calcutta. It is an oil of exceedingly good quality both with respect to colour and taste, and is obtained at a low price. *American* or *United States Castor Oil* is, for the most part, imported from New York. It is generally of very fine quality, and in the opinion of some writers, has a less unpleasant flavour than the East Indian variety. It is objected to in this country, on the ground of its depositing a white substance (*margarine*) in cold weather—a circumstance which has led some persons to imagine that it had been mixed with another fixed oil. *Italian Castor Oil* has appeared in the London market since the *Exhibition* of 1862. It is an oil of the finest quality and commands the highest price.

Adulteration.—Two kinds of frauds have been practised with regard to castor oil. One consists in the addition of a small quantity of croton oil to it, with the view of increasing its activity. This mixture is introduced into gelatine capsules, and sold as *concentrated castor oil.* This fraud is a very dangerous one. I have heard of several cases in which very violent and dangerous effects were produced by these capsules on pregnant females. The other fraud consists in the adulteration of the castor oil with some bland viscid cheaper oil. It is stated that the oleine of lard, called *lard oil*, has been used for this purpose. This kind of fraud is said to be detected by alcohol, which dissolves the genuine castor oil, but not the admixed oil; and accordingly, in the late Edinburgh Pharmacopœia (and now in the British Pharmacopœia), the test of the purity of the oil is that 'it is entirely soluble in one volume of alcohol.' Unfortunately, however, for this test, castor oil enables other fixed oils (olive, nut, lard, &c.) to dissolve in alcohol, and may be adulterated with 33 per cent. of another fixed oil, and yet be soluble in its own volume of alcohol. If 1 volume of olive oil, 2 volumes of castor oil, and 2 volumes of rectified spirit, be mixed and heated, a transparent homogeneous solution is obtained.

Composition.—Castor oil contains three fatty acids,—*Ricinic*, *Ricino-margaritic*, and *Ricino-stearic*, each in combination with *Glycerine.* It also contains an *acrid resin.*

Physiological Effects.—*Injected into the veins*, castor oil gripes and purges, and causes a nauseous oily taste in the mouth: hence it would appear to have a specific influence over the mucous lining of the alimentary canal. *Swallowed* to the extent of one or two fluid ounces, it usually acts quickly as a mild but tolerably certain purgative or laxative, without producing any uneasiness in the bowels. When castor oil has been taken by the mouth, it may be frequently recognised in the alvine evacuations; but it presents itself under various forms, 'sometimes resembling caseous flakes, or a soap-like scum, floating on the more fluid part of the dejection; occasionally it has been arranged in a form not unlike bunches of grapes, or more nearly of hydatids of a white colour; more generally, however, it is found mixed up with the fæces as a kind of emulsion: and in some few instances it has been discharged under the form of solid tallow-like masses.'

Therapeutics.—Castor oil is used to evacuate the contents of the bowels in all cases where we are particularly desirous of avoiding the production of abdominal irritation, especially of the bowels and urino-genital organs. The principal, or I might say the only, objection to its use in these cases, is its somewhat nauseous taste. The following are the leading cases in which we employ it:—*In inflammatory affections of the alimentary canal*, as enteritis, peritonitis, and dysentery, a mild but certain purgative is oftentimes indicated. No substance, I believe, answers the indication better, and few so well, as castor oil. *In obstructions and spasmodic affections of the bowels*, as intussusception, ileus, and colic, especially lead colic, this oil is the most effectual evacuant we can employ. *In inflammatory or spasmodic diseases of the urino-genital organs*, inflammation of the kidneys or bladder, calculous affections, gonorrhœa, or stricture, castor oil is a most valuable purgative. *In affections of the rectum*, especially piles, and stricture, no better evacuant can be employed. *As a purgative for children and pregnant women*, as well as after parturition, it is useful on account of its mildness. *In habitual costiveness*, also, it has been recommended. *As an eliminant in Asiatic or malignant cholera*, it has been strongly recommended by Dr. Johnson of King's College and extensively tried, at first with very varying results, but its use is gradually gaining ground among medical practitioners, and has the high authority of Sir Thomas Watson in its favour.

Administration.—The dose of castor oil for children is one or two tea spoonfuls and for adults one to three table spoonfuls. To cover its unpleasant flavour, some take it floating on spirit (especially gin), but which is frequently contra-indicated; others on coffee, or on peppermint or some other aromatic water or infusion of cloves; or it may be made into an emulsion by the aid of the yolk of egg or mucilage of tragacanth, or the addition of a little solution of potash.

Pharmaceutical Uses.—It is used to combine the ingredients of the compound calomel pill. It is also an ingredient in flexible collodion and compound liniment of mustard.

ROTTLERA TINCTORIA, *Roxb.* The Kamala Plant.

Synonym.—Mallotus Philippiensis, *Mull.*

Botanical Character.—A small *tree*, from ten to fifteen feet in height, with alternate, oblong, pointed, entire *leaves*, which are 3-ribbed, and 4–8 inches long. *Flowers* diœcious, in terminal panicles. *Males: Calyx* 2-cleft. *Corolla* 0. *Stamens* 30–40. *Females: Calyx*, 3–5 toothed. *Corolla* 0. *Ovary* ovate. *Styles* 3, feathered. *Capsule* roundish, 3-furrowed, 3-celled, 3-valved, the size of a small cherry, covered with minute sessile roundish semi-transparent glands of a bright red colour. *Seed* solitary, globular.—*Roxb. Corom.* pl. 168.

Habitat.—India, Ceylon, China, Northern Australia, and Southern Arabia.

[§ **Kamala.** *Kamala.*

A powder which consists of the minute glands that cover the capsules of Rottlera tinctoria, *Roxb.* Imported from India.]

General Characters.—It is of an orange-red or brick-red colour, and is known throughout India, where it is used as a dye for silk, by the names of Kamala and Wurrus. When examined with a microscope, it is seen to consist of minute garnet-red semi-transparent roundish granules, more or less mixed with stellate hairs and grains of sand, the former of which may be easily removed by sifting. It resembles lycopodium in the difficulty with which it is mixed with water, and by igniting when thrown over the flame of a candle. It has little smell or taste, is insoluble in cold water, and nearly so in boiling water; but ether, alcohol, and solutions of caustic alkalies or of alkaline carbonates, dissolve a considerable part of it, and acquire a deep red colour. Ether dissolves most of it; the residue consisting principally of tufted hairs. It should be free from sand or earthy impurities generally.

Varieties.—A new kind of kamala has been described by Dr. Flückiger of Bern, which appears to be derived, like the official kamala, from a species of *Mallotus*. This new variety occurs as a dark chocolate-coloured powder, consisting of grains of larger size than those of ordinary kamala and of very different structure; it is almost free from any earthy admixture, which is but very rarely the case with the official variety.

Composition.—Kamala appears to consist of *resinous colouring substances*, *gum*, *cellulose* and *albuminous matters*. From the ethereal solution of the resinous part Dr. Thomas Anderson, of Glasgow, has obtained a yellow crystallised body, which he has called *Rottlerine*, $C_{11}H_{10}O_3$. It is insoluble in water, sparingly soluble in alcohol, but readily soluble in ether and alkaline solutions. Leube was unable to obtain this principle, and considers that the active constituent of kamala is the resin, and that a tincture, or a dried ethereal extract is the best preparation of it.

Physiological Effects.—Our knowledge of the physiological and therapeutic effects of kamala are chiefly derived from the observations of Drs. Mackinnon and Anderson in India. Kamala usually purges speedily. Some nausea and slight griping are frequently experienced, but quite as frequently no uneasiness whatever is felt from its operation. A single dose of 180 grains usually purges from five to seven times. In feeble persons such a dose may operate twelve or fourteen times.

Therapeutics.—Dr. Mackinnon administered the powder to fifty patients suffering from tænia, and only twice failed to expel the worm. In almost every case the long slender neck of the worm appeared in the motion. He came to the conclusion 'that kamala is a safe and efficient remedy for tapeworm, and more certain than either turpentine or kousso.' Dr. Anderson writes:—'The worm is generally passed entire, and almost always *dead*, and in all the cases I have examined (fifteen) *I was able to detect the head*.' He was only aware of two failures out of ninety-five cases in which it was prescribed. It has not yet had an extensive trial in this country, but the reports of its efficacy are mostly favourable.

Administration.—Dr. Mackinnon considers that to a strong European 180 grains may be safely given as a dose, but that to a person of feeble habit, or to a female, 90 grains, followed if necessary by half a fluid ounce of castor oil, is a sufficient dose. Until we have had more experience of it in this country, the dose may be stated as from 30 to 150 grains. A second dose is seldom required. The Pharmacopœia has given no preparation of kamala, but Dr. Anderson says that a tincture, formed by macerating eight ounces of the powder in twenty fluid ounces of rectified spirit, and taken in doses of from one to four fluid drachms, is more certain and milder than the powder, and is rarely followed by nausea and griping.

MANIHOT UTILISSIMA, *Pohl.* The Cassava Plant.

Synonyms.—Jatropha Manihot, *Linn.*; Janipha Manihot, *H. B. K.*

Botanical Character.—*Root* large, whitish-yellow, thick, tubercular, fleshy; containing an acrid, milky, highly poisonous juice. *Leaves* with very long petioles, deeply 7-parted, in a palmate manner; the segments lanceolate, acuminate, attenuated at the base, quite entire, the outer ones smaller, unequal, diverging, straggling. *Flowers* axillary, racemose, monœcious. *Calyx* petaloid, campanulate, 5-cleft, convolute. *Stamens* 10, inserted on the margin of a fleshy disk, free, the alternate ones shorter: *filaments* filiform; *anthers* turned inwards, 2-celled. *Ovary* placed on the fleshy disk, 3-celled, with 1 ovule in each cell. *Style* short. *Stigmas* 3, many-lobed, the lobes consolidated into a conical sinuated-sulcated mass. *Capsule* 3-coccous; the *cocci* 2-valved and 1-seeded.

Varieties.—Two varieties of this plant (which are by some considered as distinct species) are known under the names of the *bitter cassava* and *sweet cassava*: the latter is the *Manihot Aipi*, Pohl., and the former *Manihot Janipha*, Pohl.

Habitat.—Native of the Brazils; where, as well as in other parts of South America, it is cultivated.

General Characters and Products of the Roots.—1. *Bitter cassava root* is large and tubercular, and abounds in a poisonous milky juice. It is difficult to distinguish it by its appearance from the sweet cassava root; but it is devoid of the tough, fibrous, or woody filaments found in the heart of that root; and it does not become soft, like it, by boiling or roasting. *Cassava meal* is obtained by subjecting the grated root to pressure to express the juice, and then drying and pounding the residual cake. Of this meal *cassava bread* is made. The expressed juice by repose deposits the starch called *cassava starch*, of which *tapioca* is made. A sauce called *casareep* or *cassireepe* is made from the juice. 2. *Sweet cassava root* resembles the bitter cassava root in external appearance; but unlike the latter, it is not poisonous. By boiling or roasting it becomes soft, and is used at table. *Cassava meal* and *bread*, *cassava starch*, and *tapioca*, are prepared from the sweet as well as from the bitter cassava root.

Composition.—The principal constituents of bitter cassava root are *hydrocyanic acid* and *starch*. No hydrocyanic acid is found in the sweet cassava root, which accounts for its non-poisonous character.

Cassava Starch or Tapioca Meal.

The starch deposited from the expressed juice of the roots of the Manihot utilissima, *Pohl.*

(*Not official.*)

General Characters.—This starch is found in two states, which are known under the names of *cassava starch* and *tapioca*. α. *Cassava starch; tapioca meal; Brazilian arrow-root.*—The starch deposited from the expressed juice of the cassava root, after being washed and dried in the air without heat, constitutes the *tapioca meal* or *Brazilian arrow-root* of commerce. It is usually imported into this country from Rio Janeiro. It is white and pulverulent, and resembles in external appearance maranta starch. When examined by the microscope, however, it is readily distinguished. Cassava starch is then found to consist of small single granules, which, in the living plant, were united in groups or compound granules, each composed of 2, 3, or 4 grains. Most of the granules are mullar-shaped, and, therefore, have been united in groups of two each: when seen endwise, they appear circular or globular. Some of them are truncated egg-shaped granules, with one or two facets at the truncation. The hilum is circular, surrounded with rings, and bursts in a stellate manner. These statements apply equally to *bitter cassava starch* and *sweet cassava starch.*

β. *Tapioca.*—This is imported from Bahia and Rio Janeiro. The tapioca imported from Rio Janeiro is without exception much whiter, and has a more pearl-like appearance, than that from Bahia, which is coarse and has a yellowish tint. Tapioca is nothing more than cassava starch which while moist or damp has been heated, for the purpose of drying it, on hot plates. By this treatment the starch granules swell, many of them burst, and the whole agglomerate in small irregular masses or lumps. In consequence of the change thus effected in the starch granules, tapioca is partially soluble in cold water; and the filtered cold infusion strikes a blue colour with tincture of iodine. The drying to which it has been subjected renders it difficult of solution. In boiling water it swells up, and forms a transparent, viscous jelly-like mass. Submitted to prolonged ebullition in a large quantity of water, it leaves an insoluble residue, which precipitates. This, when diluted with water and coloured by iodine, appears to consist of mucous flocks.

Effects and Uses.—Its effects and uses are like those of other starches. Made into puddings, tapioca is extensively employed as a dietetical substance. Boiled in water or milk, and flavoured with sugar, spices, or wine, according to circumstances, it is used as an agreeable, nutritious, light, easily digestible article of food for the sick and convalescent. It is devoid of all irritating and stimulating properties.

ARISTOLOCHIACEÆ, *Lindl.* The Birthwort Order.

ARISTOLOCHIA SERPENTARIA, *Linn.* The Virginian Snake Root.

Botanical Character.—*Stem* flexuous, ascending. *Leaves* alternate, cordate, acuminate, on both sides pubescent. *Peduncles* nearly radical, unifloral. *Calyx* tubular, ventricose at the base, dilated and extended at the apex. *Anthers* 6, subsessile, inserted on the style. *Stigma* 6-lobed. *Capsule* 6-angled, 6-celled.—*Steph. and Church.* pl. 180.

Habitat.—North America, in Western Pennsylvania and Virginia, in Ohio, Indiana, and Kentucky.

[§ Serpentariæ Radix. *Serpentary Root.*

The dried rhizome of Aristolochia Serpentaria, *Linn.* From the southern parts of North America.]

General Characters.—It consists of a tuft of long, slender, yellowish or brownish rootlets, attached to a roundish contorted head or rhizome. The odour is aromatic and agreeable, and the taste warm, bitter, and camphoraceous.

Composition.—Serpentary root contains *volatile oil* and *bitter extractive*. *Volatile Oil.*—Grassmann obtained only half a fluid ounce from 100 pounds of the root. Its colour is yellowish, its odour powerful, its taste not very strong. Grassmann compares the odour and taste to those of valerian and camphor combined. *Bitter Principle, Extractive.*—This is very bitter, and slightly acrid. It is soluble in both water and spirit. Its solution, which is yellow, is rendered brown by alkalies, but is unchanged by the ferruginous salts.

Physiological Effects.—In *small doses* serpentary root promotes the appetite. In *large doses* it causes nausea, flatulence, uneasy sensation at the stomach, and frequent but not liquid stools. After its absorption, it increases the frequency and fulness of the pulse, augments the heat of the skin, and promotes secretion and exhalation. Furthermore, it would appear, from the experiments before referred to, that it causes disturbance of the cerebral functions, and produces headache, sense of oppression within the skull, and disturbed sleep. In these properties serpentary root bears some analogy to, but is much weaker than, camphor.

Therapeutics.—Its employment is indicated in cases of torpor and atony. It was formerly termed *alexipharmic*, on account of its fancied power of curing the bite of a rattlesnake and of a mad dog. At the present time it is rarely employed. It was formerly much esteemed as a stimulant in *fevers*, both continued and intermittent.

Administration.—The dose of it in substance is from 10 to 30 grains. The infusion is the best form for its administration.

Pharmaceutical Use.—Serpentary root is an ingredient in the compound tincture of cinchona.

[§ **Infusum Serpentariæ.** *Infusion of Serpentary.*

Take of

Serpentary Root, bruised . .	$\frac{1}{4}$ ounce.
Boiling Distilled Water . .	10 fluid ounces.

Infuse in a covered vessel, for two hours, and strain.

Dose.—1 to 2 fluid ounces.]

[§ **Tinctura Serpentariæ.** *Tincture of Serpentary.*

Take of

Serpentary Root, in coarse powder .	$2\frac{1}{2}$ ounces.
Proof Spirit	1 pint.

Macerate the serpentary for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of the spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.]

Dose.—½ to 2 fluid drachms.]

Tonic and diaphoretic. Used as an adjunct to tonic infusions.

LAURACEÆ, *Lindley*. The Laurel Order.

CINNAMOMUM, *Nees*.

Generic Character.—*Leaves* ribbed. *Leaf-buds* naked. *Flowers* panicled, or rarely fascicled, hermaphrodite or polygamous. *Calyx* 6-cleft, with the limb deciduous. *Stamens* 12, in 4 rows; the 9 external ones fertile, the 3 inner ones capitate, abortive; the three most internal of the fertile stamens having 2 sessile glands at their base: *anthers* 4-celled, the 3 inner turned outwards. *Ovary* 1-celled, with 1 ovule. *Fruit* baccate, seated in a cup-like calyx.

CINNAMOMUM ZEYLANICUM, *Breyn*. The Ceylon Cinnamon.

Specific Character.—*Branches* somewhat 4-cornered, smooth. *Leaves* opposite, ovate or ovate-oblong, tapering to an obtuse point, 3-ribbed, reticulated on the under side, smooth (fig. 49). *Panicles* terminal and axillary, stalked. *Flowers* hoary and silky. *Wight, Icon. Plant. Ind. Orient.* pl. 123.

Fig. 49.

Cinnamomum zeylanicum.

[§ Cinnamomi Cortex.

Cinnamon Bark.

The inner bark of shoots from the truncated stocks of Cinnamonum zeylanicum, *Breyn*. Imported from Ceylon, and distinguished in commerce as Ceylon Cinnamon.]

Production.—The cinnamon bark of Ceylon is obtained from the cultivated plant. The principal cinnamon gardens lie in the neighbourhood of Columbo. Percival states that the bark-peelers, having selected a tree of the best quality, lop off such branches as are three years old, and which appear proper for the purpose. But Simmonds says that, although the trees in their wild state will grow ordinarily to the height of thirty feet, when cultivated for their bark they are not permitted to rise above ten feet. The general appearance of the plantation is that of a copse with laurel leaves and stems about the thickness of the common hazel, and when in full bloom the cinnamon bushes have a very beautiful appearance. The best cinnamon is obtained from the stalks or twigs which shoot up in a cluster of eight or ten together from the roots after the parent bush or tree has been cut down. The shoots are cut once in about three years, and those which are considered fit for cutting are usually about three-quarters of an inch in diameter, and five feet or more long. This agrees with the information which Drs. Farre and Garrod received from Mr. Power and Mr. Rudd, of Ceylon. Mr. Rudd writes, that the young cinnamon trees are always cut down, that the part cut down forms coarse cinnamon, and the shoots from the stock the fine cinnamon. Mr. E. R. Power, who acted as Commissioner for Ceylon in the *Exhibition* of 1862, also writes to nearly the same effect. From each old root, one or two sticks are cut, care being taken to cut the stick obliquely, in order to assist the young shoot which grows from this stem. It generally comes to perfection in the cultivated gardens in eighteen months. The peeling is effected by making two opposite, or when the branch is thick, three or four, longitudinal incisions, and then elevating the bark by introducing the peeling knife beneath it. In twenty-four hours the epidermis and greenish pulpy matter are carefully scraped off. 'The bark is carefully sorted into firsts, seconds, and thirds; that near the middle and upper end of the sticks being used for firsts, a lower portion for seconds, and the lowest and coarser parts and old sticks for thirds.' In a few hours smaller, i.e. narrower, quills are introduced into the larger ones, and in this way a congeries of quills formed, often measuring forty inches or more in length. The bark is then dried in the sun, and made up into bales. 'Care is taken to fill up each pipe with the same kind of bark as that which is outside, and as few joints are placed in each pipe as possible. There is no fixed number of pieces for filling the pipes; sometimes as many as eight or ten are used, according to the fineness of the bark.' The finest pipes are usually well-filled, as the preservation of the odour and flavour is greatly assisted by excluding the air.

General Characters.—Cinnamon is in closely rolled quills, each of which contains several smaller quills. It has a light yellowish-brown colour, a fragrant odour, and warm sweet aromatic taste. The bark is thin (the finest being scarcely thicker than drawing-paper), smooth, moderately pliable, breaking readily in the longitudinal direction, but transversely with a splintery fracture. Ceylon cinnamon is characterised by each single quill being cut obliquely at the bottom, whereas the other kinds are cut transversely. In the London market three qualities of Ceylon cinnamon are distinguished; viz. *firsts*, *seconds*, and *thirds*. Inferior kinds are thicker, darker, browner, and have a pungent, succeeded by a bitter taste. When cinnamon arrives in London, it is unpacked and examined; all the mouldy and broken pieces are removed from it. It is then re-made into bales and cut. These bales are cylindrical, about three feet six inches long, but of variable diameter, perhaps sixteen inches on the average. The cinnamon in boxes and chests is usually the small, inferior, and mouldy pieces.

Varieties.—*Ceylon Cinnamon* is the most esteemed kind, and is alone official. *Tellicherry or Bombay Cinnamon* in appearance is equal to the Ceylon kind, but the internal surface of the bark is more fibrous, and the flavour is inferior. *Madras or Malabar Cinnamon* is coarser and inferior in flavour to both the other kinds. In thickness it approximates to Cassia bark. Both the Bombay and Malabar cinnamon resemble the Ceylon cinnamon in the composite character of their quills, though the latter, on account of its thickness, is frequently only double. Other varieties are *Java Cinnamon* and *Cayenne Cinnamon*, but the latter is unknown in the London market. The former is imported almost exclusively into Holland, and thence distributed throughout Europe. It has much less flavour than Ceylon cinnamon, and is inferior in quality to it.

Substitution.—In commerce, Cassia bark (called on the Continent Chinese cinnamon) is frequently substituted for cinnamon. (See *Cassia Bark*, p. 546.) It is distinguished by its greater thickness, its short resinous fracture, its less delicate and stronger flavour, its shorter and single quills, and in its being packed in small bundles. Moreover it may be distinguished chemically by the action of iodine on its infusion (see *infra*). The difference of flavour is best distinguished when the barks are ground to powder.

Composition.—Cinnamon contains *volatile oil* and *tannic acid.* Perchloride of iron causes a greenish flocculent precipitate in infusion of cinnamon (*tannate of iron*). Solution of gelatine also occasions a precipitate in the infusion (*tannate of gelatine*). A decoction of cinnamon bark may be distinguished from a decoction of cassia bark by tincture of iodine, which gives a blue colour (*iodide of starch*) with the latter, but not with the former. Both barks contain starch, but cinnamon appears to contain a larger proportion of some principle (tannic acid?) which destroys the blue colour of iodide of starch; for if the decoction of cassia bark rendered blue by iodine be added to the decoction of cinnamon bark, the blue colour disappears.

Physiological Effects.— Cinnamon, *in moderate doses*, stimulates the stomach, produces a sensation of warmth in the epigastric region, and promotes the assimilative functions. The repeated use of it disposes to costiveness. *In full doses* it acts as a general stimulant to the vascular and nervous systems. Some writers regard it as acting specifically on the uterus.

Therapeutics.—Cinnamon is frequently added to other substances—as to the bitter infusions to improve their flavour, and to purgatives to check their griping qualities. As a cordial, stimulant, and tonic, it is indicated in all cases characterised by feebleness and atony. As an astringent, it is employed in diarrhœa, usually in conjunction with chalk, the vegetable infusions, or opium. As a cordial and stimulant, it is exhibited in the latter stages of low fever. In flatulent and spasmodic affections of the alimentary canal it often proves a very efficient carminative and antispasmodic. It checks nausea and vomiting. It has also been used in uterine hemorrhage.

Administration.—The dose of it in substance is from 10 to 20 grains.

Pharmaceutical Uses.—Cinnamon is an ingredient in aromatic sulphuric acid, decoction of logwood, infusion of catechu, compound powder of catechu, aromatic powder of chalk, compound powder of kino, powder of kino and opium, compound tincture of cardamoms, tincture of catechu, tincture of cinnamon, compound tincture of lavender, and wine of opium.

[§ **Aqua Cinnamomi.** *Cinnamon Water.*

Take of

Cinnamon Bark, bruised . . .	20 ounces.
Water	2 gallons.

Distil one gallon.]

Cinnamon water is principally employed as a vehicle for other medicines. It is aromatic and carminative. It is an ingredient in chalk mixture, guaiacum mixture, and mixture of spirit of French wine. Its dose is 1 to 2 or more fluid ounces.

[§ **Pulvis Cinnamomi Compositus.** *Compound Powder of Cinnamon.*

Synonym.—Pulvis Aromaticus, *Edin.*

Take of

Cinnamon Bark, in powder	of each . .	1 ounce.
Cardamom Seeds, in powder		
Ginger, in powder		

Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle.

Dose.—3 to 10 grains.]

Aromatic and carminative.

[§ **Tinctura Cinnamomi.** *Tincture of Cinnamon.*

Take of

Cinnamon Bark, in coarse powder . .	$2\frac{1}{2}$ ounces.
Proof Spirit	1 pint.

Macerate the cinnamon for forty-eight hours, in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

It is commonly used as an adjuvant to cretaceous, astringent, tonic, and purgative mixtures. It has also been employed in uterine hemorrhage.

[§ **Oleum Cinnamomi.** *Oil of Cinnamon.*

The oil distilled from Cinnamon Bark.]

Preparation.—Oil of Cinnamon is obtained in Ceylon by macerating the inferior pieces of the bark, reduced to a coarse powder, in sea-water for two days, when both are submitted to distillation.

General Characters.—As imported, the oil varies somewhat in its colour, from yellow to cherry-red; the paler varieties are most esteemed. The deeper colour is due to the oxidation of the oil. When fresh it is always yellowish, but if of good quality it gradually becomes red by keeping. Its odour is pleasant, and purely cinnamomic. Its taste is at first sweetish, afterwards cinnamomic, burning, and acrid. It sinks in water.

Composition.—Oil of cinnamon of commerce consists of a mixture of two or more bodies. The principal constituent, and which is considered to be oil of cinnamon properly so called, is represented by the formula, C_9H_8O. By exposure to the air, oil of cinnamon absorbs oxygen, and forms cinnamic acid, two resins, and water.

Adulteration.—On account of their great difference in commercial value, and resemblance in physical and chemical properties, oil of cassia is sometimes substituted for, or mixed with, genuine oil of cinnamon. The finer and more delicate odour of the latter is the chief distinction between them.

Therapeutics.—Oil of cinnamon is sometimes employed as a powerful stimulant in paralysis of the tongue, in syncope, and in cramp of the stomach. But its principal use is as an adjuvant to other medicines.

Dose.—1 to 3 minims.

CINNAMOMUM CASSIA, *Blume*. The Cassia Plant.

Synonym.—Cinnamomum aromaticum, *Nees.*

Specific Character.—*Stem* arborescent. *Leaves* opposite, or sometimes alternate, oblong-lanceolate, triple-ribbed, the veins vanishing at the apex of the leaf. *Petioles* and *young branches* silky, tomentose.

Habitat.—China.

Cassia Lignea. *Cassia Bark.*

The dried inner bark of Cinnamomum Cassia, *Blume.*

(*Not official.*)

General Characters and Commerce.—Cassia bark is regarded on the continent of Europe, and in America, as a sort of cinnamon. In English commerce it is, however, always distinguished. It is made up in bundles, which are tied with slips of bamboo. It has the same general appearance, smell, and taste, as cinnamon; but its substance is thicker, its appearance coarser, its colour darker, browner, and duller; its flavour, though cinnamomic, is much less sweet and fine than that of Ceylon cinnamon, but more pungent, and followed by a bitter taste; it is less closely quilled, and breaks shorter, than genuine cinnamon (see p. 543). The quills are also generally single, or rarely double; whereas cinnamon quills are compound. It is imported in chests from Canton, Singapore, Calcutta, Bombay, and Manilla, but it is derived originally from China, and the largest quantity is now imported directly from Canton.

Varieties. — *China cassia* (sometimes called China cinnamon) is the best kind. Other varieties have been distinguished as *Malabar*, *Manilla*, and *Mauritius.* The latter, however, is nothing more than China cassia, and the origin of the Malabar and Manilla varieties is very doubtful.

Composition and Chemical Characteristics.—*Cassia bark* contains *volatile oil*, *resin*, *gummy* (*astringent*) *extractive*, and other unimportant constituents. Perchloride of iron renders decoction of cassia bark dark green, and causes a precipitate (*tannate of iron*). Gelatine also produces a precipitate (*tannate of gelatine*). If tincture of iodine be added to it, a blue colour (*iodide of starch*) is produced. By this test, cassia may be distinguished from genuine cinnamon (see p. 543). *Volatile Oil of Cassia.*—This is obtained from cassia bark by distillation with water. Its properties and composition are similar to those of oil of cinnamon already described. Its odour and flavour, however, are inferior to those of the latter. Its colour is usually pale yellow. Nitric acid converts it into a crystalline mass. Its effects and uses are similar to those of oil of cinnamon.

Physiological Effects.—Similar to those of cinnamon, but commonly regarded as being somewhat more astringent.

Therapeutics.—Its uses are the same as those of cinnamon.

Dose.—*Of Cassia bark*, 10 to 30 grains. *Of Oil of Cassia*, 1 to 3 minims.

Cassiæ Flores Immaturæ. *Cassia Buds.*

The dried flower buds of Cinnamomum Cassia, *Blume.*

(*Not official.*)

General Characters.—Cassia buds are the produce of China, and are probably procured from the same plant which yields cassia bark. Mr. Reeves states that he has always understood and has no doubt that both cassia buds and cassia bark are obtained from the same plant. Each cassia bud consists essentially of the dried calyx closely surrounding the ovary. Cassia buds bear some resemblance to cloves, but are smaller,—or to nails with round heads; they have the odour and flavour of cassia bark or cinnamon.

Composition.—Cassia buds have not been analysed; but their constituents are doubtless similar to those of cassia bark; they yield a *volatile oil* by distillation, and contain *tannic acid.*

Uses.—Analogous to those of cassia bark. They have been used as a condiment and in medicine.

CAMPHORA OFFICINARUM, *Nees.* The Camphor Laurel.

Botanical Character.—Young *branches* yellow and smooth. *Leaves* alternate, evergreen, oval, acuminate, attenuate at the base, bright-green and shining above, paler beneath, triple-ribbed, glandular in the axils of the principal veins. *Petioles* from 1 to 1½ inch long. *Flowers* hermaphrodite, panicled, small, yellowish-white. *Calyx* 6-cleft, papery, with a deciduous limb. *Fertile stamens* 9, in 3 rows; the inner with 2 stalked compressed glands at the base; *anthers* 4-celled, the outer turned inwards, the inner outwards, bursting by valves; 3 *sterile stamens*, shaped like the last, placed in a whorl, alternating with the stamens of the second row; 3 *other stamens* stalked, with an ovate glandular head. *Fruit* baccate, round, blackish-red, size of a black currant. *Seed* solitary.—*Woodv.* p. 419, pl. 155 (*Laurus Camphora*).

Habitat.—China, Japan, and Cochin China. Introduced into Java from Japan.

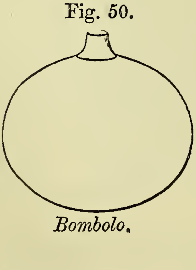
[§ **Camphora.** *Camphor.*

A concrete volatile oil, obtained from the wood of Camphora officinarum, *Nees.* Imported in the crude state from China and Japan, and purified by sublimation in this country.]

Crude Camphor.—*Varieties, Preparation, General Characters, and Commerce.*—Two kinds of *unrefined* or *crude camphor* are known in commerce; one is the produce of China, or rather of the island of Formosa, the other of Japan. *China Camphor, Formosa Camphor.*—This is the *ordinary crude camphor.* To obtain crude camphor in Formosa the chopped branches are steeped in water, and afterwards boiled until the camphor begins to adhere to the stick used in stirring. The liquid is then strained, and, by standing, the camphor concretes. Alternate layers of a dry earth, finely powdered, and of this camphor, are then placed in a copper basin to which another inverted one is luted, and sublimation effected. This kind of crude camphor is imported from Singapore and Bombay, in square chests lined with lead-foil, and containing from $1\frac{1}{4}$ to $1\frac{1}{2}$ cwt. It is chiefly if not entirely produced in the island of Formosa, and is brought in very large quantities to Canton, whence foreign markets are supplied. It consists of dirty-greyish grains, which are smaller than those of Dutch camphor. Its quality varies: sometimes it is wet and impure, but occasionally it is as fine as the Dutch kind. *Japan Camphor.*—Japan or Dutch camphor is brought to Europe by way of Batavia. It is imported in tubs (hence it is called *tub camphor*). It consists of pinkish grains, which, by their cohesion, form various sized masses. It differs from the ordinary crude camphor in having larger grains, in being cleaner, and in subliming usually at a lower temperature. In consequence of these properties, it fetches a somewhat higher price in the market. There is not much brought to England, and of that which does come the greater part is re-shipped to the Continent.

Refinement.—Crude Camphor is refined by sublimation. The method adopted in this metropolis is, as I am informed, as follows:—The vessels in which this sublimation is effected are called *bomboloes.*

Fig. 50.



Bombolo.

They are made of very thin flint glass, and weigh about 1 pound each. Their shape is that of an oblate spheroid, whose shorter or vertical axis is about ten inches, and the longer or horizontal axis about twelve inches. They are furnished with a short neck. When filled with crude camphor, they are imbedded in the sand-bath, and heated, and when the camphor is melted, lime is added, and the heat raised so as to make the liquid boil. The vapour condenses on the upper part of the vessel. As the sublimation proceeds, the height of the sand around the vessel is diminished. In about forty-eight hours the process is usually completed. The vessels are then removed and their mouths closed with tow; water is sprinkled over them by watering-pots, by which they are cracked. When quite cold, the bowl of camphor, which weighs about eleven pounds, is removed, and trimmed by paring and scraping. In this process the lime retains the impurities and a portion of the camphor; hence, to extract the latter the lime is submitted to a strong heat in an iron pot with a head to it, and the sublimed product refined by a second sublimation. Drs. Taylor and Rees witnessed this process at a large chemical factory in the neighbourhood of London. The bombolo was not there used in the mode described by the author, but the short neck was fitted to the mouth of the subliming-pot, which was imbedded in sand. The thin glass globe receives the pure sublimed camphor in a thick crust. The glass vessel is then broken, and a hollow hemisphere of camphor is removed from it.

Refined Camphor.—*General Characters.*—*Refined Camphor* (which is alone official) is met with in the form of large hemispherical bowls, perforated in the middle; or in portions of such bowls. It is solid at ordinary temperatures, white, translucent, crystalline, soft, and somewhat tough, but may be readily powdered by the addition of a few drops of rectified spirit. It has a powerful penetrating odour, and a pungent taste followed by a sensation of cold; floats on water; volatilises slowly at ordinary temperatures; and sublimes entirely when heated. In closed vessels exposed to light it sublimes and crystallises on the sides of the bottle. It burns in the air like the volatile oils generally. It fuses at 347° F., and forms a transparent liquid, which boils at 400° F., and in close vessels condenses unchanged. It is lighter than water, its specific gravity being usually stated as 0·9867. The density of camphor, however, varies considerably, according to the temperature. At 32° it is said to be denser than water. And when saturated with water, it sinks in this liquid at a temperature below 40°. By raising the temperature of the water, the camphor again rises to the surface. Small pieces, when thrown on this liquid, are violently agitated, and present a gyratory motion, which ceases directly a drop of oil is placed on the water. Camphor is but very slightly soluble in water; 1,000 parts of the latter dissolving only one part of camphor at the ordinary pressure of the atmosphere. Alcohol readily dissolves it; but if water be added to the solution, the camphor is precipitated. Ether, chloroform, the oils (both fixed and volatile), and the acids, also dissolve it.

Composition and Chemical Characteristics.—Camphor is represented by the formula $\mathbf{C_{10}H_{16}O}$. Dumas has suggested that camphor may be regarded as an oxide of a base (as yet hypothetical) which he has called *camphogen*. In its combustibility, volatility, powerful odour, solubility in alcohol and ether, and almost insolubility in water, camphor agrees with the volatile oils; and in being concrete or solid at ordinary temperatures, it obviously belongs to the class of *stearoptenes* or *solid volatile oils.* It is further distinguished by the remarkable character of its odour, by its not blackening in burning, and by its not being converted into resin by the oxygen of the air or by nitric acid. The camphor here described may be designated *official* or *laurel camphor*, in order to distinguish it from *Borneo camphor*, or *camphor of the Dryobalanops*, as well as from *artificial camphor. Laurel camphor* absorbs hydrochloric acid gas, and forms a transparent colourless liquid; *Borneo camphor*, on the contrary, is scarcely acted on by this acid gas. If Borneo camphor be boiled in nitric acid, it is converted into common camphor. The substance called *artificial camphor*, which is formed when hydrochloric acid is passed into oil of turpentine, surrounded by oil, usually evolves some hydrochloric acid when volatilised, and burns in the air with a greenish sooty flame: if the flame be blown out, the evolved vapour has a terebinthinate odour. By these characters artificial camphor may be distinguished from laurel camphor.

Physiological Effects.—Its local action on the mucous surfaces, the denuded derm, and ulcers, is that of an *acrid.* A piece of camphor held in the mouth for half an hour caused the mucous lining of this cavity to become red, hot, swollen, and painful. The pain and uneasiness which camphor, when swallowed in substance, sometimes produces in the stomach, is likewise imputed to its local action as an acrid. When applied to the denuded derm, or to ulcers, it produces pain, and appears to act as an irritant. Camphor has been charged with producing brittleness of the teeth when it has been used for a considerable time as a dentifrice, but without any valid foundation. *Camphor becomes absorbed*, and is thrown out of the system by the bronchial membrane principally, but also by the skin. Cullen, however, says that camphor, though given very largely, is never to be discovered by its smell in the urine. *Camphor specifically affects the nervous system.*—In moderate doses it exhilarates, and acts as an anodyne. Its exhilarating effects are well seen in nervous and hypochondriacal cases. In large doses it causes disorder of the mental faculties, the external senses, and volition; the symptoms being lassitude, giddiness, confusion of ideas and disordered vision, noise in the ears, drowsiness, delirium or stupor, and convulsions. Twenty grains is the smallest quantity that appears to have been followed by serious symptoms; but half an ounce has been swallowed without fatal result; so that camphor, though certainly a narcotic irritant, cannot be regarded as a very active poison. In its power of causing stupor, camphor agrees with opium; but it differs from the latter in its more frequently causing delirium and convulsions. Epilepsy has been ascribed to the use of camphor. It is often a valuable addition to opium, preventing the headache which opium is apt to occasion. *The quality of the influence which camphor exercises over the vascular system* has been a subject of much controversy. From my own limited observations of its use *in small* or *medium doses* (from five to ten grains), I am disposed to regard its leading effect as that of a vascular excitant, though I am not prepared to deny that slight depression may not have preceded this effect. Combined with diaphoretic regimen, as warm clothing and tepid diluents, I have seen camphor increase the fulness of the pulse, raise the temperature of the surface, and operate as a sudorific. If opium be conjoined, these effects are more manifest. In some well-reported cases, camphor, in large doses, caused depression of the vascular system, manifested by a languid, small, and slower pulse, coldness of the surface, and pallid countenance; in some cases with cold sweat. In some of these instances reaction followed the depression. The ancients and the moderns have alike regarded camphor as an anaphrodisiac.

Therapeutics. In fever.—Camphor has been employed in those forms of fever which are of a typhoid type. It is chiefly valuable by causing determination to the surface, and giving rise to diaphoresis. It does this more effectually when combined with other diaphoretics, as acetate of ammonia. Opium greatly contributes to the sudorific effects of camphor; and, when it is admissible, benefit is sometimes obtained by the administration of one grain of opium with from five to eight of camphor. From its specific influence over the cerebral functions, camphor has been frequently used in fever to allay the nervous symptoms—such as the delirium, the watchings, and the subsultus tendinum; but it frequently fails to give relief. *In inflammatory diseases.*—In the latter stages of acute inflammation of internal important parts (as the serous and mucous membranes), after proper evacuations have been made in the earlier periods of the disease, when great exhaustion is manifested by a small, feeble pulse and a cold, flaccid skin, small but repeated doses of camphor have been employed to determine to the skin, and to promote diaphoresis. It is particularly serviceable in rheumatic inflammation, especially, when combined with opium. *In mania, melancholia, and other forms of mental disorder*, camphor is occasionally taken to cause exhilaration. In mania and melancholia it has now and then proved useful by its narcotic effects; it induces mental quiet and causes sleep. *In puerperal mania*, Dr. Copland employed it with hyoscyamus, and Dr. Pritchard with carbonate of ammonia. *In spasmodic affections.*—The narcotic influence of camphor has occasionally proved serviceable in some spasmodic or convulsive affections, as hooping-cough, asthma, angina pectoris, hysteric and puerperal convulsions. *In palpitation.*—In doses of from 3 to 12 grains, combined with hyoscyamus, it quiets the tumultuous palpitations which often arise from hypertrophy of the heart with dilatation. *In diseases of the uterus.*—Dr. Dewees bears testimony to the value of camphor, in doses of 10 grains, in irritable uterus, in inflammation of its lining membrane, and in uterine cancer. *In irritation of the sexual organs.*—In spermatorrhœa and nymphomania, it is said to have proved advantageous by its anaphrodisiac properties. *In chronic rheumatism and gout.* A mixture of camphor and opium is useful in chronic rheumatism, by its sudorific and anodyne properties. Warm clothing and diluents should be conjoined with it. In chronic gout, also, camphor is said to have proved beneficial. *In irritable conditions of the nasal mucous membrane* with much sneezing and frontal headache it has been found useful by Dr. Ringer.

Externally, camphor is employed in the form of vapour, in solution, or, more rarely, in the solid state. The *vapour* is occasionally inhaled in spasmodic cough, and is applied to the skin to alleviate pain and promote sweat. Dupasquier recommended camphor fumigation in chronic rheumatism. The patient may be in bed, or seated in a chair; and, in either case, is to be enveloped in a blanket tied round the neck. About half an ounce of camphor is then to be placed on a heated metallic plate, and introduced within the blanket (under the chair if the patient be seated): in a few minutes it produces a copious perspiration. In *solution*, camphor is used either as an anodyne or a local stimulant. The oily and alcoholic solutions of camphor are mostly employed as stimulants. In *substance*, camphor is not frequently used. Twenty or thirty grains, added to a poultice, and applied to the perineum, allay the chordee, which is a painful attendant upon gonorrhœa. It has been employed successfully, for the prevention of pitting from small-pox, by Mr. Henry George, of Kensington. On the second day of a confluent case of small-pox, he covered one half of the face with wadding well sprinkled with powdered camphor, over which he placed oil-silk. The remainder of the face and the whole of the body were covered with powdered calamine. The side of the face which had been covered with camphor was free from pitting, while on the opposite side, a month afterwards, the areolæ and indentations of the pustules still remained.

Administration.—The medium dose of camphor is from five to ten grains; although occasionally twenty grains have been employed; but it is frequently exhibited in much smaller doses, as one grain. It is given in the form of a pill or emulsion. That of *pill* is said to be objectionable, as in this state the camphor is with difficulty dissolved in the gastric fluids, and, floating on the top, is apt to excite nausea, or pain or uneasiness at the upper orifice of the stomach. It has even been charged with causing ulceration of the stomach when given in the solid form. The *emulsion* is made by triturating the camphor with loaf sugar, gum arabic, and water; and the suspension will be rendered more complete by the addition of a little myrrh.

Antidote.—In a case of poisoning by camphor, first evacuate the contents of the stomach. Hufeland recommends the use of opium to relieve the effects of camphor. Phœbus directs solution of chlorine to be administered as the antidote, and afterwards purgatives and enemas. Vinegar and coffee, he states, promotes the poisonous operation. Wine assists the patient's recovery.

Pharmaceutical Uses.—Camphor is an ingredient of several of the official liniments; and of ointment of subacetate of lead, and compound ointment of mercury.

[§ **Aqua Camphoræ.** *Camphor Water.*

Synonym.—Mistura Camphoræ, *Lond.*, *Edin.*, *Dubl.*

Take of

Camphor, broken into pieces . . .	½ ounce.
Distilled Water	1 gallon.

Enclose the camphor in a muslin bag and attach this to one end of a glass rod, by means of which it may be kept at the bottom of a bottle containing the distilled water, the other end of the rod terminating just below the stopper of the bottle. Having thus put the camphor into the water, close the mouth of the bottle, macerate for at least two days, and then pour off the solution when it is required.

Dose.—1 to 2 fluid ounces.]

The quantity of camphor dissolved is exceedingly small, so that the liquid can scarcely be said to possess more than the flavour and odour of camphor. Hence its principal value is as a vehicle for the exhibition of other medicines.

[§ **Linimentum Camphoræ.** *Liniment of Camphor.*

Take of

Camphor	1 ounce.
Olive Oil	4 fluid ounces.

Dissolve the camphor in the oil.]

A stimulant and anodyne embrocation in sprains, bruises, and rheumatic and other local pains. In glandular enlargements it is used as a resolvent. This liniment is used in the preparation of liniment of chloroform, liniment of mercury, and liniment of turpentine and acetic acid.

[§ **Linimentum Camphoræ Compositum.** *Compound Liniment of Camphor.*

Take of

Camphor	$2\frac{1}{2}$ ounces.
Oil of Lavender	1 fluid drachm.
Strong Solution of Ammonia . .	5 fluid ounces.
Rectified Spirit	15 fluid ounces.

Dissolve the camphor and oil of lavender in the spirit; then add the solution of ammonia gradually, shaking them together until a clear solution is formed.]

This was the Dublin preparation, which contained nearly twice as much ammonia as the London liniment. A powerful stimulant and rubefacient, producing, when freely used, considerable irritation and inflammation. It is applicable in the same cases as the *liniment of camphor* and the *liniment of ammonia.* From both of these compounds it differs in not being greasy.

[§ **Spiritus Camphoræ.** *Spirit of Camphor.*

Synonym.—Tinctura Camphoræ, *Edin.*, *Dubl.*

Take of

Camphor	1 ounce.
Rectified Spirit	9 fluid ounces.

Dissolve.

Dose.—10 to 30 minims.]

The principal use of this preparation is as a stimulant and anodyne liniment in sprains and bruises, chilblains, chronic rheumatism, and paralysis. Water immediately decomposes it, separating the greater part of the camphor, but holding in solution a minute portion; thereby forming an extemporaneous camphor mixture. By the aid of sugar or mucilage, the greater part of the camphor may be suspended in water. Spirit of camphor is miscible with solution of subacetate of lead in the proportion of two parts of the former to one of the latter, and in this form it is a convenient preparation, sometimes ordered as a concentrated lotion to which water is to be added by the patient. But if a larger proportion of solution of subacetate of lead be added, the camphor is partially precipitated.

[§ **Tinctura Camphoræ Composita.** *Compound Tincture of Camphor.*

Synonyms.—Tinctura Camphoræ cum Opio, 1864. Tinctura Opii Camphorata, *Edin.*, *Dubl.*

Take of

Opium, in coarse powder Benzoic Acid	of each	40 grains.
Camphor		30 grains.
Oil of Anise		$\frac{1}{2}$ fluid drachm.
Proof Spirit		1 pint.

Macerate for seven days in a closed vessel, with occasional agitation, then filter, and add sufficient proof spirit to make one pint.

Dose.—15 minims to 1 fluid drachm.]

This is a very valuable preparation, and is extensively employed both by the profession and the public. By the latter it is familiarly known as paregoric. Its active ingredient is opium; but the camphor, which is combined with the opium, diminishes or prevents some of its ordinary ill effects, as headache and subsequent depression, and assists it as an antispasmodic. Its principal use is to allay troublesome cough unconnected with any active inflammatory symptoms. It diminishes the sensibility of the bronchial membrane to the influence of cold air, checks profuse secretion, and allays spasmodic cough. A fluid ounce contains two grains of opium. It is therefore of the same strength as the Edinburgh and Dublin tinctures, and a little ($\frac{1}{8}$) stronger than the London tincture.

SASSAFRAS OFFICINALE, *Nees.* The Sassafras Tree.

Botanical Character.—A small diœcious *tree.* *Leaves* alternate, thin, varying in form, some being oblong and entire, others lobed on one side, but the greater part 3-lobed, all wedge-shaped at the base; smooth above, finely downy beneath, deciduous. *Flowers* in racemes, yellowish-green, appearing before the leaves. *Calyx* 6-parted, membranous, with equal segments, permanent at the base. *Males: Fertile stamens* 9, in 3 rows, the 3 inner with 2 stalked glands at their base. *Anthers* linear, 4-celled, all opening inwards by valves. *Females* with 6 or more sterile stamens. *Fruit* succulent, placed on the thick fleshy apex of the pedicel, and seated in the cup-shaped base of the calyx.—*Woodv.* p. 91, pl. 31 (*Laurus Sassafras*).

Habitat.—Woods of North America, from Canada to Florida.

[§ **Sassafras Radix.** *Sassafras Root.*

The dried root of Sassafras officinale, *Nees.* From North America.]

General Characters.—Sassafras root occurs in the form of large branched pieces, frequently more or less covered with the bark. The wood is soft, light, porous, of a greyish-red or greyish-yellow tint, and has a fragrant aromatic odour and a peculiar aromatic warm taste. It is usually sold cut up into chips (*sassafras chips*). The bark, though not official in its separated state, occurs in commerce in rather small pieces, which are light, odorous, and spongy or corky. The epidermis is brownish-grey; the cortical layers and inner surface reddish cinnamon-brown, or almost rust-red, becoming darker by age. It is more odorous, and probably more active than the wood.

Composition.—The root contains *volatile oil*, *resin*, *tannic acid*, and *extractive matter.* The volatile oil has the odour of sassafras and a hot taste. It is the active principle of sassafras.

Physiological Effects.—The wood, bark, and oil, are stimulant and sudorific. The wood and bark taken in the form of infusion, and assisted by warm clothing and tepid drinks, excite the vascular system, and prove sudorific.

Therapeutics.—Sassafras is employed as a sudorific and alterative in cutaneous, rheumatic, and venereal diseases. On account of its stimulant properties, it is inadmissible in febrile or inflammatory conditions of the system. It is rarely or never used alone, but generally in combination with sarsaparilla and guaiacum.

Administration.—Sassafras may be administered in the form of *infusion* or *oil.* The dose of the oil is from 2 to 5 minims.

Pharmaceutical Use.—Sassafras is a constituent of the compound decoction of sarsaparilla.

Sassafras pith.—*Sassafras nuts.*—Besides the official sassafras root, two other substances, known as *sassafras pith* and *sassafras nuts*, are distinguished in commerce.

Sassafras pith is in use in the United States of America. It occurs in cylindrical slender pieces, which are very light and spongy, and have a mucilaginous and slightly sassafras taste. It forms a limpid mucilage with water. This mucilage may be prepared by adding sixty grains of the pith to a pint of boiling water. It is much employed as a demulcent, both externally and internally.

Sassafras nuts are the seeds (or rather cotyledons) of *Nectandra Puchury major*, and *Nectandra Puchury minor*, of Nees. They were formerly imported from Brazil, and used as a tonic and astringent. They have an aromatic sassafras taste and odour. They are now but very rarely imported. They have been also used as a bad substitute for nutmegs.

LAURUS NOBILIS, *Linn.* The Sweet Bay.

Botanical Character.—A bush or small tree; *leaf-buds* with valvate papery scales. *Leaves* evergreen, alternate, lanceolate, acute or acuminate, wavy at the margins. *Flowers* diœcious or hermaphrodite, involucrated, arranged in axillary stalked umbels, yellowish. *Calyx* 4-parted; segments equal, deciduous. *Fertile stamens* 12, in 3 rows; the outer alternate with the segments of the calyx; all with 2 glands in, or above the middle. *Anthers* oblong, 2-celled, all looking inwards. *Female flowers*, with 2 to 4 abortive stamens surrounding the ovary. *Stigma* capitate. *Fruit* succulent, seated in the irregular base of the calyx, oval. *Seed* solitary, pendulous.

Habitat.—South of Europe. Cultivated in gardens and shrubberies.

Lauri Fructus et Folia. *Bay Berries and Leaves.*

The fruits and leaves of Laurus nobilis, *Linn.*

(*Not official.*)

General Characters.—*Of the Fruit.*—Laurel fruits, (or bay berries as they are commonly called,) as found in commerce, are oval in shape, and consist of a brittle blackish-brown, more or less wrinkled pericarp, enveloping a solitary loose oval seed, which mainly consists of two large fatty cotyledons. The seed has a bitter aromatic taste, and a somewhat aromatic odour. *Of the Leaves.*—These have a similar odour and taste to the fruits. They are described above in the botanical character.

Composition.—Bay berries contain a *volatile oil*, *fixed oil*, *stearine*, *laurin*, *extractive*, and other ingredients.

Physiological Effects and Uses.—The berries, leaves, and oil, are said to possess aromatic, stimulant, and narcotic properties. The leaves, in large doses, prove emetic. They are employed by the cook on account of their flavour. Both leaves and berries have been used to strengthen the stomach, to expel flatus, and to promote the catamenial discharge. But they are rarely, if ever used, in medicine at the present time, in this country.

Administration.—Both berries and leaves are used in the form of infusion.

Oleum Lauri. *Oil of Bays.*

A concrete oil obtained by expression and heat from Bay Berries. Imported from Trieste.

(*Not official.*)

Preparation.—*Oil of Bays* may be obtained from either the fresh or dried berries. Duhamel states that it is obtained from the fresh and ripe berries by bruising them in a mortar, boiling them afterwards for about three hours in water, and then pressing them in a sack. The expressed oil is then mixed with the decoction, and, when cold, the butyraceous oil is found floating on the surface.

From the dried berries it is procured by exposing them to the vapour of water until they are thoroughly soaked, and then rapidly subjecting them to pressure between heated metallic plates. By the latter method they yield one-fifth of their weight of oil.

Composition and General Characters.—Oil of bays is a mixture of volatile oil, elaine and stearine. It has a butyraceous consistence and a granular appearance. Its colour is greenish; its odour that of the berries. It is partially soluble in alcohol, completely so in ether.

Uses.—It is occasionally employed externally as a stimulating liniment in sprains and bruises, as well as in paralysis. Its principal use, however, is in veterinary medicine.

NECTANDRA RODIÆI, *Schomburgk.* The Beeberu or Greenheart Tree.

Botanical Character.—A large forest *tree*, 60 or more feet high, with a trunk undivided by branches until near the top, and covered by an ash-grey smooth bark. *Leaves* opposite, oblong, acute, entire, shining, undulated, 5 or 6 inches long, and 2 or 3 inches broad, with reflexed margins ; *petioles* short. *Inflorescence* cymose, axillary. *Flowers* hermaphrodite, each about 2 lines in diameter, on short pedicels, yellowish-white, thickly studded with minute glands, having a strong jessamine odour. *Calyx* 6-parted, rotate ; segments deciduous. *Stamens* 12, in 4 series ; the 9 outer fertile, the 3 inner sterile, without glands ; the *anthers* in the outer two series turned inwards, those of the 3rd series turned outwards, all thick, oblong, nearly sessile, 4-celled, and dehiscing by four valves. *Ovary* 1-celled, with 1 ovule. *Style* very short; *stigma* short and truncated. *Fruit* somewhat obovate, slightly compressed ; the pericarp greyish-brown, hard, about a line in thickness. *Seed* 1 in each fruit, about the size and shape of a walnut, and containing 2 large plano-convex cotyledons.

Habitat.—British Guiana : on rocky hill-sides on the borders of rivers (the Essequibo, Demerara, Pomeroon, and Berbice).

[§ Nectandræ Cortex. *Bebeeru Bark.*

The bark of Nectandra Rodiæi, *Schomburgk.* Imported from British Guiana.]

General Characters.—In large flat very hard heavy pieces, from one to two feet long, from two to six inches broad, and about a quarter of an inch thick. External colour greyish-brown, internal dark cinnamon-brown. Its fracture is tough and rather fibrous. Taste strongly and persistently bitter, with considerable astringency and somewhat aromatic and pungent. Its infusion, like that of the cinchona barks, reddens litmus-paper. When long subjected to a boiling temperature (212°), or long contact with alkaline or caustic earthy substances, its bitterness is destroyed.

Composition.—In 1834, Dr. Rodie discovered that the bark contained an alkaloid, which he used with great success in intermittents. He terms the tree the *Bebeeru*, and the alkaloid *Bebeerine.* Dr. Maclagan found in bebeeru bark about 2·5 per cent. of *beberia* or *bebeerine*, and the same quantity of *tannic acid* and *resin.* Beberia is obtained by decomposing sulphate of beberia by ammonia : the precipitate is washed with cold water, triturated, while still moist, with moist hydrated oxide of lead, and the magma dried on a water-bath, and exhausted by rectified spirit. In this way is obtained an alcoholic solution of beberia, while the oxide of lead, tannic acid, and other impurities are left behind. The alcohol is to be distilled off, and the resinous-looking residue treated with pure ether, which dissolves the beberia. It is uncrystallisable, and when obtained by evaporation from its ethereal solution, it is a yellow amorphous resinous-looking substance; but in the form of powder it is white. It is very soluble in alcohol, less so in ether, and very sparingly in water. Its alcoholic solution has an alkaline reaction on reddened litmus-paper. It dissolves in acids, and neutralises them, forming amorphous yellow salts. Colourless or crystallised salts have not yet been procured.

Physiological Effects.—Bebeeru bark appears to possess the tonic, antiperiodic, febrifuge, and astringent properties of cinchona barks. Like the latter, its bitter, tonic, and antiperiodic powers reside in a vegetable alkaloid ; and its astringent property in that kind of tannic acid which strikes a green colour with the salts of iron.

Therapeutics.—See *Beberiæ Sulphas.*

Pharmaceutical Use.—It is used for the preparation of sulphate of beberia.

[§ **Beberiæ Sulphas.** *Sulphate of Beberia.*

$C_{35}H_{20}NO_6,HO,SO_3$ or $\mathbf{C_{35}H_{40}N_2O_6.H_2SO_4}$.

The sulphate of an alkaloid prepared from Nectandra or Bebeeru bark.

It may be obtained by the following process :—

Take of

Bebeeru Bark, in coarse powder .	1 pound.
Sulphuric Acid	$\frac{1}{2}$ a fluid ounce.
Slaked Lime	$\frac{3}{4}$ of an ounce, or a sufficiency.
Solution of Ammonia . . .	a sufficiency.
Rectified Spirit	16 fluid ounces, or a sufficiency.
Diluted Sulphuric Acid . . .	a sufficiency.
Water	1 gallon.
Distilled Water	a sufficiency.

Add the sulphuric acid to the water; pour upon the bebeeru bark enough of this mixture to moisten it thoroughly; let it macerate for twenty-four hours; place it in a percolator; and pass through it the remainder of the acidulated water. Concentrate the acid liquor to the bulk of one pint, cool, and add gradually the lime in the form of milk of lime, agitating well, and taking care that the fluid still retains a distinct acid reaction. Let it rest for two hours; filter through calico; wash the precipitate with a little cold distilled water, and to the filtrate add solution of ammonia until the fluid has a faint ammoniacal odour. Collect the precipitate on a cloth, wash it twice with ten ounces of cold water, squeeze it gently with the hand, and dry it by the heat of a water-bath. Pulverise the dry precipitate, put into a flask with six ounces of the rectified spirit, boil, let it rest for a few minutes, and pour off the spirit. Treat the undissolved portion in a similar manner with fresh spirit until it is exhausted. Unite the spirituous solutions, add to them four ounces of distilled water, and distil so as to recover the greater part of the spirit. To the residue of the distillation, add by degrees and with constant stirring, diluted sulphuric acid, till the fluid has a slight acid reaction. Evaporate the whole to complete dryness on the water-bath, pulverise the dry product, pour on it gradually one pint of cold distilled water, stirring diligently; filter through paper, evaporate the filtrate to the consistence of syrup, spread it in thin layers on flat porcelain or glass plates, and dry it at a heat not exceeding 140°. Preserve the product in stoppered bottles.]

In this process the acidulated aqueous solution of the bark, after being concentrated by evaporation, and nearly neutralised by milk of lime, is filtered and precipitated by ammonia in slight excess. The impure beberia thus obtained is boiled with rectified spirit until all the alkaloid is dissolved; water is then added, and the greater part of the spirit having been recovered, the residue is treated with dilute sulphuric acid, until it exhibits a faint acid reaction, and is then evaporated to dryness. Finally, it is digested in cold water, which dissolves the sulphate of beberia; and the solution is filtered, evaporated, and scaled.

[§ *Characters and Tests.*—In dark brown thin translucent scales, yellow when in powder, with a strong bitter taste, soluble in water and in alcohol. Its watery solution gives a white precipitate with chloride of barium; and with caustic soda a yellowish-white precipitate, which is dissolved by agitating the mixture with twice its volume of ether. The ethereal solution, separated by a pipette and evaporated, leaves a yellow translucent residue, entirely soluble in dilute acids. It is entirely destructible by heat. Water forms with it a clear brown solution.]

Therapeutics.—Bebeeru bark and sulphate of beberia have been used as peptics in anorexia and dyspepsia; as general tonics in debility, protracted phthisis, and strumous affections; as febrifuges in intermittent and remittent diseases; and as antiperiodics in periodical headache and intermittent neuralgias. Sufficient experience has not yet been obtained of bebeeru bark and its alkaloid, to enable us to form an accurate opinion of their therapeutical power in comparison with cinchona bark and quinia. In some cases beberia has appeared to produce its peptic and tonic effects with less tendency to cause headache, giddiness, ringing in the ears, and feverishness, than quinia; and it can in consequence be administered to some patients with whom quinia disagrees. On the other hand, it is undoubtedly inferior to the latter in febrifugal and antiperiodic power.

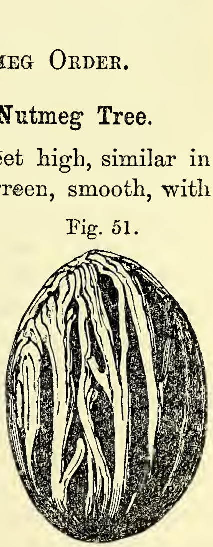
Administration.—Sulphate of beberia may be administered in doses of from one to three grains as a tonic, and from five to twenty grains as a febrifuge. In substance it is given in the form of pill, made with confection of roses; and in solution with dilute sulphuric acid. The following is given as a convenient form for its exhibition as a tonic:—Sulphate of beberia, 30 grains; dilute sulphuric acid, 25 minims; syrup, 1 fluid ounce; tincture of orange peel, 1 fluid ounce; water, 4 fluid ounces. One table spoonful to be taken three times a day.

MYRISTICACEÆ, *Lindl.* The Nutmeg Order.

MYRISTICA OFFICINALIS, *Linn.* The Nutmeg Tree.

Botanical Character.—A *tree* from 20 to 25 feet high, similar in appearance to a pear tree. *Bark* dark greyish-green, smooth, with a yellowish juice. *Leaves* oblong, subacute at the base, smooth, aromatic. *Racemes* axillary, few-flowered. *Flowers* usually diœcious sometimes monœcious. *Males*: 3 to 5 or more on a peduncle. *Calyx* urceolate, trifid, fleshy, pale yellow, with a reddish pubescence. *Anthers* united throughout their whole length into a cylindrical column. *Females*: scarcely different from the males, except that the pedicel is very frequently solitary. *Stigma* sessile, emarginate, somewhat 2-lobed. *Fruit* globose, smooth, about the size of a peach, marked by a longitudinal groove. *Pericarp* fleshy, dehiscing by two nearly equal longitudinal valves. *Arillus* or *arillode* (when dry, constituting the *mace* of commerce), large, fleshy, branched, scarlet. *Seed* (*nutmeg in the shell*) (fig. 51),

Fig. 51.



Nutmeg in the shell surrounded by its mace, (from a specimen preserved wet.)

oval; its outer coat or *shell* is dark brown, hard, glossy; its inner coat closely invests the nucleus, and dips down into the substance of the albumen, giving it a marbled or *ruminated* appearance. The *nucleus* or *kernel* (forming the *round*, *true*, or *official nutmeg*) consists chiefly of the oleaginous *albumen*, the so-called veins of which are processes of the inner coat, and have a reddish-brown colour, and abound in oil.—*Steph. and Church.* pl. 104.

Habitat.—Molucca islands, especially the group called the Banda or Nutmeg isles. Cultivated in Java, Sumatra, Penang, Singapore, Bengal, Bourbon islands, Madagascar, and some parts of the West Indies. At Penang, Malacca, and Singapore, its cultivation has declined of late years.

[§ **Myristica.** *Nutmeg.*

The kernel of the seed, of Myristica officinalis, *Linn.* Cultivated extensively in the Banda Islands of the Malayan Archipelago.]

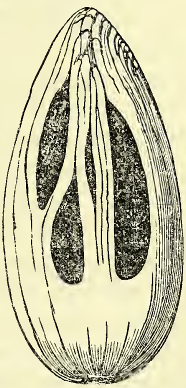
Curing.—Nutmegs require great care in curing, on account of their liability to the attacks of an insect. It is necessary therefore, to have them well and carefully dried in their shells, as in this state they are secure from the attack of the insect. In order to effect this they are placed on hurdles or gratings after the removal of the mace, and smoke-dried for about two months by a slow wood fire at a heat not exceeding 140° F. (In the Banda isles they are first sun-dried for a few days.) When thoroughly dried the nuts rattle in the shells, which are then cracked with wooden mallets, and the worm-eaten and shrivelled nuts thrown out. To prevent the attacks of the insect after being thus dried, the nutmegs are frequently limed. For the English market, however, the brown or unlimed nutmegs are preferred. The Dutch lime them by dipping them into a thick mixture of lime and water; but this process is considered to injure their flavour. Others lime them by rubbing them with recently-prepared well-sifted lime. The nutmegs are then packed for exportation in tight casks, the insides of which have been smoked and covered with a coating of fresh water and lime.

General Characters.—The shape of the nutmeg is roundish or elliptical, like that of the French olive. The colour of the *unlimed* or *brown* nutmeg is ashy-brown; that of *limed* nutmegs is brown on the projecting parts, and white (from the presence of lime) in the depressions. It is marked externally with reticulated furrows, and internally it is greyish-red with dark brownish veins. It has a strong peculiar pleasant and aromatic odour, and agreeable aromatic bitterish taste.

Varieties.—In the London market the following are the kinds of nutmegs commonly distinguished by the dealers:—*Penang nutmegs.*—These are unlimed or brown nutmegs, and fetch the highest price. They are sometimes limed here for exportation, as on the Continent the limed sort is preferred. The quality of these nutmegs has lately declined. *Dutch or Batavian nutmegs.*—These are limed nutmegs. In London they scarcely fetch so high a price as the Penang sort. *Singapore nutmegs.*—These are a rougher, unlimed, narrow sort, of somewhat less value than the Dutch kind.

Long Nutmegs.—Besides the true or official nutmeg, another, but very inferior nutmeg, which is the produce of *Myristica fatua*, is met with in commerce in three conditions:—in the shelled or clean state (*long or wild nutmegs*); contained within the shell (*long or wild nutmegs in the shell*); and with the mace dried around the shell (*long or wild nutmegs covered with mace*) (fig. 52). It is called the long nutmeg from its greater length.

Fig. 52.



Long or Wild Nutmeg in the shell, surrounded by its mace, (from a dry commercial specimen.)

Mace.—The mace after being separated from the nut is prepared for the market by drying it for some days in the sun; or in rainy weather by artificial heat. It is then commonly sprinkled with salt water, and packed in casks for exportation. Mace is *not official.* The true or genuine mace is the produce of *Myristica officinalis.* It occurs in single or double pieces, called *blades*, which are flat, smooth, irregularly slit, slightly flexible or brittle, of a pale cinnamon-brown or golden-yellow colour, and an odour and taste analogous to those of nutmegs. Although the natural colour of fresh mace is red, yet commercial mace of this colour is generally looked on with suspicion. The mace of the long nutmeg is insipid, and almost without odour.

Composition.—Nutmegs yield, by distillation with water, *a volatile oil*, characterised by its peculiar odour; and by expression, a *fixed butyraceous oil.* Both these oils are official, and are described below.

Physiological Effects.—The activity of nutmeg depends on the volatile oil which it contains. Swallowed *in moderate quantities*, it produces the stimulant effect of the spices. *In large doses* it proves narcotic, and causes giddiness, delirium, precordial anxiety, sleepiness, or actual stupor.

Therapeutics.—Nutmeg is used, like other spices, as a stimulant, carminative, and flavouring ingredient. In mild cases of diarrhœa I have frequently employed nutmeg as a substitute for opium. It may be taken in warm brandy and water, unless the use of spirit be contra-indicated. It is largely used for flavouring food substances.

Administration.—It may be taken to the extent of twenty or thirty grains, having been previously reduced to powder.

Pharmaceutical Uses.—Nutmeg is a constituent of aromatic powder of chalk, compound catechu powder, compound spirit of horse-radish, and compound tincture of lavender.

[§ **Oleum Myristicæ Expressum.** *Expressed Oil of Nutmeg.*

Synonym.—Myristicæ Adeps, B. P. 1864.

A concrete oil obtained by means of expression and heat from nutmegs.]

Preparation.—*Expressed oil of nutmegs* or *mace*, or *butter of nutmegs*, is prepared by beating the nutmegs to a paste, which is to be inclosed in a bag, and then exposed to the vapour of water, and afterwards subjecting to pressure by heated plates.

General Characters.—It is imported in oblong cakes having nearly the form of common bricks, but their size is somewhat smaller; they are covered by some monocotyledonous leaves, which are commonly called *flag leaves.* They are unctuous to the touch, but not adhesive; they have an orange colour, firm consistence, and fragrant odour, like that of nutmeg.

Composition.—Schrader found that 16 parts of oil, expressed by himself, consisted of 1 part of volatile oil, 6 parts of brownish-yellow fat, and 9 parts of white fat. In 48 parts of the commercial concrete oil he found 2 parts of volatile oil, 25 yellow fat, and 21 white fat. The volatile oil and yellow fat are soluble in both cold alcohol and cold ether. The white fat is soluble in boiling alcohol and boiling ether, but is insoluble in cold alcohol and ether. Dr. Playfair calls it *myristin.*

Therapeutics.—Expressed oil of nutmeg is occasionally employed externally in chronic rheumatism and palsy.

Pharmaceutical Uses.—It is a constituent of warm plaster and pitch plaster.

[§ **Oleum Myristicæ.** *Volatile Oil of Nutmeg.*

The oil distilled in Britain from nutmeg.]

Preparation and General Characters.—It is procured by submitting nutmegs and water to distillation. The usual produce of volatile oil when distilled in this country, is about 4·5 per cent.; but the oil is more generally imported. It is colourless or pale yellow, and has the odour and taste of nutmegs. By agitation with water it separates into two oils, one lighter, the other heavier than water. By keeping it deposits crystals of stearoptene (*myristicine*), which are fusible at 212° F., volatile, soluble in alcohol, in ether, and in boiling water. From the latter liquid myristicine separates in a crystalline form as the liquid cools.

Physiological Effects and Therapeutics.—Volatile oil of nutmeg in small doses is cordial and carminative; but according to Mitscherlich, it is capable of acting as a strong poison, fatally affecting the heart and lungs.

Administration.—*Dose*, one or two minims, taken on sugar, or dissolved in spirit as in the official spirit of nutmeg.

Pharmaceutical Uses.—Volatile oil of nutmeg is a constituent of pill of Socotrine aloes, and aromatic spirit of ammonia.

[§ **Spiritus Myristicæ.** *Spirit of Nutmeg.*

Take of

Volatile Oil of Nutmeg . . .	1 fluid ounce.
Rectified Spirit	49 fluid ounces.

Dissolve.

Dose.—$\frac{1}{2}$ to 1 fluid drachm.]

It is cordial and carminative, and is employed as a pleasant addition to stimulant, narcotic, or purgative draughts. It is a constituent of compound mixture of iron.

THYMELACEÆ, *Lindl.* The Mezereon Order.

DAPHNE, *Linn.*

Generic Character.—*Flowers* hermaphrodite. *Calyx* funnel-shaped; limb in 4 segments; throat without scales. *Stamens* 8, inclosed within the tube, inserted in 2 rows near the throat. *Ovary* 1-celled; *style* terminal, very short; *stigma* capitate. *Fruit* baccate, 1-seeded. *Seed* inverted, exalbuminous.

DAPHNE MEZEREUM, *Linn.* Mezereon.

Specific Character.—*Stem* brown, bushy, 3 to 5 feet high, with upright, smooth, tough, and pliant branches; leafy while young. *Leaves* deciduous, scattered, stalked, lanceolate, smooth, 2 inches long, appearing after the flowers. *Flowers* fragrant, sessile, about 3 together on the naked branches, with several brown smooth ovate bracts underneath. *Calyx* crimson, the tube externally hairy. *Berries* scarlet.—*Steph. and Church.* pl. 65.

Habitat.—A doubtful native, rare in England, perhaps truly wild near Andover. Cultivated in gardens.

DAPHNE LAUREOLA, *Linn.* Spurge Laurel.

Specific Character.—*Stem* very smooth, green, rather stout, erect, 1–3 feet high, little branched, leafy above, naked below. *Leaves* lanceolate, attenuated at the base, glabrous, evergreen. *Racemes* axillary, of about five glabrous drooping bracteated flowers. *Flowers* green. *Berry* oval, bluish-black.—*Engl. Bot.*, vol. ii. pl. 119.

Habitat.—Indigenous, in woods, thickets, and hedges throughout England, rare in Scotland.

[§ **Mezerei Cortex.** *Mezereon Bark.*

The dried bark of Daphne Mezereum, *Linn.* Or of Daphne Laureola, *Linn.*]

Botanical Source, Official Parts, and Commerce.—Before the appearance of the British Pharmacopœia in 1864, the only official mezereon bark was the *root-bark of Daphne Mezereum.* But the true mezereon is far too rare a plant in England in its wild state, and too valuable as a garden plant when cultivated, to supply the medicinal demand. Moreover, the cultivated mezereon is frequently grafted on the stock of the spurge laurel. The *stem-bark* of mezereon is usually considered to be somewhat less active than the root-bark; but in the United States, and most of the continental Pharmacopœias, the bark of both root and stem is included under the general name of *mezereon bark. The bark of both root and stem is now official.* Mezereon bark is also imported from Hamburg. Sometimes the entire root (bark and wood) of mezereon is used instead of the root-bark ; but this proceeding is highly objectionable, as the wood possesses only a feeble acridity.

General Characters.—Mezereon bark occurs in strips or quilled pieces of various lengths, tough and pliable, brown or olive-brown on the surface, internally white, cottony, and very tough. When chewed, the taste is at first sweetish, afterwards an acrid burning sensation is felt in the mouth and fauces, and extends to the gullet and stomach if the bark and saliva be swallowed. This sensation continues for several hours. It has a faint nauseous odour. The stem-bark of true mezereon, in the fresh state, is externally brown and rougher than the root-bark, which is nearly white; but it is most readily recognised, in the fresh state, by the green colour of the cellular integument beneath the epidermis. The fresh bark of the spurge laurel is green.

Composition.—Mezereon contains an *acrid resin*, an *acrid volatile oil ? daphnin*, and other unimportant substances.—*Daphnin* is a bitter slightly astringent crystalline body, possessing neither basic nor acid properties; it is not the active principle of mezereon. *Acrid Resin.*—Obtained by boiling the bark in alcohol. When the solution cools some wax is deposited. The supernatant liquid is to be evaporated, and the residual extract washed with water. The resin then left behind is dark green, and soluble in both alcohol and ether. To this substance mezereon owes its acridity. There is, however, some reason to suspect that this resin is itself a compound of two principles, viz. an acrid vesicating fixed oil, and another substance. The resin is rendered soluble in water by means of the other constituents of the bark. Mr. Squire could not obtain any blistering effect from the resin extracted by alcohol. *Acrid Volatile Oil.*—According to Mr. Squire, mezereon contains a volatile acrid substance which is carried off by the vapour of water, but not by the vapour of alcohol. He says, 'the pungent odour given off by boiling mezereon root in water over a lamp is so powerful, that, after holding my head over it for a short time, great irritation was produced, and it was difficult to carry on respiration.'

Physiological Effects.—All parts of the true mezereon plant, but more especially the root-bark, are endowed with acridity; in virtue of which they cause irritation and inflammation in tissues to which they are applied. When swallowed, therefore, in large quantities, they prove poisonous. The topical action of mezereon bark is that of an irritant, and, when the bark has been applied to the skin, vesicant. A decoction of mezereon bark, taken in moderate quantities, sometimes appears to promote the action of the secreting and exhaling organs (especially the kidneys and the skin). In larger doses it causes irritation of the alimentary canal and kidneys.

Therapeutics.—In this country mezereon is scarcely ever given alone. It is usually administered in conjunction with sarsaparilla, and is employed as a sudorific and alterative in venereal, rheumatic, scrofulous, and chronic cutaneous diseases. As a topical remedy, it is sometimes applied to relieve toothache. It is occasionally used as a masticatory. Dr. Withering cured a case of difficulty of swallowing, arising from a paralytic affection, by mezereon, which he directed to be chewed frequently. In France it is used as a vesicatory. The mode of using it is this:—First soften the bark by soaking it in hot vinegar and water, and then apply it to the part by a compress and bandage. The application is to be renewed night and morning until vesication is produced.

Administration.—Mezereon is usually administered internally in the form of decoction. As a masticatory, a few grains of the bark may be chewed.

Pharmaceutical Use.—It is a constituent of the compound decoction of sarsaparilla.

[§ **Extractum Mezerei Æthereum.** *Ethereal Extract of Mezereon.*

Take of

Mezereon Bark, cut small	1 pound.
Rectified Spirit	8 pints.
Ether	1 pint.

Macerate the mezereon in six pints of the spirit for three days, with frequent agitation; strain and press. To the residue of the mezereon add the remainder of the spirit, and again macerate for three days, with frequent agitation; strain and press. Mix and filter the strained liquors; recover the greater part of the spirit by distillation, evaporate what remains to the consistence of a soft extract; put this into a stoppered bottle with the ether, and macerate for twenty-four hours, shaking them frequently. Decant the ethereal solution; recover part of the ether by distillation, and evaporate what remains to the consistence of a soft extract.]

The ethereal extract is well suited for external application as a vesicatory or rubefacient as in the compound liniment of mustard, into the composition of which it enters.

POLYGONACEÆ, *Lind.* The Rhubarb Order.

RHEUM, *Linn.* Rhubarb.

Generic Character.—Calyx petaloid, 6-parted, withering. *Stamens* about 9, inserted into the base of the calyx. *Styles* 3, reflexed. *Stigmas* peltate, entire. *Nut* (*achenium*) 3-cornered, winged, with the withered calyx at the base. *Embryo* in the centre of the albumen.

Botanical Source of Official Rhubarb.—It is not yet ascertained what species of *Rheum* yields the official rhubarb. Notwithstanding the inquiries of Kauw Boerhaave, first physician to the Emperor of Russia, who was led to believe that *Rheum palmatum* was the true species, and of Sievers, who went to Siberia, under the auspices of Catherine II. of Russia, with a view of settling the question, the source of the official rhubarb is still unknown. Sievers, after four years of persevering attempts to reach the country where the true rhubarb grew, or to obtain the seeds, says, 'My travels have satisfied me that as yet nobody—that is, no scientific person—has seen the true rhubarb plant. All the seeds procured under the name of true rhubarb are false; all the descriptions in all the Materia Medicas are incorrect.' Calau, apothecary in the rhubarb factory at Kiachta, and who, from his appointment, might be expected to know the origin of the rhubarb he received from the Bucharians, says, 'All that we know of the rhubarb plant or its origin is defective and wrong. A severe prohibition from the Chinese Government prevents all possibility of eliciting the truth.' Dr. Royle states that 'all the information obtained of late years in Russia only confirms what was before known, that *R. palmatum* is not the species, but that the genuine plant is a small one with roundish denticulate leaves.' In a communication published a few years since, in the *Pharmaceutical Journal*, Dr. F. Farre has expressed his confident belief, founded on data which he has there given, that the official rhubarb is derived from *Rheum palmatum.* Of thirteen species of *Rheum* grown in the Chelsea Botanic garden, the root of *R. palmatum*, carefully dried by artificial heat, most nearly resembled official rhubarb in the combined qualities of odour, colour, and marbling. In the absence, therefore, of any definite information as to the botanical source of the official rhubarb, it will be sufficient if we describe *Rheum palmatum.*

RHEUM PALMATUM, *Linn.* Palmated Rhubarb.

Specific Character.—A perennial herbaceous plant. *Leaves* (fig. 53), alternate, roundish-cordate, half palmate; the lobes pinnatifid, acuminate, deep dull green, not wavy, but uneven, and very much wrinkled on the upper side, hardly scabrous at the margins, minutely downy on the under side; *petiole* pale green, marked with short purple lines, terete, obscurely channelled quite at the upper end. *Flowering stems* taller than those of any other species. *Flowers* (fig. 53) in panicles.

Habitat.—China, Chinese Tartary, Thibet.

Fig. 53.

Flowering stem and leaf of Rheum palmatum.

[§ Rhei Radix.

Rhubarb Root.

The dried root deprived of the bark from one or more undetermined species of Rheum, *Linn.* From China, Chinese Tartary, and Thibet. Imported from Shanghai and Canton, and brought overland by way of Moscow.]

History.—We have no certain knowledge of the time in which rhubarb was introduced into Europe. The later Greek writers are supposed to have been acquainted with our rhubarb. Alexander of Tralles used it in weakness of the liver and dysentery. Paulus Ægineta, in noticing the practice of the ancients, says, 'alvine discharges they promoted by giving turpentine to the extent of an olive, when going to rest; or, when they wished to *purge* more effectually, by adding a little *rhubarb*' (rheon). This is the first notice of the purgative properties of rhubarb.

Collection, Preparation, and Commerce.—Rhubarb is generally gathered in summer, from plants of six years of age. When the root is dug up, it is first washed to free it from earthy particles, then peeled, bored through the centre, strung on a thread, and dried in the sun. In autumn, all the dried rhubarb collected in the province is brought in horse hair sacks, containing about 200 pounds, to Sinin, the residence of the dealers, loaded on camels, and sent over Mongolia to Kiachta, and partly to Peking. In reference to this Dr. Farre, a former editor of this work, remarks:—' "The Rules of the Drug Trade of China," a MS. work in the Chinese language much used by the drug merchants of Shanghai—states that the rhubarb carried from Kiachta to St. Petersburg is collected in Western Kansuh, in Kokonor, and along the slopes of the Kwanlun mountains which form the northern boundary of Thibet; while that which is sold in Canton is collected in the more southern and eastern provinces of Sz'chuen, Shensi, Shansi, and Honan.* "The Chinese Commercial Guide," published at Canton in 1856, by Dr. Williams, Secretary of Legation to the U.S. Embassy at Peking, after mentioning the native names of the rhubarb brought from Shansi, Shensi, and Honan, adds that the produce of Sz'chuen is called *chuen* rhubarb, and sometimes *horse-hoof* rhubarb (*Ma-ti*). Mr. Lockhart, who resided fifteen years at Shanghai, as medical missionary, and to whom I am indebted for the preceding information, also informs me that the rhubarb exported from Shanghai is *chuen* (pronounced *chaun*) rhubarb.'

General Characters. — The characters of rhubarb root, as given in the British Pharmacopœia, are as follows:—[§ Trapezoidal roundish cylindrical or flattish pieces, frequently bored with one hole, yellow externally, internally marbled with fine waving greyish and reddish lines, finely gritty under the teeth; taste bitter, faintly astringent and aromatic; odour peculiar. Free from decay, not worm-eaten. Boracic acid does not turn the yellow exterior brown.]

This description includes the Russian, East Indian, and Dutch-trimmed or Batavian rhubarbs of commerce; and although the characters of some of these commercial kinds have been much modified of late years, it will be better, at first, for us to describe them essentially as formerly by the author, and to make such observations afterwards as may be necessary to account for their altered nature.

Varieties.—The ordinary varieties of rhubarb are the *Russian*, *East Indian*, *Dutch-trimmed* or *Batavian*, and *English*; these we shall describe. Other varieties are the *Himalayan*, *Canton Stick*, *French*, and *Austrian*. The Russian, East Indian and Dutch-trimmed or Batavian are the official varieties; and may indifferently be used in making the preparations of rhubarb ordered in the Pharmacopœia.

* Shanghai is not mentioned in 'The Rules' as a place of sale or exportation of rhubarb, as it was not made a port of foreign trade until 1843, after this work was written.

Russian Rhubarb.—This is Chinese rhubarb, which is taken in exchange, on behalf of the Russian Crown, at Kiachta (see observations below). In Russia it is known as *Chinese rhubarb*, and on the Continent it is called *Russian rhubarb*. In English commerce it is commonly termed *Turkey rhubarb*, because formerly this description of rhubarb came into Europe by way of Asiatic Turkey. The barter of this rhubarb is carried on by the Russian Government under a contract made with Bucharians at Kiachta for ten years, and confirmed by the Chinese Government. According to this contract, the Bucharians undertake to furnish a certain quantity of rhubarb annually to the Russian Crown for a particular quantity of goods of a specified quality, and to deliver up all rhubarb not approved of, without remuneration, and permit it to be burnt by the Russian Government. All the rhubarb brought to Kiachta undergoes an examination, prescribed by the Imperial Russian Medical Council, according to directions of the Russian Government. The selection of the rhubarb bartered for by Russian merchants takes place in the custom-house at Kiachta, and of that for the Crown in a house for that purpose on the Chinese borders. All pieces of inferior quality are destroyed. Russian rhubarb is imported in chests holding from 156 to 160 pounds each. Each chest is pitched on the outside, and covered with a hempen cloth and a hide. On the outside of the chest is a printed paper, stating the year in which the rhubarb was imported into Russia, and the weight of the chest. The following is a literal translation of one of these papers :

RAD: RHEI PALMAT:

CHINESE HOOF RHUBARB

OF THE YEAR 1840.

No. 6

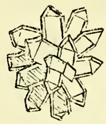
poods. lbs.

NET WEIGHT 4.—26

The shapes of the pieces are various, being angular, rounded, or irregular ; and commonly distinguished in commerce as *flats* and *rounds*. The flat surfaces and the angles which the pieces present show that the cortical portion of the root has been removed by slicing, and not by scraping, as in the East Indian rhubarb. Holes are observed, in some of the pieces, extending completely through them : these have evidently been made for the purpose of hanging the pieces to dry, but all traces of the cord have been carefully removed, and the holes scraped or filed to get rid of all decayed portions. Other holes are also occasionally found, which extend only partially through the pieces; these are borings which have been made to examine the condition of the interior of the pieces. Externally the pieces are covered with a bright yellow-coloured powder, usually said to be produced by the mutual friction of the pieces in the chests during their passage to this country; though many believe it is derived from the process of *rouncing* (that is, shaking in a bag with powdered rhubarb) before its exportation. As stated by Dr. F. Farre, in a former edition of this work published in 1865, the foregoing statement requires, at the present time, material correction. Dr. Farre says, 'I have received from Messrs. Horner, the principal importers of Russian rhubarb, the following information:—"The treaty between the Russian and Chinese Governments as to the supply of rhubarb expired about two years since, and up to the present time has not been renewed, although we are informed that negotiations are going on for its renewal. The supply at present is obtained through mercantile houses at Moscow, and is imported in the untrimmed state, similar to Canton rhubarb, and trimmed here. We have imported it in this state in chests similar to Canton chests, but covered with a hide. The Government are in no way responsible for its quality, nor have they anything to do with it." On examining the contents of some chests recently imported, I found the bark very imperfectly removed, apparently by rasping, and the cord frequently left in the holes; or, if it had been removed, the holes not cleaned out. The pieces were not covered with powder; the chests, also, had no label on the outside.' This treaty has not been renewed, and the same remarks apply at the present time to this kind of rhubarb. The odour of Russian rhubarb is strong and peculiar, but somewhat aromatic. When chewed, it feels gritty under the teeth, from the presence of numerous crystals of oxalate of lime. It communicates a bright yellow colour to the saliva, and has a bitter, slightly astringent taste. Beneath the dust with which the pieces are covered, the surface has a reddish-white tint, owing to the intermixture of white and red parts. The yellowish-white parts have the form of lines or veins, which, by their union with one another, assume a reticular form. Irregularly scattered over the surface, we observe small star-like spots and depressions of a darker colour. The transverse fracture is uneven, and presents numerous brownish-red or dark carmine-coloured undulating veins. The longitudinal fracture is still more uneven, and shows the longitudinal direction of the veins, which are often interrupted with white. The surface obtained by cutting is more or less yellow, and frequently exposes the veins, disposed in groups. By boiling very thin slices of the root in water, and then submitting them to the microscope, we observe numerous *conglomerate raphides* (masses of crystals of oxalate of lime) (fig. 54).

From 100 grains of Russian rhubarb the late Mr. Edwin Quekett procured between 35 and 40 grains of these raphides. Turpin considered the presence of these crystals sufficient to distinguish Asiatic rhubarb from that grown in Europe; but in some specimens of English rhubarb I have met with them in as great abundance as in foreign rhubarb. The powder of Russian rhubarb is of a bright yellow colour, with a reddish tint; but as met with in the shops, it is almost invariably mixed with the powder of English rhubarb.

Fig. 54.



Crystals (conglomerate raphides) of Oxalate of Lime in Russian Rhubarb.

East Indian Rhubarb.—This, like the Russian rhubarb, is the produce of China, but is exported from Canton and Shanghai; but chiefly from the latter port, which is nearer than Canton to the provinces in which it is produced. It is known in English commerce as *Chinese* or *East Indian rhubarb*, being imported either directly from China, or indirectly by Singapore and other parts of the East Indies. Two kinds of East Indian rhubarb are distinguished in commerce: these are, the *untrimmed* or *half-trimmed*; and the *trimmed*, or as it is sometimes called, *Dutch trimmed* or *Batavian rhubarb*. Both kinds are official.

1. *Half-trimmed* or *untrimmed East Indian rhubarb.*—This is the *Chinese* or *East Indian rhubarb* of commerce. It varies in quality much more than the Russian rhubarb, and is sometimes worm-eaten. The best Chinese rhubarb is brought from Shanghai. It is called 'untrimmed,' or 'half-trimmed,' because the cortical portion of the root has been incompletely scraped, not sliced, off; and consequently the pieces have a rounded character, and are devoid of the flat surfaces and angles produced by slicing, as in the Russian and Dutch trimmed rhubarbs. The inferior pieces present the remains of the greenish-brown or blackish bark. The pieces are frequently cylindrical or roundish, but sometimes flattened; in trade they are distinguished as *rounds* and *flats*. They are generally perforated with holes, in many of which we find portions of the cords by which they were suspended. These holes are smaller than those observed in Russian rhubarb, and that portion of the root forming their sides is usually dark-coloured, decayed, and of inferior quality. The best pieces are heavier and more compact than those of the Russian kind, and are covered with an easily separable dust. When this is removed we observe that the surface is not so regularly reticulated, is of a yellowish-brown rather than reddish-white colour, and has coarser fibres than Russian rhubarb. On the finer pieces we notice numerous star-like spots or depressions. The fracture is uneven; the veins, especially towards the middle, have a less deter-

minate direction, and are of a duller or reddish-brown colour, and, in very bad pieces, of an amber-brown colour, with a grey substance between the veins. The odour of this species is much less powerful than that of Russian rhubarb, and is somewhat less aromatic. The taste, grittiness when chewed, and microscopic appearances, are similar to those of Russian rhubarb. The colour of the powder is of a duller yellow or brownish cast.

2. *Trimmed East Indian*, *Dutch trimmed*, or *Batavian Rhubarb.*—This kind of rhubarb is closely allied to, if it be not identical with, the preceding in its texture. In commerce, however, it is always regarded as distinct. It is imported from Canton and Singapore. It has been dressed or trimmed to resemble the Russian rhubarb, which it does in shape, size, and general appearance; for the cortical portion of the root has been separated by slicing, and hence the pieces have the same angular appearance on the surface as that of Russian rhubarb. The pieces are frequently perforated, and in the holes are found the remains of the cord by which the root has been suspended; in this it differs from the Russian rhubarb. In the drug trade this kind of rhubarb is said to be trimmed, and, according to the shape of the pieces, they are called *flats* or *rounds.* The colour and weight of the pieces are variable.

English Rhubarb.—This is the produce of *Rheum Rhaponticum*; it is largely cultivated in the neighbourhood of Banbury in Oxfordshire. It is not official, but is sometimes sold for Asiatic rhubarb in the piece, and still more frequently in powder. It occurs in pieces of various sizes and shapes, which are prepared and trimmed in different ways, so as to represent in appearance the foreign kinds of rhubarb: some of the pieces are cylindrical in their form, and are evidently segments of cylinders; others are flat. This kind of rhubarb is very light, spongy (especially in the middle of the large flat pieces), attractive of moisture, pasty under the pestle, and has a purplish, reddish, or pinkish hue not observed in the Asiatic kinds. Internally it has usually a marbled appearance; the streaks are pinkish, parallel, and have a radiated disposition; and in the centre of some of the larger pieces the texture is soft and woolly, and may be easily indented by the nail. Its taste is astringent, and very mucilaginous; it is not at all, or only very slightly, gritty under the teeth; its odour is feeble, and more unpleasant than either the Russian or East Indian kinds. The microscope discovers in it, for the most part, very few crystals of oxalate of lime. The radiated, and more or less parallel disposition of its lines or veins are the best diagnostic characters of English rhubarb.

Adulterations.—Dr. R. D. Thompson stated before the Committee on the Adulteration of Drugs, in July 1855, that samples of powdered rhubarb frequently contained as much as fourteen pounds of flour and eight ounces of turmeric in a hundredweight. Paper stained by a strong decoction of tincture of rhubarb is not affected by boracic acid, or by the borates rendered acid, whereas turmeric paper is reddened by these agents. Hence the presence of turmeric in powdered rhubarb may be detected by this means. Flour is not so easily detected in the powder. The production of an intensely blue colour by the addition of iodine to a cold decoction of the powder would not necessarily indicate the presence of flour. In general, a decoction of Russian or of East Indian rhubarb becomes, with a solution of iodine, greenish-blue (*iodide of starch*) : but after a few minutes the colour disappears, and no iodine can be detected in the liquid by starch, unless nitric acid be previously added. A decoction of English rhubarb is also rendered, by a solution of iodine, intensely blue (*iodide of starch*) ; but the colour does not entirely disappear by standing. These peculiarities are not constant. Some specimens of Russian rhubarb contain so much starch that they react on iodine, like those of English rhubarb.

Composition.—Rhubarb contains *odorous matter*, *chrysophanic acid*, *tannic* and *gallic acids*, *resins*, *bitter principle*, *starch*, and *oxalate of lime*. *Odorous matter.*—The odorous principle is probably a volatile oil, but it has not hitherto been isolated. *Chrysophanic acid.*—Yellow crystalline granular matter of rhubarb, $C_{10}H_8O_3$, found in Russian and East Indian rhubarbs. In the pure, or more or less impure state, it has long been known under the names of *rheic acid* and *rhein*. It may be procured from rhubarb by means of ether in Robiquet's displacement apparatus. Pure chrysophanic acid is a beautiful clear yellow odourless and tasteless substance, which is separated in granular masses, and shows little disposition to crystallise. It is tolerably soluble in hot rectified spirit of wine, not very soluble in ether, even when boiling, and almost insoluble in cold water, but more soluble in boiling water. Heated, it evaporates, emits yellow fumes, which condense and form yellow flocculi, and at the same time a part becomes carbonised. It dissolves in alkalies, producing a brilliant red colour ; if the potash solution be evaporated to dryness, the red colour changes to violet, and then to a beautiful blue. It dissolves in oil of vitriol, forming a red solution, from which water precipitates yellow flocculi. *Resins.*—Rhubarb contains three resins—black, brown, and red, soluble in alcohol and in the alkalies, insoluble in water. *Bitter principle.*—The nature of this is not well determined. *Astringent matter*, *tannic and gallic acids.*—The red veins are the seat of the astringent matter. This is proved by brushing the cut surface of rhubarb with a weak solution of a ferruginous salt; the red veins, only, undergo a change of colour. *Oxalate of Lime.*—The conglomerate raphides before noticed are crystals of oxalate of lime. They may be separated in great abundance by boiling Russian or East Indian rhubarb in water until the cohesion of the tissue is completely destroyed. When the decomposed tissue is well shaken with water, the crystals fall to the bottom of the vessel. If the powder of rhubarb be heated in a glass capsule over a lamp, an odorous yellow vapour (*oil ?* or *resin with chrysophanic acid*) is obtained, which communicates a red colour to a solution of caustic potash. The aqueous infusion of rhubarb is rendered green by the perchloride of iron (*tanno-gallate of iron*) ; with a solution of gelatine it yields a copious yellow precipitate (*tannate of gelatine*), which is dissolved on the application of heat, or by the addition of an excess of gelatine ; with a solution of sulphate of quinia, a yellowish precipitate (*tannate of quinia*) is formed; with the alkalies (potash, soda, and ammonia), a red-coloured solution (*soluble alkaline chrysophanates*) ; with lime-water, a reddish precipitate (*chrysophanate of lime*) ; with the acids (the acetic excepted), precipitates; and with various metallic solutions (as of acetate of lead, chloride of tin, protonitrate of mercury, and the nitrate of silver), precipitates (principally *metallic chrysophanates* and *tannates*).

Physiological Effects.—In small doses, as from four to eight grains, rhubarb acts as an astringent tonic, its operation being principally or wholly confined to the digestive organs. In relaxed conditions of these parts it promotes the appetite, assists the digestive process, improves the quality of the alvine secretions, and often restrains diarrhœa. *In large doses*, as from twenty to sixty grains, it operates slowly and mildly, as a purgative, sometimes causing slight griping. It never inflames the mucous membrane of the alimentary canal, as is the case at times, with jalap, scammony, colocynth, and some other drastic purgatives. The constipation which follows its cathartic effect has been ascribed to the operation of its astringent matter. In febrile complaints and inflammatory diseases, it sometimes accelerates the pulse and raises the temperature of the body ; whence the impropriety of its use in these cases. Under the use of rhubarb, the secretions, especially the urine, become coloured by it. The cutaneous secretion, especially of the arm-pits ; and the milk also, become coloured under the use of rhubarb. The milk of nurses who have taken it is said to acquire a purgative property. Considered in relation to other medicinal agents, rhubarb holds an intermediate rank between the bitter tonics on the one hand, and the drastics on the other. From the first it is distinguished by its purgative qualities ; from the latter, by its tonic operation and the mildness of its evacuant effects. As a purgative, it is perhaps more closely allied to aloes than to any other cathartic in ordinary use ; but it is distinguished by its much milder operation, and its want of any specific action on the large intestines. Russian, East Indian, and Dutch trimmed rhubarb appear to be about equal in power. English rhubarb is about two-thirds the strength of the above kinds.

Therapeutics.—The remedial value of rhubarb depends on the mildness and safety of its operation, and on its tonic and astringent influence over the alimentary canal. *As a purgative.*—There are many cases in which the above-mentioned qualities render rhubarb most valuable as a purgative. In mild cases of *diarrhœa* it sometimes proves peculiarly efficacious, by first evacuating any irritating matter contained in the bowels, and afterwards acting as an astringent. Given at the commencement of the disease, it is a very popular remedy; and though doubtless it is often employed unnecessarily, yet it rarely, if ever, does harm. Sulphate of potash is a very useful adjunct to it, and promotes its purgative operation. Antacids, as chalk or magnesia, are frequently conjoined with it. It is not fitted for inflammatory or febrile cases. As an infant's purgative it is deservedly celebrated. It is well suited for a variety of children's complaints; but is peculiarly adapted to scrofulous subjects, and those afflicted with enlargement of the mesenteric glands accompanied with tumid belly and atrophy. Magnesia, sulphate of potash, mercury with chalk, or calomel, may be associated with it, according to circumstances. For an ordinary purgative in habitual costiveness it is scarcely adapted, on account of the constipation which follows its purgative effect. *As a stomachic and tonic.*—In dyspepsia, accompanied with a debilitated condition of the digestive organs, small doses of rhubarb sometimes prove beneficial, by promoting the appetite and assisting the digestive process.

Administration.—The powder may be exhibited, as a stomachic and tonic, in doses of from five to ten grains; as a purgative, from twenty to forty grains.

[§ **Extractum Rhei.** *Extract of Rhubarb.*

Take of

Rhubarb Root, sliced or bruised .	1 pound.
Rectified Spirit	10 fluid ounces.
Distilled Water	5 pints.

Mix the spirit and the water, and macerate the rhubarb in the mixture for four days; then decant, press, and set by, that the undissolved matter may subside; pour off the clear liquor, filter the remainder, mix the liquors, and evaporate by a water-bath at a temperature not exceeding 160°, until the extract has acquired a suitable consistence for forming pills.

Dose.—5 to 15 grains.]

The British Pharmacopœia follows the London in employing spirit as well as water; but the evaporation, being conducted at a temperature not exceeding 160°, will produce a better result. Great care is required in the preparation of this extract, as both the purgative and tonic properties of rhubarb are very apt to become deteriorated by the process. Some extract prepared *in vacuo* more than twenty years has retained the proper odour and flavour of rhubarb.

[§ **Infusum Rhei.** *Infusion of Rhubarb.*

Take of

Rhubarb Root, in thin slices . .	$\frac{1}{4}$ ounce.
Boiling Distilled Water . . .	10 fluid ounces.

Infuse in a covered vessel, for one hour, and strain.

Dose.—1 to 2 fluid ounces.]

This is nearly the Dublin infusion. It is stronger than the London infusion, but only half as strong as that of Edinburgh. The spirit of cinnamon (*Ed.*) is omitted, and the long maceration (*Ed.*) reduced to one hour. Boiling water extracts from rhubarb, chrysophanic acid, resin, tannic and gallic acids, extractive, and starch. As the liquor cools it becomes turbid. Infusion of rhubarb is stomachic and gently purgative. It is usually employed as an adjunct to, or vehicle for, other mild purgatives or tonics. The alkalies or magnesia are sometimes conjoined. The stronger acids, and most metallic solutions, are incompatible with it.

[§ **Pilula Rhei Composita.** *Compound Rhubarb Pill.*

Take of

Rhubarb Root, in powder . .	3 ounces.
Socotrine Aloes, in powder . .	$2\frac{1}{4}$ ounces.
Myrrh, in powder, Hard Soap, in powder } of each .	$1\frac{1}{2}$ ounce.
Oil of Peppermint . . .	$1\frac{1}{2}$ fluid drachm.
Treacle, by weight . . .	4 ounces.

Mix the powders with the oil, then add the treacle and beat the whole into a uniform mass.

Dose.—5 to 10 grains.]

In this pill hard soap and oil of peppermint (*Ed.*, *Dub.*) are ordered instead of soft soap and oil of caraway (*Lond.*), and treacle (*Lond.*, *Dub.*) instead of conserve of roses (*Ed.*). The proportions of the other ingredients remain unaltered. It should be observed that the pill of Barbadoes aloes, pill of Socotrine aloes, compound pill of colocynth, and compound rhubarb pill of the British Pharmacopœia, are each prepared with a different volatile oil, in order that the odour may assist in distinguishing them. Compound rhubarb pill is tonic and mildly purgative. It is often used as a dinner pill.

[§ **Pulvis Rhei Compositus.** *Compound Powder of Rhubarb.*

Take of

Rhubarb Root, in powder . . .	2 ounces.
Light Magnesia	6 ounces.
Ginger, in powder	1 ounce.

Mix them thoroughly, and pass the powder through a fine sieve.]

Dose.—For adults, 20 to 60 grains; for children, 5 to 10 grains.

A very useful antacid and mild stomachic purgative, especially adapted for children; it is commonly known as Gregory's powder.

[§ **Syrupus Rhei.** *Syrup of Rhubarb.*

Take of

Rhubarb Root, in coarse powder } of each	2 ounces.
Coriander Fruit, in coarse powder }	
Refined Sugar	24 ounces.
Rectified Spirit	8 fluid ounces.
Distilled Water	24 fluid ounces.

Mix the rhubarb and coriander; pack them in a percolator, pass the spirit and water, previously mixed, slowly through them; evaporate the liquid that has thus passed until it is reduced to thirteen fluid ounces, and in this, after it has been filtered, dissolve the sugar with a gentle heat.

Dose.—1 to 4 fluid drachms.]

This is a mild and agreeable purgative for children and delicate persons.

[§ **Tinctura Rhei.** *Tincture of Rhubarb.*

Take of

Rhubarb Root, in coarse powder . .	2 ounces.
Cardamom Seeds, freed from the pericarps, and bruised . . } of each	$\frac{1}{4}$ ounce.
Coriander Fruit, bruised . . }	
Saffron . . . . . . }	
Proof Spirit	1 pint.

Macerate the solid ingredients for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

Dose.—1 to 2 fluid drachms as a stomachic; 4 to 8 fluid drachms as a purgative.]

Stronger than any of the former tinctures of rhubarb, and nearly twice as strong as that of London. The liquorice root (*Lond.*, *Ed.*) and ginger (*Lond.*) are omitted, and coriander introduced, in addition to cardamoms (*Ed.*, *Dub.*) Tincture of rhubarb contains chrysophanic acid, tannic acid, and resin. It is cordial, stomachic, and mildly purgative. A popular remedy in various disordered conditions of the alimentary canal, especially at the commencement of diarrhœa and in flatulent colic. A useful adjunct to purgative mixtures when a cordial cathartic is required.

[§ **Vinum Rhei.** *Wine of Rhubarb.*

Take of

Rhubarb Root, in coarse powder . .	$1\frac{1}{2}$ ounce.
Canella Alba Bark, in coarse powder .	60 grains.
Sherry	1 pint.

Macerate for seven days in a closed vessel with occasional agitation, then strain, press, filter, and add sufficient sherry to make one pint.

Dose.—1 to 2 fluid drachms.]

Cordial, stomachic, and mildly purgative.

Sub-class II.—Corolliflorœ.

LABIATÆ, *Jussieu.* The Labiate Order.

LAVANDULA VERA, *D.C.* **Lavender.**

Botanical Character.—An *undershrub* 1 to 3 feet high. *Leaves* linear-lanceolate or oblong-linear, quite entire, when young hoary and revolute at the margins. *Spikes* interrupted. *Whorls* of 6 to 10 flowers. *Floral leaves* rhomboid-ovate, acuminate, membranous, all fertile, the uppermost shorter than the calyx. *Bracts* scarcely any. *Flowers* purplish-grey. *Calyx* ovate-tubular, 13-ribbed, shortly 5-toothed. *Corolla* with the tube exserted, the throat somewhat dilated, the limb oblique and bilabiate; upper lip 2-lobed, lower 3-lobed; all the divisions nearly equal. *Stamens* 4, didynamous, included, bent downwards. *Style* shortly bifid at the apex. *Nuts* (*achenia*) 4, smooth.—*Woodv.* p. 150, pl. 55 (*L. Spica*).

Habitat.—South of Europe. Extensively cultivated at Mitcham in Surrey, and at Hitchin in Hertfordshire.

[§ **Oleum Lavandulæ.** *Oil of Lavender.*

The oil distilled in Britain from the flowers of Lavandula vera, *D.C.*]

Preparation.—Oil of lavender distilled in Britain is alone official, as it was in the London Pharmacopœia. Foreign oil of lavender is very inferior, and is frequently obtained from *Lavandula Spica, D.C.* English oil of lavender should be prepared by submitting lavender *flowers* to distillation with water. 69⅕ pounds of the flowers, carefully separated from the stalks, yielded Mr. Bell 1 pound of oil, or 1·44 per cent. At Hitchin 60 pounds of good flowers yield on an average 16 fluid ounces of oil. When the stalks and leaves are distilled with the flowers, the odour of the oil is considerably deteriorated, and becomes somewhat rank. At Mitcham the flowers are put into the still with the stalks, as cut from the ground. The finest oil is drawn for two and a half hours, and is considered to come from the flowers. That which comes afterwards is second or third quality. The oil from the stalks is less volatile than the other, and comes last.

General Characters.—Colourless or pale yellow, with a very fragrant odour, and a hot bitter aromatic taste. Its specific gravity varies from 0·877 to 0·905; the lightest oil being the purest. It boils at 397° F.

Therapeutics and Pharmaceutical Uses.—It is a stimulant and stomachic, and is given in hysteria and headache, chiefly however in the form of the compound tincture and spirit. It is also commonly employed as a perfume for scenting evaporating lotions, ointment, or liniments, and is thus used in the preparation of the compound liniment of camphor.

Dose.—2 to 5 minims.

[§ **Spiritus Lavandulæ.** *Spirit of Lavender.*

Take of

Oil of Lavender	1 fluid ounce.
Rectified Spirit	49 fluid ounces.

Dissolve.

Dose.—½ to 1 fluid drachm.]

Lavender Water.—The fragrant perfume sold in the shops under the name of *lavender water* is a solution of the oil of lavender and other odoriferous substances in rectified spirit. There are various formulæ for its preparation, scarcely two manufacturers adopting precisely the same one. The following yields a most excellent product: oil of lavender, oil of bergamot, aa. fl. drs. iij.; otto of roses, oil of cloves, aa. min. vj.; oil of rosemary, fl. drm. j.; musk, gr. ij.; honey, oz. j.; benzoic acid, gr. xl.; rectified spirit, Oj.; distilled water, fl. oz. iij. Mix, and after standing a sufficient time (the longer the better), filter. This agreeable perfume may be employed for scenting spirit washes, but it is principally consumed for the toilette.

[§ **Tinctura Lavandulæ Composita.** *Compound Tincture of Lavender.*

Synonym.—Spiritus Lavandulæ Compositus, *Edin.*

Take of

Oil of Lavender . . .		$1\frac{1}{2}$ fluid drachm.
Oil of Rosemary . . .		10 minims.
Cinnamon Bark, bruised	of each	150 grains.
Nutmeg, bruised . .	of each	150 grains.
Red Sandal-wood . . .		300 grains.
Rectified Spirit . . .		2 pints.

Macerate the cinnamon, nutmeg, and red sandal-wood in the spirit for seven days in a closed vessel, with occasional agitation; then strain and press, dissolve the oils in the strained tincture, filter, and add sufficient rectified spirit to make two pints.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

This is the London tincture. The Edinburgh contained about the same quantity of oils but more spices. The Dublin was twice as strong, and was coloured with cochineal. The red sandal-wood is used merely as a colouring ingredient. It is stimulant, cordial, and stomachic; and is employed to relieve gastric uneasiness, flatulence, low spirits, languor, and faintness. A favourite remedy with hysterical and hypochondriachal persons.

Pharmaceutical Use.—It is a constituent of the official arsenical solution.

MENTHA.

Generic Character.—Calyx campanulate or tubular, 5-toothed, nearly equal or somewhat 2-lipped, with the throat naked inside or villous. *Corolla* with the tube inclosed; the limb campanulate, nearly equal, 4-cleft, the upper segment broader, nearly entire or emarginate. *Stamens* 4, equal, erect, distinct; *filaments* smooth, naked; *anthers* with 2 parallel cells. *Style* shortly bifid, with the lobes bearing stigmas at the points. *Nuts* (*achenia*) 4, smooth.

MENTHA VIRIDIS, *Linn.* Spearmint.

Specific Character.—Creeping-rooted. *Stem* erect, smooth. *Leaves* subsessile, ovate-lanceolate, unequally serrated, smooth; those under the flowers all bract-like, rather longer than the whorls. *Spikes* cylindrical, acute, loose. *Whorls* approximated, or the lowest or all of them distant; teeth of the *calyx* linear subulate.—*Woodv.* pl. 170, p. 463.

Habitat.—Marshy places. Indigenous. A native of the milder parts of Europe: also of Africa and America.

[§ **Oleum Menthæ Viridis.** *Oil of Spearmint.*

The oil distilled in Britain from fresh flowering spearmint, Mentha viridis, *Linn.*]

General Characters and Uses.—It is colourless or of a pale yellow colour, but becomes reddish by age. It has the odour and taste of the plant, and is lighter than water, its specific gravity being 0·914. It boils at 320° F. The average produce of the essential oil is not more than 1-500th of the fresh herb. It is carminative and stimulant.

Dose.—2 to 5 minims rubbed with sugar and a little water.

[§ **Aqua Menthæ Viridis.** *Spearmint Water.*

Take of

Oil of Spearmint . . .	$1\frac{1}{2}$ fluid drachm.
Water	$1\frac{1}{2}$ gallon.

Distil 1 gallon.]

The distillation of the oil with the water is an improvement on the London and Dublin processes of admixture by trituration and agitation. Mr. Squire has found by experience that the medicated waters are better prepared from the part of the plant which contains the oil, than from the oil itself; but when so prepared they are liable to vary in strength. The omission of the spirit (*Ed., Dub.*) is another improvement, as the water keeps better without it. Spearmint water is carminative and stomachic. It is commonly used as a vehicle for other medicines.

Dose.—1 to 3 fluid ounces.

MENTHA PIPERITA, *Linn.* Peppermint.

Specific Character.—Creeping-rooted, herbaceous, perennial. *Stem* erect, smooth. *Leaves* stalked, ovate-oblong, acute, serrate, rounded-crenate at the base, smooth. *Spikes* lax, obtuse, short, interrupted at the base. *Pedicels* and *calyces* smooth at the base; teeth hispid. —*Woodv.* pl. 169, p. 461.

Habitat.—Watery places. Indigenous. Extensively cultivated at Mitcham, Hitchin, and Market Deeping. Found in various parts of Europe; also in Asia, Africa, and America.

[§ **Oleum Menthæ Piperitæ.** *Oil of Peppermint.*

The oil distilled in Britain from fresh flowering peppermint, Mentha piperita, *Linn.*]

Preparation.—In a warm, dry, and favourable season, the produce of oil from a given quantity of the fresh herb is double, or more than double, that which it yields in a wet and cold season. The largest produce is three fluid drachms and a half of oil from two pounds of fresh peppermint (or 1·4 per cent.), and the smallest, about a fluid drachm and a half from the same quantity (or 0·6 per cent.) (*Brande*); but I was informed by a distiller at Mitcham, that twenty mats of the herb (each mat containing about 1 cwt.) yield about seven pounds of oil (or 0·3 per cent.).

General Characters and Composition.—Oil of peppermint is colourless or pale yellow, with the odour of peppermint. It has occasionally a greenish tint, and it becomes deeper yellow by age. Its taste is warm and aromatic, succeeded by a sensation of coldness in the mouth. It has a specific gravity of 0·902. The vapour of it, applied to the eye, causes a feeling of coldness. Oil of peppermint consists of two isomeric oils,—one liquid, the other solid; the latter is called *peppermint camphor*, or the stearoptene of oil of peppermint. Its composition is $C_{10}H_{20}O$. It is in colourless prisms, which have the odour and taste of peppermint, are almost insoluble in water, but readily soluble in alcohol and ether, and are fusible at 92° F.

Adulteration.—Oil of peppermint is said to be adulterated with foreign oil of rosemary: the odour would probably serve to distinguish the fraud. *American Oil of Peppermint* is inferior in odour and flavour to the English oil. The American oil is often adulterated with oil of turpentine, which is perceptible to the smell. This adulterated oil gives a black smoky flame in burning.

Physiological Effects.—Oil of peppermint is carminative, stimulant, stomachic, and antispasmodic.

Therapeutics.—It is employed in medicine for several purposes, but principally to expel flatus, to cover the unpleasant taste of other medicines, to relieve nausea, griping pain, and the flatulent colic of children.

Administration.—It is taken on sugar in doses of from 2 to 5 minims.

Pharmaceutical Use.—It is an ingredient of compound rhubarb pill.

[§ **Aqua Menthæ Piperitæ.** *Peppermint Water.*

Take of

Oil of Peppermint . . .	$1\frac{1}{2}$ fluid drachm.
Water	$1\frac{1}{2}$ gallon.

Distil one gallon.]

Equal in strength to the Dublin peppermint water. Carminative and stimulant. Used to relieve flatulence, and as a vehicle for other medicines. It is an ingredient in the aromatic mixture of iron.

Dose.—1 to 3 fluid ounces.

[§ **Essentia Menthæ Piperitæ.** *Essence of Peppermint.*

Take of

Oil of Peppermint	1 fluid ounce.
Rectified Spirit	4 fluid ounces.

Mix.

Dose.—10 to 20 minims.]

[§ **Spiritus Menthæ Piperitæ.** *Spirit of Peppermint.*

Take of

Oil of Peppermint	1 fluid ounce.
Rectified Spirit	49 fluid ounces.

Dissolve.

Dose.—$\frac{1}{2}$ to 1 fluid drachm.]

MENTHA PULEGIUM, *Linn.* Pennyroyal.

Specific Character.—Creeping-rooted. *Stem* very much branched, prostrate. *Leaves* stalked, ovate. *Whorls* all remote, globose, many-flowered. *Calyces* hispid, bilabiate, villous in the inside of the throat.

Habitat.—Wet commons and margins of brooks. Indigenous. A native of most parts of Europe, of the Caucasus, Chili, and Teneriffe.

Oleum Menthæ Pulegii. *Oil of Pennyroyal.*

The oil obtained by submitting the fresh-flowering herb, Mentha Pulegium, *Linn.*, to distillation with water.

(*Not official.*)

General Characters and Uses.—It has a pale colour, a warm taste, and the peculiar odour of the herb. It boils at 395° F. Its sp. gr. is 0·925. The fresh herb yields from 1-100th to 1-120th of its weight of oil. It is stimulant and carminative, and is used, as an antispasmodic and emmenagogue, in doses of from two to five minims taken on sugar.

ROSMARINUS OFFICINALIS, *Linn.* Rosemary.

Botanical Character.—An *undershrub* 3–5 feet high, densely leafy. *Leaves* sessile, linear, entire, revolute at the margins, hoary beneath. *Calyx* purplish, 2-lipped; the upper lip entire, the lower bifid. *Corolla* white or pale purplish-blue, with a protruding tube, not ringed in the inside, somewhat inflated in the throat; limb with

2 equal lips, the upper of which is erect and emarginate, the lower trifid, with the middle lobe very large, concave, and hanging down. *Stamens* 2, protruding; *filaments*, shortly toothed near the base; *anthers* linear, with 2 straggling confluent cells. Upper lobe of the *style* very short. *Nuts* (*achenia*) 4, smooth.—*Steph. and Church.* pl. 24.

Habitat.—South of Europe: also Asia Minor. Cultivated in England.

[§ **Oleum Rosmarini.** *Oil of Rosemary.*

The oil distilled from the flowering tops of Rosmarinus officinalis, *Linn.*]

General Characters.—Colourless, with the odour of rosemary, and a warm aromatic taste. Its specific gravity is 0·897, and it boils at 365° F. One pound of the fresh herb yields about one fluid drachm of oil.

Therapeutics.—Carminative and stimulant, but rarely taken *internally* except in the compound tincture of lavender. It is frequently used *externally*, in conjunction with other substances, as a stimulating liniment; for example, in alopecia or baldness.

Dose.—2 to 5 minims.

Pharmaceutical Uses.—It is a constituent of liniment of soap and compound tincture of lavender.

[§ **Spiritus Rosmarini.** *Spirit of Rosemary.*

Take of

Oil of Rosemary	1 fluid ounce.
Rectified Spirit	49 fluid ounces.

Dissolve.

This is one-fifth the strength of the preparation of the same name in the British Pharmacopœia 1864.]

Dose.—½ to 2 fluid drachms, but chiefly used as an external application.

SCROPHULARIACEÆ, *Lindley.* The Figwort Order.

DIGITALIS PURPUREA, *Linn.* Purple Foxglove.

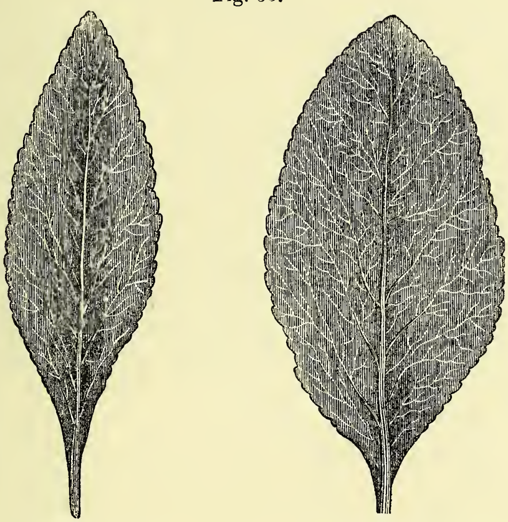
Botanical Character.—*Herbaceous*, biennial. *Stem* erect, 3–5 feet high, downy. *Leaves* alternate, ovate-lanceolate or oblong, the lower ones tapering at the base into winged foot-stalks, crenate or crenate-dentate, veiny, rugose, of a dull green above, the under surface paler and downy. *Raceme* long, terminal, erect, simple. *Calyx* 4–5-partite, segments ovate or oblong. *Corolla* somewhat campanulate, with an oblique 4–5 fid limb, the lowermost segment being the largest, purplish-pink, elegantly marked with eye-like spots, as well as hairy, within. *Stamens* 4, didynamous, ascending. *Anthers* approximated in pairs, their cells diverging and confluent. *Style* bilobed at the apex; the lobes stigmatic within. *Capsule* ovate, 2-valved, with septicidal dehiscence. *Seeds* numerous, minute, oblong, somewhat angular.—*Woodv. Med. Bot.* pl. 24.

Habitat.—Indigenous; in pastures and about hedges or banks, on a gravelly or sandy soil.

[§ **Digitalis Folia.** *Digitalis Leaf.*

The dried leaf of Digitalis purpurea, *Linn.* Collected from wild indigenous plants, when about two-thirds of the flowers are expanded.]

Fig. 55.



First year's leaf. Second year's leaf.

Digitalis Leaves.

Collection and Drying.—The leaves are directed to be gathered when about two-thirds of the flowers are expanded, i.e. before the seeds have begun to ripen; the plant at this time being in the greatest perfection. The reason of the greater activity of the leaves and other vegetative organs after the flowering stage has commenced has been explained by Professor Bentley (see *Phar. Journ.* 2nd ser. vol. iii. p. 475) as follows:—'There are two series of compounds formed by the action of light and air in plants, those of one series having for their object the nutrition of the plants in which they are formed, and being directly concerned in their growth and development,—and those of the other series called secretions, playing no active part in the plant after their perfect formation, and being also commonly formed later in the life of the plant. . . . In the process of flowering, the only compounds that are taken up in any amount are those which are concerned in the growth and development of new tissues; no further growth can therefore take place, (to any great extent at least,) in the vegetative organs of the plant; but the secretions, by the removal of these products, become more concentrated, and the organs in which they are produced, by being left for a longer period in connection with the plant, have time to elaborate them more perfectly.' Although the leaves should be gathered, as directed, at the period of inflorescence, yet not unfrequently first year's leaves, when the plant does not flower, and which are considered to be of inferior activity, are substituted for them. The first year's leaves (fig. 55), are frequently more tapering than those of the second year's (fig. 55) growth; but this character is not much to be relied on. The character of *shortly petiolate* as given in the Pharmacopœia, is another distinction, the radical or first year's leaves having longer petioles than those of the second year; but as the petioles may be cut off, the best and safest plan, to avoid the substitution, is to purchase the fresh leaves at the proper season (namely, at the period of inflorescence, which is during the month of July), or still better, to purchase the entire plants when in flower. The leaves are usually dried in baskets in a dark place, in a drying stove. Both dried leaves and powder should be preserved in well stoppered bottles, covered externally by dark coloured paper and kept in a dark cupboard. As both undergo changes by keeping, whereby their medicinal activity is considerably diminished, they ought to be renewed annually.

General Characters.—Ovate-lanceolate, or oblong, more or less petiolate, rugose, downy, paler on the under surface, crenate or crenate-serrate, or dentate; with a faint odour, and a bitter, nauseous taste.

Adulterations.—The leaves of *Inula Conyza, D.C.*, *Ploughman's Spikenard*, closely resemble those of digitalis: but, when rubbed, are readily distinguished by their odour, which by some is called aromatic, by others fetid. Moreover, they are rougher to the touch, and are less divided on their margins. The leaves of *Symphytum officinale*, Linn., Comfrey, and those of *Verbascum Thapsus*, Linn., Mullein, are also sometimes intermixed with those of digitalis, but a careful attention to the characters as given above will readily distinguish them. Mullein leaves are at once detected by their more woolly appearance, and by *both surfaces of the leaves being woolly* instead of simply *downy on the under surface*, as in those of digitalis or foxglove.

Digitalis or *Foxglove seeds* were formerly official, and are sometimes employed in medicine. They are very small, roundish, angular, pitted, and of a greyish-brown colour.

Composition.—Digitalis contains a non-nitrogenised neutral principle, called *digitalin*, to which its properties are essentially due. This is official, and will be described presently.

Physiological Effects.—We may, for convenience, establish three degrees of the operation of digitalis, or foxglove. *In the first degree*, or that produced by *small and repeated doses*, digitalis sometimes affects what are termed the organic functions, without disordering the animal or cerebro-spinal functions. Thus we sometimes have the stomach disordered, the pulse altered in frequency, and occasionally also in fulness and regularity; and the secretion of urine increased without any other marked symptoms. The order in which the symptoms just mentioned occur is not uniform; sometimes the diuresis, at others nausea, and occasionally the affection of the circulation, being the first obvious effect. The influence of digitalis over the *circulation* is not at all constant. In some cases the frequency of the pulse is augmented, in others decreased, while in some it is unaffected. Lastly, in a considerable number of instances the pulse becomes irregular or intermittent under its use. A few drops of the tincture will, in some cases, reduce the frequency of the pulse, and render it irregular and intermittent, while in other instances much larger doses may be taken without any obvious effect on it. In some cases the slowness of the pulse is preceded by an increased activity of the vascular system. A great deal, however, depends on the position of the patient. If it be desired to reduce the frequency of the pulse, the patient should be kept in a recumbent posture. The sudden change of position in those who are much under the influence of this medicine is attended with great danger, and in several instances has proved fatal; for the power of the heart being enfeebled by digitalis, when a demand is made on this viscus for an increase in the force of its contractions by the change from the recumbent to the standing attitude, it endeavours to make up for its diminished force by an increase in the frequency of its contractions; and not having sufficient power to propel the blood to the head, fatal syncope has been the result. The influence of digitalis over the pulse is more marked in some individuals or cases than in others; thus the reduction of the frequency of the pulse is in general more readily induced in weak and debilitated constitutions than in robust and plethoric ones. Occasionally no obvious effect on the number, force, or regularity of the pulse is produced, though the medicine may have been given to an extent sufficient to excite vomiting and cerebral disorder. Dr. Bence Jones says: 'It may safely be assumed that digitalis acts on the nerves that regulate the heart's action, first as a stimulant, and in large doses as a sedative.' The recent researches of Dr. Brunton lead to the belief that digitalis contracts the capillaries generally throughout the body, while it stimulates at the same time the vagi or regulatory nerves of the heart, as well as its musculo-motor or sympathetic nerves. By increasing the quantity of digitalis, there results paralysis of the capillaries, the vagi, and the sympathetic nerves. The very able investigations of Dr. Brunton enable us to explain much that was previously conflicting in the experiments of former investigators. Dr. Howship Dickenson has shown (*Med.-Chir. Trans.* vol. xxxix.) that digitalis has an immediate special action on the uterus, producing its forcible contraction, which is often even attended with pain. The *diuretic* operation for which we employ digitalis is very inconstant. Dr. Withering stated that this medicine more frequently succeeds as a diuretic than any other, and that if it fail, there is but little chance of any other remedy succeeding. My experience, however, is not in accordance with Dr. Withering's. I have frequently seen digitalis fail in exciting diuresis, and have often found the decoction of broom subsequently succeed.

The *second degree of operation* of digitalis, or that resulting from the use of too large or too long-continued doses, is manifested by the disordered condition of the alimentary canal, of the circulating organs, and of the cerebro-spinal system. The more ordinary symptoms are nausea or actual vomiting, slow and often irregular pulse, coldness of the extremities, syncope, or tendency to it, giddiness and confusion of vision. Sometimes the sickness is attended with purging, or even with diuresis; at other times there is neither sickness, nor purging, and the principal disorder of the system is observed in the altered condition of the nervous and vascular organs. Disordered vision, and a sensation of weight, pain, or throbbing of the head, especially in the frontal region, are experienced; giddiness, weakness of the limbs, loss of sleep, occasionally stupor or delirium, and even convulsions, may also be present. The pulse becomes feeble, sometimes frequent, sometimes slow; there may be actual syncope, and profuse cold sweats. A most important fact connected with the repeated uses of small doses of digitalis, is the *cumulative effect* sometimes observed. It has not unfrequently happened that, in consequence of the continued use of small doses of this medicine, very dangerous symptoms, in some cases terminating in death, have occurred. The most prominent of these were great depression of the vascular system, giddiness, want of sleep, convulsions, and sometimes nausea and vomiting. A knowledge of its occasional occurrence impresses us with the necessity of exercising great caution in the use of this remedy, particularly with respect to the continuance of its administration and increase of dose; and it shows that after the constitutional effect has become obvious, it is prudent to suspend from time to time its exhibition, in order to guard against the effects of this alarming accumulation. I may add, however, that I have used it, and seen others employ it, most extensively, and in full doses, and have rarely seen any dangerous consequences; and I believe, therefore, the effects of accumulation to be much less frequent than the statements of authors of repute would lead us to expect. The quantity of digitalis that may be given to a patient without destroying life, is much greater than is ordinarily imagined. In one instance I saw twenty minims of the tincture given to an infant labouring under hydrocephalus, three times daily for a fortnight, at the end of which time the little patient had completely recovered, without one untoward symptom. I have frequently given a fluid drachm of the tincture (of the best quality) three times daily to an adult, for a fortnight, without observing any marked effect. I know that some practitioners employ it in much larger doses (as a fluid ounce or half a fluid ounce of the tincture) with much less effect than might be imagined. Mr. King, of Saxmundham, in Suffolk, assured me that he had been for many years in the habit of administering the tincture of digitalis to the extent of from half a fluid ounce to a fluid ounce at a time, not only with safety, but with the most decided advantage, as a remedy for acute inflammation,—not, however, to the exclusion of blood-letting, which, on the contrary, he previously uses with considerable freedom. To adults he often gives a fluid ounce of the tincture (seldom less than half a fluid ounce), and waits the result for twenty-four hours, when, if he does not find the pulse subdued, or rendered irregular by it, he repeats the dose; and this he says, seldom fails to lower the pulse in the degree wished for; and when this is the case, the disease rarely fails to give way, provided it has not gone the length of producing disorganisation of the part. He has given as much as two fluid drachms to a child of nine months. Sometimes vomiting quickly follows these large doses of digitalis, but never any dangerous symptom, so far as his observation has gone, which has been very extensive. In less acute cases he sometimes gives smaller doses, as thirty minims, several times in a day. The experience of Dr. Clutterbuck, Dr. T. Williams, and Mr. Jones of Jersey (see *Therapeutics*), is to the same effect.

The *third degree* of the operation of digitalis, or that resulting from the use of *fatal doses*, is characterised usually by vomiting, purging, and griping pain in the bowels; slow, feeble, and irregular pulse, great faintness, and cold sweats; disordered vision; at first giddiness, and extreme debility; afterwards insensibility and convulsions, with dilated insensible pupils.

If we compare the effects of digitalis with those of other medicinal agents, we find that they approximate more closely to those of tobacco than of any other cerebro-spinant. These two agents specially agree in their power of enfeebling the action of the heart and arteries. Considered as a diuretic, it is, in some respects, comparable with squills.

Therapeutics.—We employ digitalis for various purposes, as,—1st, to reduce the frequency and force of the heart's action; 2ndly, to promote the action of the absorbents; 3rdly, as a diuretic; and 4thly, sometimes on account of its specific influence over the cerebro-spinal system. In the following remarks on the uses of digitalis in particular diseases, I refer to the administration of this remedy in the doses in which it is ordinarily employed. I have no experience of its therapeutical effects when given in excessive doses. *In Fever.*—Digitalis is occasionally useful in fever to reduce the frequency of the pulse when the excitement of the vascular system is out of proportion to the other symptoms of fever, such as the increased temperature and the cerebral or gastric disorder. It cannot, however, be regarded, in the most remote way, as a curative means; on the other hand, it is sometimes hurtful. Thus, not unfrequently it fails to reduce the circulation; nay, occasionally it has the reverse effect, accelerates the pulse, while it increases the cerebral disorder, and perhaps irritates the stomach. In estimating its value as a remedial agent for fever, we must not regard it merely as a sedative means (I refer now to the vascular system). It is an agent which exercises a specific influence over the brain; and, therefore, to be able to lay down correct indications and contra-indications for its use in disordered conditions of this viscus, we ought to be acquainted, on the one hand, with the precise nature of the influence of the remedy, and, on the other, with the actual condition of the brain in the disease which we wish to relieve. Now, as we possess neither of these data in reference to fever, our use of digitalis is, with the exception of the sedative influence over the circulation, empirical; and experience has fully shown us it is not generally beneficial. But, I repeat, where the frequency of pulse bears no relation to the local or constitutional symptoms of fever, digitalis may be serviceable.

In Inflammation.—Digitalis has been employed in inflammatory diseases, principally on account of its power of reducing the frequency of the pulse, though some have referred part of its beneficial operation to its influence over the absorbent system. Inflammation, of a chronic kind, may be going on in one part of the body to an extent sufficient to produce complete disorganisation, and ultimately to cause the death of the patient, without the action of the larger arterial trunks (i.e. of the system generally) being remarkably increased. In such cases digitalis is, for the most part, of little use. Again, in violent and acute inflammation, accompanied with great excitement of the general circulation, especially in plethoric subjects, digitalis is, in some cases, hurtful; in others it is a trivial and unimportant remedy; and we therefore rely, in our treatment, on blood-letting and other powerful antiphlogistic measures; and digitalis, if serviceable at all, can only be used after the other means. As a remedy for inflammation, it is principally useful in less violent cases, particularly when accompanied with increased frequency of pulse, and occurring in subjects not able to support copious evacuations of blood. Moreover, it has more influence over inflammation of some parts of the body (as the arachnoid membrane, the pleura, the pericardium, and the lungs) than of others. In gastric and enteritic inflammation it would appear to be objectionable on account of its irritant properties; while its specific influence over the brain would make it doubtful in phrenitis. In arachnitis of children it is certainly a most valuable agent. In conclusion, then, it appears that digitalis, as a remedy for inflammation, is principally valuable where the disease has a tendency to terminate in serous effusion. But in no case can it be regarded as a substitute for blood-letting. Its powers as an antiphlogistic remedy have, I suspect, been greatly overrated.

In Dropsy.—Of all remedies for dropsy, none have gained more and few so much, celebrity as digitalis. Whatever may be its *modus operandi*, its powerful and salutary influence in many dropsies cannot be a matter of doubt. Dr. Withering has observed that 'it seldom succeeds in men of great natural strength, of tense fibre, of warm skin, of florid complexion, or in those of a tight and cordy pulse.' 'On the contrary, if the pulse be feeble and intermitting, the countenance pale, the lips livid, the skin cold, the swollen belly soft and fluctuating, or the anasarcous limbs readily pitting under the pressure of the finger, we may expect the diuretic effects to follow in a kindly manner.' In those with a florid complexion blood-letting and purgatives will often be found useful preparatives for digitalis. In some forms of dropsy digitalis is more serviceable than in others. Thus anasarca, ascites, hydrothorax, and phlegmasia dolens, are sometimes benefited by it. Its diuretic effect is greatly promoted by combining other diuretics with it, especially squill, calomel, or the saline diuretics (as the acetate of potash). A combination of vegetable bitters (as infusion of gentian or calumba) with digitalis forms, I think, a valuable form of exhibition in many old dropsical cases. Decoction of broom might probably be advantageously conjoined with it where a powerful diuretic is required. In old cases of general dropsy, in œdematous swellings from debility, and in anasarca following scarlet fever, where, together with weakness, there is still left an excited and irritable state of the arterial system, chalybeates, as the tincture of perchloride of iron, may be conjoined with digitalis with the happiest effects.

In hemorrhages.—In active hemorrhages from internal organs, accompanied with a quick, hard, and throbbing pulse, digitalis as a sedative is oftentimes serviceable. Epistaxis, hæmoptysis, and menorrhagia, are the forms of hemorrhage most frequently benefited by its use. *In diseases of the heart and great vessels.*—An important indication in the treatment of many diseases of the heart and great vessels, is to reduce the force and velocity of the circulation. The most effectual means of fulfilling this indication are, the adoption of a low diet, repeated blood-letting, and the employment of digitalis. *In aneurism of the aorta* our only hope of cure is by the coagulation of the blood in the aneurismal sac, and the consequent removal of the distensive pressure of the circulation. To promote this, we endeavour to retard the movement of the blood within the sac by diminishing the quantity of blood in the system generally, and by reducing the force and velocity with which it circulates. Blood-letting and digitalis are, in these cases, very important agents; and under their use cases now and then recover. Again, in *simple dilatation* of the cavities of the heart our objects are to remove, if possible, the cause (usually obstruction in the pulmonic or aortic system), to strengthen the muscular fibres of the heart, and to repress any preternatural excitement of the vascular system. Digitalis is useful to us in attaining the latter object. In *simple hypertrophy* or *hypertrophy with dilatation*, we have to reduce the preternatural thickness of the heart's parietes; and this we do by removing, when it can be done, any obstruction to the circulation, by using a low diet, by repeated blood-letting, and by the employment of digitalis. No means, says the late Dr. Davies, excepting the abstraction of blood, diminishes the impulsion of the heart so completely and so certainly as digitalis. *In some disordered conditions of innervation of the heart and great vessels*, as in angina pectoris, nervous palpitation of the heart, and augmented arterial impulsion, it is also at times beneficial. In patients affected with an intermittent or otherwise irregular pulse, I have several times observed this medicine produce regularity of pulsation,—a circumstance also noticed by Sir Henry Holland.

In delirium tremens.—We are indebted to the late Mr. Jones, of Jersey, for first directing attention to digitalis as a remedy in delirium tremens. Mr. Jones was in the habit of giving half a fluid ounce of tincture of digitalis in this disease, and of repeating the same dose once, if not twice, at intervals of twenty-four hours. After this, if necessary, he gave a smaller dose, as two fluid drachms.

Smaller quantities than this, he says, were of no service. With these large doses he states that he cured, with very few exceptions, all the cases of delirium tremens (and they were many), that came under his care; several of these having been previously treated unsuccessfully with opium. He describes some patients, who were apparently at the point of death, who were restored by it, and whose pulse, previously irregular and intermittent, became steady and regular under its use. Several practitioners in this country have also used it with marked success in large doses, frequently repeated, in delirium tremens. *In acute mania.*—Dr. Lockhart Robinson has used digitalis with success in acute mania.

Administration.—The ordinary dose of digitalis, *in powder*, is from half a grain to a grain and a half.

Antidotes.—In a case of poisoning by digitalis, or its preparations, expel the poison from the stomach by the stomach-pump, or by emetics if vomiting should not have already commenced; assist the vomiting, when it is established, by the use of diluents; and counteract the depressing influence of the poison on the circulation, by the use of ammonia and brandy; and keep the patient in a recumbent posture, to guard against syncope. I am unacquainted with any chemical antidote for digitalis; perhaps infusion of galls might prove serviceable, by the tannic acid which it contains.

[§ **Infusum Digitalis.** *Infusion of Digitalis.*

Take of

Digitalis Leaves, dried . . .	30 grains.
Boiling Distilled Water . . .	10 fluid ounces.

Infuse in a covered vessel, for one hour, and strain.

Dose.—2 to 4 fluid drachms.]

This infusion has half the strength of Infusum Digitalis, *Edin.*, *Dubl.* The spirit of cinnamon (*Lond.*, *Edin.*) is omitted. I believe this to be the most effectual of the preparations of digitalis.

[§ **Tinctura Digitalis.** *Tincture of Digitalis.*

Take of

Digitalis Leaves, in coarse powder . .	$2\frac{1}{2}$ ounces.
Proof Spirit	1 pint.

Macerate the digitalis for forty-eight hours in fifteen fluid ounces of the spirit in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.]

Dose.—The usual dose of the tincture for an adult is 10 minims, cautiously increased to 30 minims. I usually begin with 20 minims; but, as I have already stated, it has been given to the extent of one fluid ounce!

[§ **Digitalinum.** *Digitalin.*

Take of

Digitalis Leaf, in coarse powder	. .	40 ounces.
Rectified Spirit	. .	of each a sufficiency.
Distilled Water	. .	
Acetic Acid	. . .	
Purified Animal Charcoal.		
Solution of Ammonia	.	
Tannic Acid	. . .	
Oxide of Lead, in fine powder		
Pure Ether	. . .	

Digest the digitalis with a gallon of the spirit, for twenty-four hours, at a temperature of 120°, then put them into a percolator, and when the tincture has ceased to drop, pour a gallon of spirit on the contents of the percolator, and allow it slowly to percolate through. Distil off the greater part of the spirit from the tincture, and evaporate the remainder over a water-bath until the whole of the alcohol has been dissipated. Mix the residual extract with five ounces of distilled water, to which half an ounce of acetic acid has been previously added, and digest the solution thus formed with a quarter of an ounce of purified animal charcoal, then filter and dilute the filtrate with distilled water until it measures a pint. Add solution of ammonia nearly to neutralisation, and afterwards add one hundred and sixty grains of tannic acid dissolved in three ounces of distilled water. Wash the precipitate that will be formed with a little distilled water; mix it with a small quantity of the spirit and a quarter of an ounce of the oxide of lead, and rub them together in a mortar. Place the mixture in a flask, and add to it four ounces of the spirit; raise the temperature to 160°, and keep it at this heat for about an hour; then add a quarter of an ounce of purified animal charcoal; put it on a filter and from the filtrate carefully drive off the spirit by the heat of a water-bath. Lastly, wash the residue repeatedly with pure ether.]

This is the process of O. Henry. On treating the alcoholic extract with water and acetic acid, the greater part of the extractive matter with some colouring and resinous matters, are left undissolved, while the digitalin is taken up by the acid. The solution, after partial decolorisation, is nearly neutralised by ammonia, and the digitalin precipitated by the tannic acid. This precipitate is then slightly washed, and carefully rubbed with oxide of lead, which unites with the tannic acid. The digitalin is next dissolved in spirit, the solution decolorised, filtered, the spirit distilled off, and the residual digitalin washed with ether to remove any fatty matter. Great care must be taken in these operations to use as little heat as possible, as digitalin is very liable to change from this cause. This is the *digitalin* of Homolle. It was afterwards called *la digitaline* by Homolle and Quevenne, and shown not to be a pure proximate principle, but to contain other compounds. 100 parts of dried leaves yield about 1·25 of digitalin.

General Characters and Tests.—[§ In porous mammillated masses or small scales, white, inodorous, and intensely bitter; readily soluble in spirit, but almost insoluble in water and ether; dissolves in acids, but does not form with them neutral compounds; its solution in hydrochloric acid is of a faint yellow colour, but rapidly becomes green. It leaves no residue when burned with free access of air. It powerfully irritates the nostrils, and is an active poison.] Digitalin is difficultly crystallisable, and does not contain nitrogen. Concentrated sulphuric acid blackens it, and then dissolves it, forming a blackish-brown solution, which in a few days becomes successively reddish-brown, smoky amethyst, pure amethyst, and ultimately a beautiful crimson. If during this time a small quantity of water be added, a limpid beautiful green solution is obtained. If digitalin be moistened by sulphuric acid and afterwards exposed to the vapour of bromine, it immediately assumes a violet colour. This test will indicate the smallest trace of digitalin.

Physiological Effects and Therapeutics.—The effects of digitalin have been examined by Homolle, and by Bourchardat and Sandras. From their experiments it appears that its effects are similar to those of digitalis leaves; but that it is at least one hundred times as powerful as the powder of the dried herb. In the human subject, doses of from two to six milligrammes (from about 1-32nd to 1-11th of an English grain) diminished the frequency of the pulse, and caused nausea, vomiting, griping, purging, and increased secretion of urine. M. Bouillaud states that during four or five years not a day has passed without his employing digitalin on many patients affected with diseases of the heart or great vessels. He has given it to from 150 to 200 patients of all ages. In all excepting three the pulse was reduced. Two of these had endocarditis and pericarditis. If the pulse was irregular previous to the taking of digitalin, it became regular as the medicine took effect. In fifteen cases, taken at hazard, in La Charité, the maximum pulse before the action of the digitalin was 96; after the medicine, 41 pulsations less. In three cases, the pulse was reduced 80, 102, and 106 beats. The minimum reduction in three other cases was 12, 14, 16. As soon as pain in the head, vertigo, or nausea came on, the medicine was stopped.

Administration.—Digitalin has been employed in medicine in doses of from $\frac{1}{60}$ to $\frac{1}{30}$ of a grain. It may be administered in substance in the form of pills, or dissolved in alcohol and given as a mixture or syrup. But the difficulty of adjusting these small doses, as well as the uncertainty of the purity and activity of the remedy, are great drawbacks to its use. Dr. Bence Jones considers that 'the best form for keeping and giving digitalin as medicine is in granules, and not in tincture. Thus it keeps best, and is more certain in composition. It is thus most easily given, as its bitter taste is concealed. Each granule is made to contain one milligramme (=·015 grain) of digitalin.'

ATROPACEÆ, *Miers.* The Deadly Nightshade Order.

SOLANACEÆ, *Lindley.*

HYOSCYAMUS NIGER, *Linn.* **Henbane.**

Botanical Character.—*Stem* 1 to 3 feet high, simple, or but little branched. *Leaves* alternate, oblong, pinnatifid or sinuate, sessile, amplexicaul, acute, lower ones stalked, all of a pale dull green colour. Whole herbage downy, glandular, and clammy, exhaling a powerful, fetid, and oppressive odour. *Flowers* numerous, unilateral, drooping, nearly sessile. *Calyx* 5-lobed. *Corolla* lurid yellow, with dark purple veins, irregularly funnel-shaped; the limb 5-lobed; the lobes obtuse, unequal. *Stamens* 5, declinate; the 3 lower longer than the 2 others. *Ovary* superior, 2-celled; *ovules* numerous. *Stigma* capitate. *Fruit* capsular, called a pyxis, membranous, 2-celled, opening transversely by a convex lid. *Seeds* many, small, kidney-shaped, finely dotted, yellowish-grey.—*Steph. and Church.* pl. 9.

Varieties.—There are two varieties of henbane, an annual and a biennial. *The latter only is official.* It is larger, stronger, more branched, and more clammy than the annual variety, and has a more powerful odour. During the first year of its growth the plant has no stem, all the leaves being radical and stalked. It is less odorous and clammy than the mature plant, and is also said to yield less extract. In the autumn the leaves die, but the root survives during the winter, and in the following spring sends up a stem, which grows to the height of from about one to three feet. The leaves of the second year are large, and deeply sinuate or pinnatifid.

Habitat.—Indigenous: waste ground, banks, and commons. Flowers in July. Cultivated at Mitcham, Hitchin, Market Deeping, and about Cambridge.

[§ **Hyoscyami Folia.** *Hyoscyamus Leaves.*

The fresh leaves, with the branches to which they are attached, of Hyoscyamus niger, *Linn.*; also the leaves separated from the branches and carefully dried; gathered from wild, or cultivated British biennial plants when about two-thirds of the flowers are expanded.]

Collection.—For the advantage of collecting the leaves and other vegetative organs of plants after the flowers have expanded, see *Digitalis Folia* (p. 587). The reason why the young branches should be taken with the leaves has been explained by Professor Bentley (*Pharmaceutical Journal*, 2nd series, vol. iii. p. 475) as follows:—After showing the action of the leaves in the formation of the products and secretions of plants, he proceeds: 'I have shown that without leaves or other organs of an analogous nature, no growth to any extent can take place, or any secretions be formed in the plant. Thus the floral leaves, and the green parts of the flower, have a similar effect to the leaves; even the young herbaceous parts, from which the leaves and other organs arise, are also directly concerned in the formation of products and secretions. This assimilating power of the young green herbaceous parts is commonly lost sight of, but in reality the structure of these parts is essentially the same as the leaves, except that their tissues are somewhat more compact and differently arranged; hence in proportion to amount of matter they do not expose so large a surface to the action of air and light as the leaves, and as the process of assimilation only takes place in the cells immediately below the epidermis, their powers of forming products and secretions are somewhat less intense, but the difference between the parts immediately in contact with the leaves and the leaves themselves must be very slight. Indeed I am by no means certain, but that the young herbaceous parts frequently contain quite as much, or even more active secretions than the leaves themselves; thus, if the latter organs be left on the stem till they have passed their active vital conditions, the active secretions which they normally contain will have passed to a great degree into the young stalks in their passage downwards to the main stem, and hence they would be then probably more active than the leaves, as they would in such a case not only be assimilating organs, but also the receptacles for the products and secretions formed in the surrounding parts. Hence, in practice, in making preparations from herbaceous plants, we may consider the young vitally active parts in immediate contact with the leaves, as not materially differing in activity from them, and that consequently they may be advantageously as well as economically used with them.' One hundred pounds of the fresh herb yield about fourteen pounds when dried.

General Characters.—Leaves oblong, pinnatifid or sinuate, pale dull green, clammy (when fresh), and glandular-hairy. The fresh herb has a strong unpleasant odour, and a slightly acrid taste, but these characters nearly disappear on drying. The fresh juice, dropped into the eye, dilates the pupil.

Hyoscyamus seeds are small, compressed, roundish, finely dotted, of a yellowish-grey colour, an oleaginous bitter taste, and the characteristic odour of the leaves. They are *not* official.

Composition.—Brandes procured from the herb of *Hyoscyamus niger* a vegetable alkaloid, which he termed *Hyoscyamia*, and his statements have been confirmed by Geiger and Hesse, as well as by Mein. However, Chevalier, as well as Brault and Poggiale, have failed to procure it. The properties assigned to it are almost identical with those of atropia, from which it differs in being more soluble in water. It is crystallisable, has an acrid taste, and, when volatilised, yields ammonia. Reisinger says that a drop of a solution of one grain of this substance in ten grains of water caused dilatation of the pupil, but did not give rise to irritation of the eye. A solution of double this strength acted as an irritant.

Physiological Effects.—*In small and repeated doses*, hyoscyamus has a calming, soothing, and tranquillising effect. This is especially observed in persons suffering from great nervous irritability, and from a too active condition of the sensorial functions. In such it frequently causes quietude, with a tendency to sleep. It commonly allays irritation and preternatural sensibility existing in any organ. It does not quicken the pulse, check secretion, or cause constipation. *Large doses* sometimes induce sleep. But its hypnotic properties are neither constant nor powerful. Very large doses are apt to be followed by delirium rather than by sleep. *In poisonous doses* it causes loss of speech, dilatation of pupil, disturbance of vision (presbyopia), distortion of face, coma, and delirium, generally of the unmanageable, sometimes of the furious kind, and phantasms; and paralysis, occasionally with convulsive movements. Irritation of the stomach and bowels (manifested by nausea, vomiting, pain, and purging) is occasionally induced. In its operation on the body hyoscyamus presents several peculiarities. From opium it is distinguished by the sedative rather than stimulant effects of small doses, and by its not confining the bowels; and, when swallowed in large doses, by the obscurity of vision it occasions, by its producing dilatation of the pupil, and by its being more apt to occasion delirium with phantasms. Furthermore, in some individuals opium causes headache and other distressing symptoms which hyoscyamus is not so apt to produce. Its power of alleviating pain and allaying spasm and of inducing sleep is greatly inferior to that of opium. From belladonna and stramonium, to which it is in several respects closely allied, it is distinguished by the very rare occurrence of any symptoms of gastro-intestinal irritation after the ingestion of large doses of it.

Therapeutics.—As an anodyne, where opium disagrees, or is from any circumstance objectionable, it may be used in neuralgia, rheumatism, gout, periostitis, milk abscess, painful affections of the urino-genital organs, scirrhus, and carcinoma. *As a calmer* and *soporific* it is available in sleeplessness, accompanied with great restlessness and mental irritability, when opium, from its stimulant or other properties, proves injurious. Sometimes, where it fails to cause actual sleep, it proves highly serviceable, by producing a calm and tranquil state, conducive to the well-doing and comfort of the patient. *As an antispasmodic* it occasionally proves serviceable in spasmodic affections of the organs of respiration (e.g. spasmodic asthma) and of the urino-genital apparatus (e.g. spasmodic stricture, and spasm of the sphincter vesicæ). *As a sedative* to allay irritation and preternatural sensibility, it is frequently a serviceable remedy. Thus in troublesome cough it sometimes proves useful, by diminishing the sensibility of the bronchial membrane to the influence of the cold air. In nephritic and vesical irritation, and in gonorrhœa, it is sometimes a useful substitute for opium. In the irritation of teething it is valuable, from its power of relieving pain and convulsion. It is equally so in strumous ophthalmia, a few minims taken at bedtime greatly diminishing the irritability on the following morning. It has great advantages over opium in the diseases of children. Combined with camphor and ether it generally relieves palpitation of the heart.

[§ **Extractum Hyoscyami.** *Extract of Hyoscyamus.*

Take of

The fresh Leaves and young Branches of Hyoscyamus . . . . } 112 pounds.

Bruise in a stone mortar, and press out the juice; heat it gradually to 130° and separate the green colouring matter by a calico filter. Heat the strained liquor to 200° to coagulate the albumen, and again filter. Evaporate the filtrate by a water-bath to the consistence of a thin syrup; then add to it the green colouring matter previously separated, and, stirring the whole assiduously, continue the evaporation at a temperature not exceeding 140° until the extract is of a suitable consistence for forming pills.]

Mr. Squire finds that 100 pounds of the leaves and young branches yield 50 pounds of juice and 5 pounds of extract. The quality of the extract met with in the shops is extremely variable. This arises principally from the unequal care with which it has been prepared, but probably also, from its having been hitherto directed to be prepared from the leaves only (see *Extractum Belladonnæ,*

p. 607). It is a valuable addition to the compound extract of colocynth, whose operation it renders milder, though not less efficacious. It is sometimes used as a topical application to inflamed or tender parts; thus, alone, or in the form of ointment, it is applied to painful hemorrhoids; spread on linen, it forms a plaster which has been used in neuralgia, rheumatic pains, and painful glandular swellings. The ordinary dose is from 5 to 20 grains; but occasionally very much larger doses have been taken without any injurious effects.

Pharmaceutical Use.—It is an ingredient of the pill of colocynth and hyoscyamus.

[§ **Tinctura Hyoscyami.** *Tincture of Hyoscyamus.*

Take of

Hyoscyamus Leaves, in coarse powder	$2\frac{1}{2}$ ounces.
Proof Spirit	1 pint.

Macerate the hyoscyamus for forty-eight hours in fifteen fluid ounces of the spirit in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

Dose.—$\frac{1}{2}$ to 1 fluid drachm.]

ATROPA BELLADONNA, *Linn.* Deadly Nightshade.

Botanical Character.—*Root* fleshy, perennial. *Stems* herbaceous, 3–5 feet high, round, branched, leafy, slightly downy. *Leaves* alternate, shortly petiolate, broadly ovate, acute, entire, smooth, mostly two together of unequal size. *Flowers* axillary, solitary, stalked, drooping. *Calyx* persistent, 5-parted. *Corolla* campanulate, about an inch long, lurid purple; *limb* with five short equal segments. *Stamens* 5. *Ovary* superior, 2-celled; *stigma* capitate. *Fruit* baccate, of a shining violet-black colour, globose, the size of a small cherry, 2-celled. *Seeds* many, reniform. Whole plant fetid when bruised, and of a dark and lurid aspect.—*Flor. Lond.* fasc. v. pl. 16.

Habitat.—Indigenous: hedges and waste ground in shady places on a calcareous soil. Flowers in June and July, and the fruits ripen in September.

[§ **Belladonnæ Folia.** *Belladonna Leaves.*

The fresh leaves, with the branches to which they are attached, of Atropa Belladonna, *Linn.*; also the leaves separated from the branches and carefully dried; gathered from wild or cultivated British plants when the fruit has begun to form.]

Collection.—The leaves are in the greatest perfection when the fruit has *begun* to form, and before the *ripening* fruit and seeds have robbed them of their active principle. (For the reasons why the leaves should be thus gathered and the young branches also used, see *Digitalis Folia*, p. 587, and *Hyoscyami Folia*, p. 599.) As the wild plant is rare, the cultivated plant is allowed to be used, but the former should be preferred.

General Characters.—Leaves alternate, of a dull green colour, three to six inches long, ovate, acute, entire, smooth, the uppermost in pairs and unequal. The fresh leaves have a feeble bitterish slightly acrid taste. The odour when bruised is peculiar and somewhat fetid. The expressed juice, or an infusion, dropped into the eye, dilates the pupil.

Composition.—The herb of belladonna contains an alkaloid *atropia* in the state of bimalate, to which it owes its active properties. (See *Atropia*, p. 610.)

Physiological Effects.—*In the first degree* of its operation, belladonna diminishes sensibility and irritability when these are morbidly increased; and very frequently causes dryness of the mouth and throat, attended with thirst. *In the second degree* of its operation, belladonna manifests, both in healthy and morbid conditions, its remarkable influence over the cerebro-spinal system. It causes dilatation of the pupils (mydriasis), presbyopia or long-sightedness, with obscurity of vision, or absolute blindness, visual illusions (phantasms), suffused eyes, occasionally disturbance of hearing (as singing in the ears), numbness of the face, confusion of head, giddiness, and delirium, which at times resembles intoxication, and may be either combined with or followed by sopor. These symptoms are usually preceded by a febrile condition, attended with a remarkable affection of the mouth, throat, and adjacent parts. Besides dryness of these parts, it causes difficulty of deglutition, and of articulation, a feeling of constriction about the throat, nausea, and sometimes actual vomiting, with, now and then, swelling and redness of the face. The pulse is usually hurried and small. The cutaneous, renal, and mucous secretions are frequently augmented; and an exanthematous eruption, like that of scarlet fever, has sometimes occurred. In some cases very severe effects have been induced by the application of the extract of belladonna to abraded surfaces. The continued application of it to the sound skin has also been attended with similar effects. *In the third degree* of its operation, belladonna produces effects similar to the preceding, but in a more violent form; also injection of the conjunctiva with a bluish blood; protrusion of the eye; feeling of weakness, lipothymia, syncope; difficulty or impossibility of standing, frequent bending forward of the trunk; continual motion of the hands and fingers; gay delirium, and a vacant smile; aphonia, or confused sounds, uttered with pain, followed, in case of recovery, by gradual restoration to health and reason, without any recollection of the preceding state. Seven cases (two of which proved fatal) of poisoning by belladonna fruits have occurred under my notice in the London Hospital. The effects observed in these cases were tolerably uniform.

In comparing the operation of belladonna with that of other cerebro-spinals or narcotics, the most remarkable symptoms which attract our attention are dilatation of the pupil, with insensibility of the iris to light, disturbance of vision (presbyopia), giddiness, staggering, delirium (extravagant, pleasing, or furious), with phantasms, followed by sopor, dryness of the throat, and difficulty of deglutition and articulation. Convulsions are rare, and, when they occur, are slight. Lethargy or sopor occurs subsequently to the delirium. These characters distinguish the effects of belladonna from those of any other medicinal substance, except henbane and stramonium. When applied to the eyebrow, belladonna causes dilatation of the pupil of that eye, without necessarily affecting the other eye, or disturbing vision. The action on the iris depends, according to Müller, not on the operation of the belladonna on the central organs of the nervous system, but on its topical paralysing influence on the ciliary nerves. When, however, belladonna is swallowed, it is obvious that the iris can only become affected through the general system; and in this case the dilatation of the pupil is accompanied with disturbance of vision. The pneumogastric nerve is obviously concerned in producing the affection of the mouth, and the difficulty of deglutition and articulation. The disorder of the intellect and of the external senses caused by belladonna proves that the influence of this agent is not limited to the excitomotory system, but is extended to those portions of the nervous centres which are the seat of the intellect and of sensibility. The active principle of belladonna becomes absorbed, and may be detected in the urine.

Therapeutics.—Belladonna has been employed to allay pain and nervous irritation, to produce dilatation of the pupil, to counteract that condition of brain which is accompanied with contraction of the pupil, to lessen rigidity and spasmodic contraction of muscular fibres, as a vasculo-cardiac stimulant, and as a diuretic. These uses obviously arise out of the ascertained physiological effects of the remedy. *To allay pain and nervous irritation.*—As an anodyne in most internal pains, no remedy hitherto proposed is equal to opium; but this agent totally fails us in many of those external pains known as neuralgia and tic douloureux. In such, belladonna occasionally succeeds in abating, sometimes in completely removing, pain; while it totally fails to give relief in the internal pains for which experience has found opium so efficacious. It is remarkable, therefore, that while both these cerebro-spinals or narcotics agree in lessening pain, they totally disagree as to the cases in which they succeed, and for which they are individually applicable. Dr. John Harley states, that when belladonna is given in combination with opium or morphia, it increases the hypnotic effect of the opiate, while at the same time it lessens the disagreeable after effects. In the treatment of neuralgia, belladonna is employed both internally and externally, but my experience of the use of this remedy leads me to regard it as very much inferior to aconite as a local remedy for this disease. Besides neuralgia there are many other painful affections in which belladonna is used as a local anodyne. Such are arthritic pains, painful ulcers, and glandular enlargements which are painful to the touch. 'In cancer of the uterus, one grain of the extract should be used as a suppository' (*Brodie*).

As an antispasmodic.—To relieve rigidity and spasmodic contraction of muscular fibres, belladonna sometimes proves serviceable as a topical remedy. In rigidity of the os uteri, during lingering labours or puerperal convulsions, the extract or ointment of belladonna has been applied to the part by way of friction. In spasmodic stricture of the urethra, and of the sphincters of the bladder and rectum, as well as in spasmodic contraction of the uterus, the topical use of the extract (smeared on a bougie, applied to the perineum or other parts, or employed by way of an enema) has in some cases appeared to give relief. In strangulated hernia it has been employed to produce relaxation of the abdominal muscles. Dr. A. P. Stewart recommends it in intestinal obstruction. Considerable benefit is frequently gained by its use in hooping-cough. But it also often fails to produce any relief in this disease. Belladonna is also useful in spasmodic asthma, and in angina pectoris.

In maladies of the eyes.—Belladonna is applied to the eye for two purposes: the first, and the most common, is to dilate the pupil; the other is to diminish the preternatural sensibility of the retina to the impression of light. *Dilatation of the pupil* is sometimes produced, in certain diseases of the eye, in order to enable us to examine the condition of the refractive humours, and thereby to ascertain the nature and extent of the malady, as in cases of incipient cataract, especially the marginal cataract of old persons, which might otherwise be occasionally confounded with glaucoma or amaurosis; or, in advanced cataract, to ascertain the existence of adhesions between the iris and the lens prior to the operation of extraction. In the operation by solution or absorption, the full dilatation of the pupil by belladonna is essential; and in central congenital cataract, frequently nothing more is necessary in order to remedy the defect.

The daily use of belladonna in the latter case, perhaps for many years, produces no injurious or permanently paralysing effect on the iris, the natural motory power of which remains unimpaired. In iritis, dilatation of the pupil is important, in order to prevent, or in recent cases to rupture, adhesions of the uvea to the capsule of the crystalline lens. Dilatation is usually effected by applying the extract, diluted with water to the consistence of cream, to the parts round the eye. The dilatation commonly takes place within a quarter or half an hour, and sometimes continues for twenty-four hours. Belladonna is occasionally employed in inflammatory and other affections of the eye, to diminish the morbid sensibility of this organ to the influence of light. Thirty grains of the extract dissolved in eight fluid ounces of water, filtered through linen and used warm, forms an excellent fomentation in ophthalmia with great intolerance of light, especially in scrofulous ophthalmia.

In fever, with contraction of the pupil.—Dr. Graves has proposed the use of belladonna in those cases of fever with cerebral disease which are attended with contraction of the pupil; and the favourable opinion thus expressed of its employment in such cases, is also supported by its action in some other cerebral diseases when attended with the same condition of pupil. Thus in the *Lancet* is recorded the case of a man suffering from *delirium tremens*, who had not slept for twelve days, and was in a state of furious delirium *with contracted pupils*. The undiluted extract of belladonna having been applied to a portion of the skin, three inches by two, which had been blistered and deprived of its cuticle, the pupils became fully dilated in nine minutes, and the man fell into a profound sleep, which lasted seven hours, and awoke quite rational.

As a prophylactic against scarlatina.—The introduction of belladonna into practice as a preventive of scarlet fever, is owing to the absurd homœopathic axiom of '*similia similibus curantur*;' for as this plant gives rise to an affection of the throat, and sometimes to a scarlet rash on the skin, its power of guarding the system against the reception of scarlet fever has been assumed. But the experience of a number of practitioners is entirely opposed to this prophylactic action of belladonna. *As a diuretic*, belladonna is frequently most beneficially employed. Dr. John Harley found it of great value in acute nephritis, in chronic albuminuria (when not arising from fatty degeneration of the kidney), in uræmia, and in suppression of urine. Dr. Harley believes its action as a diuretic is owing to the stimulant effect it exerts on the sympathetic nerve-centres of the kidneys. *Other Uses.*—Belladonna has the power of preventing the secretion of milk; and it is useful during pregnancy in diminishing the excessive salivary secretion which then sometimes occurs. *In profuse salivation* belladonna has also been found highly beneficial.

Administration.—The dose of the *powder* for an adult is one grain, which should be gradually increased until dryness of the throat, dilatation of the pupil, or some head symptoms are produced. For children, the dose at the commencement should be a quarter of a grain. The *extract* or *tincture* is, however, commonly employed for internal as well as external use. Belladonna and its preparations act far more quickly and effectually when taken on an empty stomach. For external use an *infusion* of the leaves is sometimes used as a fomentation, or is made into a poultice with bread or linseed meal.

Antidotes.—After the use of evacuants, the vegetable acids have appeared to give great relief. Infusion of galls or green tea might probably prove serviceable. Recent experiments appear to indicate that opium, which taken internally produces an opposite state of pupil, is also a direct antidote to the action of belladonna. The results obtained by Dr. John Harley would appear, however, to be entirely opposed to this. (See p. 605.)

[§ **Extractum Belladonnæ.** *Extract of Belladonna.*

Take of

The fresh Leaves and young Branches of Belladonna . . . . . } 112 pounds.

Bruise in a stone mortar, and press out the juice; heat it gradually to 130°, and separate the green colouring matter by a calico filter. Heat the strained liquor to 200° to coagulate the albumen, and again filter. Evaporate the filtrate by a water-bath to the consistence of a thin syrup; then add to it the green colouring matter previously separated, and, stirring the whole together assiduously, continue the evaporation at a temperature not exceeding 140°, until the extract is of a suitable consistence for forming pills.

Dose.—$\frac{1}{4}$ to 1 grain.]

The *young branches* are now directed to be employed as well as the *fresh leaves*, in the preparation of the extract, for the following reasons:—At a meeting of the Pharmaceutical Society, called to consider the advantage of using other parts of herbaceous plants in addition to the leaves in the preparation of extracts from the expressed juice, it appeared that, according to the experience of the manufacturers present, there was a decided advantage in pressing the soft young herbaceous stems or branches as well as the leaves, and that extracts so prepared kept much longer unchanged than those prepared from the leaves only, the latter being very liable to become mouldy. The results of the trials made by Dr. Garrod, Mr. Dixon, Mr. W. Cooper, and others, of the comparative efficacy of the two extracts, were also decidedly favourable to the employment of the young branches as well as the leaves. (See *Pharmaceutical Journal*, 2nd series, vol. iii. pp. 300, 368; see also *Hyoscyami Folia*, p. 599, for Professor Bentley's physiological explanation.)

Mr. Squire obtained from $64\frac{1}{2}$ pounds of the leaves of 100 pounds of the trimmed herb (i.e. deprived of its stem and larger branches) 5 pounds 3 ounces of extract; and from the remaining $35\frac{1}{2}$ pounds of soft parts (branches, flowers, and young fruit), 1 pound 11 ounces; in all, 6 pounds 14 ounces. The first of these extracts became mouldy in ten days; the second, as well as an extract made from all the soft parts, kept well.

[§ **Emplastrum Belladonnæ.** *Belladonna Plaster.*

Take of

Extract of Belladonna, Resin Plaster	of each .	3 ounces.
Rectified Spirit		6 fluid ounces.

Rub the extract and spirit together in a mortar, and when the insoluble matter has subsided, decant the clear solution, remove the spirit by distillation or evaporation, and mix the alcoholic extract thus obtained with the resin plaster melted by the heat of a water-bath, continuing the heat until with constant stirring the plaster has acquired a suitable consistence.]

Anodyne and antispasmodic. Applied for the relief of neuralgic, rheumatic, and other pains. It is said to relieve the pain of dysmenorrhœa when applied to the sacrum; and it certainly affords relief in angina pectoris and in palpitation of the heart when applied to the chest. In spreading this plaster care must be taken not to employ a very hot spatula, or the properties of the extract will be injured.

[§ **Tinctura Belladonnæ.** *Tincture of Belladonna.*

Take of

Belladonna Leaves, in coarse powder .	1 ounce.
Proof Spirit	1 pint.

Macerate the leaves for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

This tincture has about half the strength of Tinctura Belladonnæ, *Lond.*, *Dub.*

Dose.—5 to 20 minims.]

[§ **Unguentum Belladonnæ.** *Ointment of Belladonna.*

Take of

Extract of Belladonna	80 grains.
Prepared Lard	1 ounce.

Rub the extract smooth with a few drops of distilled water, then add the lard, and mix thoroughly.]

This ointment contains nearly one half more extract than the London ointment. It is a very useful preparation; and may be used as an anodyne and antispasmodic in some of the before-mentioned cases. Mr. Squire says that this is not a clean application, and that half a fluid drachm or a fluid drachm of liniment of belladonna, mixed with an ounce of lard, answers as well, and does not colour the skin.

[§ **Belladonnæ Radix.** *Belladonna Root.*

The dried root of Atropa Belladonna, *Linn.* Cultivated in Britain, or imported from Germany.]

Collection.—It should be collected for drying in the autumn or early spring.

General Characters.—From one to two feet long, and from half an inch to two inches thick; branched and wrinkled, brownish-white externally, and whitish internally. It has a feebly sweetish taste; and but little odour. An infusion dropped into the eye dilates the pupil.

Composition.—It owes its active properties to the alkaloid atropia.

[§ **Linimentum Belladonnæ.** *Liniment of Belladonna.*

Take of

Belladonna Root, in coarse powder .	20 ounces.
Camphor	1 ounce.
Rectified Spirit	a sufficiency.

Moisten the belladonna with some of the spirit, and macerate in a closed vessel for three days; then transfer to a percolator, and adding more spirit percolate slowly into a receiver containing the camphor, until the product measures one pint.]

This is a strong preparation, being, according to Squire, four times the strength of the extract of belladonna. As it is intended only for external use, it is termed a *liniment*, for which purpose it is adapted by the addition of camphor. When used it may be diluted with an equal quantity of soap liniment.

Chloroformum Belladonnæ. *Chloroform of Belladonna.*

Mr. Squire has introduced this preparation, which is made in the same way as *Linimentum Belladonnœ*, but substituting chloroform for rectified spirit. One part mixed with seven parts of *Linimentum Belladonnœ*, has been used with great advantage under the name of *Linimentum Belladonnœ compositum*, as an application for lumbago, sciatica, &c. It is to be sprinkled on impermeable piline and applied to the affected part, pressing the piline with the hand as long as the glow it produces in the skin can be endured.

[§ **Atropia.** *Atropia.*

$C_{34}H_{23}NO_6$ or $\mathbf{C_{17}H_{23}NO_3}$.

An alkaloid obtained from Belladonna.

It may be obtained by the following process:—

Take of

Belladonna Root, recently dried, and in coarse powder . . .	2 pounds.
Rectified Spirit	10 pints.
Slaked Lime	1 ounce.
Diluted Sulphuric Acid, Carbonate of Potash } of each .	a sufficiency.
Chloroform	3 fluid ounces.
Purified Animal Charcoal . .	a sufficiency.
Distilled Water	10 fluid ounces.

Macerate the root in four pints of the spirit, for twenty-four hours, with frequent stirring. Transfer to a displacement apparatus, and exhaust the root with the remainder of the spirit by slow percolation. Add the lime to the tincture placed in a bottle, and shake them occasionally several times. Filter, add the diluted sulphuric acid in very feeble excess to the filtrate, and filter again. Distil off three-fourths of the spirit, add to the residue the distilled water, evaporate at a gentle heat, but as rapidly as possible, until the liquor is reduced to one-third of its volume and no longer smells of alcohol; then let it cool. Add very cautiously, with constant stirring, a solution of the carbonate of potash so as nearly to neutralise the acid, care, however, being taken that an excess is not used. Set to rest for six hours, then filter, and add carbonate of potash in such quantity that the liquid shall acquire a decided alkaline reaction. Place it in a bottle with the chloroform; mix well by frequently repeated brisk agitation, and pour the mixed liquids into a funnel furnished with a glass stopcock. When the chloroform has subsided, draw it off by the stopcock, and distil it on a water-bath from a retort connected with a condenser. Dissolve the residue in warm rectified spirit; digest the solution with a little animal charcoal; filter, evaporate, and cool, until colourless crystals are obtained.]

In this process the alcohol extracts, from the belladonna root, a salt of atropia: this is decomposed by the lime, which removes the organic acid and colouring extractive matter. Sulphuric acid is then added to the filtered solution, to unite with the disengaged atropia; for this alkaloid, when free, and especially when in contact with alkalies, readily undergoes decomposition by heat. The filtered solution of sulphate of atropia is then evaporated by a very gentle heat, as the atropia salts, especially in the impure state, easily undergo decomposition. A small quantity of carbonate of potash is next added, to separate a resinous substance which impedes the crystallisation of the atropia. After the separation of this, an excess of a concentrated solution of carbonate of potash is used to precipitate, as speedily as possible, the atropia, which is then removed from the mixture by solution in the chloroform. When the chloroform has been removed by distillation, the residual impure alkaloid is dissolved in spirit, decolorised, filtered, and the atropia crystallised. 'Two pounds of the root should yield about 40 grains of atropia' (*Brandes*).

General Characters and Tests.—[§ In colourless acicular crystals sparingly soluble in water, more readily in alcohol and in ether. Its solution in water has an alkaline reaction, gives a citron-yellow precipitate with terchloride of gold, has a bitter taste, and powerfully dilates the pupil. It leaves no ash when burned with free access of air.] It is odourless. Impure atropia is not crystalline, is more or less coloured, and has an unpleasant odour. When pure it is soluble in $1\frac{1}{2}$ times its weight of cold alcohol, but requires, at ordinary temperatures, 25 parts of cold ether to dissolve it, or 6 parts of boiling ether. It fuses by heat, and at a higher temperature is partly volatilised and partly decomposed. Nitric acid dissolves it, forming a yellow solution. Cold oil of vitriol dissolves it without colour; but if heat be applied, the mixture acquires a red colour. When heated with a solution of potash or soda, atropia undergoes decomposition, and gives out ammonia. A watery solution of a salt of atropia is reddened by tincture of iodine; yields a whitish flocculent precipitate with tincture of galls; and a yellowish-white with perchloride of platinum. The *sulphate*, *hydrochlorate*, and *acetate of atropia*, are crystalline salts. (See also *Daturia*, page 615.)

Physiological Effects.—Atropia is a most energetic poison. It effects are similar to, but more powerful than, those of belladonna. One centigramme (about 1-6th of a grain) produces the following symptoms :—The first and most constant symptom is dry throat, with difficulty of swallowing, and acceleration of the pulse by eight to twenty strokes. The second is dilatation of the pupils, with dimness of sight, also giddiness, noise in the ears, hallucination, phantasms, lively delirium with unconsciousness of all surrounding objects, incoherence, numbness of the limbs, a sensation of formication in the arms, rigidity of the thighs, depression of the pulse, and occasionally strangury. The voice is sometimes weakened ; or there may be complete aphonia. The unfavourable symptoms disappear after from twelve to twenty hours. A very minute (imponderable) quantity applied to the eye is sufficient to dilate the pupil. The experiments of Dr. Fleming lead to the conclusion that atropia does not paralyse the retina, but merely deranges the visual apparatus.

Therapeutics. — Atropia is employed medicinally (usually as an external agent) in place of belladonna ; to which it is considered superior, on account chiefly of the uncertainty of the latter. It is, of course, much more energetic, and, for external use especially, is much cleaner than the extract of belladonna. As a topical agent it is employed as a mydriatic or dilator of the pupil, in cataract, &c. The local pain which atropia produces when used endermically is of very short duration, and is unattended with any ill consequences. *Internally* atropia has been employed in hooping-cough, chorea, and some other nervous diseases. The experience of atropia as a dilator of the pupil has hitherto been chiefly derived from the use of a solution of the sulphate ; and it is found at the London Ophthalmic Hospital, that the solution of the uncombined alkaloid is not nearly so well borne by the eye, as one of the sulphate. The following remarks will therefore apply to this salt, which was in the last London Pharmacopœia, and which, though omitted in the British Pharmacopœia of 1864, was restored in the British Pharmacopœia of 1867.

The *sulphate of atropia* may be regarded as one of the best preparations of belladonna. In a weak solution it has no irritant effect (which appears not to be the case with the solution of atropia), and it is free from that mechanical action which may be objected to in the extract of belladonna, while, owing to its uniform composition, it can be applied of a precisely regulated strength. Two grains of this salt have been usually dissolved in one fluid ounce of distilled water. (In the official solution of Sulphate of Atropia four grains are, however, directed to be dissolved in a fluid ounce of water.) A single drop of the first solution, retained in contact with the cornea and conjunctiva for only a few instants, produces, in twenty to twenty-five minutes, *complete dilatation with immovability of the pupil.* A solution of this strength has been chiefly used for the purpose of diagnosis, to prevent threatening adhesion of the iris, and to increase the capacity of sight in central cataract, or in central opacity of the cornea, &c. But it is liable to disturb vision for three or four days, and to make reading almost impossible in cases where this could be accomplished readily in the ordinary state of the pupil. Hence a weaker solution is often preferred, and a solution of a quarter of a grain in a fluid ounce of water, has been found to induce full dilatation, with transient immovability of the pupil, and to enable a full examination to be made of the internal parts, in all directions. The dilatation ensues after from thirty to forty-five minutes; and ordinarily, in twenty-four hours, it ceases to disturb the vision. A still weaker solution of an eighth of a grain in a fluid ounce of water, is kept at the London Ophthalmic Hospital, for the use of patients suffering from cataract in its early stage. Mr. Luxton found a strong solution of the nitrate, prepared by mixing two grains of atropia with one minim of nitric acid (sp. gr. 1·5), and adding to these one fluid drachm of water, a most useful preparation for the relief of the severe paroxysms of facial neuralgia. The affected portion of the face is to be painted with the above solution, and the pain is frequently subdued in from three to five minutes. Sometimes a second, third, or fourth application may be required. Its chief efficacy is witnessed in those cases in which the neuralgia has arisen from exposure to vicissitudes of temperature or other external causes.

Administration.—The *dose* of atropia for internal use is from about 1-30th to 1-10th of a grain. Its employment requires great caution. The safest mode of administration is in solution, on account of the facility with which the dose may be adjusted; but it has also been given, mixed with sugar, in the form of powder; and, mixed with the powder of liquorice root and honey, in the form of pills. It may be employed endermically in doses of about the $\frac{1}{30}$th of a grain gradually increased to $\frac{1}{15}$th of a grain.

[§ **Liquor Atropiæ.** *Solution of Atropia.*

Take of

Atropia	4 grains.
Rectified Spirit	1 fluid drachm.
Distilled Water	7 fluid drachms.

Dissolve the atropia in the spirit, and add this gradually to the water, shaking them together.]

Dose.— For internal use from four minims (= gr. $\frac{1}{30}$ of atropia) to twelve minims, or when used endermically from four to about eight minims. It may also be employed, diluted with distilled water, to dilate the pupil.

[§ **Unguentum Atropiæ.** *Ointment of Atropia.*

Take of

Atropia	8 grains.
Rectified Spirit	$\frac{1}{2}$ fluid drachm.
Prepared Lard	1 ounce.

Dissolve the atropia in the spirit, add the lard, and mix thoroughly.]

Employed to relieve neuralgia and to dilate the pupil.

[§ **Atropiæ Sulphas.** *Sulphate of Atropia.*

Take of

Atropia	120 grains.
Distilled Water	4 fluid drachms.
Diluted Sulphuric Acid . . .	a sufficiency.

Mix the atropia with the water and add the acid gradually, stirring them together until the alkaloid is dissolved and the solution is neutral. Evaporate it to dryness at a temperature not exceeding 100°.

Characters and Tests.—A colourless powder, soluble in water, forming a solution which is neutral to test-paper, and when applied to the eye dilates the pupil as the solution of atropia does. It leaves no ash when burned with free access of air.

Intended for external application. It is a powerful poison.]

[§ **Liquor Atropiæ Sulphatis.** *Solution of Sulphate of Atropia.*

Take of

Sulphate of Atropia	4 grains.
Distilled Water	1 fluid ounce.

Dissolve.]

Used in the same way as Solution of Atropia.

DATURA STRAMONIUM, *Linn.* Thorn Apple.

Botanical Character.—A bushy, smooth, fetid, annual *herb*. *Stem* about two feet high, much branched, forked, spreading, leafy. *Leaves* alternate, large, ovate, wedge-shaped at the base, unequally sinuate-dentate, smooth. *Flowers* solitary, erect, axillary. *Calyx* tubular, 5-cleft at the apex, dropping off from above its base by a circular horizontal incision; which remains permanently at the base of the ovary. *Corolla* funnel-shaped, angular, with a 5-toothed limb, white. *Stamens* 5, included; anthers dehiscing longitudinally. *Ovary* superior, incompletely 4-celled, the alternate dissepiment terminating above the middle, the other one complete; *style* simple; *stigma* 2-lobed. *Fruit* ovate, or sub-globose, very prickly externally, 4-valved, half 4-celled. *Seeds* numerous, brownish-black, reniform.—*Woodv.* pl. 124, p. 338.

Habitat.—A doubtful native; but occasionally found in waste ground and on dunghills. Flowers in July.

Species.—Several other species of Datura have been used in the East, and of late years the leaves of one of these, *Datura Tatula*, have been much employed, smoked in a pipe or in the form of a cigar, as a remedy in spasmodic asthma.

[§ **Stramonii Folia.** *Stramonium Leaves.*

The dried leaves of Datura Stramonium, *Linn.* Collected from plants in flower, cultivated in Britain.]

General Characters.—Large, ovate, wedge-shaped at the base, smooth, unequally sinuate-dentate. The fresh leaves, when bruised, have an unpleasant and narcotic odour, and a nauseous bitter taste. When dried the odour is lost, but the bitter taste remains.

[§ **Stramonii Semina.** *Stramonium Seeds.*

The ripe seeds of Datura Stramonium, *Linn.*]

General Characters.—The seeds are small, compressed, roughish, reniform, brownish-black; they have a feebly bitter taste, and when bruised they emit a peculiar heavy odour.

Composition.—The leaves and seeds of stramonium contain a vegetable alkaloid *daturia*, combined according to Brandes with *malic acid.* *Daturia* has been minutely examined by Dr. Planta, and he finds that it not only possesses the properties of atropia, but that it is isomeric with that alkaloid, its formula, according to him, being $C_{17}H_{23}NO_3$, which precisely corresponds to the formula for atropia, based on Liebig's analysis. (See *Atropia.*) Dr. Planta finds that atropia and daturia both crystallise in colourless needles, are permanent in the air, inodorous, heavier than water, and not very soluble in that liquid, daturia requiring 288 parts of cold and 72 of boiling water to dissolve it. They are very soluble in alcohol, but less soluble in ether. Both alkaloids melt at about 190°, without losing weight or undergoing decomposition. At a higher temperature they are decomposed. The aqueous solution of each has a strong alkaline reaction. Both alkaloids form neutral uncrystalline salts with sulphuric and hydrochloric acids, which are very soluble in water and alcohol, but not easily dissolved by ether. Chemical reagents produce similar results with the solutions. The two alkaloids also resemble each other physiologically in their power of causing dilatations of the pupil.

Physiological Effects.—The symptoms produced by stramonium closely resemble those caused by belladonna. *In small but gradually increased doses* it diminishes sensibility, and thereby frequently alleviates pain. It does not usually affect the pulse; it slightly and temporarily affects the pupil, and has no tendency to cause constipation, but rather relaxation. *In larger doses* it produces thirst, dryness of the throat, nausea, giddiness, nervous agitation, dilatation of the pupil, obscurity of vision, headache, disturbance of the cerebral functions, perspiration, occasionally relaxation of bowels, and in some cases diuresis. It has no direct tendency to induce sleep, and hence it cannot be called *soporific.* But indirectly, by alleviating pain, and thereby producing serenity and ease, it often disposes to sleep. *In fatal doses* the leading symptoms are flushed countenance, delirium (usually maniacal), dilatation of the pupil, dryness of the throat, loss of voice, difficulty of deglutition, convulsions, and, in some cases, palsy.

Therapeutics.—A more extended experience of this plant is requisite to enable us to speak with much confidence of its employment. The similarity of its effects to those of belladonna would lead us to expect a similarity of uses. Like the last-mentioned plant, it has been successfully employed to diminish sensibility, and thereby to relieve external pain. In *neuralgia* (*tic douloureux*, *sciatica*, &c.) it has been employed with considerable success by Lentin, Marcet, and Begbie. It was given internally in the form of extract. Its external application has scarcely been tried. In *rheumatism* it has frequently proved serviceable from its anodyne qualities. In *enterodynia* (that is, spasmodic pain of the bowels unconnected with inflammatory action or the presence of irritating substances), Dr. Elliotson found it a most successful remedy. The diseases in which stramonium has been principally used are *mania* and *epilepsy.* Without denying the occasional benefit of stramonium in these diseases, I believe the cases in which it is serviceable to be very rare, while those in which it is calculated to be injurious are very common. In some cases of *spasmodic asthma*, smoking the herb has given at least temporary relief: but its use in this way requires great caution, as it has proved highly injurious, and in some instances fatal. General Gent, who was instrumental in introducing the practice, fell a victim to it. Aggravation of the dyspnœa, paralytic tremblings, epilepsy, headache, and apoplexy, are some of the evils said to have been induced in different cases. In those disposed to head affections, and in aged persons, it is, therefore, a highly dangerous practice. As no preparation is given of the leaf, it is probably introduced into the Pharmacopœia to be smoked. It will be prudent therefore to remember the foregoing caution.

[§ **Extractum Stramonii.** *Extract of Stramonium.*

Take of

Stramonium Seeds, in coarse powder .	1 pound.
Ether	1 pint, or a sufficiency.
Distilled Water, Proof Spirit, of each . . .	a sufficiency.

Shake the ether in a bottle with half a pint of the water, and after separation decant the ether. Pack the stramonium in a percolator and free it from its oil by passing the washed ether slowly through it. Having removed and rejected the ethereal solution, pour the spirit over the residue of the stramonium in the percolator and allow it to pass through slowly until the powder is exhausted. Distil off most of the spirit from the tincture and evaporate the residue by a water-bath until the extract has acquired a suitable consistence for forming pills.

Dose.—$\frac{1}{4}$ grain to $\frac{1}{2}$ grain.]

[§ **Tinctura Stramonii.** *Tincture of Stramonium.*

Take of

Stramonium Seeds, bruised . . .	$2\frac{1}{2}$ ounces.
Proof Spirit	1 pint.

Macerate the stramonium for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

Dose.—10 to 30 minims.]

NICOTIANA TABACUM, *Linn.* Virginian Tobacco.

Botanical Character.—A viscid *herb.* *Stem* 3 to 6 feet high, erect, round, hairy, branching at the top. *Leaves* sessile (the lower ones decurrent), ovate or lanceolate, acuminate, very large, pale green, with glandular short hairs. *Flowers* in terminal panicles. *Calyx* tubular-campanulate, 5-cleft, hairy. *Corolla* rose-coloured, funnel-shaped; *throat* inflated-ventricose; *limb* plaited, 5-lobed, the segments acute. *Stamens* 5, included, of equal length. *Ovary* 2-celled; *stigma* capitate. *Capsule* 2-celled. *Seeds* many, small, somewhat reniform, brown.—*Steph. and Church.* pl. 37.

Habitat.—America. Extensively cultivated in most parts of the world, especially the United States of America. Virginia is the most celebrated for its culture. North of Maryland the plant is rarely seen.

Species.—This is the only species employed in medicine; but the tobacco used for smoking, chewing, and snuff, is also derived from several others. The generic appellation, Nicotiana, is obviously derived from Nicot, the name of an individual who sent the seeds of the plant to France, about 1560. The origin of the specific name, Tabacum, is less satisfactorily ascertained. It is probable, however, that the word is derived from *tabac*, an instrument used by the natives of America in smoking this herb; though some derive it from *Tobago.*

[§ **Tabaci Folia.** *Leaf Tobacco.*

The dried leaves of Virginian Tobacco, Nicotiana Tabacum, *Linn.* Cultivated in America.]

Commerce.—In commerce two states of tobacco are distinguished: in the one it is called *unmanufactured* or *leaf tobacco,* in the other it is termed *manufactured tobacco.* For medicinal purposes, *Virginian leaf* or *unmanufactured tobacco* is alone directed to be employed in the Pharmacopœia.

General Characters.—[§ Large mottled-brown ovate or lanceolate acuminate leaves, bearing numerous short glandular hairs; having a peculiar heavy odour and nauseous-bitter acrid taste; yielding, when distilled with solution of potash, an alkaline fluid, which has the peculiar odour of nicotia, and precipitates with perchloride of platinum and tincture of galls. Not manufactured.]

Composition.—Tobacco contains an alkaloid *nicotia* $\mathbf{C_{10}H_{14}N_2}$. It exists in the leaves (fresh and dried), root, seeds, and smoke. *Nicotia* is a colourless volatile liquid alkaloid, with an acrid odour and an acrid burning taste. The vapour has the irritating and peculiar odour of tobacco in a most powerful degree. It restores the blue colour of reddened litmus, and renders turmeric brown. It does not solidify at 14° F.: it boils at 482° F., and at the same time undergoes decomposition. By exposure to the air it becomes brown and thick. It is readily combustible with the aid of a wick. It is soluble in water, ether, alcohol, and the oils (fixed and volatile). Ether readily separates it from its aqueous solution. It combines with acids, and forms very deliquescent salts. The *sulphate, phosphate, oxalate,* and *tartrate* are crystallisable; the *acetate* is not. The compound salts with metallic oxides are more readily crystallised. A dilute aqueous solution of nicotia yields a white flocculent precipitate (double chloride) with a solution of perchloride of mercury, and a yellow granular precipitate with perchloride of platinum. In addition to the above properties it may be observed that nicotia, like hydrocyanic acid, is a compound of nitrogen, carbon, and hydrogen. The fact that this alkaloid is soluble in water and ether is a peculiarity, since an alkaloid which is easily dissolved by one of these liquids is not usually dissolved by the other. Concentrated sulphuric acid strikes a wine red colour with nicotia in the cold. If heated, it darkens, becomes black, and sulphurous acid is evolved. It gives white fumes with hydrochloric acid, precisely like ammonia. Heated with the acid it acquires a deep violet colour. Nitric acid colours it orange-yellow, and vapours of deutoxide of nitrogen are given off when the mixture is heated. It forms a soluble soap with stearic acid. In many of its reactions nicotia resembles ammonia. Among other differences it may be mentioned that the solution of iodine in water which is decolorised by ammonia produces a yellow precipitate with a solution of nicotia; and pure tannic acid, which gives a reddish colour with ammonia, throws down a copious white precipitate in a solution of nicotia. It is an energetic poison, almost equalling in activity hydrocyanic acid.

Physiological Effects.—When taken into the stomach in a liquid form in small doses, it usually operates as a diuretic, and, as dropsical swellings sometimes disappear under the use of these doses, it has been inferred that the remedy promotes the operation of the absorbents. *In larger doses* it provokes nausea, vomiting, and purging; but its most remarkable effects are languor, feebleness, relaxation of muscles, trembling of the limbs, great anxiety, and tendency to faint. Vision is frequently enfeebled, the ideas are confused, the pulse small and weak, the respiration somewhat laborious, the surface cold and clammy, or bathed in a cold sweat, and in extreme cases, convulsive movements are observed. Sir B. Brodie found that the infusion of tobacco, thrown into the rectum, often paralysed the heart, and caused death in a few minutes. But if the head of the animal was previously removed, and artificial respiration kept up, the heart remained unaffected; proving that tobacco disorders this organ through the medium of the nervous system only. In the form of enema tobacco has frequently proved fatal, sometimes from the use of inordinate doses by ignorant persons, and occasionally in the hands of the well-informed practitioner. Sir A. Cooper has found 120 grains, and even 60 grains, destroy life. Dr. Copland saw 30 grains in infusion prove fatal.

The *smoking* of tobacco by those unaccustomed to it gives rise to all the before-described effects of large doses. In habitual smokers, the practice, when employed moderately, provokes thirst, increases the secretion of saliva and buccal mucus, and produces a remarkably soothing and tranquillising effect on the mind, which has made it so much esteemed and employed by all classes of society, and by all nations, civilised and barbarous. I am not acquainted with any well-ascertained ill effects resulting from the habitual practice of smoking in moderation. A similar observation is made by Sir Robert Christison. But when indulged in to 'excess it enfeebles digestion, produces emaciation and general debility, and lays the foundation of serious nervous disorders.' It is also said by some practitioners, under such circumstances, to produce mental affections resembling delirium tremens and insanity. *The application of tobacco to abraded surfaces* is a very dangerous practice, and has in some instances been attended with violent or even fatal results. Mr. Weston has related a case in which the expressed juice of tobacco was applied to the head of a boy, aged eight years, for the cure of tinea capitis. Death took place three hours and a half after the application. The operation of tobacco resembles that of lobelia. With digitalis tobacco agrees in several circumstances, especially in that of enfeebling the action of the vascular system, although its power in this respect is inferior to that substance. In its capability of causing relaxation and depression of the muscular system, and trembling, tobacco surpasses it; as it does, also, in its power of promoting the secretions. From belladonna, stramonium, and hyoscyamus, it is distinguished by causing contraction of the pupil, both when applied to the eye and when taken internally in poisonous doses; and also by the absence of delirium and of any affection of the parts about the throat.

Therapeutics.—The principal remedial value of tobacco consists in its power of relaxing muscular fibres, whereby it becomes a valuable antispasmodic. As a purgative, but especially as an antispasmodic and purgative conjoined, it is exceedingly serviceable in alvine obstructions. It is used in the following diseases:—*colic, ileus, strangulated hernia, and constipation.* The efficacy of tobacco in these diseases depends principally on its power of relaxing muscular fibres and on its purgative properties. These effects are usually accompanied by nausea and giddiness. The remedy is best administered in the form of enema. In *ileus* the tobacco enema has been recommended by several distinguished authorities. The earlier it is resorted to the more successful it is likely to prove. Indeed, when employed in the last stage of this disease, it sometimes hastens the fatal termination by exhausting the already depressed vital powers. As it is occasionally necessary to repeat the enema, it is of importance to begin cautiously. Dr. Abercrombie used only fifteen grains of tobacco infused in six fluid ounces of boiling water for ten minutes, and repeated this in an hour if no effect had been produced. I have generally employed twenty grains, and have not seen any dangerous effects arise from its use; and it is possible that in persons long accustomed to the employment of tobacco, a somewhat larger dose might be required; but I have never met with any cases in which twenty grains did not produce the full effect on the system that was desired. In *strangulated hernia* the tobacco enema has frequently effected the return of the protruded parts when the operation appeared almost inevitable: and every surgical writer speaks in the highest terms of its use. A tense hernial tumour sometimes becomes soft and relaxed by the diminished force of circulation produced by tobacco. Notwithstanding these facts, this remedy is much less resorted to than formerly. Several circumstances have, I suspect, led to the infrequency of its use:—first, the dangerous, if not fatal, consequences which have sometimes resulted from its employment; secondly, the frequency of its failure, and the consequent loss of time, by which the chance of recovery is diminished; thirdly, the operation for hernia being much less dreaded now than formerly; but chiefly the greater advantage and smaller risk attending the use of chloroform. In *colic* from lead, and in *obstinate constipation* from spasmodic constriction, the tobacco enema has sometimes proved most beneficial. In *ischuria and dysuria.*—When retention of urine arises from spasm of the neck of the bladder or from spasmodic stricture, tobacco, by its powerful relaxing properties, is an agent well calculated to give relief. In *tetanus.*—The relaxing influence over the muscular system possessed by tobacco, suggested the employment of this remedy in tetanus. Its effects have been, like those of most other medicines in this disease, unequal. Mr. Curling has collected accounts of nineteen cases treated by tobacco: of these, nine recovered; and in seven of the fatal cases the remedy had not a fair trial: while in the eighth, organic disease of the brain was found. Mr. Curling observes, that 'more has now been advanced in proof of the efficacy of tobacco than can be adduced in favour of any other remedy yet resorted to. I have not,' he adds, 'succeeded in finding a single case in which, being fully and fairly tried before the constitution had given way, it has been known to fail.' In *spasmodic asthma.*—In this disease tobacco either smoked, or taken internally, in nauseating doses, has been found occasionally to give relief. My own observation is unfavourable to the use of tobacco smoke, which I have repeatedly found to bring on convulsive cough and spasmodic difficulty of breathing in persons afflicted with chronic catarrh.

Antidotes.—If the poison has been swallowed, empty the stomach as soon as possible by stimulating emetics, and in all cases administer ammonia, brandy, or other powerful stimulants. Vegetable astringents and artificial respiration have also been found useful. The experiments of the Rev. Dr. Haughton would indicate that the true antidote is strychnia cautiously administered. (See *Strychnia.*)

[§ **Enema Tabaci.** *Enema of Tobacco.*

Take of

Leaf Tobacco	20 grains.
Boiling Water	8 fluid ounces.

Infuse in a covered vessel, for half an hour, and strain.]

Used, as I have already stated, in ileus, strangulated hernia, obstinate constipation, and retention of urine. Twenty grains is the largest quantity of tobacco that can be administered at one time without danger, as even thirty grains have proved fatal.

SOLANACEÆ, *Miers.* The Solanum or Potato Order.

SOLANUM DULCAMARA, *Linn.* Bitter-sweet.

Botanical Character.—*Root* woody, perennial. *Stem* shrubby, with climbing or straggling branches. *Leaves* acute, entire at the margin, generally smooth: the lower ones cordate-ovate; the upper auricular-hastate. *Flowers* in lateral or terminal cymes. *Calyx* persistent, 5-cleft. *Corolla* hypogynous, rotate, limb 5-cleft, reflexed, purple, or rarely white, with two round green spots at the base of each segment. *Stamens* 5; *filaments* very short; *anthers* converging into a cone, and dehiscing by two pores at the apex. *Fruit* baccate, oval, scarlet, juicy, 2-celled with numerous subreniform *seeds.*—*Flor. Lond.*, fasc. i. pl. 14.

Habitat.—Indigenous. In hedges and thickets. Flowers in June and July.

[§ **Dulcamara.** *Dulcamara.*

The dried young branches of Solanum Dulcamara, *Linn.* From indigenous plants which have shed their leaves.]

General Characters.—[§ Light, hollow, cylindrical, about the thickness of a goose-quill, bitter and subsequently sweetish to the taste.] When fresh, they have an unpleasant odour, which they lose by drying.

Composition.—Dulcamara contains an alkaloid *solania*, $C_{43}H_{70}NO_{16}$ (Zwenger), which resembles sulphate of quinia, but its needle-like crystals are finer and shorter. If Zwenger's analysis be correct, solania differs from the other vegetable alkaloids in the small quantity of nitrogen which it contains, and in its very high atomic weight. It is said to be poisonous, but it does not dilate the pupil like atropia.

Physiological Effects.—Not very obvious. It is reputed to operate as a diaphoretic, diuretic, and demulcent, and in over doses as an acro-narcotic, but many have given the fruit and preparations of the young branches, in very large doses, without any obvious effects.

Therapeutics.—Dulcamara has been thought serviceable in chronic pulmonary catarrhs, in rheumatic and gouty complaints, in chronic skin diseases (as lepra, eczema and psoriasis), and in various cachectic conditions of the system, in which sarsaparilla has been found beneficial.

[§ **Infusum Dulcamaræ.** *Infusion of Dulcamara.*

Take of

Dulcamara, bruised	1 ounce.
Boiling Distilled Water	10 fluid ounces.

Infuse in a covered vessel, for one hour, and strain.

Dose.—1 to 2 fluid ounces.]

CAPSICUM FASTIGIATUM, *Blume.*

Botanical Character.—A small branched *shrub* 1–2 feet high. *Branches* 4-sided, fastigiate, scabrous. *Leaves* ovate or lanceolate, acuminate, ciliated. *Calyx* persistent, subcylindrical, truncated. *Corolla* hypogynous, rotate, white; tube very short: limb plaited, 5-cleft. *Stamens* 5 arising from the throat of the corolla, exserted; *filaments* very short; *anthers* connivent, dehiscing longitudinally. *Ovary* 2-celled; *style* simple, subclavate; *stigma* obtuse. *Capsule* oblong, cylindrical, straight, when ripe deep red, very pungent. *Seeds* numerous, reniform. *Wight, Icones Plant. Ind. Orient.*, vol. iv. pl. 1,617.

Habitat.—Sierra Leone.

[§ **Capsici Fructus.** *Capsicum Fruit.*

The dried ripe fruit of Capsicum fastigiatum, *Blume.* Imported from Zanzibar, and distinguished in commerce as Guinea Pepper and Pod Pepper.]

General Characters.—Pod membranous, from five to eight lines long, two lines broad, straight, conical, pointed, smooth, shining, but somewhat corrugated, orange-red, intensely hot in taste, and with a pungent odour.

Varieties.—The fruits of this plant vary much. One variety constitutes the *capsicums* or *chillies* as usually sold in this country. This fruit when dried is flat, more or less shrivelled, oblong, blunt or pointed at one end, while the remains of the calyx and pedicel are usually attached at the other. It is from two to three inches in length, and from one half to three-quarters of an inch in breadth ; the colour is yellowish or reddish-brown, the taste hot and pungent, but it has no odour. The pericarp is tough and leathery, and the seeds flat and yellowish white.

Cayenne Pepper.—This is probably the powdered fruit of several species or varieties of *Capsicum*, but principally of that of *C. fastigiatum*. Cayenne pepper is sometimes adulterated with red lead, and other substances of a like colour.

Composition.—Capsicum contains an *acrid soft resin*, and an *acrid oil*, which Bucholz terms *Capsicin*. *Capsicin* is obtained by digesting the alcoholic extract in ether, and evaporating the ethereal solution. It is a thick liquid, of a yellowish-red or reddish-brown colour, which becomes very fluid when heated, and, at a higher temperature, is dissipated in fumes. Half a grain of it, volatilised in a large room, causes all who respire the air of the room to cough and sneeze. By exposure to air and light it solidifies. It is decolorised by chlorine. It is slightly soluble in water and vinegar ; but readily so in alcohol, ether, oil of turpentine, and the caustic alkalies.

Physiological Effects.—Capsicum is more closely allied, by its effects, to the peppers already described, than to any other article of the Materia Medica. Its active principle is more fixed, and its operation more permanent and violent, than mustard or horse-radish. Its hot and fiery taste is familiar to everyone. Applied to the skin, capsicum acts as a rubefacient and vesicant. Swallowed *in small doses*, it creates a sensation of warmth in the stomach; and in torpid and languid habits proves a valuable stimulant, and a promoter of the digestive functions. *In excessive doses* it may produce abdominal pain, and gastric inflammation.

Therapeutics.—Capsicum is more employed as a *condiment* than as a medicine. It is added to various articles of food, either to improve their flavour, or, if difficult of digestion, to promote their assimilation, and to prevent flatulence. The properties of Guinea pepper are similar to those of Chillies, but the former is much hotter and more fiery. Its powder, as we have seen, is *Cayenne pepper*, which is extensively used as a condiment. The inhabitants of tropical climates employ the fruit of this and other species to stimulate the digestive organs, and thereby to counteract the relaxing and enervating influence of external heat. As a *medicine*, it is principally valuable as a local stimulant to the mouth, throat, and stomach. Its constitutional not being in proportion to its topical effects, it is of little value as a general or diffusible stimulant. Administered internally, capsicum has long been esteemed in cases of *cynanche maligna*. As a gargle, in relaxed conditions of the throat, its efficacy is undoubted. The powder or tincture may be applied, by means of a camel's-hair pencil, to a relaxed uvula. It is a valuable gastric stimulant in enfeebled, languid, and torpid conditions of the stomach. Thus in the dyspepsia of drunkards, as well as of gouty subjects, it has been found useful. In various diseases attended with diminished susceptibity of stomach, capsicum is an exceedingly useful adjunct to other powerful remedies, the operation of which it promotes by raising the dormant susceptibility of this viscus ; as in cholera, intermittents, low forms of fever, and dropsies.

Administration.—The dose of capsicum in powder is from $\frac{1}{2}$ to 1 grain or more, made into a pill with crumb of bread.

[§ **Tinctura Capsici.** *Tincture of Capsicum.*

Take of

Capsicum Fruit, bruised	$\frac{3}{4}$ ounce.
Rectified Spirit	1 pint.

Macerate the capsicum for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally ; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient rectified spirit to make one pint.

Dose.—15 to 20 minims.]

Employed in the low stage of typhus and scarlet fevers, and in gangrenous sore-throat, and to prevent the nausea which oil of turpentine is apt to occasion. A good form for a *capsicum gargle* is prepared by adding one fluid drachm of this tincture to eight fluid ounces of the acid infusion of roses.

CONVOLVULACEÆ, *R. Brown.* The Convolvulus Order.

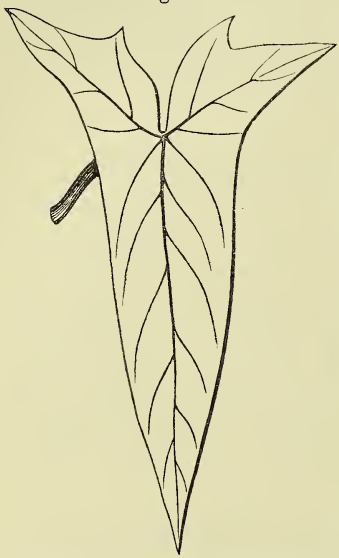
CONVOLVULUS SCAMMONIA, *Linn.* The Scammony Plant.

Botanical Character.—*Root* perennial, 3 or 4 feet long, with an acrid milky juice. *Stems* numerous, twining, herbaceous, smooth. *Leaves* alternate, on long petioles, arrow-shaped (fig. 56), acuminate, glabrous. *Peduncles* solitary, axillary, 2- or 3-flowered, scarcely twice the length of the leaves. *Bracts* awl-shaped. *Sepals* 5, obovate, truncated, and reflexed at the point, coloured at the margins. *Corolla* hypogynous, funnel-shaped, an inch long, pale yellow with purple stripes, or white with red stripes externally ; *limb* 5-lobed, plaited.

Stamens shorter than the corolla; *anthers* erect, sagittate. *Ovary* superior; *style* as long as the stamens; *stigmas* white, linear. *Capsules* 2-celled, 4-seeded.—*Woodv.*, pl. 5, p. 13.

Habitat.—The scammony plant grows wild in all parts of Anatolia, as well as in Syria, and in some of the Greek and Turkish islands of the Archipelago. Sochia, or the district of the river Meander, produces a large quantity; but Kirkagatch and Demirgik, in the plain of Mysia, furnish the largest quantity of all. It is found in mountainous districts, in the plains, and in the open ground, flourishing most luxuriantly among the Juniper, Arbutus, and wild Valonia bushes, which afford shelter and support to its branches. The yellow-flowered variety is the most abundant.

Fig. 56.



Leaf of Convolvulus Scammonia.

[§ Scammoniæ Radix.

Scammony Root.

The dried root of Convolvulus Scammonia, *Linn.* From Syria and Asia Minor.]

General Characters.—Scammony roots are tapering, and somewhat resemble a carrot in form. They are from one to five inches in diameter at the crown, and from about a foot to two or three feet in length. In colour they are brown externally, and white within, slightly odorous but tasteless. On the fractured surface the pure inspissated resin may be commonly seen in the form of irregular fragments of a pale yellowish-brown colour. Ether agitated with the powder and evaporated, leaves a residue having the properties of scammony resin.

Composition of the Root.—Marquart found in 100 parts of the dried root—*resin*, 4·12; *gum*, 5·8; *sugar*, *starch*, and *extractive*, 24·48; besides *salts* and *woody fibre.* The roots are richest in resin just before the plants flower. This is the time therefore they should be collected for obtaining the resin.

Pharmaceutical Use.—Scammony root is used in the preparation of resin of scammony.

[§ **Scammonium.** *Scammony.*

A gum resin, obtained by incision from the living root of Convolvulus Scammonia, *Linn.*, chiefly in Asia Minor.]

Collection and Preparation.—Scammony is obtained from the roots, without any regard to the colour of the flower of the plant to which they belong. The only perceptible difference in quality is to be ascribed to the soil. The scammony which has the strongest odour is that produced in mountainous districts, and on a poor soil; rich soils and marshy ground produce a juice containing a larger proportion of water, and which, when inspissated, forms a scammony of a greyish-black colour, and of less specific gravity. The method of procuring scammony is, according to Mr. Maltass (*Pharm. Journ.* vol. xiii. 1st ser. p. 264), as follows: —During the summer months, when the plant is in flower, the Greek and Turkish peasants, having cleared away the bushes which shelter it, remove the earth from the root to the depth of three or four inches. The root is then cut through, in a slanting direction, with a sickle-shaped knife, at the distance of about one inch to one inch and a half below the crown; a mussel-shell is immediately stuck into the root under the lower part of the cut portion, and the sap or milky juice runs into it. A stone is then placed to windward of the root, to protect the shell from the loose earth and dust which might be otherwise blown into it by the high winds prevalent during summer. The sap flows freely early in the morning and late in the evening, but ceases during the hottest part of the day. One root will not generally fill a shell; but it sometimes happens that a good root will fill two or three shells. The quantity afforded varies according to size, locality, and age. In some districts, one hundred roots produce but 600 grains of scammony; in others the average of each root is 60 grains; and in a good soil a four-year plant will produce 120 grains. A root four inches in diameter has been known to produce as much as 720 grains; but those cut by Mr. Maltass himself did not produce above 60 grains, and some afforded none at all. The shells are usually left till the evening, when they are collected, and the cut part of the root is scraped with a knife to remove the dry, or partially dry, tears of scammony which adhere to it. The peasants then empty the shells (from which they carefully blow the dust) into copper vessels, and work up the tears scraped from the roots together with the contents of the shells. This is done with a knife, and continued until the whole is so well mixed that it forms a stringy mass when run off the knife. This is the *pure scammony*, and is generally known under the name of *lachryma scammony.* The scammony brought to market by the Greek peasants is far better than that which is collected by the Turks; in fact, the former is almost the only pure sort that can be obtained. When purchased, it is placed in a room having the windows open, to allow the wind to blow over it; care being taken to prevent the rays of the sun from striking upon it. Here it is spread upon sheep skins, and turned occasionally, to prevent it becoming mouldy underneath. When nearly dry, it is broken into irregular pieces, and allowed to remain a few days longer, until quite dry; it is then shipped in small cases containing about thirty pounds each. This description by Mr. Maltass, of the manner in which scammony is now collected, agrees in all essential particulars with that formerly given by Dioscorides, Dr. Russel, and other writers.

Commerce.—Scammony is usually imported from Smyrna; although occasionally it comes by way of Trieste; and still more rarely it is brought from Alexandretta, the port of and road to Aleppo. It comes over in tins, or in boxes which are frequently lined with tin.

General Characters.—*Pure scammony*, *Virgin scammony*, *Lachryma scammony*, occurs in amorphous pieces or flattened cakes of an ash-grey colour externally, and sometimes covered more or less with a whitish-grey powder, which effervesces with hydrochloric acid. Such pieces have clearly been rolled in chalk, whilst in a soft state, to prevent them sticking together. Scammony is friable, easily reduced to small fragments between the fingers, or by the pressure of the nail, and has a specific gravity of about 1·210. Its fractured surface is resinous, shining, reddish or greenish-black, and presents small air-cavities; and does not effervesce on the addition of hydrochloric acid. When rubbed with the finger moistened with either water or saliva, it readily forms a milky liquid. If we examine thin fragments by transmitted light, we observe them to be semi-transparent at the edges, and of a grey-brown colour. In the same pieces we sometimes find some portions shining and blackish, as above described; while others are of a dull greyish colour. Virgin scammony readily takes fire, and burns with a yellowish flame. Its odour is peculiar, somewhat analogous to that of old cheese; its taste is slight at first; but afterwards it causes a prickly sensation in the back of the throat. The powder is of a dirty-grey colour, and forms a smooth emulsion when triturated with water. The decoction of its powder, when filtered and cold, is not rendered blue by tincture of iodine. Paper moistened with an alcoholic or ethereal tincture of scammony should undergo no change of colour when exposed to nitrous fumes. When incinerated in a crucible it leaves but a minute portion of ash, not exceeding 3 in 100 grains. Ether should remove from 80 to 90 per cent.

of resin; and what remains is chiefly soluble gum with a little moisture. This sort of scammony is usually imported from Smyrna. Pure scammony, according to Maltass, is easily recognised, when dry, by the following characters:—'It is light, and breaks easily with a glossy fracture. If no water has been added by the peasants, the colour of the fracture is reddish-black. If water has been added, or the scammony has been collected in shady places, the fracture is black, and very glossy. If the dry tears scraped from the roots have not been worked up with the milk, pieces will be found of a light red colour resembling resin. One of the best characters of genuine scammony is its golden-reddish colour when reduced to small fragments.' Hanbury, in some valuable practical remarks on scammony, describes the characters of pure natural scammony, i.e. the unmixed inspissated juice of the root, as follows:—'It has a pale yellowish-brown colour; it is transparent, very brittle, readily affords a white emulsion when rubbed with water, and leaves but a small quantity of white residue when treated with ether' (*Pharm. Journ.*, 1853, p. 270). Scammony of this quality is, however, never met with in commerce. Hanbury's description refers to that of pure scammony as it exists in the shells in which it is collected. In these thin layers it is certainly translucent, and near the edges even transparent. This pale yellowish-brown translucent scammony has no cheesy odour, and is free from the cavities found in the lumps of commerce; whence Hanbury concludes that the cavities, the cheesy odour, the dark colour, and the opacity of the lumps, which have dried more slowly, are caused by saccharine fermentation.

Adulteration.—According to Mr. Maltass, as already mentioned, most of the peasants adulterate scammony before it is brought to the market. One process is as follows:—'The scammony is brought to a liquid state by admixture with water, and a quantity of white chalky earth (probably carbonate of lime) is added. The quantity used varies from 10 to 150 per cent.! The colour of soft moist scammony is not affected by the addition, unless the proportion exceeds 20 per cent.; when dry, it is apparent to anyone acquainted with the drug.' I have been informed by a Turkey merchant, who formerly resided at Smyrna, that scammony is brought into that city, in the soft state, on camels. Here it is mixed with various impurities by persons (Jews) who are denominated scammony makers, and who adulterate it commonly with starch, wheat flour, ashes, chalk, sand, and other substances. In this way they lower its value to suit the market. According to Maltass, 'the quantity of scammony annually sold in Smyrna amounts to about 7,500 pounds weight. Out of this quantity about seven hundredweight of pure scammony can be obtained, the remainder being of different qualities, the quantity of resin that they contain varying from one ounce to fifteen ounces in every pound. If the whole crop were brought to market *unadulterated*, it is doubtful whether the annual quantity would exceed 3,000 pounds weight.'

Varieties of Adulterated Scammony.—The various sorts of adulterated scammony commonly found in the shops are distinguished by English dealers as *seconds*, *thirds*, &c. These different kinds most frequently occur in round flat cakes, or in irregular lumps, and for the most part contain carbonate of lime only; or carbonate of lime mixed with starch or dextrine, or with wheat or barley meal; or they contain simply the starch or flour of either wheat or barley—probably the former. These adulterated kinds of scammony may be arranged according to their chemical characters into *calcareous*, *calcareo-amylaceous*, *calcareo-dextrinous*, and *amylaceous* kinds of scammony. The *first* kind contains carbonate of lime only; the *second* carbonate of lime mixed with wheat or barley starch or meal; the *third* carbonate of lime and dextrine; and the *fourth* kind contains starch or flour of either wheat or barley. When they contain *carbonate of lime*, hydrochloric acid applied to a fractured surface causes effervescence. When they contain *starch* or *dextrine*, iodine produces a blue colour in the first case, or a reddish-purple tint in the latter, when added to their respective filtered decoctions after they have become cold. *Calcareous scammony* is more ponderous than the virgin sort, and usually breaks with a dull earthy ash-grey fracture. *Calcareo-amylaceous scammony* is heavy, dense, and difficult to fracture. The fractured surface, in some samples, is resinous and shining, like that of pure scammony; but usually it has a dull waxy lustre; it has air-cavities, and numerous small white specks (chalk); and its colour is greyish or greyish-black. *Amylaceous scammony* is of less frequent occurrence than the calcareo-amylaceous kind. It sometimes has a resinous fracture and a dark colour like pure scammony, but more commonly a waxy lustre and a greyish colour. It is light in weight, but tenacious. Scammony is also sometimes adulterated with guaiacum, wood-ashes, gypsum, sand, and gum arabic or gum tragacanth; and occasionally pounded scammony roots and some other substances have been added to it. This adulterated scammony is put into drums, and scammony nearly pure, and about as liquid as honey, is poured on the top to give it a good appearance. Without this precaution, detection would not be difficult, the surface of the adulterated drug being always dry. The presence of guaiacum may be detected by nitrous fumes, which give a blue colour to paper which has been moistened with a tincture containing guaiacum. Incineration will detect an abnormal amount of inorganic matter, as chalk, gypsum, or sand. In reference to adulterated scammony Dr. F. J. Farre remarks, that 'In short, scammony used to be adulterated to the extent of 30, 50, and even 75 per cent., to enable it to be sold in the market at a corresponding price. But the efforts and example of the leading pharmaceutical chemists, and the liberal and enlightened feeling that has been fostered by the institution and publications of the *Pharmaceutical Society*, have led pharmaceutists generally, in this and other cases, to prefer pure to adulterated drugs; and for several years those who were willing to pay the price of pure scammony have had little difficulty in obtaining it.'

Composition.—Sir R. Christison has analysed 'pure' scammony, both old and moist, and obtained from 77 to 83 per cent. of resin, and from 6 to 8 per cent. of gum, the remainder being chiefly water.

Physiological Effects.—The effects of pure scammony are those of a powerful and drastic purgative. As the evacuant properties of scammony depend on its local irritation, it operates most energetically when there is a deficiency of intestinal mucus, and is then very apt to gripe; and, *vice versâ*, when the intestines are well lined with secretion, it passes through with much less effect. In its operation scammony is closely allied to jalap, than which it is more active, while its odour and taste are less nauseous. It is less irritant than gamboge.

Therapeutics.—Scammony is, of course, inadmissible in inflammatory conditions of the alimentary canal, on account of its irritant qualities. It is well adapted for torpid and inactive conditions of the abdominal organs, accompanied with much slimy mucus in the intestines. It is principally valuable as a smart purgative for children, on account of the smallness of the dose necessary to produce the effect, the slight taste, and the energy, yet safety, of its operation. When used for children, it is generally associated with calomel. Where a milder purgative is required, it may be conjoined with rhubarb, sulphate of potash, and an aromatic. It may be employed to open the bowels in constipation; to expel worms, especially of children; to act as a hydragogue purgative, on the principle of counter-irritation, as in affections of the head and dropsies; and for any other purpose for which an active cathartic may be required.

Administration.—For an adult, the usual *dose* of virgin scammony is from ten to fifteen grains. In order to diminish its irritant and griping qualities, it should be finely divided. For this purpose it may be intimately mixed with some bland powder (as gum, starch, or sugar), or made into an emulsion with milk.

Pharmaceutical Uses.—Scammony is an ingredient in compound pill of colocynth, and pill of colocynth and hyoscyamus. Scammony as well as scammony root is also directed in the Pharmacopœia to be used for the preparation of resin of scammony.

[§ **Confectio Scammonii.** *Confection of Scammony.*

Take of

Scammony, in fine powder	3 ounces.
Ginger, in fine powder	$1\frac{1}{2}$ ounce.
Oil of Caraway	1 fluid drachm.
Oil of Cloves	$\frac{1}{2}$ fluid drachm.
Syrup	3 fluid ounces.
Clarified Honey	$1\frac{1}{2}$ ounce.

Rub the powders with the syrup and the honey into a uniform mass, then add the oils, and mix.]

This is the Dublin confection, which is a more definite preparation than the London confection. The scammony constitutes about one-third. A warm or aromatic cathartic.

Dose.—For an adult, 10 to 30 grains; for children, 3 to 10 grains.

[§ **Pulvis Scammonii Compositus.** *Compound Powder of Scammony.*

Take of

Scammony, in powder	4 ounces.
Jalap, in powder	3 ounces.
Ginger, in powder	1 ounce.

Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar.]

This is the London powder, with the substitution of 3 ounces of jalap for 4 ounces of hard extract of jalap. It is rather stronger than the Edinburgh and Dublin preparations. The effects of scammony and jalap being very similar, little or no advantage can be obtained by the intermixture of these substances. The ginger is intended to correct the griping of the other ingredients. Compound powder of scammony is cathartic, and is used as a smart purge for children, especially where much mucous slime is contained in the bowels, and in worm cases.

Dose.—For an adult, from 10 to 20 grains; for children under a twelvemonth old, from 3 to 5 grains.

[§ **Scammoniæ Resina.** *Resin of Scammony.*

Take of

Scammony Root, in coarse powder	8 ounces.
Rectified Spirit	a sufficiency.
Distilled Water	a sufficiency.

Digest the scammony root with sixteen fluid ounces of the spirit in a covered vessel, at a gentle heat, for twenty-four hours; then transfer to a percolator, and, when the tincture ceases to pass, add more spirit and let it percolate slowly until the root is exhausted. Add to the tincture four fluid ounces of the water, and distil off the spirit by a water-bath. Remove the residue while hot to an open dish, and allow it to become cold. Pour off the supernatant fluid from the resin, wash this several times with hot water, and dry it on a porcelain plate with the heat of a stove or water-bath.

It may also be prepared in a similar way from scammony.

Characters and Tests.—In brownish translucent pieces, brittle, resinous in fracture, of a sweet fragrant odour, if prepared from the root. It cannot form singly an emulsion with water. Its tincture does not render the fresh-cut surface of a potato blue. Ether dissolves it entirely.] The resin prepared from the root is more translucent, and has a more saccharine odour, than that prepared from the gum resin; and much resembles in its odour the resin of jalap; but the resin prepared from scammony is by no means destitute of sweetness. Scammony resin is fusible and combustible, and soluble in alcohol and ether. The alcoholic solution of the resin is feebly acid; the addition of water causes a white precipitate (*hydrate of resin*). Precipitates are also produced by alcoholic solutions of the acetate of lead and the acetate of copper. Caustic potash deepens the colour of the solution. Scammony resin may be decolorised by animal charcoal without having its purgative qualities affected.

Composition.—Its composition, according to Johnston, is $C_{20}H_{33}O_{10}$. It is remarkable for containing the largest quantity of oxygen of any resin hitherto analysed.

Adulteration.—According to M. Thorel, resin of jalap, owing to its comparative cheapness, has been used for adulterating resin of scammony. This fraud may be detected by digesting the suspected substance in rectified ether. Jalap resin is almost insoluble in this menstruum, while the resin of scammony is soluble in it in all proportions. Resin of scammony is sometimes adulterated with resin of guaiacum; this may be detected by the fumes of nitrous gas, or by the Pharmacopœia test of the fresh-cut surface of a raw potato, as the fumes of nitrous gas and the gluten of the potato both turn tincture of guaiacum blue. If the adulteration be caused by common resin, this may be dissolved out and separated from scammony resin by oil of turpentine. Sulphuric acid gives with resin immediately on contact an intense red colour; with scammony resin only a wine red, slowly produced.

Effects and Administration.—Scammony resin is a drastic cathartic, like ordinary scammony. When pure or virgin scammony can be obtained, the resin is an unnecessary preparation. Dr. F. J. Farre says: 'I have repeatedly given to the same patient ten grains of pure scammony, and at another time ten grains of scammony resin, and have been unable to perceive any difference in their effect.'

Dose.—3 to 10 grains. When administered, it should be intimately divided, either by some bland powder, or still better by an emulsion.

Pharmaceutical Use.—Resin of scammony is an ingredient in compound extract of colocynth.

[§ **Mistura Scammonii.** *Scammony Mixture.*

Take of

Resin of Scammony	4 grains.
Milk	2 fluid ounces.

Triturate the resin of scammony with a little of the milk, and continue the trituration, gradually adding the remainder of the milk, until a uniform emulsion is obtained.

Dose.—$\frac{1}{2}$ to 2 fluid ounces for a child.]

It is one of the most agreeable purgative draughts that can be taken, and being tasteless is well adapted for children.

EXOGONIUM PURGA, *Bentham.* The Jalap Plant.

Botanical Character. — *Root* perennial, with irregularly ovate-conical, or somewhat pear-shaped, or rounded tubercules. *Stems* annual, herbaceous, twining, branched, smooth. *Leaves* stalked, alternate, cordate-ovate, acuminate, quite entire, and smooth on both sides. *Peduncles* 1–3-flowered. *Sepals* 5, unequal, obtuse, smooth. *Corolla* salver-shaped, with a sub-clavate cylindrical tube, and a sub-pentagonal horizontally-expanded purplish-violet limb. *Stamens* 5, exserted. *Ovary* 2-celled; the cells 2-seeded.—*Bot. Mag.* vol. lxxiii. pl. 4,280.

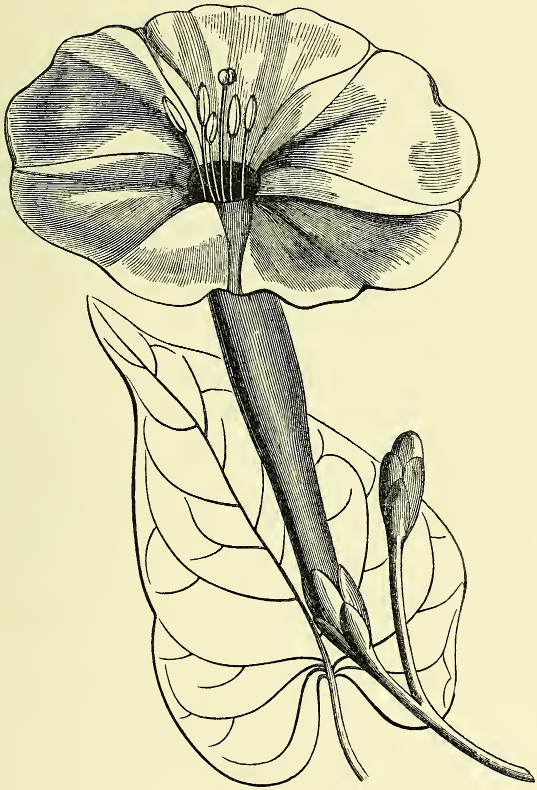
Habitat.—In woods near Chicanquiaco, at an elevation of nearly 6,000 feet above the level of the sea, and in other parts of Mexico. Jalap receives its name from Xalapa or Jalapa, a town of Mexico, and formerly the only market for jalap.

[§ **Jalapa.** *Jalap.*

The dried tubercules of Exogonium purga, *Bentham.* Imported from Mexico.]

General Characters.—The tubercules of jalap vary from the size of a nut to that of an orange. When entire, they are usually more or less oval, and pointed at the two extremities. The larger tubercules are frequently incised, apparently to facilitate desiccation. They are covered with a thin brown wrinkled epidermis ; and present, when cut, a yellowish-grey colour, with dark brown irregularly concentric rings. They should be heavy, hard, and difficult to powder. They have a peculiar nauseous odour, which is increased by rubbing or powdering them ; and a nauseous sweetish but subsequently acrid taste. Jalap is more active as a cathartic in pro-

Fig. 57.



Flower and leaf of Exogonium purga.

portion to the quantity of resin which it contains : plump, firm, heavy, and resinous pieces, therefore, are preferable. Light, whitish, amylaceous, shrivelled, or woody pieces, are of inferior quality. Jalap is very apt to become worm-eaten ; and such *jalap* has been recommended as well adapted for the preparation of the resin, but Mr. Haselden finds that it yields less resin than sound jalap.

Substitutions and Adulterations.—Besides the official jalap, some other kinds are found in commerce, the most important being that known as Tampico jalap, from the port of the same name in the Gulf of Mexico, situated north of Vera Cruz, and from which our supplies are commonly derived. The plant yielding this jalap has been described by Hanbury under the name of *Ipomœa simulans.* Tampico jalap is more wrinkled in appearance, lighter in weight, more elongated and tapering at each end, and although pieces may be found resembling the characters given above of the official or Vera Cruz jalap, it may generally be readily distinguished from it. The experiments of Mr. Sugden Evans show that Tampico jalap varies very much, and yields an extract very different in its constitution from that obtained from the official jalap, the resinous contents being much inferior, and he concludes that there can be no doubt that Tampico jalap should not be substituted for the official or Vera Cruz kind. Tampico jalap, however, from its much lower commercial value, is extensively used. The roots of *Ipomœa orizabensis* are also sometimes found intermixed with genuine jalap, or are imported separately, and are termed in commerce *jalap stalk* or *jalap wood*; but they differ from true jalap so much in their angular shape, their paler colour, their lighter weight, and their fibrous texture, that they cannot easily be mistaken for it. This so-called jalap wood is very inferior to true jalap. Guibourt has also described another kind of jalap, under the name of *false rose-scented jalap.* The tubercules of this are lighter coloured externally than true jalap, and have a more amylaceous appearance internally. Their odour is agreeable, and has been compared by Guibourt to that of oil of rhodium or of the rose, hence the name. They have scarcely any purgative action. The roots of various other plants may be also at times found intermixed with those of true jalap, but from the characters given above no difficulty ought to be found in distinguishing jalap from all roots mixed with, or substituted for, it.

Composition.—According to Guibourt's analysis, jalap contains nearly 18 per cent. of *resin* which is its active constituent, *gummy extractive*, *starch*, *sugar*, and other unimportant ingredients.

Physiological Effects.—Jalap acts as a powerful and drastic purgative, producing copious liquid stools; and, when judiciously exhibited, is both safe and efficacious. Its objectionable effects are, that while in the stomach it frequently causes nausea, and sometimes vomiting; while, after it has passed into the intestines it often gripes. It is tolerably certain in its operation,—more so, indeed, than many other purgatives. In the proper dose it may be given without the least hesitation to children, in any case where an active purge is required. It has an advantage over some other evacuants, that it does not stimulate or heat the system, its effect being confined principally to the alimentary canal—the peristaltic motion, secretions, and exhalations of which it promotes; and it is said that constipation less frequently succeeds its use than of some other purgatives. It is a more drastic purgative than senna. To scammony it is closely allied, in its effects. It is much less irritant to the intestinal mucous membrane than gamboge; and, therefore, is a much safer purgative; but inferior to aloes, in its stimulant influence over the abdominal and pelvic blood-vessels.

Therapeutics.—Daily experience proves the value of jalap, as an active purgative, in various diseases both of children and adults. Of course its irritant properties unfit it for exhibition in inflammatory affections of the alimentary canal, as well as after surgical operations about the abdomen and pelvis. Moreover, it is not an appropriate purgative in irritation of, or hemorrhage from, the uterus; or in piles, stricture, and prolapsus of the rectum. The following are some of the cases in which it is employed:—*In constipation*, when this condition is not dependent on, or connected with, irritation or inflammation of the alimentary canal or pelvic organs, jalap is admissible. Its efficiency is much increased by association with calomel. It may be employed in febrile and inflammatory diseases (those above mentioned excepted), as well as in chronic maladies. *As a vermifuge*, the compound of jalap and calomel is most efficacious, and may be used with the most happy effects in children, especially where there is an excessive secretion of mucus. *In cerebral affections*, jalap, in combination with calomel, is used with the best effect, on the principle of counter-irritation, to relieve cerebral congestion. In inflammatory affections of the brain or its membranes, or in hydrocephalus, it is a valuable purgative. *In dropsies*, it is frequently desirable to promote watery stools. Jalap, especially in combination with cream of tartar, as in the compound powder of jalap, may be used for this purpose with the best effects.

Administration.—The dose of jalap, *in powder*, is, for an adult, from ten to thirty grains: twenty grains usually act smartly and safely: for children under twelve months old the dose is from two to five grains. Fifteen grains of jalap, and two or three grains of calomel, form an efficient yet safe purgative for an adult; but this combination very readily produces salivation by repetition. From two to five grains of ipecacuanha are occasionally substituted for the calomel. To children jalap is sometimes exhibited in gingerbread cakes.

Pharmaceutical Uses.—Jalap is an ingredient in compound scammony powder, and is employed in the preparation of resin of jalap.

[§ **Extractum Jalapæ.** *Extract of Jalap.*

Take of

Jalap, in coarse powder	1 pound.
Rectified Spirit	4 pints.
Distilled Water	1 gallon.

Macerate the jalap in the spirit for seven days; press out the tincture, then filter, and distil off the spirit, leaving a soft extract. Again macerate the residual jalap in the water for four hours, express, strain through flannel, and evaporate by a water-bath to a soft extract. Mix the two extracts, and evaporate at a temperature not exceeding 140° until it has acquired a suitable consistence for forming pills.

Dose.—5 to 15 grains.]

In this process the alcohol extracts the resin, and the water subsequently takes up the gummy extractive; the alcoholic tincture is distilled to save the spirit, while the aqueous decoction is evaporated. The extract is therefore a mixture of resin with the gummy extractive. It was formerly, and indeed is now by many persons, supposed that the combination of these ingredients was necessary for the full cathartic effect of jalap. It is, however, well known that the watery extract is inert as a purgative, though it is said to be diuretic: the only advantage, therefore, that can attend the mixture of the two extracts (the watery and the alcoholic) is, that the resin is intimately divided and thereby prevented from causing violent irritation and griping in any one part of the intestinal tube. The extract is only directed to be kept in the usual *soft* state; the *hard* extract (*Lond.*) being omitted. Mr. Brande says that jalap yields about 66 per cent. of extract; that is, 16 of alcoholic, and 50 of watery extract. Mr. Squire found that the London process, which scarcely differed from the British, gave 50 per cent. of mixed extract. According to this statement, therefore, the extract of the British Pharmacopœia has about one-fourth the strength of the Edinburgh extract, which was the impure resin of jalap.

[§ **Pulvis Jalapæ Compositus.** *Compound Powder of Jalap.*

Take of

Jalap, in powder	5 ounces.
Acid Tartrate of Potash	9 ounces.
Ginger, in powder	1 ounce.

Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar.

Dose.—20 to 60 grains.]

A hydragogue purgative. Used in habitual costiveness, dropsies, &c.

[§ **Tinctura Jalapæ.** *Tincture of Jalap.*

Take of

Jalap, in coarse powder	$2\frac{1}{2}$ ounces.
Proof Spirit	1 pint.

Macerate the jalap for forty-eight hours, in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

This tincture is rather weaker than the London and Edinburgh tinctures, and only two-thirds of the strength of the Dublin tincture. An active cathartic. Rarely used alone: generally employed as an adjunct to purgative draughts, the activity of which it promotes.

[§ **Jalapæ Resina.** *Resin of Jalap.*

Take of

Jalap, in coarse powder . . .	8 ounces.
Rectified Spirit	a sufficiency.
Distilled Water	a sufficiency.

Digest the jalap with sixteen fluid ounces of the spirit, in a covered vessel, at a gentle heat, for twenty-four hours; then transfer to a percolator, and when the tincture ceases to pass, continue the percolation with successive portions of spirit until it ceases to dissolve anything more. Add to the tincture four fluid ounces of the water, and distil off the spirit by a water-bath. Remove the residue while hot to an open dish, and allow it to become cold. Pour off the supernatant fluid from the resin; wash this two or three times with hot water, and dry it on a porcelain plate by the heat of a stove or water-bath.]

General Characters and Tests.—[§ In dark brown opaque fragments, translucent at the edges, brittle, breaking with a resinous fracture, readily reduced to a pale brown powder, sweetish in odour, acrid in the throat, easily soluble in rectified spirit, but only partially so in ether, and insoluble in oil of turpentine.] Resin of jalap is insoluble in water; it has acid properties and dissolves in alkaline solutions. It fuses at a moderate heat, giving off its peculiar odour, and when more strongly heated inflames, leaving no residue.

Administration.— To prevent irritation and griping, the resin should be well mixed by trituration with some mild agent, as almonds, sugar, or sulphate of potash. *Dose.*—2 to 5 grains.

GENTIANACEÆ, *Lindley*. The Gentian Order.

GENTIANA LUTEA, *Linn.* Yellow Gentian.

Botanical Character.—*Root* perennial, cylindrical, forked, somewhat ringed, externally brown, internally yellow. *Stem* simple, erect, 2–3 feet high, hollow. *Leaves* opposite, ovate or oval, acute, pale green, entire, smooth, 5–7-ribbed; lower ones on short sheathing petioles; upper ones amplexicaul, concave. *Flowers* whorled, crowded, pedunculate, of a brilliant yellow colour. *Calyx* inferior, membranous, with unequal segments, persistent. *Corolla* twisted in æstivation, withering, the limb regular, the segments oblong-linear, acuminate. *Stamens* as long as the corolla, and inserted in its tube. *Ovary* 1-celled; *stigmas* 2, revolute; *style* 0. *Capsule* 1-celled, septicidal, 2-valved. *Seeds* numerous, parietal, roundish, compressed, with a membranous margin.—*Steph. and Church.* pl. 132.

Habitat.—Sub-alpine and mountainous meadows (3,000–6,500 feet above the level of the sea), of central and southern Europe.

[§ Gentianæ Radix. *Gentian Root.*

The dried root of Gentiana lutea, *Linn.* Collected in the mountainous districts of Central and Southern Europe.]

Collection.—The roots are collected and dried by the peasants of Switzerland, the Tyrol, Burgundy, and Auvergne. They are imported into this country from Havre, Marseilles, and other ports.

General Characters.—Gentian root is found in cylindrical, usually more or less branched often twisted pieces, varying in length from a few inches to a foot or more, and in thickness from half an inch to one or two inches. These pieces are marked by transverse annular wrinkles and longitudinal furrows. Externally the root is yellowish-brown, and internally brownish-yellow; its texture is tough and spongy; and its taste is at first sweetish, and afterwards intensely bitter. It has no marked odour in a dried state, although when fresh it is peculiar and disagreeable.

Adulterations.—The roots of other species of gentian are frequently mixed with those of the official species: their effects however are analogous. Martius says that the roots of *Gentiana purpurea* have strong longitudinal furrows, and are of a darker brown colour internally, but want the transverse wrinkles. The roots of *G. pannonica* are similar to those of *G. purpurea*. Both kinds are met with in Bavaria, and serve in Switzerland for the preparation of a spirit. *Gentiana punctata* has roots which are just as bitter, but of a more yellow colour. The roots of both the last-mentioned species are dug up at, and exported from, Salzburg: in the fresh state they are white when sliced. Belladonna, aconite, orris, white hellebore, and other roots or rhizomes have been found intermixed with gentian roots, but are readily distinguishable by the characters above given.

Composition.—Gentian root consists for the most part of a volatile odorous and butyraceous oily matter, a bitter crystalline body consisting of an acid (gentisic acid), and a bitter principle (gentianite), with gum, sugar, pectin, wax, caoutchouc, a yellow colouring matter, and woody fibre. *Gentisic Acid, Gentisin.*—Procured by washing the alcoholic extract of the root with water, and then treating it with alcohol. The tincture obtained is evaporated, and the extract treated by ether: the residue, by successive solutions and evaporations, yields gentisin or gentisic acid. Gentisic acid is pale yellow, crystallises in needles, and has a peculiar but weak smell. When cautiously heated, it gives out some yellow vapours, which are condensed on the upper part of the tube. It is scarcely soluble in water, but dissolves in alcohol. With alkalies it unites to form salts. Trommsdorff states that a solution of gentisic acid is unaffected by subacetate of lead, nitrate of silver, and most other tests. Chloride of iron and the salts of copper produced in the alcoholic solution the most characteristic changes. *Bitter Principle of Gentian, Gentianite.* This has not hitherto been isolated. By digesting the alcoholic extract of gentian in water, an acidulous intensely bitter solution is obtained. The acid may be thrown down by solution of subacetate of lead. When the excess of lead has been removed from the solution by sulphuretted hydrogen, a liquid is obtained, which, by evaporation, yields an extract, from which ether removes an aromatic fat, an odorous resin, and wax. The bitter matter has not been separated from the sugar. *Pectin.*—The existence of pectic acid (pectin) in gentian was ascertained, in 1835, by Denis. To this substance is to be in part, perhaps, ascribed the gelatinisation of infusion of gentian, which under certain circumstances is not unfrequently observed. *Sugar.*—To the presence of this matter in gentian is to be ascribed the capability of the infusion of gentian to undergo the vinous fermentation, and to form an alcoholic liquor (*gentian spirit*) much admired by the Swiss.

Physiological Effects.—Gentian root is very properly regarded as a *pure* or *simple bitter*; that is, as being bitter, but without possessing much astringency or aroma. It has, therefore, the usual tonic properties of medicines of this class. Given in full doses, it appears more disposed to relax the bowels than the other simple bitters. It is somewhat less bitter, and therefore, I presume, somewhat less powerful, than quassia. Like certain other vegetable bitter tonics (for example, quassia and calumba), gentian has been found to possess some deleterious properties, and is not quite so innocuous as is generally supposed. It is said sometimes to have a narcotic effect.

Therapeutics.—Gentian is adapted to most of the cases requiring the use of the pure or simple bitters. It agrees best with phlegmatic individuals, and is apt to disagree with irritable or susceptible persons. It is contra-indicated in febrile disorders and inflammatory conditions of the gastro-intestinal membrane. It is employed principally in dyspepsia and other gastric disorders, attended with debility or torpidity, and unaccompanied by any marks of inflammation or irritation, or great susceptibility of the digestive organs, and in other diseases principally marked by weakness and debility.

[§ **Extractum Gentianæ.** *Extract of Gentian.*

Take of

Gentian Root sliced	1 pound.
Boiling Distilled Water	1 gallon.

Infuse the gentian in the water for two hours; boil for fifteen minutes; pour off, press, and strain. Then evaporate the liquor by a water-bath until the extract is of a suitable consistence for forming pills.

Dose.—2 to 10 grains.]

The cold water ordered by the three colleges in the last editions of their Pharmacopœias, extracted the bitter principle, and acted but little on the pectin. Hence the extract was very bitter, but wanted the cohesion requisite in a pill mass. Boiling water is now again ordered, and an excellent bitter extract is obtained, and one that is at the same time well adapted for the formation of pills. Extract of gentian is tonic. It is usually employed as a vehicle for the exhibition of the metallic substances (especially chalybeates), in the form of pill.

[§ **Infusum Gentianæ Compositum.** *Compound Infusion of Gentian*

Take of

Gentian Root, sliced . .	of each .	60 grains.
Bitter Orange Peel, cut small		
Fresh Lemon Peel, cut small . . .		$\frac{1}{4}$ ounce.
Boiling Distilled Water		10 fluid ounces.

Infuse in a covered vessel, for one hour, and strain.

Dose.—1 to 2 fluid ounces.

This is the Infusum Gentianæ Compositum. *Lond.*]

[§ **Mistura Gentianæ.** *Gentian Mixture.*

Synonym.—Infusum Gentianæ Compositum, 1864.

Take of

Gentian Root, sliced	. . . .	$\frac{1}{4}$ ounce.
Bitter Orange Peel, cut small } each	.	30 grains.
Coriander Fruit, bruised } each	.	30 grains.
Proof Spirit	. . . . . .	2 fluid ounces.
Distilled Water	. . . . .	8 fluid ounces.

Macerate the gentian, orange peel, and coriander in the proof spirit for two hours, then add the water, macerate again for two hours, and strain through calico.

Dose.— $\frac{1}{2}$ to 1 fluid ounce.]

This was the Infusion of Gentian of the Edinburgh Pharmacopœia of 1841, and being less liable to spoil by keeping than the preparations ordered under the same name in the London and Dublin Pharmacopœias, it was introduced to the exclusion of the others in the British Pharmacopœia of 1864. But although it is undoubtedly a more stable preparation than that of London or Dublin, it has been generally considered to be a less agreeable and efficient stomachic, and as it partakes more of the characters of a weak tincture or mixture than of an infusion, while as such it is not unfrequently prescribed, it has been retained in the present edition of the Pharmacopœia under an altered name. The cold water used in its preparation dissolves less than boiling water would of the mucilaginous matter, or pectin, of the gentian, while the spirit increases the solubility of the gentisin, another constituent of gentian.

[§ **Tinctura Gentianæ Composita.** *Compound Tincture of Gentian.*

Take of

Gentian Root, cut small and bruised	. .	$1\frac{1}{2}$ ounce.
Bitter-Orange Peel, cut small and bruised	.	$\frac{3}{4}$ ounce.
Cardamom Seeds, freed from the pericarps and bruised	. . . .	$\frac{1}{4}$ ounce.
Proof Spirit	. . . .	1 pint.

Macerate the solid ingredients for forty-eight hours, in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

This tincture corresponds in its ingredients with the London and Dublin tinctures, but differs widely from the Edinburgh. It is a grateful cordial tonic and stomachic.

OPHELIA CHIRATA, *Grisebach.* **The Chiretta.**

Synonym.—Agathotes Chirayta, *Don.*

Botanical Character.—*Annual. Stem* round, tall, smooth, branched. *Branches* elongated, semi-erect. *Leaves* opposite, amplexicaul, cordate-ovate, acuminate, entire, smooth, 5–7-ribbed. *Cymes* umbelliform, lax, few-flowered. *Calyx* persistent, 4-parted; *segments* sub-lanceolate, acuminate, shorter than the corolla. *Corolla* yellow, twisted in æstivation, rotate, 4-parted, withering. *Stamens* 4, inserted in the throat of the corolla. *Stigmas* 2, terminal, short. *Capsule* 2-valved, septicidal, 1-celled; *placentas* parietal. *Seeds* very numerous, small.—*Wallich, Plant. Asiat.* vol. iii. pl. 252 (*Gentiana Chirata*).

Habitat.—Temperate Himalaya, east of Kumaon.

[§ **Chirata.** *Chiretta.*

The entire plant, Ophelia Chirata, *Griseb.* Collected in Northern India.]

Collection and General Characters.—The plant is pulled up by the root, about the time that the flowers begin to decay, and the capsules are well formed. The dried plant with, or more commonly without the root, is met with in the shops. The root is fibrous, the stems about three feet long, of the thickness of a goose-quill, round, smooth, pale brown, branched. The branches are opposite. The flowers are small, numerous, and panicled. The whole plant is intensely bitter, but has no odour.

Composition.—The *bitter matter* is the most important constituent. No vegetable alkaloid has been detected in it. The substance sometimes sold as *sulphate of chirayitine* is sulphate of quinia.

Physiological Effects.—In its operation it is closely allied to gentian. It appears to possess rather a relaxing than a constipating effect.

Therapeutics.—It has long been employed by the natives of India in the same class of cases in which gentian has been used in Europe. As a stomachic it is especially serviceable in the dyspepsia of gouty subjects. It strengthens the stomach, obviates flatulency, and diminishes the tendency to acidity.

Administration.—It may be given in *powder* in the dose of twenty grains, or it may be employed in the form of infusion or tincture.

[§ **Infusum Chiratæ.** *Infusion of Chiretta.*

Take of

Chiretta, cut small	$\frac{1}{4}$ ounce.
Distilled Water, at 120°	10 ounces.

Infuse in a covered vessel, for half an hour, and strain.

Dose.—From 1 to 2 fluid ounces.]

[§ **Tinctura Chiratæ.** *Tincture of Chiretta.*

Take of

Chiretta, cut small and bruised . .	$2\frac{1}{2}$ ounces.
Proof Spirit	1 pint.

Macerate the chiretta for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

LOGANIACEÆ, *D.C.* The Strychnos Order.

SPIGELIA MARILANDICA, *Linn.* Carolina Pink; Perennial Wormgrass.

Botanical Character.—*Root* perennial. *Stems* erect, several, smooth, simple, quadrangular. *Leaves* sessile, ovate-lanceolate, acute or acuminate, entire, decussate. *Flowers* sessile, in unilateral spikes. *Calyx* 5-partite, the segments four times shorter than the tube of the corolla. *Corolla* funnel-shaped, 5-lobed, with a valvate æstivation, lobes lanceolate, rich carmine colour externally, paler at the base, and orange-yellow within. *Stamens* 5, exserted. *Ovary* 2-celled. *Fruit* capsular, smooth, somewhat shorter than the calyx.

Spigeliæ Radix. *Spigelia.*

The root of Spigelia marilandica, *Linn.* It was formerly official in the Edinburgh Pharmacopœia, and is so still in the United States Pharmacopœia.

(*Not official.*)

Collection.—It was formerly collected by the Creek and Cherokee Indians in Georgia and the neighbouring states: they disposed of it to the white traders, and by these it was packed in casks, or more commonly in large bales, weighing from three hundred to three hundred and fifty pounds. The whole plant was gathered and dried. At present, however, the supply, which consists chiefly of roots, is obtained from the Western and South Western States of America.

General Characters.—The dried plant is of a greyish-green colour, has a faint odour, and a bitter taste. The so-called root consists of numerous slender, branching, dark brown rootlets attached to a short brownish or yellowish-brown rhizome. It has a faint peculiar odour, and a slightly disagreeable sweetish-bitter taste.

Composition.—Its principal constituents are *a bitter principle* upon which its activity essentially depends, *resin*, and *volatile oil.*

Physiological Effects.—The physiological effects of spigelia have not been accurately determined; but the observations hitherto made, show them to be those of a local irritant (or acrid) and narcotic substance. In the *ordinary dose* it has very little sensible effect on the system, though it may act efficaciously as an anthelmintic. In *larger doses* it appears to operate as an irritant to the gastro-intestinal canal, and gives rise to purging, and sometimes to vomiting, though its effects in this way are very uncertain. In *poisonous doses* it operates as a cerebro-spinal or narcotic, giving rise to 'vertigo, dimness of vision, dilated pupils, spasms of the facial muscles, and sometimes even to general convulsions. Spasmodic movements of the eyelids have been observed among the most common attendants of its narcotic action.'

Uses.—Employed only as an anthelmintic. Though scarcely used in this country, it is highly esteemed in the United States of America.

Administration.—The dose of the *powder*, for a child of three or four years old, is from 10 to 20 grains; for an adult, from 60 to 180 grains. This quantity is repeated, every morning and evening, for several days, and is then followed by a brisk cathartic. It is frequently combined with calomel.

STRYCHNOS NUX VOMICA, *Linn.* The Nux Vomica Plant.

Botanical Character.—Middle-sized *tree; trunk* short, often crooked; the *branches* irregular, without spines or tendrils. *Leaves* (fig. 58) opposite, shortly stalked, ovate or elliptical, 3–5-ribbed, entire, shining, quite smooth. *Corymbs* (fig. 58) terminal. *Calyx* with 5 short teeth. *Corolla* funnel-shaped, smooth within, greenish-white. *Stamens* 5, inserted into the throat of the corolla; *filaments* very short; *anthers* sub-exserted. *Ovary* superior, 2-celled. *Fruit* 1-celled, round, smooth, size of a pretty large apple, covered with a smooth, somewhat hard *shell*, of a rich orange colour when ripe, and filled with a white soft gelatinous *pulp*. *Seeds* several, immersed in the pulp of the fruit.—*Steph. and Church.* pl. 52.

Fig. 58.

Leaves and inflorescence of Strychnos Nux vomica.

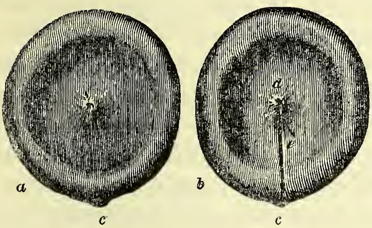
Habitat.—Coromandel, and other parts of India, Ceylon.

[§ **Nux Vomica.** *Nux vomica.*

The seeds of Strychnos Nux vomica, *Linn.* Imported from the East Indies.]

General Characters.—The *seeds* (fig. 59 *a*, *b*) are nearly circular, about an inch in diameter, nearly flat, or very slightly convex on the dorsal surface, and concave on the other or ventral surface, and are usually surrounded by a filiform annular stria. In the centre of the

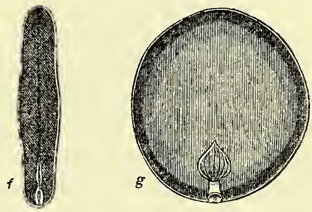
Fig. 59.



Nux vomica.

a. The dorsal surface.
b. The ventral or concave surface.
c. Prominence indicating the chalaza and radicle.
d. Hilum or umbilicus.
e. Raphe.

Fig. 60.



Sections of Nux vomica.

f. Transverse section of seed, showing the bipartite albumen, the cavity, and the embryo.
g. Vertical section, exposing the internal cavity, and showing the situation and figure of the embryo.

ventral surface is the rounded hilum or umbilicus (fig. 59, *d*). At one part of their circumference or margin there is a slight prominence (fig. 59, *c*), which answers to the chalaza and radicle of the embryo. From this prominence to the hilum is a more or less obvious line, forming the raphe (fig. 59, *e*). The testa or seed coat is of an ash-grey colour, thickly covered with short satiny hairs. The *nucleus* (fig. 60, *f*, *g*) is composed of two parts—namely, albumen and embryo. The albumen is bipartite (fig. 60, *f*), cartilaginous, or horny, of a dirty-white colour, an intensely bitter taste, and has in its interior a cavity. The embryo (fig. 60, *g*), which is milky white, is seated in the circumference of the seed, and is furnished with two large heart-shaped, acuminated, triple-ribbed, very thin cotyledons. Nux vomica has no perceptible odour. Its powder has a yellowish-grey colour.

Composition.—The seeds contain the alkaloids *strychnia* and *brucia*, in combination with *igasuric* or *strychnic acid*. *Strychnia.*—(See p. 654.) *Brucia* ($C_{23}H_{26}N_2O_4$), when combined with water, is capable of crystallising, in oblique four-sided prisms; or sometimes the crystals have a pearly laminated appearance, something like boracic acid. Its taste is very bitter, though less so than that of strychnia. It is soluble in 850 parts of cold, or 500 parts of boiling water; but the presence of colouring matter, of which it is difficult to deprive it, promotes its solubility. It is very soluble in alcohol, but is insoluble in ether and the fixed oils, and is very slightly soluble in the volatile oils. Nitric acid communicates a fine red colour to it; and the colour changes to violet on the addition of chloride of tin: sulphuretted hydrogen and sulphurous acid destroy the colour. Chlorine also communicates a red colour to brucia. Bromine communicates a violet tint to its alcoholic solution. Sulphuric acid first reddens brucia, and then turns it yellow and green, but does not produce the deep violet colour on the addition of bichromate of potash. According to Dr. Fuss, brucia is not a peculiar alkaloid, but a compound of strychnia and resin (yellow colouring matter). He says that he has proved this both analytically and synthetically, and he ascribes this property of becoming reddened by nitric acid, and by chlorine, to the resin present. The *salts of brucia* are readily formed by saturating dilute acids with brucia. They are soluble, crystallisable, and have a bitter taste. They are decomposed by potash, soda, ammonia, the alkaline earths, morphia, and strychnia, which precipitate the brucia. They produce precipitates on the addition of tannic acid. Nitric acid colours them as it does free brucia. The effects of brucia on man and animals appear to be precisely similar to those of strychnia, though larger doses are required to produce them. Magendie considers it to possess only one-twelfth of the activity of strychnia; while Andral regards it as having but one-twenty-fourth that of pure strychnia. *Strychnic* or *Igasuric Acid* is crystallisable, and has an acid rough taste. It is soluble in water and alcohol. The salts of iron, mercury, and silver in solution are unaffected by it; but those of copper are rendered green, and after some time a light green precipitate is deposited. *Powdered nux vomica* is blackened by concentrated sulphuric acid. Nitric acid communicates to it a deep orange-yellow colour. If the powder be digested with boiling water acidulated with sulphuric acid, the filtered liquor is turbid and slightly yellow. Nitric acid, after some minutes, reddens it. If the sulphuric solution be digested with finely powdered marble (to saturate the excess of acid), then evaporated to dryness, and the residue treated with boiling alcohol, we obtain a spirituous solution of sulphates of strychnia and brucia, with colouring matter. This has a bitter taste, is reddened by nitric acid, and forms a flocculent coloured precipitate on the addition of ammonia. Sometimes crystals of strychnia are deposited from the alcoholic liquor on standing for two or three days. Ammoniacal sulphate of copper added to the infusion or decoction of nux vomica produces an emerald-green colour, and gradually a greenish-white precipitate (*igasurate of copper*) : ammoniacal sulphate of strychnia remains in solution. Nitric acid communicates an orange-red colour to the decoction, owing to its action on the brucia and yellow colouring matter. Tannic acid, or infusion of galls, produces in the decoction a copious precipitate (*tannates of strychnia, brucia,* and *some other vegetable matter*). Subacetate of lead causes an abundant precipitate (*gummate and igasurate of lead, with colouring and fatty matter*).

Physiological Effects.—1. *Local Effects.* In medicinal doses nux vomica does not usually disorder the stomach, nor is it invariably irritant in its operation, even when swallowed as a poison. In some instances, however, the pain and heat in the stomach, the burning in the gullet, and the nausea and vomiting, are evidences of its local action; and in several cases marks of inflammation have been observed in the stomach on examination of the body after death. Strychnia is also a local irritant. 2. *Effects after absorption of the active principle.*—Three degrees of the operation of nux vomica may be admitted : *First degree : tonic and diuretic effects.*—In very small and repeated doses, nux vomica usually promotes the appetite, assists the digestive process, increases the secretion of urine, and renders the excretion of the fluid more frequent. In some cases it acts slightly on the bowels, and occasionally produces a sudorific effect. The pulse is usually unaffected. *Second degree: rigidity and convulsive contraction of the muscles.*—In larger doses the effects of nux vomica manifest themselves by a disordered state of the muscular system. A feeling of weight and weakness in the limbs, and increased sensibility to external impressions of light, sound, touch, and variations of temperature. are usually the precursory symptoms. The limbs tremble, and a slight rigidity or stiffness is experienced when an attempt is made to put the muscles into action. The patient experiences a difficulty in keeping the erect posture, and, in walking, frequently staggers. If the use of the medicine be still persevered in, these effects increase in intensity, and the voluntary muscles are thrown into a convulsed state by very slight causes. Thus, when the patient inspires more deeply than usual, or attempts to walk, or even to turn in bed, a convulsive paroxysm is brought on. The sudden contact of external bodies also acts like an electric shock. The further employment of nux vomica increases the severity of the symptoms; the paroxysms now occur without the agency of any evident exciting cause, and affect the patient even when lying perfectly quiet and still in bed. The muscular fibres of the pharynx, larynx, œsophagus, penis, and bladder, also become affected, while the sexual feelings are also excited. The pulse does not appear to be uniformly affected; generally, however, it is slightly increased in frequency between the convulsive attacks. Previously to the production of the affection of the muscles, various painful sensations are often experienced in the skin, which patients have compared to the creeping of insects (formication), or to the passage of an electric shock. It is remarkable that in paralysis the effects of nux vomica are principally observed in the paralysed parts. *Third degree: tetanus, asphyxia, and death.*—Death is frequently caused by the stoppage of respiration (asphyxia), in consequence of the spasmodic condition of the respiratory muscles. In other instances death seems to arise from excessive exhaustion of the nervous power. As in other cases where death takes place from obstructed respiration, venous congestion, especially in the lungs, is found after death. Occasionally there is redness or inflammation of the alimentary canal, and now and then softening of the brain or spinal cord.

Part of the body on which nux vomica exercises a specific effect.—Every part of the nervous system is probably specifically affected by nux vomica, though the principal manifestations of its action are in the cerebro-spinal system. The tetanic symptoms, and the absence of narcotism, have led to the conclusion that the spinal cord was the part principally affected,—a conclusion supported by the fact that the division of this cord—nay, even complete decollation—will not prevent the poisonous effects of nux vomica; whereas the destruction of the cord by the introduction of a piece of whalebone into the spinal canal causes the immediate cessation of the convulsions; and if only part of the cord be destroyed, the convulsions cease in that part of the body only which is supplied with nerves from the portion of medulla destroyed. These facts, then, lead to the conclusion that the abnormal influence, whatever it may be, which causes the convulsions to take place, is not derived from the contents of the cranium, but from the medulla spinalis itself. But nux vomica also affects the sensibility of the body, and heightens the sensations of touch, vision, and hearing. These effects are referable to its action on the cerebrum; though Dr. Stannius considers that this increased susceptibility to external impressions arises from the action of the poison on the spinal cord. Although the intellectual functions are not usually much disordered by this drug, yet the mental anxiety commonly experienced by persons under its use, the occasional appearance of stupor, and the observations of Andral and Lallemand on the injurious effects of it in apoplexies with cerebral softening, leave no doubt that the cerebrum is affected by this agent. Bally has observed an appearance of stupor, vertigo, tinnitus aurium, sleeplessness, and turgescence of the capillaries of the face, result from the use of strychnia. The ganglia also appear to be affected by nux vomica: and hence the influence with this agent exercises over the movements of the intestinal canal and heart.

Therapeutics.—The obvious indications for the use of nux vomica, or strychnia, are torpid or paralytic conditions of the motor or sensitive nerves, or of the muscular fibre; while these agents are contra-indicated in spasmodic or convulsive diseases. Experience, however, has fully proved that when paralysis depends on inflammatory conditions of the nervous centres these agents prove injurious, and accelerate organic changes. *In paralysis.*—Of all the diseases for which nux vomica has been employed, in none has it been so successful as in paralysis; and that a remedy which stimulates so remarkably the muscular system to action should be serviceable when that system no longer receives its accustomed natural stimulus, is, *à priori*, not astonishing. Paralysis, however, is the common effect of various lesions of the nervous centres, in some of which nux vomica may be injurious, in others useless, and in some beneficial. It is, therefore, necessary to point out under what circumstances this remedy is likely to be advantageous or hurtful. A very frequent, and, indeed, the most common cause of paralysis, is hemorrhage of the nervous centres. It is almost superfluous to say that no radical cure of these cases can be effected until the effused blood is removed by absorption. But the effused blood and the ruptured brain may not be the only lesions. The part surrounding the sanguineous clot is usually much softened; and this softening, though it sometimes follows the effusion, more frequently precedes it, and is generally the result of acute or chronic inflammation or irritation. In these cases, especially while the clot is recent and itself acting as a source of irritation, experience confirms our theoretical anticipations that nux vomica can only do harm, and increase the evil it is intended to mitigate. But there are cases in which paralysis, arising from cerebral hemorrhage, may be advantageously treated by nux vomica. After a time, the effused blood gradually disappears. Now it is well known that by long disuse of some of the voluntary muscles the power over them becomes gradually diminished; and it appears that occasionally in cerebral hemorrhage, after the absorption of the effused blood, the paralysis remains, as it were by habit. In these cases the cautious employment of nux vomica, or of its active principle, may be attended with beneficial results, by favouring the return both of motion and sensation. But paralysis, like some other diseases of the nervous system, may exist without our being able to discover after death any lesion of the nervous centres; and it is then denominated a functional disorder, as if there were actually no organic lesion. To me, however, the fact of the lesion of action is a strong ground for suspecting that there must have been an organic lesion of some kind, though we see nothing. Be this as it may, experience has fully established the fact that nux vomica is more beneficial in those forms of paralysis usually unaccompanied by visible lesions of structure; such, for example, as paralysis resulting from exposure to the influence of lead and its various compounds. As hemiplegia more frequently depends on cerebral hemorrhage than some other forms of paralysis, so it is, for the most part, less amenable to remedial means. Thus, while out of twenty-six cases of paraplegia nineteen were cured by nux vomica or its active constituent, in thirty instances of hemiplegia only thirteen were cured. In six cases of general paralysis (that is, paralysis of both sides at once), four were cured by this remedy. In the paralysis which sometimes affects the muscles of certain organs, nux vomica (or strychnia) has been employed with advantage. Thus a case of amaurosis, accompanied with paralysis of the eyelid, is said to have been cured by it; and several cases of incontinence of urine, depending on paralysis or diminished power of the muscular fibres of the bladder, have also been benefited by the same means. In some cases of local paralysis strychnia has been employed endermically with benefit.

In paralysis of the sentient nerves.—The good effects procured from the use of nux vomica in paralysis of the motor nerves, have led to its employment in functional lesions of the sentient nerves, characterised by torpor, inactivity, and paralysis. Hitherto, however, the trials have not been numerous, nor remarkably successful. In amaurosis benefit has been obtained in some few instances; and where no organic lesion is appreciable, this remedy deserves a trial. The endermic method of using it has been preferred. Small blisters, covered with powdered strychnia, have been applied to the temples and eyebrows. The remedy causes sparks to be perceived in both eyes, especially the affected one; and it is said, the more of these, the better should be the prognosis: moreover, the red-coloured sparks are thought more favourable than sparks of other colours. When the malady is complicated with disease of the brain, the remedy must be employed with extreme caution.

In other affections of the nervous system.—I have seen nux vomica very serviceable in shaking or *tremor of the muscles* produced by habitual intoxication. A gentleman thus affected, who had for several weeks lost the power of writing, re-acquired it under the use of this medicine. *Chorea* has been benefited by it. It has also been used in *neuralgia* with good effect.

In affections of the alimentary canal.—On account of its intense bitterness, nux vomica has been resorted to as a tonic and stomachic in dyspepsia, especially when this affection depends on, or is connected with, an atonic condition of the muscular coat of the stomach. In pyrosis, arising from simple functional disorders of the stomach, even when symptomatic of organic disease of this viscus, it has been found very useful. In febrile states of the system its employment is contra-indicated. In dysentery, particularly when of an epidemic nature, nux vomica has gained some reputation, from the experience of several practitioners. In *colica pictonum*, a combination of strychnia and hydrochlorate of morphia has been found highly successful. In *prolapsus of the rectum* Dr. Schwartz has recommended the use of nux vomica; he has employed it for ten years, both in adults and children, with great benefit (in consequence of its stimulant action on the sphincter ani). One or two grains of the extract of nux vomica are to be dissolved in two fluid drachms of water; and of this solution he gives to infants at the breast two or three minims; and to older children from six to ten or fifteen minims, according to their age. Dr. F. Farre says that the addition of extract of nux vomica or of strychnia to purgatives, as aloes or compound extract of colocynth, greatly assists their action in habitual constipation arising from a distended and atonic state of the bowels.

In impotence.—The excitement of the sexual feelings which Trousseau had seen produced by nux vomica, led him to employ this remedy against impotence, and he found it successful both in males and females. In some cases, however, its good effects were observed only while the patients were taking the medicine.

Administration.—Nux vomica is used in the form of extract, powder, or tincture. The powder of nux vomica is administered in doses of two or three grains gradually increased. Fouquier has sometimes increased the quantity to fifty grains.

[§ **Extractum Nucis Vomicæ.** *Extract of Nux Vomica.*

Take of

Nux Vomica	1 pound.
Rectified Spirit	a sufficiency.

Apply steam to the nux vomica until it is thoroughly softened, then dry rapidly, and reduce to fine powder. Exhaust the powder by boiling it with successive portions of the spirit, until the latter comes off nearly free from bitterness. Strain, distil off the spirit, and evaporate by a water-bath to the consistence of a soft extract.

Dose.—$\frac{1}{2}$ to 2 grains.]

In the preparation of this extract, the Edinburgh process is followed, and the softened and subsequently dried seed is directed to be reduced to powder, and boiled (not macerated, *Lond.*) in the spirit.

[§ **Tinctura Nucis Vomicæ.** *Tincture of Nux Vomica.*

Take of

Nux Vomica	2 ounces.
Rectified Spirit	1 pint.

Apply steam to the nux vomica until it is thoroughly softened, then dry rapidly, and reduce it to fine powder. Macerate the powder for forty-eight hours in fifteen fluid ounces of the spirit in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient rectified spirit to make one pint.

Dose.—10 to 20 minims.]

Besides its use internally, it is sometimes used as an embrocation to paralysed parts, and its good effects in this way seem to be increased by combining it with ammonia.

[§ **Strychnia.** *Strychnia.*

$C_{42}H_{22}N_2O_4$ or $\mathbf{C_{21}H_{22}N_2O_2}$.

An alkaloid prepared from Nux Vomica.

It may be obtained by the following process :—

Take of

Nux Vomica	1 pound.
Acetate of Lead	180 grains.
Solution of Ammonia, Rectified Spirit, Distilled Water, of each . .	a sufficiency.

Subject the nux vomica for two hours to steam in any convenient vessel; chop or slice it; dry it in a water-bath or hot-air chamber, and immediately grind it in a coffee mill. Digest the powder at a gentle heat for twelve hours with two pints of the spirit and one of the water, strain through linen, express strongly and repeat the process twice. Distil off the spirit from the mixed fluid, evaporate the watery residue to about sixteen ounces, and filter when cold. Add now the acetate of lead, previously dissolved in distilled water, so long as it occasions any precipitate; filter; wash the precipitate with ten ounces of cold water, adding the washings to the filtrate; evaporate the clear fluid to eight ounces, and when it has cooled add the ammonia in slight excess, stirring thoroughly. Let the mixture stand at the ordinary temperature for twelve hours; collect the precipitate on a filter, wash it once with a few ounces of cold distilled water, dry it in a water-bath or hot-air chamber, and boil it with successive portions of rectified spirit, till the fluid scarcely tastes bitter. Distil off most of the spirit; evaporate the residue to the bulk of about half an ounce, and set it aside to cool. Cautiously pour off the yellowish mother liquor (which contains the brucia of the seeds) from the white crust of strychnia which adheres to the vessel. Throw the crust on a paper filter, wash it with a mixture of two parts of rectified spirit and one of water, till the washings cease to become red on the addition of nitric acid: finally, dissolve it by boiling it with an ounce of rectified spirit, and set it aside to crystallise. More crystals may be obtained by evaporating the mother liquor.]

Strychnia, as before stated, exists in the nux vomica associated with brucia, in combination with igasuric acid. These are dissolved out by dilute spirit, and the spirit having been removed by distillation, solution of acetate of lead is added to the watery residue. This forms acetates of the alkaloids, and precipitates the igasuric acid together with resin, &c., which are separated by filtration. To the extract obtained by evaporating the filtrate, ammoni is added in slight excess to precipitate the alkaloids. These are collected, slightly washed, dried, and then redissolved in spirit, and the solution evaporated to half an ounce by measure. The strychnia separates as a crystalline crust, leaving the greater part of the brucia in solution. This is decanted off, and the strychnia is then washed with dilute alcohol, to remove the adhering brucia, and is lastly dissolved in rectified spirit and crystallised.

General Characters and Tests.—[§ In right square octahedrons or prisms, colourless and inodorous; sparingly soluble in water, but communicating to it its intensely bitter taste; soluble in boiling rectified spirit, in ether, and in chloroform, but not in absolute alcohol or in ether. Pure sulphuric acid forms with it a colourless solution, which on the addition of bichromate of potash acquires an intensely violet hue, speedily passing through red to yellow. Not coloured by nitric acid; leaves no ash when burned with free access of air. A very active poison.] It is soluble in 6,667 parts of water, at 50°: that is, one grain needs more than fifteen ounces of water to hold it in solution. It requires 2,500 parts of boiling water to dissolve it, and it renders 40,000 parts of water sensibly bitter. It acts on vegetable colours as an alkali, saturates acids forming salts, and separates most of the metallic oxides (the alkaline substances excepted) from their combinations with acids. In some cases part only of the metal is precipitated, a double salt being formed in solution. Thus, when strychnia is boiled with a solution of sulphate of copper, a green solution of cupreous sulphate of strychnia is obtained, while a portion only of the oxide of copper is precipitated. A solution of chloride of mercury added to a solution of strychnia in hydrochloric acid, produces a white clotty precipitate composed of chloride of mercury and hydrochlorate of strychnia. Tannic acid or tincture of galls occasions a whitish precipitate in a neutral solution of hydrochlorate of strychnia. *Commercial strychnia* usually forms with strong nitric acid a red-coloured liquid, which afterwards becomes yellow. This change does not occur with pure strychnia but depends on the presence of one or both of two substances—viz. brucia and yellow colouring matter. As the red colour is destroyed by deoxidising agents (sulphurous acid and sulphuretted hydrogen), it appears to depend on the oxidisement of the substances referred to.

The *salts of strychnia*, when pure, are for the most part crystalline, white, and very bitter. They possess the following chemical characteristics:—1st, their solutions yield white precipitates with the alkalies and their carbonates; 2ndly, they are precipitated by tannic, but not by gallic acid; 3rdly, they are unchanged by the action of the persalts of iron.

Physiological Effects.—The effects of strychnia are of the same kind as those of nux vomica, but more violent in degree. As ordinarily met with in the shops, it may be regarded as about six times as active as the extract of nux vomica. The salts of strychnia act in the same manner. Some individuals are more susceptible of the action of strychnia than others. Andral has seen a single pill, containing one-twelfth of a grain, cause slight trismus, and the commencement of tetanic stiffness of the muscles; and Dr. F. J. Farre says, 'I have seen this effect produced in a boy aged twelve, by one-*hundredth* of a grain taken three times a day, and on several occasions in adults by the continued use of one-sixteenth;' while in other cases the dose may be gradually increased beyond a grain, with comparatively little effect. The largest dose I have given is a grain and a half, and this was repeated several times before the usual symptoms indicative of the affection of the system came on. Smaller doses had been previously given without any obvious effect. Subsequent experience has satisfied me that so large a dose is dangerous. The dose here mentioned destroyed the life of a healthy young woman in an hour and a half (*Lancet*, Aug. 31, 1850, p. 259). Dr. Warner, U. S., died from the effects of *half a grain* of the sulphate of strychnia in fourteen minutes. Several cases of poisoning by strychnia will be found reported in the *Medical Times and Gazette* for December 16, 1854, and April 28, 1855. In one of these a person recovered after taking a dose of four grains. A Swede on board the Dreadnought Hospital Ship, suffering from paralysis, took one-eighth of a grain of strychnia three times a day for several weeks, without apparent effect; but the dose having been increased first to one-third and afterwards to half a grain, he died rather suddenly with the whole body (trunk and limbs) in a state of tetanic spasm. This case gives some colour to the idea that strychnia, like digitalis and some other potent remedies, accumulates in the system. Dr. A. Fleming says that the cumulative action only occurs when the medicine is given in the form of pill, which in consequence of its slow solution accumulates in the bowels. It is never observed when strychnia is given in solution. The *local* action of strychnia is that of an irritant. Applied to the naked derm, it causes burning and pungent pain, lasting from half an hour to an hour; and where blisters have been applied, the raw surface inflames under the use of the remedy, and affords a copious suppuration.

The recent most interesting experiments of Professor Crum Brown and Dr. T. R. Fraser show, that although strychnia is in itself such a powerfully convulsant poison, 'its methyl and ethyl compounds, while retaining their chemical properties, have their physiological actions completely changed, so that, instead of producing tetanic convulsions, like strychnia, they induce a condition of general paralysis of the body by paralysing the extremities of the motor nerves. These experimenters have also proved that the same is true of at least two other convulsant poisons, viz., brucia and thebaia. The change of physiological action is so absolute, that Drs. Brown and Fraser recommend the methyl and ethyl compounds of these poisons as antidotes in cases of poisoning with them.'

Therapeutics.—The uses of strychnia are similar to those of nux vomica already stated. *In cholera.*—M. Abeille has employed this medicine in cholera, and states that it modifies advantageously and rapidly the phenomena of cholera, by its influence upon the sensitive nerves. In the algide stage it excited reaction 19 times in 23 cases, and there were 10 recoveries. Ice should be taken after each dose, to prevent vomiting: if this take place, the dose may be repeated with safety. *In incontinence of urine.*—A man suffered from incontinence of urine for five months, in consequence of paralysis of the neck of the bladder, brought on by being disturbed in micturition. The urine passed from him in drops. After the fruitless administration of strychnia internally, a solution was injected into the bladder (0·50 centigramme of strychnia to 500 centigrammes of water). The patient is stated to have recovered in thirteen days. Dr. Girard, of the Asylum at Auxerre, has applied minute quantities of sulphate of strychnia to the surface of the rectum in involuntary evacuation of the fæces. Dr. F. J. Farre has also found the application of the hydrochlorate of strychnia to the anus useful in restraining the involuntary evacuations of paraplegia. M. Duchassay has employed this salt in the prolapsus ani of children. He removed a small portion of cuticle, applied one-eighteenth of a grain of the sulphate to the surface, and thereby stimulated the sphincter muscle.

Administration.—The *dose* of strychnia or of its hydrochlorate is, at the commencement, one-sixteenth or one-twentieth of a grain, which is to be very gradually increased until its effects on the muscular system are observed. Strychnia is usually given in the form of pill made with confection of roses, or it may be dissolved in alcohol or dilute hydrochloric acid, as in solution of strychnia. The *endermic* dose of strychnia should not, at the commencement, exceed half a grain, and of its salts, one-fourth of a grain.

Antidotes.—Evacuate the contents of the stomach as speedily as possible. No chemical antidotes are known. Probably astringents (as infusion of galls, or strong green tea freely administered) would be serviceable. To relieve the spasms, narcotics may be employed. Chloroform vapour has been successfully used for this purpose. As conia is the counterpart of strychnia, it deserves a trial. I applied it to a wound in a rabbit affected with tetanus from the use of strychnia: the convulsions ceased, but the animal died. In the absence of conia, the extract of hemlock should be employed. In the *British Medical Journal* of January 28, 1860, and in the *American Journal*, July 28, 1862, will be found some experiments on dogs poisoned by strychnia, the effects of which were counteracted and removed by the use of nicotia or tobacco. This antagonism is said to be not a chemical but a physiological one, strychnia powerfully contracting the muscles, and nicotia powerfully relaxing them. The antidotal property of nicotia was first suggested by the Rev. Dr. Haughton, in 1856; and the *Medical Times* of June 12, 1858, records the case of a man poisoned by six grains of strychnia, who, after vomiting, was saved by the rapid administration, in half-ounce doses, of an infusion of *an ounce and a quarter* of tobacco leaf. These statements accord with the observations of Mr. Curling, who considers tobacco the most efficacious remedy we possess in ordinary tetanus (see p. 621); but the experiment of Orfila should not be forgotten, that twelve drops of nicotia given to a middle-sized dog produced convulsions, rapidly followed by tetanus, opisthotonos, and death. As mentioned before, Drs. Crum Brown and T. R. Fraser have recommended the methyl and ethyl compounds of strychnia as antidotes in cases of strychnia poisoning; and recently hydrate of chloral has also been recommended as an antidote to poisoning with strychnia.

[§ **Liquor Strychniæ.** *Solution of Strychnia.*

Take of

Strychnia, in crystals . . .	4 grains.
Diluted Hydrochloric Acid . .	6 minims.
Rectified Spirit	2 fluid drachms.
Distilled Water	6 fluid drachms.

Mix the hydrochloric acid with four drachms of the water, and dissolve the strychnia in the mixture by the aid of heat. Then add the spirit and the remainder of the water.

Dose.—From 5 to 10 minims.]

IGNATIA AMARA, *Linn. fil.*

Synonym.—Strychnos Ignatia, *Bentham.*

Ignatia. *St. Ignatius's Beans.*
The Seeds.
(*Not official.*)

Botanical Source.—The plant which yields these seeds is said to be a climbing shrub, native of some of the Philippine Islands. It is supposed to be a species of *Strychnos*, but of this we have no certain knowledge.

General Characters, Composition, and Uses.—St. Ignatius's beans are about the size of olives, rounded and convex on one side, and somewhat angular on the other. Externally they are brownish, with a bluish-grey tint. Within the integuments of the seed is a very hard, horny, or cartilaginous albumen, in whose cavity is contained the embryo. These seeds have the same constituents as those of nux vomica, but they yield strychnia in larger proportions, and have therefore been much used as a source of that alkaloid. Their effects and uses are similar to those of nux vomica. They are official in the United States Pharmacopœia.

ASCLEPIADACEÆ, *Lindley.* The Milkweed Order.

HEMIDESMUS INDICUS, *D.C.*

A twining glabrous *shrub*, with long cylindrical *roots. Leaves* opposite, varying from cordate-ovate to narrow-linear, usually oblong-lanceolate, acute, entire, shining above. *Flowers* greenish-purple, in cymes, small. *Calyx* 5-cleft. *Corolla* hypogynous, 5-lobed, rotate; *throat* furnished with 5 scales, alternate with the lobes. *Stamens* 5, inserted in the tube of the corolla; *filaments* connected at the base, distinct at top; *anthers* cohering over the stigma, but unconnected with it. *Pollen-masses* 4 in each anther, adhering after dehiscence to the 5 processes of the stigma. *Ovaries* 2; *styles* 2; *stigmas* united, flat, peltate, 5-cornered, with cartilaginous processes at the angles. *Follicles* 2, cylindrical, slender, divaricate, straight. *Seeds* comose. *Wight, Icon. Plant. Ind. Orient.*, vol. ii. pl. 594.

Habitat.—India.

[§ **Hemidesmi Radix.** *Hemidesmus Root.*

The dried root of Hemidesmus indicus, *D.C.* Imported from India.]

General Characters.—Hemidesmus root is long, cylindrical, twisted, rugous, furrowed longitudinally, and has its cortical portion divided transversely so as to form annular cracks. It is yellowish-brown externally, has a peculiar aromatic fragrant odour, which has been compared to sassafras and new hay, and a very agreeable feebly bitter taste. The cortical portion has a corky consistence, and surrounds a woody cordlike centre (*meditullium*).

Composition.—The properties of this root are said to depend upon a volatile and a peculiar crystallisable principle called *hemidesmine.* According to Christison, the latter substance is in reality only a stearoptene.

Uses.—In India it is regarded as possessing similar properties to sarsaparilla, and is employed as a substitute for that substance. In this country, however, it is chiefly employed on account of its agreeable flavour.

[§ **Syrupus Hemidesmi.** *Syrup of Hemidesmus.*

Take of

Hemidesmus Root, bruised	4 ounces.
Refined Sugar	28 ounces.
Boiling Distilled Water	1 pint.

Infuse the hemidesmus in the water, in a covered vessel, for four hours, and strain. Set it by till the sediment subsides; then decant the clear liquor, add the sugar, and dissolve by means of a gentle heat. The product should weigh two pounds ten ounces, and should have the specific gravity 1·335.

Dose.—1 fluid drachm.]

OLEACEÆ, *Lindley.* The Olive Order.

OLEA EUROPÆA, *Linn.* The European Olive.

Botanical Character.—A small evergreen *tree*, about twenty feet in height, of dull aspect. *Leaves* (fig. 61) opposite, oblong or lanceolate, entire, mucronate, smooth above, leprous-hoary beneath. *Flowers* in axillary racemes, small, white. *Calyx* short, campanulate, 4-

toothed. *Corolla* with a short tube, and a 4-parted flat spreading limb. *Stamens* 2. *Ovary* 2-celled. *Style* short. *Stigma* bifid. *Fruit* (fig. 61, *a*) drupaceous, ellipsoidal, dark bluish-green, with oily pericarp, and a bony kernel; usually 1-seeded.—*Steph. and Church.* pl. 15. *Woodv.* pl. 136, p. 369.

Habitat.—Native of Asia; naturalised, and extensively cultivated on the shores of the Mediterranean, both in the South of Europe and North of Africa.

Fig. 61.

Olea europæa.
a. Fruit.

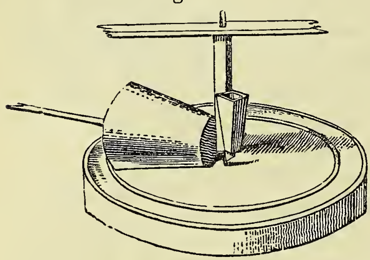
Products of the Olive Tree.—The products of the olive tree deserving notice are the *resiniform exudation*, the *leaves*, and the *fruit*. *Resiniform exudation.* — The older writers speak of the exudation from olive trees, described by Dioscorides as the tears of the Æthiopic olive. In modern times it has been improperly termed *olive gum* or *Lecca gum*. It consists of a peculiar matter (*olivile*), *brown resin* soluble in ether, and *benzoic acid*. It was formerly employed in medicine. *Olive leaves and bark.*—The leaves of the olive tree have been analysed by Pallas, who found, amongst other constituents, a *bitter principle*, a *black resin*, a *peculiar crystalline substance* (*vauqueline*), *tannic* and *gallic acids.* They have been employed externally as astringents and antiseptics; internally, as tonics in intermittents. From a communication made to the *Pharmaceutical Journal*, it would appear that a decoction of these leaves, made by boiling two handfuls in a quart of water until reduced to half a pint, has been very successfully used in the Levant in the treatment of obstinate cases of fever. Mr. Maltass, of Smyrna, states that he has found this remedy more effectual than quinia. It appears that during the Peninsular War, 1808–13, olive leaves were used by French practitioners as a substitute for cinchona bark; and Dr. Pallas, whose analysis is above quoted, observed marked beneficial effects from the use of an alcoholic extract of the bark. The crystalline substance discovered by Pallas, and designated by him *vauqueline*, was found to be a constituent of the young bark as well as of the leaves. It was associated with a bitter principle, to which the febrifuge properties are strictly due. The young bark contained more of these matters than the leaves or the old bark. *Fruit of the Olive trees; Olives.*—The preserved or pickled olives used as a dessert, are the green unripe fruits deprived of part of their bitterness by soaking in water, and then preserving them in an aromatised solution of salt. Several varieties are met with in commerce, but the most common are the *small French* or *Provence olive*, and the *large Spanish olive.* Ripe olives are remarkable from the circumstance of their sarcocarp abounding in a bland fixed oil. *The oil is the only official product of the olive tree.*

[§ **Oleum Olivæ.** *Olive Oil.*

The oil expressed in the South of Europe from the ripe fruit of Olea europæa, *Linn.*]

Expression.—The process of procuring olive oil varies somewhat in different countries, though the principle is the same in all. In Spain the olives are pressed by conical iron rollers (fig. 62) elevated above the stage or floor, round which they move on two little margins to prevent the kernel being injured, the oil from which is said to have an unpleasant flavour. Spanish olive oil, however, is inferior to other kinds, from the circumstance of the time which elapses between the gathering and the grinding of the olives. This arises from the number of mills not being in proportion to the quantity of fruit to be ground; so that the olives are placed in heaps to wait their turn, and in consequence often undergo decomposition. In France the finest oil is procured by bruising the fruit in the mill immediately it is gathered, and then submitting the paste to pressure. The first product has a greenish tint, and is termed virgin oil. The cake or marc is removed from the press, broken up with the hand, moistened with boiling water, and re-pressed. The products are water and oil of a second quality: these separate by standing. With the view of increasing the quantity of oil, some persons allow the olives to undergo incipient fermentation, which breaks down the parenchyma of the fruit before they are pressed; but the quality of the oil is thereby injured. The machinery employed by the Neapolitan peasants in the preparation of the Gallipoli oil, is of the rudest kind. The olives are allowed to drop when ripe from the tree on the ground, they are then picked up chiefly by women and children, and carried to the mill. The oil, when expressed, is sent, in sheep- or goat-skins, carried on mules, to Gallipoli, where it is allowed to clarify in cisterns cut in the rock on which the town is built. From these it is conveyed, in skins, to basins near the sea-shore; and from these basins the oil-casks are filled. According to Sieuve, 100 pounds of olives yield about 32 pounds of oil; 21 of which come from the pericarp, 4 from the

Fig. 62.



Spanish Olive Oil-mill.

seed, and 7 from the woody matter of the olive. That obtained from the pericarp is of the finest quality.

General Characters.—Olive oil (*sweet oil*) is an unctuous fluid of a pale yellow or greenish-yellow colour, with scarcely any odour, and a bland oleaginous taste. It congeals partially at about 36°. Its specific gravity varies from 0·9158 to 0·9176 at 59° Fahr. It is soluble in about $1\frac{1}{2}$ times its weight of ether; but is only very slightly soluble in alcohol. By admixture with castor oil, its solubility in rectified spirit is augmented. Pure olive oil has less tendency to become rancid by exposure to the air, than most other fixed oils; but the second qualities readily acquire rancidity. This seems to depend on the presence of some foreign matter. Olive oil is not a drying oil, and, being less apt than many oils to increase in consistence by exposure to air, is preferred for greasing delicate machinery, and especially watch- and clock-work.

Varieties.—*Provence oil*, the produce of Aix, is the most esteemed variety. *Florence oil* is also a very fine kind of olive oil; it is imported from Leghorn in flasks surrounded by a kind of net-work formed by the leaves of a monocotyledonous plant, and packed in half-chests. It is used at table, under the name of *salad oil*. *Lucca oil* is imported in jars holding fifteen gallons each. *Genoa oil* is another fine kind. *Gallipoli oil* forms the largest portion of the olive oil brought to England; it is imported in casks. Apulia and Calabria are the provinces of Naples most celebrated for its production: the Apulian is the best. *Sicily oil* is of inferior quality; it is principally produced at Milazzo. *Spanish oil* is the worst. (See *Expression*, p. 662.)

Adulteration.—Olive oil is liable to adulteration with some of the cheaper fixed oils; as poppy oil, lard oil, and others. Olive oil is completely solidified when cooled by ice; poppy oil, however, remains in part liquid. Even two parts of olive oil to one of poppy oil will not completely congeal. Various tests have been proposed for the detection of the fraud, but none of them are very accurate, or to be absolutely relied on,—partly, perhaps, because olive oil itself is not uniform in its qualities.

Composition.—When olive oil is cooled to about 36° F. it begins to congeal, and at about 21° it separates into two distinct bodies, one fluid, and the other solid: the solid portion is called *margarine*; and the part which remains fluid at this temperature is termed *oleine* or *elaine*. The margarine forms about 28, and the oleine 72 per cent. *Oleine* is colourless, inodorous and tasteless, insoluble in water, but soluble in cold alcohol and in ether. By saponification it yields *oleic acid* with a sweet principle, *glycerine*. *Oleic acid* ($HC_{18}H_{33}O_2$) is a colourless fluid, which reddens litmus and concretes at about 50°, is very soluble in alcohol, cold ether and solution of potash, is insoluble in water, and combines with metallic oxides forming oleates. The oleate of lead is soluble in ether. *Margarine* is obtained from the congealed oil by pressing out the oleine and dissolving the residue in boiling alcohol, from which when cold the margarine separates in pearly crystals. By saponification it yields *margaric acid* with *glycerine*. *Margaric acid* ($HC_{17}H_{33}O_2$) is a white crystalline solid of a pearly lustre, without odour or taste, reddens litmus, fuses at 140°, and is carried over in distillation by superheated steam. It is soluble in alcohol, ether, and solution of potash, insoluble in water. It unites with bases forming margarates. The margarate of lead is not soluble in ether, which is therefore used for separating these acids in the lead plaster. Margaric acid is by some considered to be a mixture of stearic and palmitic acids.

Physiological Effects.—Swallowed in large doses, olive oil acts as a laxative, in general, without occasioning pain.

Therapeutics.—Medicinally it is not often administered by the mouth. As a *mild laxative* it may be used in irritation, inflammation, or spasm of the alimentary canal, or of the urino-genital organs. As an *antidote*, it has been used in mineral, animal, and vegetable poisoning; but its operation appears to be entirely mechanical. It envelops the poison, sheathes the living surface, and mechanically obstructs absorption. At one time it was supposed to possess antidotal properties for arsenical poisons. There is no just ground for supposing that olive oil, applied externally or taken internally, has any particular influence in counteracting the operation or relieving the effects of the poison of venomous serpents, notwithstanding the high encomiums that have been passed on it, except by the mechanical action mentioned above. Dr. F. J. Farre says that 'the obstruction, however, which it causes to the absorption of poison is often very serviceable, and is sometimes sufficient to prevent any bad effects from following. I have often applied oil to the recent sting of a wasp or bee, even after the pain had extended from the wounded finger to the entire arm, and have always found the pain cease after a few minutes. It has sometimes returned for a day or two immediately after washing the hands, until oil was again applied to the wound.' Olive oil is a frequent constituent of *laxative enemas*, especially in dysentery, or irritation of the bowels or of the neighbouring viscera. *Externally* it may be employed to relax the skin and sheathe irritable surfaces. Frictions of olive oil have been employed in ascites and anasarca.

Pharmaceutical Uses.—Olive oil is a constituent of blistering paper, and of enema of sulphate of magnesia: it is also employed in the preparation of several liniments, ointments, plasters, and linseed poultice. It serves for making both hard and soft soap, and is one source of glycerine.

Administration.—The dose of olive oil as a laxative is from 1 to 2 fluid ounces.

FRAXINUS, *Linn.*

Generic Character.—*Flowers* polygamous or diœcious. *Calyx* 4-cleft or none. *Petals* either none or four, usually in pairs, cohering at the base, oblong or linear. *Stamens* 2. *Stigma* bifid. *Fruit* (samara) 2-celled, compressed, winged at the apex, with 2 ovules in each cell, or by abortion 1-seeded. *Seeds* pendulous, compressed.

FRAXINUS ORNUS, *Linn.* European Flowering or Manna Ash.

Specific Character.—A small *tree* 20–25 feet high. *Leaves* opposite, large, impari-pinnate; *leaflets* 7–9 large, sub-petiolate, lanceolate, serrated at the apex, entire at the base, bearded beneath near the midrib. *Buds* velvety. *Panicles* large and many-flowered, crowded, shorter than the leaves. *Flowers* small and polygamous. *Calyx* 4-cleft. *Corolla* yellowish or greenish-white. *Fruit* narrow, linear-lanceolate, smooth, winged, obtuse.—*Steph. and Church.* pl. 53.

Habitat.—South of Europe, in mountainous situations, especially Calabria and Sicily.

FRAXINUS ROTUNDIFOLIA, *D.C.* Round-leaved Flowering or Manna Ash.

Specific Character.—A small *tree* 16 to 20 feet high. *Leaves* opposite, impari-pinnate; *leaflets* 4–9 smooth, ovate or roundish, obtusely serrate, subsessile, *petioles* channelled. *Buds* brown externally, somewhat velvety. By some botanists considered to be a variety of the preceding species.

Habitat.—Grows in Calabria.

[§ **Manna.** *Manna.*

A concrete saccharine exudation from the stem of Fraxinus Ornus, *Linn.*, and F. rotundifolia, *D.C.* Obtained by making incisions in the stems of the trees, which are cultivated for the purpose, chiefly in Calabria and Sicily.]

Extraction.—In the manna districts of Sicily, where the best manna is obtained, the *Fraxinus Ornus* is cultivated in separate square plantations. The trees are not tapped till they cease to produce leaves, which happens about July or August. Cross or transverse incisions (fig. 63) about two inches long, are made in the stem by means of a hooked or curved knife, beginning at the lower part, near the soil, and are repeated daily in warm weather, extending them perpendicularly upwards, so as to leave the stem uninjured on one side, which is cut the following year. In this way is obtained *manna in sorts.* The *flake manna* is obtained during the height of the season, when the juice flows vigorously. It is procured from the upper incisions, the juice there being less fatty than that in the lower part; and, consequently, it more easily dries in tubes and flat pieces. The masses left adhering to the stems are scraped off, and constitute the *cannulated manna in fragments.* Although all three kinds of manna are got from the same stem, yet the younger stems yield more of the cannulated sort, and the older ones more of the fatty kind. Dry and warm weather are necessary for a good harvest.

Fig. 63.

Extraction of Manna.

a. Stem of the tree.
b. Leaf of the *Fraxinus Ornus.*
c. Incision.
d. Leaf of the Indian fig.
e. Hooked knife.

In the right hand of each of the collectors is a box to contain the manna, which is afterwards transferred to a basket.

Commerce.—Manna is imported into this country principally from Palermo and Messina. It is also brought from Naples, Leghorn, Trieste, Genoa, and Marseilles. It is imported in deal boxes, having partitions, and frequently lined with tin plate.

General Characters and Varieties.—Several kinds of manna are described by pharmacologists; the finest is called *flake manna.* This is the official variety of the Pharmacopœia. The pieces are from one to six inches in length, from one to two inches in width, and from half an inch to an inch thick. Their form is irregular, but more or less stalactitic ; most of the pieces being flattened or slightly hollowed out on one side, where they adhered to the tree or substance on which they have concreted, and on this side they are frequently soiled. Their colour is white, or yellowish-white ; they are light, porous, friable ; and soluble in water and rectified spirit. Their odour is faint, resembling honey, and rather unpleasant, and they have a sweetish, subsequently somewhat acrid taste. This variety of manna is universally preferred, and fetches everywhere a much higher price than the other sorts. Fresh and flaky manna has a less irritating and nauseous flavour, and a less purgative effect, than old and common or fatty manna.—The commonest kind in English commerce is called *Sicilian manna.* It appears to me to be the *common* or *fatty manna* of some writers. It consists of small, soft, viscid fragments, of a dirty yellowish-brown colour, intermixed with some few dark-coloured small pieces of the flake variety. It contains many impurities intermixed. *Manna in sorts.*—This and the last kind are of inferior quality.

Adulteration.—Some years ago some *fictitious manna* was offered for sale in Paris. It appears to have been potato sugar. It was distinguished from genuine manna by its general appearance ; its granular fracture ; its taste, which was that of caramelised sugar, followed by a slight bitterness; its non-inflammability in the candle; its more marked fermentation when its aqueous solution was mixed with yeast, and the residual liquor not yielding mannite; its containing sulphate of lime ; and its property of circular polarisation. Some fictitious manna, resembling the above in some of its characters, has also recently been offered for sale in London.

Composition.—Manna contains *mannite*, *sugar*, *resin*, and *extractive matter. Mannite, Manna-sugar* ($C_3H_7O_3$), is obtained by boiling manna in alcohol from which it separates in colourless shining crystals. It forms from 60 to 80 per cent. of the best manna. Mannite is a white, crystalline, odourless substance, and has a sweet agreeable taste. It is soluble in five parts of cold water, and in a smaller proportion of boiling water; it is readily soluble in boiling acohol, but less so in cold alcohol. Its solution does not undergo the vinous fermentation when in contact with yeast. It differs essentially from sugar not only in this respect, but also in its elementary composition, containing a slight excess of hydrogen. It appears to possess little if any purgative quality. *Extractive matter.*—The aperient quality of manna appears to reside in this. *Resin.*

—Manna also contains a very small quantity of resin, which is by some considered its laxative principle.

Physiological Effects.—In large doses it is mildly laxative. It acts on the bowels without exciting vascular irritation. It is apt, however, to produce flatulence and griping. The fresher and less changed the manna, the feebler are said to be its powers. The commoner kinds of manna are more aperient, and more apt to excite flatulence, than the finer varieties. Manna approaches tamarinds as a laxative.

Therapeutics.—It is employed as a laxative for delicate persons, as females and children; partly on account of the mildness of its operation, and partly for its sweet flavour. On account of its sweetness it is frequently added to flavour purgative draughts, and is also used as a gentle aperient for children, who readily eat it.

Administration.—It may be taken in substance, or dissolved in warm milk or water. The dose for an adult is from 1 to 2 ounces; for children, 60 grains to $\frac{1}{4}$ of an ounce.

STYRACACEÆ, *Lindley*. The Benzoin Order.

STYRAX BENZOIN, *D.C.* The Benzoin Tree.

Botanical Character.—A large *tree* with a *stem* the thickness of a man's body. *Branches*, round, tomentose. *Leaves* alternate, oblong, acuminate, smooth above, whitish and tomentose beneath. *Racemes* compound, axillary, nearly the length of the leaves, and, as well as the flowers, tomentose. *Pedicels* one-third as long as the flowers. *Calyx* hemispherical, obscurely 5-toothed. *Corolla* grey, 5-partite, several times longer than the calyx. *Stamens* 10; *filaments* connate at the base into a short tube. *Ovary* adherent at the base, ovoid, pubescent, incompletely 3-celled; *style* filiform. *Ovules* indefinite. *Fruit* 1-seeded.—*Phil. Trans.* vol. lxxvii. pl. 12.

Habitat.—Sumatra, Siam, Borneo, Java.

[§ **Benzoinum.** *Benzoin.*

A balsamic resin obtained from Styrax Benzoin, *D.C.* It is procured by making incisions into the bark of the tree, and allowing the liquid that exudes to concrete by exposure to the air. Imported from Siam and Sumatra.]

Extraction.—Benzoin is obtained in Sumatra as follows. When the tree is six years old, longitudinal or somewhat oblique incisions are made in the bark of the stem, at the origin of the principal lower branches. A liquid exudes, which, by exposure to the sun and air, soon concretes, and the solid mass is then separated by means of a knife or chisel. Each tree yields about three pounds of benzoin annually, for the space of ten or twelve years. That which exudes during the first three years is white, and is denominated *head benzoin*; and that which subsequently flows is of a brownish colour, and is termed *belly benzoin*. After the tree is cut down the stem is split, and some benzoin scraped from the wood; but its colour is dark, and its quality bad, owing to the intermixture of parings of wood and other impurities; this sort is called *foot benzoin*. The relative values of head, belly, and foot benzoin, are as 105, 45, 18.

General Characters.—[§ In lumps, consisting of agglutinated tears, or of a brownish mottled mass, with or without white tears imbedded in it; has little taste, but an agreeable odour; gives off, when heated, fumes of benzoic acid; is soluble in rectified spirit and in solution of potash.]

Varieties and Commerce.—The several varieties of benzoin met with in commerce may be conveniently arranged under two heads; viz. *Siam benzoin* and *Sumatra benzoin*. 1. *Siam benzoin.*—Siam benzoin is brought to England, either direct from Siam, or indirectly by way of Singapore. It includes the best commercial kinds, or those known in commerce as *benzoin of the finest quality*. It occurs in tears, in irregular lumps, and in cubical blocks; but, unlike the Sumatra sort, it never comes over enveloped in calico. It is in general distinguished from the other kinds by its warmer or richer (yellow, reddish, or brown) tints. *Siam benzoin in tears* consists of irregular flattened pieces, some of which are angular, and the largest of them barely exceeding an inch in length. Externally these pieces are shiny, or dusty from their mutual friction, and are of an amber or reddish-yellow colour; they are brittle, and may be easily rubbed to powder. Internally they are translucent or milky, and frequently striped; they have a pleasant odour, but little or no taste. *Siam lump benzoin.*—The finest kind consists of agglutinated tears (*white or yellow lump benzoin*). More commonly we find the tears are connected by a brown resiniform mass, which when broken, presents an amygdaloid appearance, from the white tears imbedded in the mass (*amygdaloid benzoin*). Inferior sorts of lump benzoin are reddish. 2. *Sumatra benzoin.*—Though placed second, this sort is the more important, being in many countries the only kind known. It is rarely imported direct from Sumatra, but in general indirectly by way of Singapore or Bombay, and now and then from Calcutta. It occurs in large rectangular blocks, marked with the impression of a mat, and covered with white cotton cloth. When broken, we observe but few large white tears in it. The mass is generally made up of a brown resiniform matter, with numerous white small pieces or chips intermixed, which thereby give the broken surface a speckled appearance, somewhat like that of a fine-grained granite.

Composition.—Benzoin contains from 15 to 20 per cent. of benzoic acid, and about 80 per cent. of resins. *Benzoic acid* is described below. The *resins* are two, one of which is soluble, the other insoluble in ether and in carbonate of potash.

Physiological Effects.—Benzoin produces the general effects of the balsams. Its power of producing local irritation renders it apt to disorder the stomach, especially in very susceptible individuals. Its constitutional effects are those of a heating and stimulating substance, whose influence is principally directed to the mucous surfaces, especially of the air-tubes. It is more acrid and stimulant, and less tonic, than myrrh, to which some pharmacologists have compared it. As it contains benzoic acid, it must increase the proportion of hippuric acid in the urine.

Therapeutics.—As an internal remedy, the employment of benzoin is almost wholly confined to chronic pulmonary affections, especially those of the bronchial membrane. Its stimulant properties render it improper in all acute inflammatory complaints, and its acridity prevents its employment where there is much gastric irritation. Its use, therefore, is better adapted for torpid constitutions.

Administration.—Benzoin is scarcely ever administered alone. The dose of it in powder is from ten to twenty grains.

Uses.— Benzoin is chiefly used in the preparation of incense, which is largely consumed in the ceremonies of the Catholic Church. It is also commonly employed as an ingredient in fumigating pastilles; and as it possesses the power of lessening the tendency of fatty matters to become rancid, it is an ingredient in Adeps Benzoatus.

[§ **Tinctura Benzoini Composita.** *Compound Tincture of Benzoin.*

Take of

Benzoin, in coarse powder . . .	2 ounces.
Prepared Storax	$1\frac{1}{2}$ ounce.
Balsam of Tolu	$\frac{1}{2}$ ounce.
Socotrine Aloes	160 grains.
Rectified Spirit	1 pint.

Macerate for seven days in a closed vessel, with occasional agitation, then filter, and add sufficient rectified spirit, if required, to make one pint.

Dose.—$\frac{1}{2}$ to 1 fluid drachm.]

A stimulating expectorant, which is administered in chronic catarrhs. It is decomposed by water. A very pleasant mode of exhibiting it is in the form of emulsion, prepared with mucilage and sugar, or yolk of egg. Compound tincture of benzoin is occasionally applied to foul and indolent ulcers, to excite the vascular action and to improve the quality of the secreted matter. If applied to cut surfaces it causes temporary pain, and cannot promote adhesion or union by the first intention, though, by exciting too much inflammation, it may sometimes prevent it. But when the edges of the wound have been brought together, the tincture may be carefully applied to the lint or adhesive plaster as a varnish or cement. Here it acts mechanically, excluding air, and keeping the parts in their proper position. In the same way, it may sometimes prove serviceable in contused wounds. *Court* or *black sticking plaster* is prepared by brushing first a solution of gelatine, and afterwards a spirituous solution of benzoin, over black sarcenet.

[§ **Acidum Benzoicum.** *Benzoic Acid.*

$HO,C_{14}H_5O_3$ or $\mathbf{HC_7H_5O_2}$.

A crystalline acid obtained from benzoin, and prepared by sublimation.]

Preparation.—The following is Mohr's process, as given in the British Pharmacopœia, 1864.

Take of Benzoin four ounces.

Place the benzoin in a cylindrical pot of sheet iron, furnished with a flange at its mouth; and, having fitted the pot into a circular hole in a sheet of pasteboard, interpose between the pasteboard and flange a collar of tow, so as to produce a nearly air-tight junction. Let a cylinder of stiff paper open at one end, eighteen inches high, and having a diameter of at least twice that of the pot, be now inverted on the pasteboard, and secured to it by slips of paper and flour paste. Pass two inches of the lower part of the pot through a hole in a plate of sheet tin, which is to be kept from contact with the pasteboard by the interposition of a few corks; and let a heat just sufficient to melt the benzoin (that of a gas lamp answers well) be applied, and continued for at least six hours, that benzoic acid may be sublimed. Let the product thus obtained, if not quite white, be pressed firmly between folds of filtering paper, and again sublimed.

Benzoic acid, on the large scale, is usually prepared by heating benzoin in a shallow iron pot, communicating with a box (or *house* as it is frequently termed), made of pasteboard and laths, or of thin wood, and lined with loose sheets of blotting-paper. A piece of fine muslin or paper is interposed between the mouth of the subliming pot and the box, to prevent the sublimate falling back into the pot. The vapours of the acid traverse the muslin or pores of the paper, and condense in the box.

General Characters and Tests.—[§ In light feathery crystalline plates and needles, which are flexible, nearly colourless, and have an agreeable aromatic odour, resembling that of benzoin. It is sparingly soluble in water, but is readily dissolved by rectified spirit; soluble also in solutions of the caustic alkalies and of lime, and it is precipitated from these on the addition of hydrochloric acid unless the solution be very dilute. It melts at 248°, and boils at 462°. When heated to the last-named temperature, it passes off in vapour, leaving only a slight residue.] It is combustible, burning with a bright yellow flame. It dissolves in about two hundred parts of cold water, and in about twenty-five parts of boiling water. Benzoic acid is also distinguished by the character of its soluble salts. Thus the benzoate of ammonia produces with the persalts of iron a pale red precipitate ($2Fe_2O_3,3\bar{B}z$); and with the nitrate of silver and acetate of lead white precipitates. From cinnamic acid (with which it has been confounded) it is distinguished by not yielding oil of bitter almonds when distilled with oxidising agents, as chromic acid or a mixture of bichromate of potash and sulphuric acid.

Physiological Effects.—The *local* action of benzoic acid is that of an acrid. When swallowed, it occasions a sensation of heat and acridity in the back part of the mouth and throat, with heat at the stomach. The inhalation of its vapour causes violent coughing. On the *general system* it acts as a stimulant, whose influence is, however, principally directed to the mucous surfaces, especially the bronchial membrane. In its passage through the system, it abstracts the elements of glycocol or gelatine sugar, and becomes converted into hippuric acid, which is thrown out of the system in the urine in combination with a base. Benzoic acid, $\mathbf{HC_7H_5O_2}$ + glycocol ($\mathbf{C_2H_5NO_2}$)=hippuric acid ($\mathbf{HC_9H_8NO_3}$)+$\mathbf{H_2O}$. Mr. Alexander Ure first pointed out the fact that the quantity of hippuric acid in the urine is increased by the use of benzoic acid. Mr. Ure's observations were confirmed by the experiments of Dr. Garrod and Keller. It was also found by Keller that the urine which yielded hippuric acid, contained the normal proportion of both uric acid and urea. The urine is rendered more acid by its use.

Therapeutics.—Benzoic acid is not much employed in medicine. It is, however, occasionally administered in chronic bronchial affections, but little benefit results from its use. Its property of increasing the acidity of the urine makes it occasionally useful in diseases attended with alkaline urine and phosphatic deposits. It may be given in the form of *benzoate of ammonia*, which is more soluble than the free acid, and has a similar action on the urine.

Pharmaceutical Uses.—It is a constituent of ammoniated tincture of opium, and compound tincture of camphor, and is used in the preparation of benzoate of ammonia.

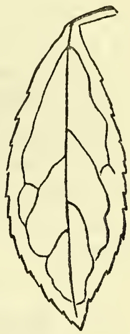
PYROLACEÆ, *Lind.* The Winter Green Order.

CHIMAPHILA UMBELLATA, *Nuttall.* Pipsissewa, or Winter Green.

Synonym.—Pyrola umbellata, *Linn.*

Botanical Character.—A perennial *under-shrub.* *Rhizome* woody, creeping. *Stems* ascending, somewhat angular, marked with the scars of former leaves. *Leaves* in irregular whorls, evergreen, coriaceous, cuneate-lanceolate, on short petioles, serrate (fig. 64), smooth, shining. *Bracts* linear-awl-shaped. *Calyx* 5-cleft. *Petals* 5, white tinged with red, spreading, deciduous. *Stamens* 10, 2 in front of each petal; *filaments*, smooth, dilated in the middle. *Ovary* roundish, obscurely 5-lobed, with a funnel-shaped cavity at the top. *Style* very short, inserted in the cavity of the ovary. *Stigma* orbicular, tuberculated, 5-crenate. *Capsule* 5-celled, 5-valved.—*Steph. and Church.* pl. 93.

Fig. 64.



Leaf of Chimaphila umbellata.

Habitat.—Woods of Europe, Asia, and North America.

Chimaphila. *Winter Green.*

The dried plant of Chimaphila umbellata, *Nuttall.*

(*Not official.*)

General Characters.—The leaves (the official parts in the United States Pharmacopœia) are somewhat lanceolate in shape, but broadest at their apex, and wedge-shaped at base. They are serrate, coriaceous, smooth, of a greenish colour, shining, on short petioles, and arranged in irregular whorls, two whorls being usually placed on the same stem. The leaves have a pleasantly bitter, sweetish, and astringent taste; that of the stems being also pungent. There is no marked odour. The infusion is rendered green by perchloride of iron, and very slightly turbid by a solution of gelatine.

Composition.—The principal constituents are *bitter extractive,* which is said to contain a yellow crystalline peculiar principle, called *chimaphilin*; a *resin,* and *tannic acid.*

Physiological Effects.—The infusion of the dried leaves or plant, when swallowed, acts as a tonic and astringent, producing an agreeable sensation in the stomach, and assisting the appetite and digestive process. It promotes the action of the secreting organs, more especially the kidneys, over which, indeed, it appears to exercise a specific influence; increasing the quantity of urine; diminishing, as some have imagined, the quantity of lithic acid or lithates secreted; and beneficially influencing several forms of chronic nephritic disease. Indeed, this plant possesses medicinal qualities analogous to those belonging to uva ursi.

Therapeutics.—In dropsies, accompanied with great debility and loss of appetite, it is useful as a diuretic, as well as on account of its stomachic and tonic qualities. *In chronic affections of the urinary organs.*—Chimaphila has been found serviceable in the various disorders of the urinary organs, in which the uva ursi frequently proves beneficial; such as cystirrhœa and calculous complaints. It has occasionally alleviated some cases of hæmaturia, ischuria, dysuria, and gonorrhœa. *In scrofula.*—We can readily believe that, as a tonic, this remedy may be useful in various forms of scrofula. But it has been supposed by some to possess almost specific powers; and in America its reputation is so high, that in the provinces it has acquired the title of '*King's Cure*.' In some ill-conditioned scrofulous ulcers chimaphila is used in the form of a wash.

Administration.—Chimaphila is given in the form of *decoction* or *extract.*

ERICACEÆ, *Lindley*. The Heath Order.

ARCTOSTAPHYLOS UVA URSI, *Sprengel*. The Bearberry.

Botanical Character.—Small evergreen *shrub*. *Stems* long, procumbent. *Leaves* (fig. 65) alternate, shortly stalked, persistent, from half an inch to an inch long, obovate, entire, smooth, shining, coriaceous; upper surface dark green, under surface paler and marked with reticulated veins. *Flowers* in small terminal racemes (fig. 65), *pedicels* short, more or less reflexed. *Calyx* 5-parted, pale reddish, persistent. *Corolla* smooth, pale rose-coloured, with a small contracted 5-cleft reflexed limb, deciduous. *Stamens* 10, included; *filaments* flattened; *anthers* compressed, with 2 pores at their apex, and with two lateral reflexed appendages. *Ovary* round, surrounded with 3 scales; *style* short; *stigma* obtuse. *Fruit* small, round, scarlet, mealy within, with generally *five* more or less cohering seeds.—*Woodv.* vol. ii. p. 194, pl. 70 (*Arbutus Uva Ursi*).

Fig. 65.

Arctostaphylos Uva Ursi.

Habitat.—Indigenous. Native principally of the northern parts of Europe, Asia, and America. It occurs on dry, barren, stony, alpine heaths.

[§ **Uvæ Ursi Folia.** *Bearberry Leaves.*

The dried leaves of Arctostaphylos Uva Ursi, *Spreng.* From indigenous plants.]

Collection.—The leaves should be collected for use in September or October.

General Characters.—[§ Obovate entire coriaceous shining leaves, about three-fourths of an inch in length, reticulated beneath; with a strong astringent taste, and a feeble hay-like odour when powdered; the infusion giving a bluish-black precipitate with perchloride of iron. The leaves not dotted beneath nor toothed on the margin.]

Substitutions and Adulterations.—The leaves of *Vaccinium Vitis Idœa* (*Red Whortleberry*) are occasionally substituted for, or mixed with, those of uva ursi. The fraud may be detected by the margins of the leaves of the former being revolute and somewhat crenate, and the under surface dotted; whereas the margins are entire, and the under surface reticulated, in the genuine leaves. Furthermore, the false leaves are but very slightly astringent, and their watery infusion is coloured green by perchloride of iron; whereas the true ones are highly astringent, and their watery infusion forms a bluish-black precipitate with perchloride of iron. Box leaves have also some resemblance to those of uva ursi, but are at once distinguished by being devoid of astringency.

Composition.—Uva ursi leaves contain about 36 per cent. of *tannic acid*, and 1·5 of *gallic acid*; together with some *resin*, a little *volatile oil*, *extractive*, a crystallisable principle named by its discoverer, Mr. Hughes, *ursin*, a substance called *arbutin*, and another crystallisable resinous principle, termed by Trommsdorff, who first isolated it, *urzone*; besides other unimportant substances. But little is known of either *ursin* or *urzone*, although the former is reputed to possess energetic diuretic properties. *Arbutin* was discovered by Kawalier. It is a neutral substance, crystallising in long, thin, colourless acicular prisms, of a bitter taste, and soluble in water, alcohol, and ether. The active principles of uva ursi are extracted both by water and rectified spirit.

Physiological Effects.—The most obvious effect of uva ursi is that of a vegetable astringent. Its activity as an astringent depends on tannic and gallic acids. Uva ursi also slightly augments the quantity, and somewhat modifies the quality, of the urine. In large doses it causes nausea.

Therapeutics.—As an astringent, it is applicable to all the purposes for which vegetable astringents generally are used. It has been employed as an antidote in cases of poisoning by ipecacuanha. But the principal use of this remedy is in *chronic affections of the bladder*, attended with increased secretion of mucus, and unaccompanied with any marks of active inflammation. Thus, in the latter stages of catarrhus vesicæ, the continued use of uva ursi is frequently most beneficial. Combined with hyoscyamus, says Dr. Prout, and persevered in steadily *for a considerable time*, it seldom fails to diminish the irritation and quantity of mucus, and thus to mitigate the sufferings of the patients. 'It undoubtedly possesses,' he adds, 'considerable powers in chronic affections of the bladder, *for which only it is adapted*, its operation being slow and requiring perseverance.' Sir Benjamin Brodie, on the other hand, observes that 'uva ursi has the reputation of being useful in some cases of chronic diseases of the bladder, and in this (inflammation) among the rest. I must say, however, that I have been disappointed in the use of uva ursi, and that I have not seen those advantages produced by it which the general reputation of the medicine had led me to expect. I have seen much more good done by a very old medicine, Pareira.' Such are the opposite statements of the effects of this remedy, made by two of the most eminent writers on diseases of the urinary organs. It is to be remembered that its astringent operation unfits it for acute cases, and that the alteration which it produces in the condition of the urinary organs is effected very slowly; so that, to be beneficial, it requires to be exhibited for a considerable period. *In calculous affections* it has occasionally given relief. It alleviates the pain, checks the purulent and mucous secretion, and restores the urine to its natural condition.

Administration.—The dose of the *powder* is from 20 to 60 grains. But the powdered leaves of this plant are so bulky and disagreeable, that few stomachs will bear to persevere long enough in the use of the requisite quantity.

[§ **Infusum Uvæ Ursi.** *Infusion of Bearberry.*

Take of

Bearberry Leaves, bruised . . . ½ ounce.
Boiling Distilled Water . . . 10 fluid ounces.

Infuse in a covered vessel, for two hours, and strain.

Dose.—1 to 2 fluid ounces.]

LOBELIACEÆ, *Jussieu*. The Lobelia Order.

LOBELIA INFLATA, *Linn.* Indian Tobacco.

Botanical Character.—Annual or biennial *herb*, a foot or more in height. *Root* fibrous. *Stem* (fig. 66) solitary, erect, angular, very hairy below; the upper part branched and smooth. *Leaves* (fig. 66) scattered, irregularly serrate-dentate, hairy; the lower ones oblong, obtuse, shortly petiolate; those towards the middle ovate, acute, sessile. *Flowers* (fig. 66) small, racemose; *pedicels* short, with an acuminate bract. *Calyx* smooth, with an ovoid tube, 5-lobed; the lobes linear, acuminate. *Corolla* delicate blue, bilabiate, the upper lip 2-cleft, the lower 3-cleft. *Stamens* 5; *anthers* united into an oblong curved body, purple; *filaments* white. *Ovary* more or less inferior; *style* filiform; *stigma* curved and inclosed by the anthers. *Fruit* capsular, 2-celled, 10-angled, inflated, crowned with the calyx. *Seeds* numerous, small, reticulated. *Bigelow Med. Bot.* pl. 19. *Berg. u Schmidt Off. Gewächse*, pl. 1, *a*.

Fig. 66.

Lobelia inflata.

Habitat.—North America, from Canada to Carolina and the Mississippi.

[§ **Lobelia.** *Lobelia.*

The dried flowering herb of Lobelia inflata, *Linn.* Imported from North America.]

Collection.—The herb should be collected for use in medicine in August or September.

General Characters.—[§ Stem angular; leaves alternate, ovate, toothed, somewhat hairy beneath; capsule ovoid, inflated, ten-ribbed; herb acrid.] The colour of the dried herb is pale greenish-yellow, its smell is somewhat nauseous and irritating; and its taste burning and acrid, very similar to that of tobacco. Its powder has a greenish colour, somewhat resembling powdered senna leaves.

Commerce.—Lobelia is generally imported in compressed rectangular oblong packages, weighing from half a pound to a pound each, and enveloped in blue paper. These packages are chiefly prepared by the Shaking Quakers of New Lebanon, in North America. The accompanying figure is copied from a label attached to an imported package. Lobelia is also found in commerce in an uncompressed state—that is, consisting of the flowering herb cut up into pieces of varying sizes, and possessing the botanical characters already noticed.

Lobelia seeds.—The seeds are brownish, small (about $\frac{1}{33}$ of an inch long, and $\frac{1}{85}$ of an inch broad), oval or almond-shaped, reticulated with brown fibres, the interspaces irregular in shape, and yellow. Their powder is brown, somewhat resembling rappee, but scarcely so uniform in colour, and communicates a greasy stain to paper.

When examined by the microscope, this powder is found to consist chiefly of broken seeds, but intermixed with some whole ones. These seeds are not official, except so far as they may form a portion of the dried flowering herb. (See below.)

Means of detecting Lobelia.—As death is not unfrequently a consequence of the empirical use of lobelia, it is desirable that we should possess some means of detecting the poison. I am, however, unacquainted with any chemical characteristics by which it can be recognised. The tobacco-like flavour of the powder and decoction, and the remarkable acrid sensation, like that caused by tobacco, which these excite in the fauces, may sometimes aid in recognising them. Mr. Frederick Curtis has drawn attention to the microscopic characters of the seeds as a means of detecting the herb of lobelia, or its powder, as these seeds, on account of their minuteness, escape complete destruction by the mill or mortar. I have, however, been unable to detect any seeds or fragments of seeds in the *pulvis lobeliœ* sold at a herb shop in London; the herb which is sent to the mill not being sufficiently ripe to contain seeds: but the *pulvis seminum lobeliœ* may be readily detected by the microscope. When the ordinary lobelia powder contains seeds or fragments of seeds, no difficulty will be found in recognising them by the microscope. Mr. Curtis recommends the powder to be sifted in order to separate the coarser from the finer particles; and he says that the uninjured seeds will be left on a sieve whose apertures are $\frac{1}{75}$ of an inch. Mr. Curtis describes the seeds as having 'oblong square' reticulations. Dr. Otto Berg has also depicted these spaces as being rectangular. I have, however, found them irregular in shape.

Composition.—The principal constituents of lobelia which have been indicated are a *volatile oil*, to which its peculiar odour is due; a *resin* with an exceedingly acrid taste; a peculiar acid called *lobelic acid*; and a peculiar alkaline principle named *lobelina*, to which the narcotic properties of lobelia are evidently due. The active properties of the plant are extracted by proofspirit and by ether. *Lobelina* is a liquid alkaloid, lighter than water, of a pale yellow colour, and somewhat aromatic odour. It is soluble in water, but more so in alcohol and ether. It is also soluble in oil of turpentine and oil of sweet almonds. It has an alkaline reaction on reddened litmus paper, and unites with sulphuric, nitric, hydrochloric, oxalic, and lobelic acids, to form crystallisable salts, which are more soluble in water than the alkaloid itself. Tannic acid throws it down from its solution in the form of a white bitannate. Mr. Bastick says lobelina is volatile, but does not evaporate entirely unchanged. A quarter of a grain excited vomiting and much prostration in a cat. A grain caused immediate and total prostration, which for half an hour rendered the animal almost motionless, and caused dilatation of the pupils.

Physiological Effects.—An accurate account of the effects of this plant on man is yet wanting; but, from the observations hitherto made, its operation appears to be very similar to, but milder than, that of tobacco; and from this circumstance, indeed, it has been called *Indian Tobacco. In small doses* it operates as a *diaphoretic* and *expectorant. In full medicinal doses* (as 20 grains of the powder) it acts as a powerful nauseating *emetic.* Hence, it has been called the *emetic weed.* It causes severe and speedy vomiting, attended with continued and distressing nausea, sometimes purging, copious sweating, and great general relaxation. These symptoms are usually preceded by giddiness, headache, and general tremors. It sometimes gives almost instantaneous relief in an attack of spasmodic asthma. Administered by the rectum, it produces the same distressing sickness of stomach, profuse perspiration, and universal relaxation, which result from a similar use of tobacco. *In excessive doses*, or *in full doses too frequently repeated*, its effects are those of a powerful *acro-narcotic poison.* Its effects, according to Dr. Wood, are 'extreme prostration, great anxiety and distress, and ultimately death, preceded by convulsions.' He also tells us that fatal results (in America) have been experienced from its empirical use. These are the more apt to occur when the poison, as is sometimes the case, is not rejected by vomiting. Several cases of poisoning by lobelia have also occurred in England, in consequence of the administration of this agent by ignorant persons acting under the guidance or instruction of a notorious empiric.

Therapeutics.—Lobelia is probably applicable to all the purposes for which tobacco has been used. From my own observation of its effects, its principal value is as an antispasmodic. Given in full doses, so as to excite nausea and vomiting at the commencement of, or shortly before, an attack of *spasmodic asthma*, it sometimes succeeds in cutting short the paroxysm, or in greatly mitigating its violence; at other times, however, it completely fails. Occasionally it has proved serviceable in a few attacks, and, by repetition, has lost its influence over the disease. To obtain the beneficial influence in asthma, it is not necessary, however, to give it in doses sufficient to excite vomiting. Dr. Elliotson recommends the use of small doses at the commencement, and says that these should be gradually increased if neither headache nor vomiting occur; but immediately these symptoms come on, the use of the remedy is to be omitted. Given in this way, I can testify to its good effects in spasmodic asthma. It has also been used in *croup*, *hooping cough*, and *catarrhal asthma*, but with no very encouraging effects.

Administration.—It may be given in powder or tincture (alcoholic or ethereal). The dose of the powder, as an emetic, is from ten to twenty grains: as an expectorant, from one to five grains. It deserves especial notice, that the effects of lobelia are very unequal on different persons, and that some are exceedingly susceptible of its influence.

Antidotes.—After the poison has been evacuated from the stomach, opium and demulcents may be used to allay the gastro-intestinal irritation.

[§ **Tinctura Lobeliæ.** *Tincture of Lobelia.*

Take of

Lobelia, in coarse powder . . .	$2\frac{1}{2}$ ounces.
Proof Spirit	1 pint.

Macerate the lobelia for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.]

Dose.—As an emetic and antispasmodic, from 1 to 2 fluid drachms, repeated every two or three hours, until vomiting occurs; as an expectorant, from 10 minims to $\frac{1}{2}$ fluid drachm.

[§ **Tinctura Lobeliæ Ætherea.** *Ethereal Tincture of Lobelia.*

Take of

Lobelia, in coarse powder . . .	$2\frac{1}{2}$ ounces.
Spirit of Ether	1 pint.

Macerate for seven days in a closed vessel, with occasional agitation; then strain, press, filter, and add sufficient spirit of ether to make one pint.

Dose.—10 minims to $\frac{1}{2}$ fluid drachm.]

COMPOSITÆ, *D.C.* The Composite Order.

INULA HELENIUM, *Linn.* Elecampane.

Botanical Character.—*Root* perennial, thick, branching. *Stem* erect, 3–5 feet high. *Leaves* serrate-dentate, velvety-tomentose beneath, acute; the radical ones stalked; those of the stem semi-amplexicaul. *Peduncles* few, 1-headed, corymbose at the apex. *Capitulum* many-flowered, heterogamous; *florets* bright yellow, those of the ray female, in one row, sometimes by abortion sterile, usually ligulate, rarely somewhat tubular and trifid; those of the disk hermaphrodite, tubular, 5-toothed. *Involucre* imbricated in several rows. *Receptacle* flat or somewhat convex, naked. *Fruit* without a beak, 4-cornered. *Pappus* uniform, in one row, composed of capillary roughish setæ.—*Steph. and Church.* pl. 49.

Habitat.—Indigenous. Moist pastures throughout Europe.

Inulæ Radix. *Elecampane Root.*

The dried root of Inula Helenium, *Linn.*

(*Not official.*)

General Characters.—The dried root consists of longitudinal or transverse slices, which are yellowish-grey, and have an aromatic or camphoraceous smell, and a warm mucilaginous bitter taste. Iodine colours the root brown. Perchloride of iron produces in the infusion a green colour.

Composition.—The principal constituents are:—*helenin* or *elecampane-camphor*, *bitter extractive*, and *inulin.*

Physiological Effects.—An aromatic tonic. It acts as a gentle stimulant to the organs of secretion, and is termed diaphoretic, diuretic, and expectorant. Large doses cause nausea and vomiting.

Therapeutics.—It is rarely employed now by the medical practitioner. It has been used in pulmonary affections (as catarrh) attended with profuse secretion and accumulation of mucus, but without febrile disorder or heat of skin. In dyspepsia, attended with relaxation and debility, it has been administered with benefit. It has also been employed in the exanthemata to promote the eruption.

Administration.—Dose of the *powder*, 20 to 120 grains; of the *decoction* (prepared by boiling $\frac{1}{2}$ ounce of the root in 1 pint of water), from 1 to 2 fluid ounces.

ANTHEMIS NOBILIS, *Linn.* Common Chamomile.

Botanical Character.—*Root* perennial, with long rootlets. *Stems* herbaceous, in a wild state prostrate, when cultivated more or less erect, from about eight inches to a foot long, much branched, downy-villose, round, hollow. *Leaves* sessile (fig. 67), somewhat downy, bipinnate; *leaflets* linear-subulate, rather fleshy, acute. *Flower-heads* (capitula) terminal, solitary (fig. 67), with a yellow convex disk, and white ray; *involucre* hemispherical, with nearly equal imbricated bracts, which are broadly membranous at their margins; *receptacle* conical, solid, and covered with thin, concave, obtuse, chaffy or membranous scales. *Florets* of the disk hermaphrodite, tubular, 5-toothed, yellow. *Florets* of the ray female, ligulate,

Fig. 67.

Anthemis nobilis.

in one row, white. *Fruit* obtusely tetragonal, smooth, without pappus, but crowned with an obsolete margin.—*Engl. Bot.* vol. xiv. pl. 980.

Habitat.—Indigenous; on open gravelly pastures or commons. It is also found in a wild state in all the temperate parts of Europe. Cultivated at Mitcham, Derbyshire, and in some other parts of England.

[§ **Anthemidis Flores.** *Chamomile Flowers.*

The dried single and double flower-heads of Anthemis nobilis, *Linn.* Wild and cultivated.]

General Characters.—[§ The single variety consists of both yellow tubular, and white strap-shaped florets; the double, of white strap-shaped florets only; all arising from a conical scaly receptacle; and both varieties, but especially the single, are bitter and very aromatic.]

Varieties.—Two kinds of chamomiles are distinguished in commerce—the one called *single* and the other *double. Single Chamomile Flowers.*—Strictly speaking, *single* chamomile flowers are those which have one row only of white female ligulate (strap-shaped) florets: but few flowers are in this condition, for in most of the so-called single flowers some of the yellow tubular florets have become converted into white ligulate florets. It is obvious, therefore, that the distinction between the so-called single and double flowers is to a certain extent arbitrary. Single chamomile flowers should be preferred for the preparation of the extract and infusion, on account of their having the largest yellow disks, in which the oil chiefly resides. They are, therefore, more powerfully odorous. *Double Chamomile Flowers.*—These constitute the kind of chamomile flowers most commonly met with. In these, all or most of the yellow tubular florets have become converted into the white ligulate ones. The flower-heads are consequently whiter, larger, and more showy; though less odorous, and containing less volatile oil than the single chamomile flowers.

Substitutions and Adulterations.—In France, M. Timbal-Lagrave has had supplied to him in the place of chamomile flowers, the flower-heads of two other plants, namely, those of the *Matricaria Parthenium*, Linn., and *Matricaria parthenoides*, Desf. The latter adulteration is scarcely likely to occur in this country. Neither is it probable that the single flowers of the former, which are commonly called Feverfew flowers, would be supplied for, or mixed with, Chamomile flowers; but if such should be the case, the *latter* could be at once distinguished by their pleasantly aromatic odour, and their scaly conical receptacle, as the *former* or feverfew flowers, have an unpleasant odour, and a nearly flat receptacle without scales. Double feverfew flowers have, however, been found by Professor Bentley in this country, mixed with double chamomile flowers. In a paper published in the *Pharma-*

ceutical Journal (vol. i. 2nd ser. p. 447), Professor Bentley has described these flowers, and given illustrative figures, from which it appears that the two may be readily distinguished by their different odours and forms of receptacle, as noticed above, with respect to the single flowers; but double feverfew flowers differ from single feverfew flowers in having a scaly receptacle, in which character they resemble double chamomile flowers. The scales, however, of the latter are chaffy, and densely cover the receptacle, while those of the former are much fewer in number, and less membranous in their nature; and hence the flower-heads of the two may be readily distinguished.

Composition.—Chamomile flowers have been found to contain a *volatile oil*, *bitter extractive*, a little *tannic* acid, *resin*, and a *volatile acid*, resembling valerianic acid. Their active properties depend essentially upon the volatile oil and extractive. Both water and alcohol extract the bitterness and aroma of the flowers.

Physiological Effects.—Chamomile flowers produce the effects of an *aromatic bitter tonic*; their aromatic qualities depend on the volatile oil, their stomachic and tonic qualities on the bitter extractive and tannic acid. In large doses they act as an emetic.

Therapeutics.—Chamomile flowers are an exceedingly useful stomachic and tonic in *dyspepsia*, with a languid and enfeebled state of stomach, and general debility. As a remedy for *intermittents*, though they have gained considerable celebrity, they are inferior to many other medicines. The oil is sometimes used to relieve *flatulence*, *griping*, and *eructation*; and the warm infusion is given as an *emetic*.

Administration.—The powder is rarely employed, on account of the inconvenient bulk of the requisite quantity, and its tendency to excite nausea. It may be given in *doses* of from 10 to 30 grains or more. The extract and infusion are better forms for administration. *Fomentations of* chamomile flowers consist of the infusion or decoction, and are used quite hot; but they scarcely present any advantage over water at the same temperature. Flannel bags filled with chamomile flowers and soaked in hot water are useful topical agents for the application of moist warmth, on account of their retention of heat.

[§ **Extractum Anthemidis.** *Extract of Chamomile.*

Take of

Chamomile Flowers	1 pound.
Oil of Chamomile	15 minims.
Distilled Water	1 gallon.

Boil the chamomile with the water until the volume is reduced to one half, then strain, press, and filter. Evaporate the liquor by a water-bath until the extract is of a suitable consistence for forming pills, adding the oil of chamomile at the end of the process.

Dose.—2 to 10 grains.]

The oil of chamomile is added at the end of the process to compensate for the oil dissipated from the flowers during the preparation. One hundredweight of the flowers yields about forty-eight pounds of extract. The extract is a bitter stomachic and tonic. It is generally used as a vehicle for the exhibition of other tonics, in the form of pills. Conjoined with the oil of chamomile, we obtain from it all the effects of the recent flowers.

[§ **Infusum Anthemidis.** *Infusion of Chamomile.*

Take of

Chamomile Flowers . . .	$\frac{1}{2}$ ounce.
Boiling Distilled Water . . .	10 fluid ounces.

Infuse in a covered vessel, for fifteen minutes, and strain.

Dose.—1 to 4 fluid ounces.]

This infusion agrees very nearly with the Dublin preparation, and is much stronger than the London and Edinburgh forms. It is taken warm to excite gentle vomiting, or to promote the operation of an emetic. The cold infusion is usefully employed as a domestic stomachic bitter and tonic in dyspepsia.

[§ **Oleum Anthemidis.** *Oil of Chamomile.*

The oil distilled in Britain from Chamomile flowers.]

Production.—One hundredweight of flowers yields from one and a half to two fluid ounces of oil.

General Characters.—[§ Pale blue or greenish-blue, but gradually becoming yellow; with the peculiar odour and aromatic taste of the flowers.] Lewis says that the yellow oil, with a cast of greenish or brown, has a sp. gr. of 0·908.

Substitution.—The oil is frequently brought from abroad, and is probably the produce of another plant (*Matricaria Chamomilla*): hence the oil distilled in Britain is alone made official.

Effects and Uses.—It is stimulant and antispasmodic. It is a frequent addition to tonic and cathartic pills; it communicates stimulant qualities to the former, and is believed to check the griping caused by the latter.

Dose.—1 to 5 minims.

Pharmaceutical Use.—It is an ingredient in extract of chamomile.

ANACYCLUS PYRETHRUM, *De Cand.* Pellitory of Spain.

Botanical Character.—*Root* perennial. *Stems* several, procumbent, somewhat branched, pubescent. *Radical leaves* spreading, stalked, smooth, pinnatisected; the segments pinnatipartite, with linear subulate lobes; the *cauline leaves* sessile. *Branches* 1-headed. *Head* many-flowered, heterogamous. *Florets* of the ray female, white on the upper side, purplish beneath, sterile, ligulate or somewhat so, very rarely tubular; of the disk yellow, hermaphrodite, with 5 callous teeth. *Involucre* in few rows, somewhat campanulate, shorter than the disk. *Involucral* scales lanceolate, acuminate, brown at their margins. *Receptacle* convex, with oblong-obovate, obtuse scales. *Corollas* with a 2-winged, exappendiculate tube. *Fruit* flat, obcompressed, bordered with broad entire wings. *Pappus* short, irregular, tooth-letted, somewhat continuous with the wings on the inner side.—*Steph. and Church.* vol. iii. pl. 97.

Habitat.—Barbary, Arabia, Syria, and perhaps Candia.

[§ Pyrethri Radix. *Pellitory Root.*

The root of Anacyclus Pyrethrum, *De Cand.*, imported from the Levant.]

General Characters.—It consists of inodorous pieces, about the length and thickness of the little finger, covered with a thick brown bark, studded with black shining points, breaking with a resinous fracture, and presenting internally a radiated structure. When chewed, pellitory root excites a pricking sensation in the lips and tongue, with a glowing heat; and causes a copious flow of saliva.

Composition.—It contains an acrid matter (*pyrethrin*), *inulin*, and other unimportant substances. The activity of the root resides in the acrid matter.

Physiological Effects.—Pellitory root is an energetic local irritant. Applied to the skin, it acts as a rubefacient.

Therapeutics.—Scarcely ever employed internally. Its principal use is to yield a tincture for the relief of toothache. As a masticatory and sialogogue, it is chewed in some rheumatic and neuralgic affections of the head and face, and in palsy of the tongue. In relaxation of the uvula it is occasionally employed in the form of gargle. It was formerly employed internally as a gastric stimulant.

Administration.—As a masticatory 30 to 60 grains may be chewed.

[§ Tinctura Pyrethri. *Tincture of Pellitory.*

Take of

Pellitory Root, in coarse powder . .	4 ounces.
Rectified Spirit	1 pint.

Macerate the pellitory for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient rectified spirit to make one pint.]

For external application a few drops applied in cotton wool may be used to relieve toothache. When diluted with water it may be used as a gargle.

ARTEMISIA, *Linn.*

Generic Character.—Flower-heads (capitula) discoidal, homogamous or heterogamous. *Florets* of the ray in one row, usually female and 3-toothed, with a long bifid protruding style; of the disk, 5-toothed, hermaphrodite, or, by the abortion of the ovary, sterile or male; *involucral* scales imbricated, dry, scarious at the margins; *receptacle* flattish or convex, without scales, naked or fringed with hairs. *Fruit* obovate, with a minute epigynous disk.

[§ **Santonica.** *Santonica.*

The unexpanded flower-heads of an undetermined species of Artemisia, *Linn.* Imported from Russia.]

Botanical Source.—Santonica, although new as compared with the last London, Edinburgh, and Dublin Pharmacopœias, was formerly official in the Dublin, but was omitted in 1850. The same kind of santonica has been made official in the last United States Pharmacopœia. Its botanical source, as stated in the British Pharmacopœia, is undetermined, but it is supposed by some writers to be principally derived from *Artemisia contra*, Linn., (*Artemisia Sieberi*, Besser.)

General Characters.—The flower-heads are usually designated seeds; and hence the common names applied to them of *Wormseed*, *Semen Santonici*, *Semen contra*, and *Semen sanctum*. With the flower-heads we commonly find in commercial santonica a variable proportion of stalks and minute linear leaves, or fragments of leaves intermixed. Santonica is thus described in the Pharmacopœia:—[§ Flower-heads rather more than a line in length and nearly half a line in breadth, fusiform, blunt at each end, pale greenish-brown, smooth; resembling seeds in appearance, but consisting of imbricated involucral scales with a green midrib, enclosing four or five tubular flowers; odour strong, taste bitter, camphoraceous. Flower-heads not round or hairy.]

Varieties.—Three kinds of Santonica have been described by pharmacologists, under the respective names of Levant Wormseed, Barbary Wormseed, and Indian or East Indian Wormseed. The two latter much resemble each other, except in colour, the Barbary sort being more greenish-yellow; and may be readily distinguished from the former by being covered with a whitish down, and by their globular form. The former, or Levant Wormseed, is the best kind, and is alone official. It is said to be the produce of Bucharia, Persia, &c.; it comes to England by way of Russia.

Composition.—The most important constituents of santonica are, a *volatile oil*, and a *crystalline principle*, termed *santonin*. The latter is now commonly regarded as the active principle, and has been made official in the British and United States Pharmacopœias; but some of the medicinal activity of santonica is doubtless due to the volatile oil, and hence santonin will not in every case supply the place of santonica. These observations refer more especially to Levant santonica, for at present, so far as is known, *no santonin* has been obtained from the Barbary or Indian varieties of santonica.

Physiological Effects and Uses.—An accurate account of the effects of santonica is yet wanting. It appears to act upon the general system as a mild stimulating tonic; and more especially as an energetic anthelmintic. It has been employed with success in cases of *round*, *tape*, and *thread-worm*.

Administration.—Santonica has been given in *substance* and *infusion*. The dose in substance is from 10 to 60 grains, or more, repeated night and morning for about three days, and then followed by some active cathartic. (See *Santoninum.*)

Pharmaceutical Use.—It is used for the preparation of Santonin.

[§ **Santoninum.** *Santonin.*

$C_{30}H_{18}O_6$ or $\mathbf{C_{15}H_{18}O_3}$.

A crystalline neutral principle prepared from Santonica.

It may be obtained by the following process:—

Take of

Santonica, bruised	1 pound.
Slaked Lime	7 ounces.
Hydrochloric Acid	a sufficiency.
Solution of Ammonia	½ fluid ounce.
Rectified Spirit	14 fluid ounces.
Purified Animal Charcoal	60 grains.
Distilled Water	a sufficiency.

Boil the santonica with a gallon of the water and five ounces of the lime, in a copper or tinned iron vessel, for an hour, strain through a stout cloth, and express strongly. Mix the residue with half a gallon of the water and the rest of the lime, boil for half an hour, strain and express as before. Mix the strained liquors, let them settle, decant the fluid from the deposit, and evaporate to the bulk of two pints and a half. To the liquor while hot, add, with diligent stirring, the hydrochloric acid until the fluid has become slightly and permanently acid, and set it aside for five days that the precipitate may subside. Remove by skimming any oily matter which floats on the surface, and carefully decant the greater part of the fluid from the precipitate. Collect this on a paper filter, wash it first with cold distilled water till the washings pass colourless and nearly free from acid reaction, then with the solution of ammonia previously diluted with five fluid ounces of the water, and lastly with cold distilled water till the washings pass colourless. Press the filter containing the precipitate between folds of filtering paper, and dry it with a gentle heat. Scrape the dry precipitate from the filter and mix it with the animal charcoal. Pour on them nine ounces of the rectified spirit, digest for half an hour, and boil for ten minutes. Filter while hot, wash the charcoal with an ounce of boiling spirit, and set the filtrate aside for two days in a cool dark place to crystallise. Separate the mother liquor from the crystals, and concentrate to obtain a further product. Collect the crystals, let them drain, redissolve them in four ounces of boiling spirit, and let the solution crystallise as before. Lastly, dry the crystals on filtering paper in the dark, and preserve them in a bottle protected from light.]

General Characters and Tests.—[§ Colourless flat rhombic prisms, feebly bitter, fusible and sublimable by a moderate heat; scarcely soluble in cold water, sparingly in boiling water, but abundantly in chloroform and in boiling rectified spirit. Sunlight renders it yellow; not dissolved by diluted mineral acids; entirely destructible by a red heat with free access of air.] Santonin is soluble in the fixed oils. It is decomposed by the sun's light, formic acid and resinous substances being produced. It is neutral in its action on test-papers, yet it behaves as an acid (*santonic acid*), forming crystallisable and soluble salts with the alkalies; and one of its salts, the *santonate of soda*, has been recommended for use in medicine. It possesses the advantage over santonin of being soluble in water. It contains 25 per cent. of santonin.

Physiological Effects and Uses.— Santonin is a most energetic anthelmintic. The experiments of Küchenmeister prove that an oily solution of santonin will kill the lumbricus or round worm, in a shorter space of time than any other anthelmintic. Hence, it has been found of great service in cases where that worm was present in the system, as also in cases of tape and thread-worm. In excessive doses it appears to act as an acrid poison, causing purging, vomiting, cold sweats, severe abdominal pains, and symptoms generally of great prostration. In some cases its use in excess has produced a singular effect upon those under its influence, in their perception of colours, red becoming orange, and blue green.

Administration.—As it is insoluble in water, it is best dissolved in some oily liquid, such as castor oil. The dose for a child is about half a grain twice a day; and for an adult, from two to six grains. Santonin is commonly preferred as an anthelmintic, to santonica, more especially for children, from its being tasteless and inodorous. Santonica, moreover, is too bulky for general administration.

ARNICA MONTANA, *Linn.* Mountain Arnica.

Botanical Character. — Perennial *herb. Stem* striated, hairy, 1–3-headed, about 1 foot high. *Radical leaves* obovate or oblong, entire, 5-ribbed; *cauline leaves* in 1 or 2 pairs lanceolate, both more or less pubescent on their upper surface. *Heads* (*capitula*) many-flowered; *involucre* in 2 rows, campanulate, with linear-lanceolate equal scales, rough, glandular; *florets* of the ray in one row, pistillate or female, ligulate; *florets* of the disk hermaphrodite, tubular, 5-toothed, the tube of the corolla shaggy; both kinds of florets of an orange-yellow colour; *receptacle* fringed, hairy. *Fruit* somewhat cylindrical, tapering to each end, and somewhat ribbed and hairy. *Pappus* in one row, composed of close rigid rough hairs.—*Steph. and Church.* pl. 123.

Habitat.—Meadows of the cooler parts of Europe, from the sea-shore to the limits of eternal snow. It is also found in the northern parts of America and Asia.

[§ **Arnicæ Radix.** *Arnica Root.*

The dried rhizome and rootlets of Arnica montana, *Linn.* Collected in the mountainous parts of middle and southern Europe.]

General Characters.—The so-called arnica root consists of the rhizome and attached rootlets. The rhizome is from one to three inches long, and two or three lines thick, cylindrical, contorted, and rough from the scars of the fallen coriaceous leaves. The rootlets are generally two or more inches in length, and about the thickness of a common knitting-needle. Both the rhizome and rootlets have a brownish colour externally. Their odour is peculiar, and feebly aromatic, and their taste somewhat peppery, bitterish, and nauseous.

Arnica Flowers.—Besides the root, the dried flowers are employed in medicine, and are commonly preferred on the continent of Europe and in North America. They have a yellowish colour, and a similar odour and taste to the root. Their botanical characters have been already given. They are not official.

Composition.—The root has been found to contain *volatile oil, acrid resin*, and *extractive.* Mr. Bastick has discovered an alkaloid in the flowers, which he has termed *arnicina. Volatile Oil.*—The oil obtained from the root is yellowish, lighter than water (sp. gr. 0·98), and has a burning aromatic taste. Sixteen pounds of the dried root yield about an ounce of oil. *Resin.*—The acridity of the root and flowers resides, according to Pfaff, in the resin, which is soluble in alcohol. *Extractive Matter.*—According to Chevallier and Lassaigne, this is nauseous, acrid, bitter, and soluble in both water and spirit. They consider it to be analogous to *cytisin. Arnicina.*—This is not volatile, feebly bitter, but not acrid, slightly soluble in water, but more so in alcohol and ether. The properties of arnica appear to depend essentially upon the acrid resin, although these are doubtless modified to some extent by the volatile oil and extractive. The best solvent of the active principles is rectified spirit.

Physiological Effects.—Arnica root appears to possess acrid properties. When swallowed, it causes burning in the throat, nausea, vomiting, gastric pains, and loss of appetite. The active principle becomes absorbed, quickens the pulse and respiration, and promotes diaphoresis and diuresis. Furthermore, it appears to exert a specific influence over the nervous system, causing headache, giddiness, and disturbed sleep. Sundelin considers it to be allied in its operation, to senega, from which, he says, it differs in its stimulating influence over the nervous system, and in causing constipation.

Therapeutics.—Arnica root is indicated in diseases characterised by debility, torpor, and inactivity. It is administered as a stimulant to the general system in various debilitated conditions, and in typhoid fevers; to the nervous system in deficient sensibility, as amaurosis; to the muscular system in paralysis; to the vascular system and secreting organs, when the action of these is languid, and requires to have its energy increased, as in some forms of dropsy, chlorosis, amenorrhœa, and asthenic inflammation. It is rarely employed in this country *internally*, except by homœopathic practitioners. As an *external* application in sprains, bruises, &c., the tincture of arnica has been much employed as a domestic remedy in this country and elsewhere, and has received thereby the name of *Panacea lapsorum.* The experiments of Dr. Garrod, however, appear to indicate that its efficacy is entirely due to the rectified spirit employed in its preparation, as he found that about the same remedial effects were produced upon certain bruised surfaces by the application of simple rectified spirit as by tincture of arnica. So far as arnica has been tried in this country, it would appear that its virtues, both as an external and internal remedy, have been very much overrated.

Administration.—Arnica root has been administered in powder, in doses of from five to twenty grains, frequently repeated. When thus given, it is conveniently mixed with syrup or honey to form an electuary. The tincture is a more convenient and eligible mode of administration.

[§ **Tinctura Arnicæ.** *Tincture of Arnica.*

Take of

Arnica Root, in coarse powder . . .	1 ounce.
Rectified Spirit	1 pint.

Macerate the arnica for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient rectified spirit to make one pint.

Dose.—1 to 2 fluid drachms.]

As an external application to sprains, bruises, &c., it is commonly mixed with water in the proportion of one part of the former to from one to seven parts of the latter.

TARAXACUM DENS LEONIS, *D.C.* Common Dandelion.

Synonym.—Leontodon Taraxacum, *Smith.*

Botanical Character.—Herbaceous, perennial. *Leaves* radical, runcinate, with the divisions toothed, broad. *Scapes* simple, six inches or more in height, erect, smooth, hollow, single-headed. *Head* (*capitulum*) many-flowered; *involucre* double; inner bracts in one row, erect; external bracts imbricated, short, linear, reflexed; *receptacle* naked; *florets* yellow, ligulate, numerous. *Fruit* yellow, somewhat compressed, linear-obovate, blunt, its upper half muricated, with a long beak. *Pappus* hairy, stipitate, in many rows, very white.—*Woodv.* pl. 3, p. 7.

Varieties.—The above characters are liable to modification by locality and other circumstances, by which several varieties of this plant are formed. These have been described by De Candolle and some other botanists as distinct species, but as they are all connected by intermediate forms, they are in reality but varieties of one. As these vary however, in their medicinal activity, that one only which presents the above characters should be employed in medicine.

Habitat.—Indigenous ; very common in meadows, pastures, and waste places, and flowering from the early spring till the close of the summer. This species is also found throughout Europe, and in most other parts of the world.

[§ **Taraxaci Radix.** *Dandelion Root.*

The fresh and dried roots of Taraxacum Dens Leonis, *Linn.* Gathered between September and February, from meadows and pastures in Britain.]

Collection.—There is much difference of opinion as to the best time of collecting dandelion root for use in medicine. The more general idea is that it should be obtained from about the middle of September to the middle or end of November ; but according to Professor Bentley (*Pharmaceutical Journal*, vol. i. 2nd ser. p. 402), the root is most active at the end of February or beginning of March. According to the directions given in the British Pharmacopœia, dandelion roots may be collected any time between September and February. Care must be taken, however, not to gather them during, or even for some time after, the prevalence of frost, as this materially lessens their activity.

General Characters.—The *fresh root* is somewhat conical, fleshy, and more or less branched. Externally it is smooth, of a dull yellow, yellowish-brown, or brownish colour, and presents a plump appearance ; internally it is white, breaks readily with a short fracture, and gives out a milky juice, which becomes pale brown by exposure to the air. It has commonly a bitter taste, and more especially so in the spring and summer months, but in frosty weather it becomes sweet. It has no odour. The *dried root* presents a contracted and shrivelled appearance, a dark brown or somewhat blackish colour externally, and is marked with deep irregular longitudinal furrows. It breaks readily with a short fracture. Professor Bentley (*Pharmaceutical Journal*, vol. xvi. p. 304) has thus described its internal appearance :—'Upon making a transverse section we observe distinctly two portions, viz., a cortical or external layer, and an internal central axis. The cortical portion is of a whitish colour, and of a corky or somewhat spongy texture. Its diameter is twice, thrice, or more, that of the central axis. It presents a number of distinct irregularly concentric rings, resembling the annual rings of wood in a transverse section of an exogenous stem. The axis is of a decided yellow colour, unless the roots have been kept for a very long time, in which case the colour will be less manifest.'

Adulterations.—Dandelion root, being generally collected by ignorant persons, is liable to be adulterated with the roots of other common indigenous plants, as those of *hawkbit*, *chicory*, various kinds of *dock*, &c. It may readily be distinguished from these by the characters given above, more especially by the ringed appearance of its transverse section.

Composition.—The milky juice of the root contains a *bitter extractive*, *caoutchouc*, *gum*, *albumen*, *wax*, *sugar*, &c. The juice of the autumn root yields a considerable quantity of inulin. From the analyses of Frickhinger it appears that the root gathered in the autumn is richer in those ingredients which are extractible by water than the root collected in the spring; whereas the latter contains more albumen, wax, and mineral constituents (ashes). The bitter extractive has been called *Taraxacin* or *Dandelion bitter.* This, which is probably the active principle of the root, is obtained by receiving the milky juice in distilled water, heating the liquid to boiling, by which the resin and albumen are separated, filtering the liquid when cold, and slowly evaporating, so that crystals may be formed. These may be purified by washing, and by solution in either distilled water or alcohol. Pure taraxacin occurs in stellated and dendritic masses, has a bitter and somewhat acrid taste, and is readily soluble in ether, alcohol, and boiling water, but difficultly so in cold water. It is easily fusible and inflammable, burns without developing ammonia, dissolves in concentrated acids without producing any colour, and is neutral to test papers. This principle was first obtained in a crystallised state by M. Pollex, who named it *taraxacin.* In a more recent analysis Kramoyer did not succeed in obtaining this crystalline taraxacin, but he found a non-crystallisable bitter hydrocarbon, which he has termed *taraxacerin.* Further analyses of the milky juice of dandelion roots are therefore desirable.

Physiological Effects.—Its obvious effects are those of a bitter stomachic and tonic. It appears also to act on the liver, and to increase the biliary secretion. Hence probably in large doses it acts as a mild aperient. Its diuretic operation is less obvious and constant. When the digestive organs are weak, and readily disordered, taraxacum is very apt to occasion dyspepsia, flatulency, pain, and diarrhœa.

Therapeutics.—It is employed as a resolvent, aperient, and tonic, in chronic diseases of the digestive organs, especially hepatic affections, as jaundice, chronic inflammation or enlargement of the liver, dropsy dependent on hepatic obstruction, and dyspepsia attended with deficient biliary secretion. It is extensively used in England and in Germany; but in Scotland it is commonly but little esteemed.

Administration.—It is administered in the form of *decoction*, *extract*, and *juice.*

[§ **Decoctum Taraxaci.** *Decoction of Dandelion.*

Take of

Dried Dandelion Root, sliced and bruised	1 ounce.
Distilled Water	1 pint.

Boil for ten minutes in a covered vessel, then strain and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint.

Dose.—2 to 4 fluid ounces.]

Aperient and tonic. To increase its aperient property, a saline purgative may be conjoined.

[§ **Extractum Taraxaci.** *Extract of Dandelion.*

Take of

Fresh Dandelion Root	4 pounds.

Crush the root; press out the juice, and allow it to deposit; heat the clear liquor to 212°, and maintain the temperature for ten minutes; then strain, and evaporate by a water-bath at a temperature not exceeding 160° until the extract has acquired a suitable consistence for forming pills.

Dose.—5 to 30 grains.]

Dandelion root washed, crushed, and pressed, yields about half its weight of juice. Except in the months of April and May, when it is very aqueous, this juice spontaneously coagulates, and becomes of a fawn colour. The quantity of extract obtained from the juice varies at different seasons, the yield being the greatest from about the end of September to the beginning of December. It is obvious, then, that the expressed juice is richest in solid constituents in the months of October, November, and December, but it is very doubtful whether its activity is in proportion to the amount of its solid constituents. (See *Collection.*) Mr. Holland, of Market Deeping, finds that if extract be made from the root taken up in the autumn it becomes opaque from deposition of inulin, and requires to be redissolved in cold water in order to form a clear extract. If the extract be made in the spring, before vegetation commences, the juice yields an extract not liable to this deposit. Extract of taraxacum should be brown, not blackish. Its taste is bitter and aromatic. It should be completely soluble in water.

[§ **Succus Taraxaci.** *Juice of Dandelion.*

Take of

Fresh Dandelion Root	7 pounds.
Rectified Spirit	a sufficiency.

Bruise the dandelion root in a stone mortar, press out the juice, and to every three measures of juice add one of the spirit. Set aside for seven days and filter. Keep it in a cool place.

Dose.—1 to 2 fluid drachms.]

LACTUCA, *Linn.*

Generic Character. — *Heads* many- or few-flowered. *Involucre* cylindrical; *bracts* imbricate, in 2 or 4 rows; outer rows shorter. *Receptacle* naked. *Fruit* plane-compressed, wingless, contracted and prolonged into a filiform beak which is neither crowned nor muricate.

LACTUCA VIROSA, *Linn.* The Acrid or Strong-scented Lettuce.

Specific Character.—A *biennial herb*, full of acrid milky juice. *Stem* 2–4 feet high, erect, round, branched above, panicled. *Leaves* horizontal, oblong, auricled and clasping, prickly on the keel, mucronate-dentate or sinuate. *Flowers* yellow. *Heads* scattered; *bracts* cordate, acute. *Fruit* striated; *beak* about as long as the black fruit.

Habitat.—Indigenous.

[§ **Lactuca.** *Lettuce.*

The flowering herb of Lactuca virosa, *Linn.*]

General Characters.—*The leaves* and other parts of the plant contain, during the flowering season, a milky juice, which has a strong opiate-like odour and bitter taste. The leaves of this species are distinguished from those of *L. sativa* by the prickles on their keel.

Composition.—The fresh milky juice reddens litmus paper, and is coagulated both by acids and alcohol. It contains *lactucin*, *odorous matter*, *extractive matter*, *lactucerin*, *albumen*, *resin*, and some *salts*. By exposure to the air it becomes first yellow and afterwards brown, and gradually solidifies, and constitutes *lactucarium*.

Physiological Effects.—The experiments of Orfila on dogs show that this plant possesses narcotic qualities; but its powers are not very great, and have been much over-rated. Its activity is said to depend chiefly on the lactucin.

[§ **Extractum Lactucæ.** *Extract of Lettuce.*

Take of

The flowering Herb of Lettuce . . 112 pounds.

Bruise in a stone mortar, and press out the juice; heat it gradually to 130°, and separate the green colouring matter by a calico filter. Heat the strained liquor to 200° to coagulate the albumen, and again filter. Evaporate the filtrate by a water-bath to the consistence of a thin syrup; then add to it the green colouring matter previously separated, and stirring the whole together assiduously, continue the evaporation at a temperature not exceeding 140°, until the extract is of a suitable consistence for forming pills.

Dose.—5 to 15 grains.]

Its effects and uses are similar to lactucarium.

LACTUCA SATIVA, *De Cand.* The Garden Lettuce.

Specific Character.—*Annual.* *Stem* erect 1–2 feet high, branched above, smooth, elongated, leafy. *Leaves* rounded or oblong, semi-amplexicaul, not concave, erect, narrowed at the base, smooth on the keel. *Flowers* yellow. *Heads* few-flowered.

Habitat.—Native country unknown, perhaps the East Indies. Extensively cultivated throughout Europe under the name of the *Cos Lettuce.*

Lactuca Sativa. *The Garden Lettuce.*

The flowering herb of Lactuca sativa, *De Cand.*

(*Not official.*)

General Characters.—The *flowering plant* contains a bitter, milky, slightly narcotic juice, having an odour allied to that of opium. This juice resides in the root, cortical portion of the stem and branches, and in the involucre. Lactucarium or Lettuce Opium is the inspissated juice of this plant, and of that of *Lactuca virosa.*

Composition.—In the flowering state the juice contains *resin*, a *peculiar waxy substance* (lactucerin), and a *crystalline bitter substance* (lactucin).

Physiological Effects.—The early leaves of the lettuce, eaten as a salad, are easily digested, but they yield only a small portion of nutritive matter. They probably possess, in a very mild degree, soporific properties. The ancients considered them anti-aphrodisiac. The flowering plant is more powerful, and produces, in a very feeble degree, the effects of opium.

Uses.—Lettuce leaves are employed at the table as a salad. As they appear to possess slight hypnotic properties, they may be taken with advantage at supper, to promote sleep. On the other hand, prudence points out the propriety of abstaining from their use if there be any tendency to apoplexy. The extract of the flowering herb possesses similar properties to that prepared from the wild lettuce; but it is not so powerful in its action.

Lactucarium. *Lettuce Opium.*

The inspissated milky juice obtained by incision of the stems of *Lactuca sativa*, and (chiefly) *L. virosa.*

(*Not official.*)

Collection and Preparation.—When incisions are made into the stems of the above-mentioned plants, the milky juice they contain exudes, and, by exposure to the air, dries and becomes the brown solid called *lactucarium* or *lettuce opium.* The incisions are effected either by cutting off the top of the stem and removing a fresh slice as often as the surface ceases to yield juice, or by cutting the sides of the stem. The exuded juice is removed by the finger, or by scraping with a knife, placed in a glass or earthenware vessel, and allowed to dry spontaneously. By drying in the air, the milky juice of *L. virosa* loses about half its weight of water, and yields from 50 to 55 per cent. of lactucarium. The quantities of lactucarium obtained by Schultz from one plant of the following species were—from *L. sativa* 17 grains, *L. scariola* 23 grains, and *L. virosa* 56 grains.

General Characters.—*Lactucarium* or *lettuce opium*, as usually found in this country, is in small lumps, which are seldom larger than a pea or small bean: they are rough and irregular on the surface, sometimes covered with an ash-grey efflorescence, of a brown or reddish-brown colour, friable, with an opiate smell and bitter taste. Lactucarium from *L. sativa* is said by Sir Robert Christison to occur in roughish, rather compact masses, weighing several ounces.

Composition.—The active principle of lactucarium would appear to be lactucin.

Physiological Effects and Uses.—Lactucarium acts as a sedative anodyne, hypnotic, and antispasmodic; it is, however, very uncertain in its action, and should only be employed where opium is considered objectionable, either from the nature of the disease, or from some other cause.

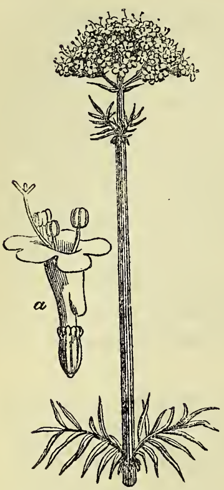
Administration.—It may be given in doses of from 3 to 10 grains, or sometimes more. Thus as much as 30 grains have been taken.

VALERIANACEÆ, *Lindl.* The Valerian Order.

VALERIANA OFFICINALIS, *Linn.* Common Valerian.

Botanical Character.—Herbaceous, perennial. *Rhizome* stoloniferous; giving off numerous long, cylindrical, slender rootlets. *Stem* (fig. 68) solitary, annual, furrowed, 2 to 4 feet high. *Leaves* all pinnate; leaflets in 7–10 pairs, lanceolate or elliptico-lanceolate, dentate-serrate or entire, terminal leaflet very little, if at all, larger than the others; *stem leaves* opposite, on short broad petioles; *radical leaves* on long petioles. *Inflorescence* panicled, cymose: *flowers* flesh-coloured or whitish. *Calyx-limb* (fig. 68, *a*) involute during flowering, then unrolled into a feathery pappus. *Corolla* with a 5-lobed limb, and a somewhat funnel-shaped tube, which is gibbous at the base. *Stamens* 3. *Fruit* indehiscent, 1-celled, 1-seeded, compressed, crowned with the pappus.—*Woodv.* pl. 96, p. 262.

Fig. 68.



Valeriana officinalis.
a. Flower.

Habitat.—It is indigenous, and is also found in most countries of Europe. It commonly grows in ditches and damp places, and sometimes in dry heaths and elevated pastures. The plant found in the latter situations has a shorter stem and narrower leaflets.

[§ **Valerianæ Radix.** *Valerian Root.*

The dried root of Valeriana officinalis, *Linn.* From plants indigenous to and also cultivated in Britain; collected in autumn, wild plants being preferred.]

Collection.—The valerian root of the shops is collected about August and September, from both wild and cultivated plants. The roots of the wild sort are now gathered chiefly in Hampshire; but the heaths of Kent and Essex formerly furnished a great deal of it. The cultivation of valerian is carried on at Ashover, near Chesterfield, in Derbyshire. The plants are either procured from the offsets of former plantations, or from wild plants found in wet places in the neighbouring woods. Soon after the plant comes up in the spring, the tops are cut off to prevent its running to seed, which materially injures its activity. At Michaelmas, the roots are dug up carefully, and washed; the remaining top is then cut close off, and the thickest part of the roots slit down to facilitate their drying, which is effected on a kiln, after which they must be packed tight, and kept very dry, to prevent their spoiling.

General Characters.—The so-called root consists of a short tuberculated rhizome, to which numerous yellowish-white rootlets, about two or three inches long, are attached below. The rhizome is whitish internally, and, when fresh, greyish or yellowish-white externally, but when dried, yellowish-brown. The taste is warm, camphoraceous, slightly bitter, somewhat acrid, and nauseous. The odour of the fresh roots is not very considerable; but of the dry (especially when they have been kept for some time) much stronger, being then fetid, and very characteristic. When distilled with water valerian root yields volatile oil and valerianic acid.

Varieties.—Two varieties of valerian root are found in English commerce: viz. the *cultivated*, which, being the finer-looking, is usually kept by pharmacists; and the *uncultivated*, or *wild sort*, which is to be preferred for medicinal use.

Composition.—Valerian yields its active properties to water and alcohol. Its more important constituents are *volatile oil*, *resin*, *peculiar extractive matter* (*valerianin*), and *yellow extractive matter. Volatile Oil.*—According to Huraut, this oil does not exist ready-formed in valerian root, for ether does not extract any volatile oil from it; but when the root is submitted to distillation with water, it yields about 1·5 per cent. of oil, which is a mixture of at least five substances. Two of these are volatile oils, and may be regarded as its essential components; the more volatile of these is *valerene*, a colourless liquid, identical with a hydrocarbon obtained from Borneo camphor, and isomeric with oil of turpentine; the less volatile ingredient is *valerol*, which is lighter than water, has the odour of hay, and by exposure to the air absorbs oxygen and yields valerianic acid. The three other constituents of the oil are *valerianic acid*, a *resin*, and a kind of *camphor*, or solid volatile oil. Fresh prepared and rectified oil of valerian is neutral, clear, and has an odour which is not disagreeable. By exposure to the air it resinifies, becomes coloured, thick, acid (owing to the formation of valerianic acid), and acquires a more disagreeable odour. Oil of valerian has been used in medicine as a powerful stimulant and antispasmodic, in doses of one, two, or more minims. *Valerianic Acid*, $C_5H_{10}O_2$.—This can be procured from valerian root, in which, according to some persons, it pre-exists, but it is probably formed by the oxidation of valerol. Rabourdin, by previously acidulating the water with sulphuric acid, obtained 1 per cent. of valerianic acid from the root; whereas, when simple water was employed, the product was only 0·25. Lefort advises that, prior to distillation, the coarsely powdered root should be macerated in water mixed with sulphuric acid and bichromate of potash, in order to promote the oxidation of the valerol, and thereby to increase the product of valerianic acid. By boiling the root in a solution of carbonate of soda, and decomposing the saline solution by sulphuric acid, the Messrs. Smith procured eighty grains of acid from a pound of root. Thirault is of opinion that caustic alkali is preferable to the carbonate. But valerianic acid is a product of the decomposition of various animal and vegetable substances, and is most economically obtained, for commercial purposes, from fousel oil. (See *Valerianate of Soda.*) Valerianic acid is a colourless limpid liquid. Its odour is strong, and somewhat allied to, though distinct from, that of valerian root: its taste is acrid. Its density at 60° F., is 0·937. It boils at 347° F. It is very slightly soluble in water, with which it forms a hydrate, $\mathbf{C_5H_{10}O_2.H_2O}$; but is soluble in all proportions in alcohol and ether. With the exception of the valerianates of silver and of the protoxide of mercury, all the valerianates are soluble in water. M. Gerhardt has obtained anhydrous valerianic acid, as a colourless, slightly odorous, oily fluid, lighter than water, boiling at 419°. *Valerianin, Peculiar Extractive Matter.*— A yellowish-brown substance, which tastes at first sweetish, and afterwards slightly bitter. It is soluble in water, but insoluble in both absolute alcohol and pure ether. Neither perchloride of iron nor acetate of lead produces any change in the aqueous solution. *Yellow Extractive Matter.*—Bitterish, soluble in water. The perchloride of iron causes a green precipitate, and acetate of lead a dirty yellowish precipitate, in the aqueous solution. *Resin.* —Insoluble in water, but soluble in alcohol, ether, and oil of turpentine. The alcoholic solution does not redden litmus, nor yield any precipitate on the addition of an alcoholic solution of either the acetate of lead or of copper.

Physiological Effects.—Valerian excites the cerebro-spinal system. Large doses cause headache, mental excitement, visual illusions (scintillation, flashes of light, &c.), giddiness, restlessness, agitation, and even spasmodic movements. Its operation on the nervous system is also evinced by its occasional therapeutic influence over certain morbid states of this system; whence it has been denominated *nervine* and *antispasmodic.* The effects of valerian on the nervous system are, however, by no means constant. More inconstant still are its effects on the functions of organic life. For while in some cases it has accelerated the pulse, augmented the heat of the body, and promoted the secretions, in others it has failed to produce these effects. Large doses often create nausea.

Therapeutics.—Valerian may be employed as a nervous excitant, and, where stimulants are admissible, as an antispasmodic. It was formerly held in great repute. It has been principally celebrated in *epilepsy.* Its employment has found numerous advocates and opponents; but at the present time most practitioners regard it as a medicine of very little power. In *chorea*, and other spasmodic affections, it has been used with variable success. I have found temporary benefit from its use in females affected with *hypochondriasis* and *hysteria*. Of its use as a nervous stimulant in the low forms of *fever*, we have but little experience in this country. In Germany, where it is more esteemed, its employment in these cases is highly spoken of.

Administration.—The dose of *powder* is from 10 to 30 grains, or more. Though objected to by some, on account of the quantity of inert woody fibre which it contains, it is, when well and recently prepared, an efficacious form of administration.

[§ **Infusum Valerianæ.** *Infusion of Valerian.*

Take of

Valerian Root, bruised . . .	120 grains.
Boiling Distilled Water . . .	10 fluid ounces.

Infuse in a covered vessel, for one hour, and strain.

Dose.—1 to 2 fluid ounces.]

This infusion contains a small quantity of volatile oil, some valerianate of potash (Trommsdorff), and extractive matter, but no resin. It is somewhat less apt to disturb the stomach than the powder.

[§ **Tinctura Valerianæ.** *Tincture of Valerian.*

Take of

Valerian Root, in coarse powder . .	$2\frac{1}{2}$ ounces.
Proof Spirit	1 pint.

Macerate the valerian root for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

Dose.—1 to 2 fluid drachms.]

This preparation contains a portion of volatile oil, some valerianate of potash, valerianin, and resin. It possesses the virtues of valerian, but is scarcely sufficiently strong to produce the full effects of the root, without giving it in doses so large as to be objectionable, on account of the spirit contained therein.

[§ **Tinctura Valerianæ Ammoniata.** *Ammoniated Tincture of Valerian.*

Take of

Valerian Root, in coarse powder . . .	$2\frac{1}{2}$ ounces.
Aromatic Spirit of Ammonia	1 pint.

Macerate for seven days in a well-closed vessel, with occasional agitation; then strain, press, filter, and add sufficient aromatic spirit of ammonia to make one pint.

Dose.—$\frac{1}{2}$ to 1 fluid drachm.]

Although the proportions of the ingredients are unaltered, this preparation contains a larger quantity of carbonate of ammonia than the London tincture, in consequence of the increased strength of the aromatic spirit. The stimulant influence of the valerian is greatly increased, and its therapeutical efficacy often augmented, by the ammonia in this preparation.

CINCHONACEÆ, *Lindl.* The Cinchona Order.

RUBIACEÆ, *Jussieu.*

CEPHAËLIS IPECACUANHA, *D.C.* The Ipecacuanha Plant.

Botanical Character.—*Root* (figs. 69 and 70) perennial, about the thickness of a quill, annulated, simple or dividing into a few diverging contorted branches, from 4 to 6 inches long. *Stem* somewhat shrubby, 2 or 3 feet long, often rooting near the ground, but ultimately ascending. *Leaves* (fig. 69) opposite, stalked, oblong-lanceolate, rough above, downy beneath, rarely more than 4 or 6; *petioles* pubescent, connected to each other by the interpetiolar stipules; *stipules* erect, membranous at their base. *Peduncles* solitary, erect when in flower, reflexed when in fruit. *Flowers* collected into semi-globose clusters, 8–10-flowered. *Calyx* minute, adherent. *Corolla* white. *Stamens* 5. *Ovary* inferior, ovate; *style* filiform, white; *stigmas* linear, spreading. *Berry* soft, fleshy, violet-black. *Seeds* pale, plano-convex.—*Steph. and Church.* pl. 62.

Fig. 69.

Cephaëlis Ipecacuanha.

Habitat.—Brazil; in moist shady situations from 8° to 20° south latitude. Abundant in the valleys of the granitic mountains, which run through the provinces of Rio Janeiro, Espirito Santo, and Bahia; also met with in Pernambuco. It appears to be more or less abundant throughout the greater part of Brazil. Humboldt and Bonpland also found it on the St. Lucar mountains of New Granada. Attempts are now being made to cultivate it in India and other parts of the world.

[§ **Ipecacuanha.** *Ipecacuanha.*

The dried root of Cephaëlis Ipecacuanha, *D.C.* Imported from Brazil.]

Collection and Preparation.—The roots are gathered at all seasons of the year, though more frequently from January to March inclusive; and as no care is taken in the cultivation of the plant, it has

Fig. 70.

Ipecacuanha Root.

become scarce around the principal towns. According to Weddell, the roots were principally collected, in the year 1851, in the interior province of Matto Grasso, in Brazil. The roots are cut from the stems by the Indians, who are the chief collectors, cleaned, and hung up in the sun to dry.

Commerce.—Ipecacuanha is principally imported into this country in bales or serons, from Rio Janeiro; but also to some extent, from Bahia, Pernambuco, and rarely from Carthagena.

General Characters.—Ipecacuanha is in pieces three or four inches long, about the size of a small writing quill, more or less contorted, and simple or branched. It has a knotty appearance, in consequence of a number of deep circular fissures (fig. 70) about a line in depth, which extend inwardly through the cortical portion to a central white ligneous cord (*meditullium*), so as to produce the appearance of a number of rings strung upon a thread (hence the name, *annulated*, which is commonly applied to it). These rings are unequal in size, both with respect to one another and to different parts of the same ring. It has a resinous fracture. In 100 parts of good ipecacuanha, there are about 80 of cortical portion, and 20 of meditullium. The cortical portion is by far the more active portion. Ipecacuanha has an acrid, and somewhat bitter nauseous taste; and a slightly nauseous but peculiar odour. The colour of the root varies, being brownish, reddish-brown, greyish-brown, or grey. The powder is of a pale brown or grey colour.

Varieties.—Three evident varieties of ipecacuanha are found in commerce, besides other subordinate ones, whose principal distinction is the colour of their epidermis. The age of the root, the nature of the soil, and the mode of drying, are among the different circumstances producing these varieties. Sometimes they are met with in the same package. *Brown Ipecacuanha.*—This is the best kind. The greater part of the ipecacuanha of commerce usually consists of this variety. Its epidermis is more or less deeply brown, sometimes even blackish; its fracture is grey or brownish, its powder grey. The cortical portion has a horny appearance. *Red Ipecacuanha.*—This differs from the preceding by the lighter and reddish colour of its epidermis, and by its less powerful odour. Sometimes it has, when broken, the same horny and semitransparent characters as the brown ipecacuanha, but more frequently it is opaque, dull, and farinaceous; in which case it is generally less active. *Grey Ipecacuanha.*—The colour of this variety is greyish-white. Grey ipecacuanha occurs in pieces of larger diameter than either of the foregoing kinds, with fewer, more irregular, and less prominent rings.

Composition.—The more important constituents of ipecacuanha are a peculiar alkaloid called *emetia*, *a trace of volatile oil*, *fatty matter* and a peculiar astringent acid, which was at first mistaken for gallic acid, but is now termed *ipecacuanhic* or *cephaëlic acid.* The emetic property resides in the emetia, which is principally contained in the cortical portion, hence this is the most active portion of the root. The medicinal properties of ipecacuanha are extracted in a great measure by water, but alcohol and the strong wines are the best solvents. Boiling injures its properties. Tincture of nutgalls forms in the decoction, as well as in the tincture diluted with water, a greyish-white precipitate (*tannate of emetia*). Perchloride of iron communicates a greenish tint (*ipecacuanhate of iron*) to the decoction as well as to the diluted tincture. A solution of gelatine forms in the infusion, after twelve hours, a precipitate. *Emetia.*—When first discovered by Pelletier and Magendie, in 1817, it was in a very impure state. Pure emetia is white, (when not absolutely pure it has a greyish-yellow tinge,) pulverulent, inodorous, with a slightly bitter taste; fusible at 122° F.; very slightly soluble in cold, but much more so in hot water; very soluble in alcohol, but scarcely soluble in ether and oils. It dissolves in acids, the acidity of which it does not entirely destroy. The following composition has been assigned to it, $C_{35}H_{25}O_9N$. The best ipecacuanha yields about 1 per cent. of pure emetia. The *salts of emetia* are slightly acid, and very crystallisable. An alcoholic solution of iodine, added to an alcoholic solution of emetia, produces a reddish precipitate. Tincture of galls copiously precipitates solutions of emetia (*tannate of emetia*). The effect of these reagents on emetia is similar to their effect on morphia; but from this last substance emetia is distinguished by the salts of iron, which produce no change of colour in it. According to Magendie, a quarter of a grain of impure emetia administered to a man excited nausea and vomiting; a grain and a half, or two grains, taken fasting, caused continued vomiting and decided disposition to sleep. The effects of *pure* emetia are similar, but more energetic. In one case $\frac{1}{16}$ of a grain caused vomiting in a man eighty-five years of age: and two grains were found sufficient to kill a dog. Emetia has been proposed as a substitute for ipecacuanha, all the advantages of which it is said to possess in a much smaller dose, and without the unpleasant taste and odour which the root is known to have. I confess, however, I think very little advantage is likely to be gained by the substitution. When we wish to give emetia in a liquid form, it may be readily dissolved in water by the aid of acetic or dilute sulphuric acid.

Physiological Effects.—If the powder or dust of ipecacuanha be applied to the eyes or face, it acts as an irritant, and causes redness and swelling of these parts. Inhaled, it irritates the respiratory passages, and, in some persons, brings on difficulty of breathing, similar to an attack of spasmodic asthma. There is one case recorded of poisoning by the incautious inhalation of the dust of ipecacuanha in the process of powdering it, by a druggist's assistant. The patient, who was suffering with catarrh and cough, inhaled, during three hours, the dust from the root; in consequence of which, vomiting came on, followed by tightness of the chest. An hour after this he complained of a sense of suffocation, and constriction of the trachea and throat: his appearance was pale and deathly. Under suitable treatment he recovered, and was able to leave the house in two days, but suffered several days from difficulty of breathing. When taken *in small and repeated doses*, ipecacuanha principally directs its influence to the secreting organs, especially those of the chest, whose activity it promotes. It specifically affects the bronchial membrane, in some morbid conditions of which it promotes expectoration; while in others, attended with a profuse secretion of phlegm, it exerts a beneficial influence, and often contributes to the restoration of the part to its normal condition. *In somewhat larger doses* it creates nausea, with its concomitant phenomena, depression, increased secretion of saliva and buccal mucus, &c. If a diaphoretic regimen be adopted, it exerts a powerfully relaxing influence over the skin. *In full medicinal doses* it occasions vomiting, followed by a tendency to sleep. Its operation as an emetic is exceedingly safe, since inflammation is not produced by it, even when an over dose has been swallowed. The vomiting produced by ipecacuanha is not so violent as that induced by tartarated antimony, neither is it so long continued, nor attended with such nausea and depression. Furthermore, ipecacuanha is less disposed to act on the bowels. The tonic and astringent qualities of the salts of zinc, as well as their want of diaphoretic power, distinguish these emetic substances from ipecacuanha. Squill (with which ipecacuanha agrees in its expectorant and emetic qualities) is distinguished by its greater acridity, and by its influence not being concentrated on the pulmonary organs, as is the case with ipecacuanha, which does not, therefore, possess that power of stimulating the urinary organs possessed by squill.

Therapeutics.—Ipecacuanha is employed in full doses as an emetic, or in smaller doses as an expectorant and nauseant. *As an emetic.*—The mildness of its operation adapts ipecacuanha for the use of delicate and debilitated persons, where our object is merely to evacuate the contents of the stomach. Thus it is well fitted for the disorders of children requiring the use of emetics (as when the stomach is overloaded with food in hooping-cough, croup, &c.). It is also exceedingly useful for adults (especially delicate females); thus, in gastric disorders, to evacuate undigested acrid matters from the stomach,—to promote the passage of biliary calculi,—as a counter-irritant at the commencement of fevers,—in many inflammatory diseases (as acute mucous catarrh, cynanche, orchitis, and ophthalmia),—in asthma,—and as an evacuant in cases of narcotic poisoning. When the indication is to excite gentle vomiting in very weak and debilitated frames, it may be effected frequently with the utmost ease and safety by ipecacuanha in doses of from two to four grains. The mildness of its operation is not the only ground for preferring ipecacuanha to other emetic substances. Its specific power over the pulmonary organs and the stomach leads us to prefer it in maladies of these parts, in which vomiting is likely to be beneficial; especially in those affections in which the nerves appear to be more than ordinarily involved, as spasmodic asthma and hooping-cough. *As a nauseant, antispasmodic, diaphoretic, and expectorant.*—When given in doses insufficient to occasion vomiting, ipecacuanha is serviceable in several classes of complaints, especially those of the chest and alimentary canal. *In affections of the respiratory organs.*—Nauseating doses of ipecacuanha are used with considerable advantage in acute cases of *mucous catarrh.* They favour expectoration and relaxation of the cutaneous vessels. In milder and more chronic forms, smaller doses, which do not occasion nausea, will be sufficient. In children, who bear vomiting much better than adults, full nauseating or even emetic doses are to be preferred. In *hooping-cough,* in which disease considerable benefit is obtained by the use of emetic substances, ipecacuanha is frequently administered with advantage. After giving it to create vomiting, it should be administered in nauseating doses. In *asthma,* benefit is obtained by it not only when given so as to occasion nausea and vomiting, as above noticed, but also in small and repeated doses. In *bronchial hemorrhage,* the efficacy of ipecacuanha has been greatly commended.

In affections of the alimentary canal.—In *dysentery* ipecacuanha has gained no trifling celebrity, whence its name of *radix antidysenterica*. In this disease it is probably best given in conjunction with opium. Its determination to the skin should be promoted by warm clothing, and the free use of mild tepid aliments. Dr. Ringer recommends ipecacuanha in drop doses to be given every hour, or three times a day, 'in the vomiting of pregnancy when not accompanied and dependent upon acidity of the stomach ; in the morning vomiting of drunkards ; in morning vomiting resulting from general weakness, and met with in puerperal women, and in convalescents from acute diseases ; in the vomiting of hooping-cough ; when the food is rejected after meals in a partially digested condition, without either pain, nausea, or discomfort ; and to check vomiting resulting from cancer of the stomach.' Such minute doses, however, have not generally succeeded with other practitioners.

Administration.—The usual dose of ipecacuanha in *powder*, as an *emetic*, is fifteen grains. But a much smaller quantity (for example, six, or four, or even two grains) will frequently suffice. But twenty or thirty grains may be taken with perfect safety. A commonly used emetic consists of one grain of tartarated antimony, and ten or fifteen grains of ipecacuanha. For infants, half a grain or a grain of this is sufficient to occasion vomiting. In all cases the operation of the remedy should be assisted by diluents. As a *nauseant*, the dose is from one to three grains. As an *expectorant* and *sudorific*, the dose should not exceed one grain : for infants, one quarter or one-eighth of a grain. *Infusion of ipecacuanha* (prepared by digesting a quarter of an ounce of coarsely powdered ipecacuanha in six ounces of boiling water) may be used as an emetic, in cases of narcotic poisoning, in doses of from one to two fluid ounces.

Pharmaceutical Uses.—It is a constituent of morphia and ipecacuanha lozenges, and compound conium pill.

[§ **Pilula Ipecacuanhæ cum Scilla.** *Pill of Ipecacuanha with Squill.*

Take of

Compound Powder of Ipecacuanha		3 ounces.
Squill, in powder	of each	1 ounce.
Ammoniacum, in powder		
Treacle		a sufficiency.

Mix the powders and beat into a mass with the treacle.

Dose.—5 to 10 grains.]

Narcotic and sudorific, employed in chronic catarrh.

[§ **Pulvis Ipecacuanhæ Compositus.** *Compound Powder of Ipecacuanha.*

Synonym.—Pulvis Ipecacuanhæ cum Opio, 1864.

Take of

Ipecacuanha, in powder	$\frac{1}{2}$ ounce.
Opium, in powder	$\frac{1}{2}$ ounce.
Sulphate of Potash, in powder . . .	4 ounces.

Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle.]

This preparation is an imitation (though not a very exact one) of a formula given by Dr. Dover, whence it is commonly known in the shops as *Dover's Powder.* It is one of our most certain, powerful, and valuable sudorifics. The sulphate of potash is intended to serve the double purpose of promoting the sudorific operation of the other ingredients, and of minutely dividing, by the hardness of its particles, the opium and ipecacuanha. The opium and ipecacuanha combined, enjoy great sudorific properties not possessed, in the same degree, by either of these substances separately. I am inclined, however, to ascribe the greater part of the activity of the compound to the opium, which, it is well known, strongly determines to the cutaneous surface, and often produces pricking or itching of the skin; and, when assisted by the copious use of warm aqueous diluents, operates as a sudorific. This effect, however, is greatly promoted by the ipecacuanha, which has a relaxing influence over the cutaneous vessels. The contra-indications for the use of powder of ipecacuanha and opium are an irritable condition of the stomach (when this preparation is apt to occasion sickness), and cerebral disorder. Thus, in fever, with a dry furred tongue, a dry skin, and with much disorder of the cerebro-spinal functions, it, like other opiates, is calculated to prove injurious; but when the tongue is moist, the skin, if not damp, at least soft, and the functions of the brain not much involved, it will probably operate beneficially. In slight colds, catarrhs, and rheumatic pains, it often proves most effectual. In various inflammatory affections, when the febrile excitement does not run too high, and when the brain is undisturbed, it may be used with good effect. In acute rheumatism it is occasionally highly serviceable, and also in diarrhœa and dysentery. In hemorrhages from internal organs, as the uterus, it is useful on the principle of revulsion or counter-irritation, by its power of determining to the skin.

Dose.—Usually from 5 to 10 grains; but where the stomach is irritable I have frequently seen 5 grains cause sickness. On the other hand, in some cases where a powerful sudorific is required, and the brain is unaffected, 15 or even 20 grains of this powder are not unfrequently given.

[§ **Trochisci Ipecacuanhæ.** *Ipecacuanha Lozenges.*

Take of

Ipecacuanha, in powder . . .	180 grains.
Refined Sugar, in powder . .	25 ounces.
Gum Acacia, in powder . . .	1 ounce.
Mucilage of Gum Acacia . .	2 fluid ounces.
Distilled Water	1 fluid ounce, or a sufficiency.

Mix the powders and add the mucilage and water to form a proper mass. Divide into 720 lozenges, and dry these in a hot-air chamber with a moderate heat.

Each lozenge contains a quarter of a grain of ipecacuanha.

Dose.—1 to 3 lozenges.]

A convenient and efficacious form in which to administer ipecacuanha as an expectorant and cough medicine.

[§ **Vinum Ipecacuanhæ.** *Wine of Ipecacuanha.*

Take of

Ipecacuanha, bruised	1 ounce.
Sherry	1 pint.

Macerate for seven days in a closed vessel, with occasional agitation, strain, press, and filter; then add sufficient sherry to make one pint.]

This preparation is diaphoretic, expectorant, and emetic.

Dose.—For an adult, as a diaphoretic and expectorant, 5 to 40 minims; as an emetic, 3 to 6 fluid drachms. On account of the mildness of its operation, it is given as an emetic to children: the *dose* is from 20 minims to 1 fluid drachm, according to the age of the child. It is also exceedingly useful as an expectorant in the diseases of infants: *dose*, from 5 to 10 minims.

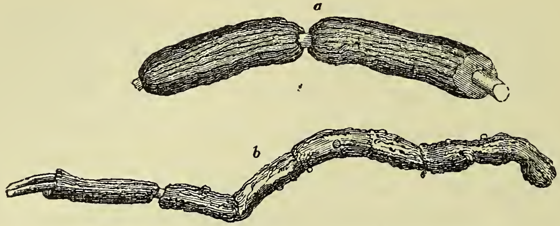
PSYCHOTRIA EMETICA, *Mutis.* Striated Ipecacuanha.

This is a small perennial plant, which grows in Peru and New Granada, and on the banks of the Magdalena. Its roots constitute striated, black, or Peruvian ipecacuanha.

(*Not official.*)

General Characters.—The roots are neither annulated nor undulated, but longitudinally striated. They have deep circular intersections (fig. 71) at various distances, which give them the appearance of being articulated; and, when slight force is used, they fracture at these parts. As met with in commerce, they have externally a blackish-grey colour, with a brownish tinge; but when fresh, they are said to be dirty reddish-grey. Their fracture is resinous; the

Fig. 71.



Striated Ipecacuanha (Roots of Psychotria emetica).

a. An old root with a well-marked intersection. *b.* Contorted root.

meditullium or central ligneous cord, is yellowish, and perforated by numerous small holes, which are very visible by a magnifier; the cortical portion is softish, easily separable, and of a greyish-black colour, which becomes much deeper when moistened with water. Its powder is deep grey.

Composition.—This root contains *emetia,* to which it owes its properties.

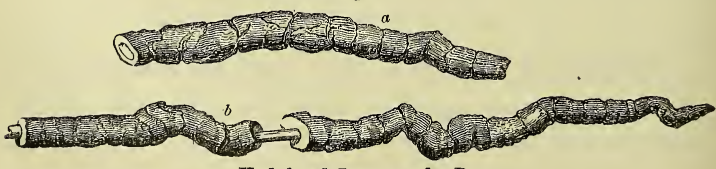
Uses.—In its medicinal qualities it resembles the annulated or true ipecacuanha, but is less powerful. It is not used in this country, although a good deal has been imported during the last few years.

RICHARDSONIA SCABRA, *De Cand.* **Undulated Ipecacuanha.**

A perennial plant; a native of Brazil, New Granada, Peru, Vera Cruz, &c. Its root constitutes undulated, white, or amylaceous ipecacuanha.

(Not official.)

Fig. 72.



Undulated Ipecacuanha Root.

a. Root of Richardsonia scabra. *b.* Root of a Richardsonia.

General Characters.—This root has a jointed appearance, from constrictions which are remote from each other (fig. 72). It is about the same size as that of the annulated species; it is twisted, attenuated at the extremities; externally of a greyish-white colour, and becoming brownish by age. It presents no rings properly so called, but is marked by semicircular grooves. It consists, like the annulated species, of a thin yellowish meditullium, and a cortical portion. The fracture of the root is not at all resinous, but farinaceous, and of a dull white colour; the fractured surface presenting, when examined by a magnifier, numerous shining, pearly, probably amylaceous, spots. The odour is musty.

Composition.—Like annulated ipecacuanha and striated ipecacuanha, it owes its properties to *emetia.*

Uses.—In its medicinal qualities it agrees with the annulated ipecacuanha, but is much less powerful. This, like the striated ipecacuanha, is not employed medicinally in England.

CINCHONA, *Weddell.*

Generic Character.—Evergreen *trees* or *shrubs. Leaves* opposite, entire, petiolated; *stipules* interpetiolar, usually free, and soon deciduous. *Flowers* cymose-paniculate, white or usually roseate or purplish, very fragrant. *Calyx* with a turbinated tube, connate with the ovary, pubescent; *limb* 5-toothed, persistent; the teeth valvate in æstivation. *Corolla* salver-shaped, with a roundish tube; *limb* 5-cleft, the segments lanceolate, valvate in æstivation. *Stamens* 5; *filaments* inserted in and adnate to the lower part of the tube; *anthers* linear. *Ovary* inferior crowned with a fleshy disk; *ovules* numerous, peltate; *style* simple; *stigma* bifid. *Capsule* ovate, oblong, or linear-lanceolate, grooved on both sides, crowned by the limb of the calyx, 2-celled, many-seeded, septicidal, dehiscing from the base to the apex. *Seeds* numerous, winged.

Habitat.—Intertropical valleys of the Andes in New Granada, Ecuador, Peru, and Bolivia, at an elevation of from 4,000 to 10,000 feet above the level of the sea. The more important species are now largely and successfully cultivated in India, Ceylon, Java, and Jamaica, so that the fear entertained but a few years since, of the supply of cinchona barks becoming exhausted, need no longer be felt.

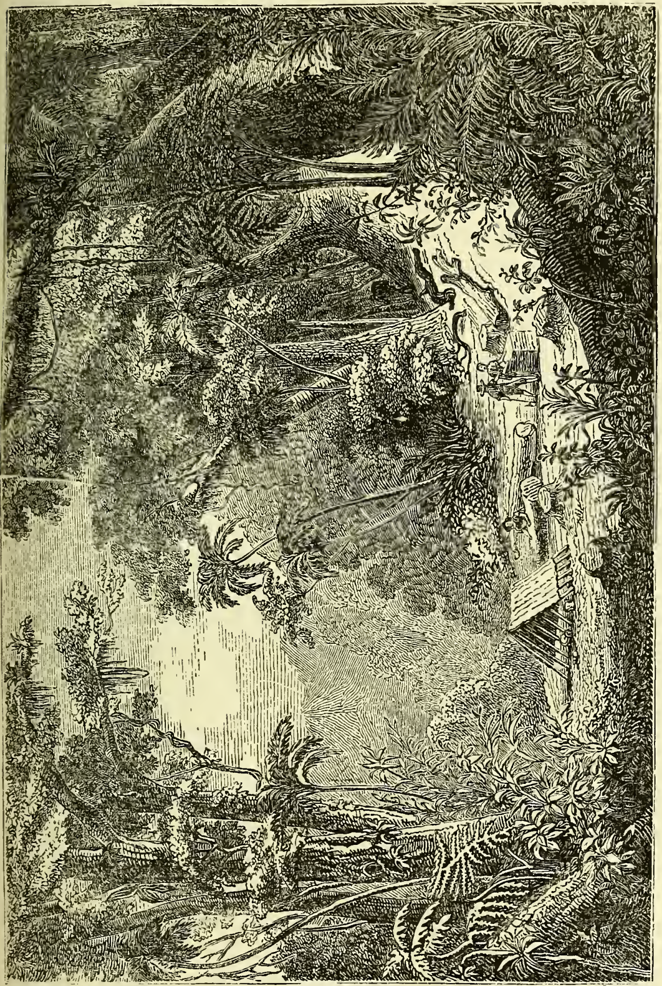
Species.—About thirteen species of Cinchona are known to yield barks which are met with in commerce; but of these only four are mentioned in the British Pharmacopœia, viz.: *Cinchona Condaminea, C. Calisaya, C. succirubra,* and *C. lancifolia.* Of these species the former three yield respectively, the official Pale, Yellow, and Red-Cinchona barks; and the fourth is also official from yielding one of the barks directed to be used in the preparation of Sulphate of Quinia.

History.—Cinchona bark is usually said to have been first introduced into Europe in 1640; but Sebastian Badus gives an extract from a letter of a Spanish physician, D. Joseph Villerobel, from which it appears that it was imported into Spain in 1632, though no trial was made of it until 1639. Condamine states that the Countess of Chinchon, wife of the Viceroy of Peru, brought some bark to Europe on her return from South America in 1639, from which circumstance it acquired the names of Cinchona bark, and Countess's powder. About ten years afterwards it was carried by the Jesuits to Rome, and distributed among the members of the order, by whom it was taken to their respective stations, and used in the treatment of ague. In this way it gained the name of Jesuit's bark. It subsequently acquired the name of Crown bark, in consequence of its having been employed by the royal family of Spain. The bark thus introduced into Europe appears to have been the bark of the species described by Condamine as growing about Loxa, which Linnæus called *Cinchona officinalis*, Pavon *C. Chahuarguera*, *Uritusinga*, and Weddell *C. Condaminea*, var. *vera*; and according to Howard, Ruiz states that the bark, to which the tradition attaches among the bark-gatherers of Loxa of having been the identical bark which cured the Countess of Chinchon, is Cascarilla Chahuarguera, which was the product of *C. Condaminea*, var. *Chahuarguera.*

Collection and Preparation.—The great importance of Cinchona barks in medicine will justify us in giving some account of the manner in which they are collected, dried, and prepared for exportation. The following notice has been condensed from Weddell, and refers more especially to yellow (Calisaya) bark. The name of *cascarilleros* (bark-peelers) is given, not only to the peelers, but to all who are engaged specially in the collection and commerce of cinchona barks. The bark is gathered at all times of the year except during the rainy season. The *cascarilleros* are accompanied into the forests by a confidential person called the *major domo*, whose especial duty it is to receive and examine the barks brought to him by the different parties in the forest.

The first thing done by those who engage in this kind of speculation in a region previously unexplored, is to have it examined by experienced *cascarilleros*. The duty of these is to penetrate the forests in different directions, and to ascertain to what points they may be profitably explored. If their report be favourable, a road is immediately commenced up to the point which is to form the centre of the operations; and the *major domo* with his cutters pitches his camp in the neighbourhood, and the *cascarilleros* are distributed through the forest one by one, or in small parties, to discover the cinchona trees, which having succeeded in doing, often after almost incredible hardships, they proceed to collect the bark (fig. 73). For this purpose, in the first place, in order to strip the tree of its bark it is felled with a hatchet, being cut a little above the root, and the bark previously removed from this part, so that nothing may be lost; and as at the base the bark is thickest, and,

Fig. 73.



The Valley of San Juan del Oro.

Bark-peeling in the Forests of Carabaya, in Peru.

(One of the *cascarilleros* is represented as engaged in barking a felled stem; two others are occupied in piling the bark in square heaps to flatten and dry it; while a fourth is seen in the distance carrying a load of the dried bark on his back to the camp.)

therefore, most profitable, it is customary to remove the earth from around the trunk, so that the barking may be more complete. When the tree is down, and the useless branches have been cut off, the periderm is removed by striking it with either a little wooden mallet, or the back of the hatchet; and the inner bark, being thus exposed, is often further cleaned by means of a brush. The bark is then divided by uniform incisions circumscribing the pieces which are to be removed, and these are afterwards separated from the trunk with a common knife or some other instrument, the point of which is carried as close as possible to the surface of the wood on being introduced into the incisions previously made ; and if the position of the trunk prevents the operator from removing the whole of the bark by the first operation, it is subsequently divided so as to admit of its being turned. The dimensions and regularity of the pieces necessarily depend more or less on circumstances ; in general, however, for the convenience of transport and facility of preparation, they endeavour to make them from fifteen to eighteen inches long, and four or five inches wide. The bark of the branches is separated in the same way as that of the trunk, excepting that this is not deprived of its exterior coating or periderm.

The details in the process of drying also vary slightly in the two cases ; the thinnest pieces of bark from the branches or small trunks intended to make the *quilled* bark, are simply exposed to the sun's rays, and they take of themselves the desired form, which is that of a hollow cylinder ; but the bark taken from large trunks which is to constitute the *flat* cinchona, must necessarily undergo a certain degree of pressure during the process of desiccation, without which it would become misshapen, or take a cylindrical form, as in the preceding case. To effect this, after first exposing the pieces of bark to the sun, they are placed one on the other in crossed squares, in a similar manner to that practised in timber-yards in the arrangement of the planks of wood ; and on the top of this pile a heavy weight is placed. This process is repeated for several days until the bark is completely dried. In many places the bark is not pressed at all, or but imperfectly so, and it is then generally out of form or more or less curled. The periderm is often but partially removed, or simply scraped. Finally, whether it be accidental, or whether it be done with the view of augmenting the weight, there frequently remains a certain quantity of moisture in the bark which greatly deteriorates it. The labour of the *cascarillero* is by no means ended, even when he has finished the preparation of the bark ; he has yet to carry his spoil to the camp, and, with a heavy load on his shoulders, to retrace his steps along those parts which, while unburdened, he traversed with difficulty.

The packing of the bark is effected by the *major domo.* As the cutters bring him the bark, he submits it to a slight examination, and rejects that which is bad. It is then, if necessary, exposed to a fresh process of desiccation, and formed into bundles of nearly equal weight, which are sewn up in coarse canvas kept for that purpose. In this condition the bundles are conveyed on the backs of men, donkeys, or mules, to the depôts in the towns, where they generally receive an exterior envelope, consisting of a fresh hide, which as it dries makes a hard and compact package. In this form the packages are known by the name of *serons*, and it is thus that they arrive in Europe. The usual weight of a *seron* is from 70 to 80 kilogrammes (=156 to 176 pounds avoirdupois); but it is sometimes much less than this.

As already stated, the above remarks apply more especially to the collection and preparation, &c., of Calisaya bark. Other barks are imported either wholly in *chests*, as the official Pale and Red Cinchona barks; or partly in chests and partly in serons, as Grey bark. The mode of collecting, &c., also varies in some minor details, in the different bark districts.

CINCHONA CONDAMINEA, *Weddell.* Condamine's Cinchona.

Synonym.—Cinchona officinalis, *Linn.*

Specific Character.—*Leaves* lanceolate, ovate, or subrotund, usually acute, very smooth and shining above, beneath sometimes pitted in the axils of the veins. *Calyx* with triangular-acuminate or lanceolate teeth; *tube* downy. *Filaments* about half the length of, or longer than, the *anthers*. *Capsule* oblong-ovate, or lanceolate, much longer than the flowers. *Seeds* elliptical, toothletted at the margin.

Habitat.—Forests of Loxa in Ecuador, and the adjacent parts of Peru. It is now cultivated with great success in India,—principally on the Neilgherries, at an elevation of about 8,000 feet above the level of the sea.

Varieties.—Several varieties of this plant have been noticed by different botanists, which by others again have been regarded as specifically distinct. The Pharmacopœia names as varieties of this species —*Cinchona Chahuarguera*, Pavon (*Howard's Illustrations*, pl. 1), occasionally a lofty tree, which yields *rusty, H.O. or yellow-crown*, and *red-crown bark*; and *C. crispa*, Tafalla (*Howard's Illustrations*, pl. 2), a small *tree* or *shrub* which grows on the mountains of Cuenca, Loxa Riobamba, Jaen de Bracamoros, &c., in Ecuador and Peru, and yields *fine crown bark.*

[§ Cinchonæ Pallidæ Cortex. *Pale-Cinchona Bark.*

The bark of Cinchona Condaminea, *D.C.*, var. Chahuarguera, *Pavon*, and crispa, *Tafalla*. Collected about Loxa in Ecuador.]

Commerce.—This bark, which is called Loxa and Crown bark, is imported from Loxa in chests. After its arrival it is frequently picked and sorted.

General Characters.—[§ From half a line to a line thick, in single or double quills, which are from six to fifteen inches long, two to eight lines in diameter, brittle, easily splitting longitudinally, and breaking with a short transverse fracture; outer surface brown and wrinkled, or grey and speckled with adherent lichens, with or without numerous transverse cracks; inner surface bright orange or cinnamon-brown; powder pale brown, slightly bitter, very astringent.]

Varieties.—Of late years, various kinds of quilled barks, differing in botanical origin, in appearance, and in chemical constitution, have been imported—sometimes mixed, sometimes unmixed—under the name of Loxa or Crown bark. The following four varieties are those which are official. It is impossible, however, to procure either of the genuine Loxa or Crown barks at the present time in this country.

1. *Rusty Crown Bark.*—This is the produce of *C. Condaminea*, var. *Chahuarguera.* It is the *true Chahuarguera* of Howard. It occurs in variously-sized quills, with a whitish or greyish epidermis, which is striated or furrowed longitudinally, is devoid of transverse cracks, and may be removed by the nail. The prevailing tint is a somewhat rusty brown, and on many of the pieces, particularly the larger ones, we observe rusty-coloured warts, which, when numerous, are disposed in irregular longitudinal lines. It has a marked aroma, resembling that of fine crown bark, which latter has been compared by Guibourt to that of tobacco. Though a good bark, and superior in medicinal value to fine crown bark, it commonly fetches a lower price than any other variety of Loxa bark. It contains chiefly cinchonidia, about 1·5 per cent. This and the fine crown bark are the sorts most commonly met with in commerce.

2. *H. O.* Crown Bark; Yellow Crown Bark.*—This appears to be the produce of *C. Chahuarguera*, Pavon, var. *Cascarilla Amarilla del Rey.* It is imported from Payta, and occurs in the form of single or double, fine and middling coated quills, which vary in length from 6 to 15 inches; in diameter from 2 lines to an inch; and in thickness from one-third of a line to 2 lines. It is generally rolled in a double volute. Some of the quills are remarkably devoid of lichens; they are composed of a thin bark, which externally has a brown shrivelled appearance, being covered with numerous longitudinal wrinkles, and having a very few transverse cracks. The transverse fracture is short. The internal surface is of a cinnamon colour, but the fractured surface is pale yellow. Howard adds, that in the freshly-imported bark the colour of the internal surface is of a pale lemon-yellow, which at first contrasts remarkably with the rusty brown of the external surface, and deepens into cinnamon colour on being kept for some time. This is a valuable bark, and well deserves its old reputation.

* H. O. was a brand adopted in the time of the Spanish dominion to indicate this kind of Crown bark.

3. *Red Crown Bark.*—This is the produce of *C. Chahuarguera*, Pavon, var. *Cascarilla Colorada del Rey.* It is far less common than the last-described variety. It is still, however, imported from Payta, and is probably collected in forests near, though not in Loxa. M. Laubert says, 'We have remarked in it the following characters: the epidermis thin, but *rather thicker than that of the yellow* (*amarilla*); wrinkled, of a chestnut-brown, and covered with silvery flakes and very small lichens; transverse fissures *more numerous*, and very distinct; thickness somewhat less than a line, size the same as the former, *internal surface not so fine*, and of a greyish-yellow; no perceptible difference from the *amarilla* in the other qualities.'

4. *Fine Crown Bark.*—This is the produce of *C. Condaminea*, var. *crispa*, *C. crispa*, Tafalla. It is the *silvery crown bark* of the author, the *quina fina de Loja* of Pavon. It is in slender quills, has a silvery appearance externally from the presence of adherent crustaceous lichens, is marked with numerous transverse cracks, and breaks transversely with a brittle vitreous fracture. As already noticed, fine crown bark and rusty crown bark are the most common commercial varieties.

Composition.—Soubeiran states, that 1 pound of Loxa bark yields from 90 to 120 grains of *sulphate of cinchonia.* It is somewhat remarkable that Von Santen obtained quinia, and but little cinchonia, from Loxa bark. Winckler procured from 16 ounces of selected Loxa bark 56 grains of alkaloids; namely, 33 grains of pure quinia and 23 grains of cinchonia. Howard's analyses have shown that the different barks, known in commerce as Loxa or crown bark, vary considerably in the proportion of alkaloids which they contain. Thus, in the larger and thicker *rusty crown* sort, he found from two to three parts of alkaloids in a hundred of bark. The principal constituent was cinchonidia, the cinchonidine of Pasteur, which was associated with more or less quinia. In the *yellow* and *red crown* varieties he also found cinchonidia, associated with traces of quinia and cinchotannic acid. A very fine specimen of '*fine Loxa*' yielded one and a half per cent. of cinchonidia and quinia, with much cinchotannic acid; but ordinary specimens of this latter sort of Loxa bark only yielded on an average from 0·50 to 1·00 percentage of alkaloids. With regard to the old original 'Crown Bark,' from *C. Uritusinga*, Pavon, Howard concluded from his analyses that the total amount of alkaloids it contained equalled the sum total of alkaloids in the Calisaya bark of Bolivia.

[§ *Test.*—200 grains of the bark, treated in the manner directed in the test for yellow cinchona bark, with the substitution of chloroform for ether, should yield not less than 1 grain of alkaloids.]

CINCHONA NITIDA, *Ruiz et Pavon.*

Specific Character.—Leaves lanceolate-obovate, acute, attenuated at the base, smooth on both sides, shining or slighty hairy beneath, not pitted. *Filaments* equalling the anthers. *Capsule* lanceolate, twice as long as it is broad. *Seeds* lanceolate, toothletted at the margin.

Habitat.—In Peru, especially Huanuco, Panatahuas, Casapi, about 10° North latitude.

CINCHONA MICRANTHA, *Weddell.*

Specific Character.—Leaves broadly ovate, obovate, or roundish, rather obtuse, more or less attenuated at the base, membranous, smooth above, very slightly pubescent beneath, pubescent or hairy on the veins and in the axils. *Teeth of the calyx* short and acuminate. *Fruit-bearing panicle* thyrse-like, somewhat compressed. *Capsule* lanceolate. *Wing of the seeds* toothletted at the margin.

Habitat.—This species grows in the Bolivian provinces Larecaja and Caupolican; in Carabaya, and also near Chicoplaya and Playa Grande, in Peru. Cultivated in India, &c.

Cinchona Cinerea. *Silver, Grey, or Huanuco Bark.*

The bark of Cinchona nitida, *Ruiz et Pavon;* and C. micrantha, *Weddell.*

(*Not official.*)

This bark was formerly official in the Edinburgh and Dublin Pharmacopœias under the name of Cinchona cinerea.

Commerce.—Grey bark is collected in Cuchero and Huanuco, and is conveyed to Lima, from whence it is exported to Europe. It comes over in chests, and also in serons. It is now scarce.

General Characters and Varieties.—Grey bark is one of the pale barks of pharmacologists. The names of grey or silver applied to this bark refer to the colour given to the bark by various lichens: that of Huanuco from the neighbourhood in which it is collected. Grey bark always occurs in the form of quills, which are usually coated. Two sorts are distinguished in English commerce,—one as *fine grey bark*; the other as *coarse* or *inferior grey bark.* These sorts generally come over mixed, but sometimes separately.

1. *Fine Grey Bark.*—Howard regards this bark as the produce of *C. nitida.* The length of the quills is from three to fifteen inches; their diameter from two lines to one and a quarter, or even two inches; their thickness one-third of a line to five lines. At the edge of most of the perfect quills we distinctly observe a sharp oblique cut, made probably to loosen the bark. These oblique cuts are rarely found on other barks. The quills are frequently some-

what spirally rolled. We observe on the epidermis numerous short, irregular, transverse cracks; but they do not form rings, as in the Loxa or crown bark, and their edges are flat, scarcely separated or everted. The colour of the outer surface is clear, or silvery grey, or whitish; in the smaller quills it is a uniform whitish grey, while in the large quills we observe a kind of cretaceous covering, owing to the thallus of some crustaceous lichen. The structure of the inner surface of this kind of bark is, in the small quills, smooth; in the larger ones fibrous: the colour is reddish, or rusty brown, rather than cinnamon-brown. The fracture is smooth and resinous; the odour clayish or sweet, and which Bergen says is peculiar to this kind. The taste is astringent, aromatic, and bitter, but not disagreeable; the powder has a deep cinnamon-brown colour.

2. *Inferior or Coarse Grey Bark.—Cascarilla provinciana*, Poeppig.—This is the bark of *C. micrantha.* It has been well described by Guibourt as follows:—'Bark in the form of long tubes, well quilled, of the size of a writing quill to that of the little finger, very frequently wrinkled longitudinally by drying. The external surface is, moreover, moderately rugous, often almost devoid of transverse fissures, having a general deep grey tint, but with black or white spots, and bearing here and there the same lichens as those found on Loxa barks. The liber is of a deep brownish-yellow, and as if formed of agglutinated fibres. The taste is bitter, astringent, acidulous, and aromatic: the odour, that of good grey barks.'

Composition.—A specimen of coarse grey bark examined by Howard yielded 1·773 per cent. of alkaloids; namely, *quinia* 0·243; *quinidia* 0·28; and *cinchonia* 1·25. An analysis of *fine grey bark* by Howard yielded him, 2·113 per cent. of alkaloids; namely, *quinia* 0·571, *quinidia crystallised* 0·142, and *cinchonia* 1·4. All analyses of this bark show that its chief constituent is *cinchonia*, and that it is a valuable bark when of good quality.

CINCHONA CALISAYA, *Weddell.* The Calisaya Cinchona.

Specific Character.—*Leaves* obtuse, oblong or lanceolate-obovate, attenuated at the base, rarely acute at both ends, smooth, shining or pubescent beneath, pitted in the axils of the veins. *Filaments* usually shorter than one half the length of the *anthers. Capsule* ovate, scarcely equal in length to the flowers. *Seeds* frequently fimbriate-denticulate at the margin.—*Weddell, Hist. Nat. des Quinquinas*, pl. 3, 3 bis, and 28.

Varieties.—Weddell has described two varieties of this species, one of which only, var. *vera* (fig. 74), yields the official yellow bark. Its botanical characters are as follows:—

A tall *tree. Trunk* straight or bent, naked, not unfrequently

Fig. 74.

Cinchona Calisaya, var. *vera*.

A. Fruit-bearing branch.
B. Flowers (*natural size*).
C. Corolla laid open (*magnified*).
D. Capsule (*magnified*).
E. Seed (*magnified*).

twice the thickness of a man's body; the leafy head for the most part elevated above all the other forest trees. *Leaves* obtuse, oblong-obovate or oblong-lanceolate.

Habitat.—This variety grows in declivities and upon steep and rugged places of the mountains, at an altitude of from 4,921 to 5,905 English feet, in the hottest forests of the valleys of Bolivia and Southern Peru; between 13° and 16° 30′ south latitude, and from 68° to 72° west longitude; in the Bolivian provinces of Enquisivi, Yungas, Larecaja, and Caupolican; and in the Peruvian province of Carabaya. Cultivated in India, &c.

[§ **Cinchonæ Flavæ Cortex.** *Yellow-Cinchona Bark.*

The bark of Cinchona Calisaya, *Weddell.* Collected in Bolivia and Southern Peru.]

Commerce.—In Bolivia there has been established a monopoly in the trade of this bark, in virtue of which it can be exported only by a National Company at La Paz; and hence the bark sold by this company is usually known in trade as *Monopoly bark.* From time to time it has been found necessary to issue decrees prohibiting, for a limited period, the cutting of the bark, in order to protect the bark-forests whose existence has been endangered by excessive cutting, and also to keep up the price of the bark. Calisaya bark is usually exported from Arica, the nearest Peruvian port to the Bolivian district of La Paz. It is imported in serons.

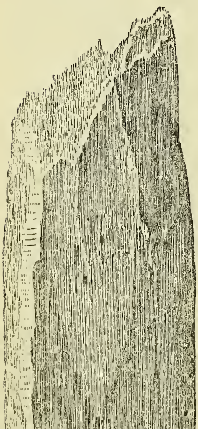
[§ *General Characters.*—In flat pieces, uncoated or deprived of the periderm, rarely in coated quills, from six to eighteen inches long, one to three inches wide, and two to four lines thick, compact and heavy; outer surface brown, marked by broad shallow irregular longitudinal depressions; inner surface tawny-yellow, fibrous; transverse fracture shortly and finely fibrous. Powder cinnamon-brown, somewhat aromatic, persistently bitter.]

Varieties.—Two kinds of yellow-cinchona bark are distinguished in commerce—*quilled* and *flat.* 1. *Quilled Yellow Bark.*—The quills usually met with vary in length from about six to twenty-four inches; in diameter, from one to one and a half inch; and in thickness, from three to six lines. Smaller quills are also occasionally found. Sometimes they are doubly, though in general they are singly quilled. Quilled yellow bark is usually *coated*; but occasionally we meet with quills which are more or less *uncoated.* The periderm or coat varies in its thickness. It is more or less rough, and is marked with transverse impressions, or furrows, or cracks, which often form complete circles or rings around the quills, and whose edges are thick, raised, and everted. When the periderm is very thick, it has a corky or elastic texture, and the annular furrows assume the appearance of deep incisions.

Between the rings there are longitudinal wrinkles and cracks. These furrows and cracks, in the coarser quills especially, give the bark a very rough appearance, by which it may generally be readily distinguished from the large quills of grey bark. The periderm is almost insipid. Its colour is naturally brown, but it is often rendered more or less silvery or grey by the crustaceous lichens with which it is covered. The derm or uncoated portion consists chiefly of liber, whose taste is very bitter and slightly astringent. Externally it is brown, and marked with impressions corresponding to the furrows or cracks of the periderm. Internally it is finely fibrous, and has a deep cinnamon-brown colour. Its transverse fracture is resinous externally, and fibrous internally.

2. *Flat yellow bark.*—The pieces of this variety are from eight to fifteen or eighteen inches long; from one to three inches broad, and from one to five lines thick. They are but little curved or arched; occasionally the inner surface is slightly convex and the outer one concave from drying. In general the pieces are uncoated, and then consist almost solely of liber, which sometimes has a thickness of one-third or even of half an inch. This derm or liber has considerable density, usually a perfectly uniform texture, and on the external surface is marked by longitudinal digital furrows, or shallow depressions, which are more or less confluent and separated from one another by projecting ridges (fig. 75). The colour of its external surface is slightly brownish tawny-yellow, frequently with blackish-red patches. The internal surface is fibrous, often with an undulating grain of a yellowish tawny colour, sometimes with an orange tint, especially when the bark is fresh. The transverse fracture is purely and uniformly fibrous (fig. 75), the fibres being short and readily detached, and irritating the skin like the hairs of the legumes of *Mucuna pruriens.* The longitudinal fracture is without splinters, and presents a surface covered with brilliant points, owing to the reflection of light from the denuded fibres, and of a uniform colour. Its taste is very bitter, — the bitterness being gradually developed on mastication,—with scarcely any astringency.

Fig. 75.



Bark of C. Calisaya entirely deprived of periderm, showing the digital furrows, and the short fibrous fracture of the liber.

Diagnosis.—'The best characters,' says Dr. Weddell, 'by which the true Calisaya may be distinguished from every other species, are—the shortness of the fibres which cover the whole surface of its transverse fracture, and the facility with which they may be detached, instead of being flexible and remaining adherent, as is the case with the barks of *C. rufinervis* and *C. scrobiculata*. Lastly, its uniform dull yellow (tawny) colour, and its substance not being marbled with white, readily distinguishes it from *C. boliviana*. Add to these characters its great density (which is such that when a nail is drawn across it a bright mark is left); the depth of the digital furrows and the prominence of their separating ridges are generally sufficient to distinguish the flat Calisaya from all the other bark with which it may be mixed. The quilled Calisaya is more difficult to distinguish, because its periderm, in its physical characters, greatly resembles several other species, especially *C. scrobiculata* and *C. rufinervis*: and also because the fracture does not present the same clear characters which it does in the older barks.' To these characters we must add the degree of bitterness, which, in doubtful cases, is the most sure method of deciding the question. Barks whose periderms are white or micaceous, or red, or which are devoid of the transverse or angular furrows or cracks, are not genuine Calisaya barks. Those barks whose derm or liber has an ochry or very red tint, or which presents two distinct colours (a whitish one internally and a reddish one externally), or whose fracture is more fibrous internally than externally, are suspicious.

In a paper published by Howard in the *Pharmaceutical Journal*, January 1864, he states that 'in almost every recent importation of the finest Calisaya bark from Bolivia, an unprecedented amount of admixture of the *root bark*' has occurred. This is readily known by its *curly shape*. Howard's experiments show that the root-bark is very inferior to the official stem-bark. This result does not, however, accord with that obtained by some other chemists.

Composition.— Pelletier and Caventou analysed this bark, and found in it *superkinate of quinia*, *cinchonia*, *kinate of lime*, *red cinchonic*, *soluble red colouring matter* (tannin), *fatty matter*, &c. Subsequently, *quinoidine* or *amorphous quinia* has been separated, which Van Heijningen has resolved into four or five different substances, one being a peculiar base called *quinidia*, or *β-quinia*, and another *γ-quinia*. Schwartz has detected both *kinovic* and *cinchotannic* as well as *kinic acid* in this bark. It may be stated generally that 100 parts of yellow or Calisaya bark yield from 3 to $3\frac{1}{2}$ per cent. of crystallised sulphate of quinia; or, 2 pounds avoirdupois of bark yield nearly 1 ounce avoirdupois of the crystallised sulphate. Assuming that this sulphate contains 74·3 per cent. of pure quinia, it follows that 100 parts of Calisaya bark contain from $2\frac{1}{5}$ to $2\frac{3}{5}$ parts of pure quinia. I have heard that as much as 4 per cent. of sulphate of quinia has been obtained from one sample of Calisaya bark.

[§ *Test.*— Boil 100 grains of the bark, reduced to very fine powder, for a quarter of an hour in a fluid ounce of distilled water acidulated with ten minims of hydrochloric acid; and allow it to macerate for twenty-four hours. Transfer the whole to a small percolator, and after the fluid has ceased to drop, add at intervals about an ounce and a half of similarly acidulated water, or add until the fluid which passes through is free from colour. Add to the percolated fluid solution of subacetate of lead, until the whole of the colouring matter has been removed, taking care that the fluid remains acid in reaction. Filter and wash with a little distilled water. To the filtrate add about thirty-five grains of caustic potash, or as much as will cause the precipitate which is at first formed to be nearly redissolved, and afterwards six fluid drachms of pure ether. Then shake briskly, and, having removed the ether, repeat the process twice with three fluid drachms of ether, or until a drop of the ether employed leaves on evaporation scarcely any perceptible residue. Lastly, evaporate the mixed ethereal solutions in a capsule. The residue, which consists of nearly pure quinia, when dry, should weigh not less than 2 grains, and should be readily soluble in diluted sulphuric acid.]

Adulterations and Substitutions.—Various barks, both quilled and flat, which are more or less allied to or somewhat resemble the genuine Calisaya sort, are known to the dealers as *false* or *spurious Calisaya barks.* They are imported from Bolivia and Peru, either alone or intermixed with genuine Calisaya bark, and frequently pass as the latter sort. The following are the more important of these barks:—

1. *Bark of Cinchona Josephiana.*—The shrub called by the Peruvians *Ichu Cascarilla*, which yields this bark, being considered by Weddell to be a variety of *C. Calisaya*, (*C. Calisaya*, var. *Josephiana*,) its bark must rank as a sort of Calisaya, though in appearance it differs considerably from the genuine Calisaya bark. The bark both of the stems and of the root is found in commerce. *Stem-bark.*—Weddell observes of it, that though it rarely occurs in commerce yet by the natives it is used as often as any other bark, in consequence of the facility with which it is procured. Its periderm (or coat), he adds, is brown or blackish-grey or slate-coloured (a colour common to all cinchona barks developed under the influence of wind and sun), and is covered by pale elegant lichens. As the bark adheres strongly to the wood, it is separated with difficulty from the latter; and to this circumstance is to be attributed the fact that the internal surface of this bark is often torn. *Root-bark.*—Weddell was shown in Peru the bark obtained from the larger roots, or rather stumps, of *C. Josephiana.* He describes it as being in short, flattened, undulated, or more or less contorted pieces, deprived of the periderm, fibrous or almost smooth on the inner surface, very slightly cellular, externally of a uniform ochre-yellow colour, and

decidedly bitter, but less intensely so than good Calisaya, whose internal structure it possesses the characters of.

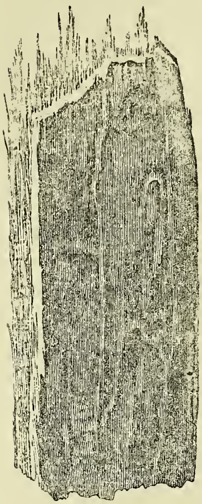
2. *Bark of Cinchona boliviana.*—It is called in Bolivia *Calisaya morada* (mulberry-coloured Calisaya), and in Peru *Cascarilla verde* (green) *morada.* It occurs in both quilled and flat pieces, and greatly resembles the genuine Calisaya, from which it is with difficulty distinguished; but its fibre is somewhat coarser, and more easily reduced to powder. Its taste is bitter, with a somewhat smoky flavour. The fractured surface presents, when quite fresh, paler or whitish patches, which, however, become at first red and afterwards brownish-yellow in the air. The periderm or coat is less thick, and its fissures less marked than in the genuine Calisaya. *Quilled Bolivian bark* is quite similar to quilled Calisaya. *Flat Bolivian bark* is composed solely of liber. It is in general equally dense, but thinner than flat Calisaya. The digital furrows are shallower, a little more confluent, and the separating ridges more rounded. Its colour is brownish fawn-yellow, with somewhat greenish tints in some places. Although the species yielding this bark is, according to Weddell, quite distinct from that which yields the official yellow bark, Howard regards it as a more or less valuable sort of Calisaya.

3. *Bark of Cinchona rufinervis; Cascarilla Carabaya; Cascarilla zamba morada,* Peruv.; *Dark Mulberry-coloured Calisaya.*—Dr. Weddell states that in the province of Carabaya, where this bark is collected, it is habitually used to adulterate Calisaya bark, from which it is with difficulty distinguished. In the quilled variety, called by Weddell *pseudo-Calisaya,* the periderm exfoliates very readily. The flat pieces consist either of liber only, or of liber with a portion of the cellular coat. The fibre is finer and closer than the Calisaya sort; and the external surface presents darkish spots, due to the remains of the cellular crust filled with a brown juice. This bark is called in Peru Carabaya bark, but I apply this name to the bark obtained from *Cinchona ovata,* var. *vulgaris,* of Weddell.

4. *Bark of Cinchona micrantha.*—This occurs in both quilled and flat pieces. It seems probable that the barks of several species are confounded together under the same name. The *quilled micrantha bark,* according to the statements of Poeppig and Reichel, constitutes part of the Huanuco or grey bark of commerce (see Grey Bark). Its characters, as given by Weddell, are as follows: periderm very thin, adherent, slightly wrinkled longitudinally as if shrivelled, or very slightly warty, bright brownish-grey, marbled with some deeper tints. Derm almost smooth externally, finely fibrous, and of a bright orange-yellow internally. Transverse fracture short externally, fibrous internally. Bitterness very marked and rapidly-developed. The *flat micrantha* resembles genuine Calisaya, but is

less dense. It consists either of liber only, or of the liber and cellular coat. The external surface frequently presents concavities or superficial digital furrows, like those of Calisaya bark, and which are separated by irregular suberous elevations. It is much more rarely smooth by the persistence of the whole of the cellular coat; and has a greyish and bright orange-yellow colour. The internal surface is remarkably fibrous, and of a brighter tint than the external one. Transverse fracture stringy throughout the whole thickness of the bark, or somewhat suberous externally. Longitudinal fracture a little splintery, with a dullish surface. Taste very bitter, speedily developed, a little piquant, scarcely styptic.

Fig. 76.



Bark of C. scrobiculata, showing stringy fracture of the liber.

5. *Bark of Cinchona scrobiculata.*—This bark is collected, and sold as a substitute for the Calisaya sort, to which it is greatly inferior. It is to this bark that Guibourt has especially applied the name of *light* (or *flimsy*) *Calisaya of commerce.* If we examine a piece of *flat scrobiculata bark*, we shall find, says Dr. Weddell, that instead of the digital furrows with a fibrous bottom, which characterise Calisaya bark, it presents a surface almost even, and consisting of cellular tissue, traversed here and there by a slight linear impression; the inner surface being, as in Calisaya bark, of a fibrous texture. The transverse fracture is more or less suberous or fungous externally, according to the thickness of the cellular coat; and very fibrous or stringy internally; the fibres being long and pliant (fig. 76).

Weddell makes two varieties of *Cinchona scrobiculata*, namely, var. *genuina* and var. *Delondriana.* The barks of these, although not distinguished by Weddell, are very distinct. The following are the characters they present:—1. *Bark of Cinchona scrobiculata*, var. *genuina.*—This bark is called in Peru red Cuzco or Cusco Bark. It occurs in flat pieces, composed of the liber covered externally by a thin layer of the cellulo-resinous tissue. My specimens are readily distinguishable from Calisaya bark by their fresher or brighter colour, but Weddell states that the colour of this bark is very variable. The external or cellulo-resinous surface is brick-red or purplish-red, or within reddish-orange, and marked by superficial transverse impressions or furrows. The internal surface (of the liber) is of a fine reddish-orange colour. Fracture more or less short or suberous externally, according to the thickness of the cellular coat; fibrous or stringy internally; the colour of the fractured surface is not uniform. Taste both astringent and bitter. The reddish colour of this bark explains why it is called *red bark* (Cascarilla colorada) in Cuzco. This bark is imported both unmixed and mixed with Calisaya. In English commerce the name of Cusco bark is also commonly applied to the bark obtained from *Cinchona pubescens*, var. *Pelleteriana* of Weddell, and this bark is also known as Arica bark. It is substituted for true Calisaya, but may readily be distinguished by its fracture. It is very inferior to true Calisaya. 2. *Bark of Cinchona scrobiculata*, var. *Delondriana.*—This bark is imported from Lima, and is known in English commerce by the name of *Peruvian Calisaya.* It occurs in flat pieces, which in colour closely resemble the genuine Calisaya bark, for which it is often passed off. The pieces are thicker and denser than those of the last described bark, from which they also differ in colour. Externally this bark is smoother than the Calisaya bark, and the ridges between the furrows are smoother and rounded—not sharp, as in the bark just mentioned. The fracture is fibrous: the taste, in the larger pieces, less bitter than that of Calisaya bark. Weddell states that 1,000 parts of the scrobiculata bark yield only from 7 to 8 parts of sulphate of cinchonia, and from 3 to 4 parts of sulphate of quinia; and he adds that the large quantity of red colouring matter which it contains is a great impediment to its use for manufacturing purposes.

6. *Bark of Cinchona australis.*—This bark, which is known in commerce as Cochabamba bark, is also largely used as a substitute for, or intermixed with, the true Calisaya. The bark called Coquetta bark, which is obtained from *Cinchona lancifolia*, Mutis, and which is official as one of the barks directed to be employed in the preparation of sulphate of quinia (see *Cinchona lancifolia*), is also frequently substituted for, or intermixed with, true Calisaya bark.

CINCHONA SUCCIRUBRA, *Pavon, MS. Nueva Quinologia.*
The Red Cinchona.

Specific Character.—A *tree* 15 to 40 feet high; *trunk* erect, with a branched head. *Leaves* petiolate, large, broadly ovate, attenuated at each end, membranous, smooth, somewhat shining and of a full green colour above, paler and downy beneath; petioles and veins red and downy. *Flowers* in dense terminal panicles. *Calyx* adherent, pubescent, turbinate, with a cup-shaped 5-toothed reddish limb. *Corolla* pubescent, salver-shaped, 5-lobed; *lobes* bearded internally with long yellowish-white hairs. *Stamens* included, smooth. *Style* bipartite, included. *Capsule* oblong, slightly incurved. The trunk, when wounded, exudes a milky juice, which afterwards becomes red, whence the name *Cinchona succirubra.*—*Howard's Illustrations*, pl. 9.

Habitat.—Western slopes of Chimborazo, between Chillanes and Guaranda (Huaranda), including the village of San Antonio in the province of Quito. It has also been introduced into India, and is now cultivated with great success in the Neilgherries, &c.

[§ **Cinchonæ Rubræ Cortex.** *Red-Cinchona Bark.*

The bark of Cinchona succirubra, *Pavon, MS.* Collected on the western slopes of Chimborazo.]

History.—The discovery of the source of red-cinchona bark, and the accurate description of the tree which yields it, are mainly due to the investigations of Mr. J. Eliot Howard.

Commerce.—Imported from Guayaquil and Lima in chests. Good samples are scarce. This bark was formerly imported in much larger-sized pieces than are now met with.

General Characters.—[§ In flat or incurved pieces, less frequently in quills coated with the periderm, varying in length from a few inches to two feet, from one to three inches wide, and two to six lines thick, compact and heavy; outer surface brown or reddish-brown, rarely white from adherent lichens, rugged or wrinkled longitudinally, frequently warty, and crossed by deep transverse cracks; inner surface redder; fractured surface often approaching to brick-red; transverse fracture finely fibrous; powder red-brown; taste bitter and astringent.]

Varieties.—Red-cinchona bark occurs in *quills* and *flat* pieces. The *quills* vary in diameter from two lines to an inch and a quarter; and in length from two to twelve or more inches. The so-called *flat pieces* are frequently slightly incurved: their breadth is from one to five inches; their thickness from one-third to three-quarters of an inch; their length from two inches to two feet. Red-cinchona bark is generally coated, and consists of liber, the cellular and suberous coats, and usually more or less of the epidermis: its outer surface is usually rough, wrinkled, furrowed, and frequently warty. The colour of the epidermis varies: in the thinner quills it is greyish-brown, or faint red-brown; in thick quills and flat pieces it varies from a reddish-brown to a chestnut-brown, frequently with a purplish tinge. As a general rule, it may be said that the larger and coarser the quills and pieces, the deeper the colour. Cryptogamic plants are not so frequent on this as on some other kinds of bark. The cellular coat is frequently thick and spongy, especially in large flat pieces; much more so than in yellow-cinchona bark. It forms the round tubercles or warts. The inner surface of the bark is, in the small thin quills, finely fibrous; in the large quills and flat pieces, coarsely fibrous, or even splintery. Its colour increases with the thickness and size of the pieces: thus, in small thin quills it is light rusty-brown; in thick quills and flat pieces it is a deep reddish or purplish-brown. Some of the specimens of red-cinchona bark found in English commerce approach yellow-cinchona bark in their colour. The transverse fracture of thin quills is smooth; of middling quills, somewhat fibrous; of thick quills and flat pieces, fibrous and splintery. The taste is strongly bitter, somewhat aromatic, but not so intense and persistent as that of yellow bark; the odour is feeble and tan-like; the colour of the powder is faint reddish-brown.

Composition.—According to Pelletier and Caventou, red-cinchona bark contains *superkinate of cinchonia*, *superkinate of quinia*, *kinate of lime*, *red cinchonic*, *soluble red colouring matter* (tannin), *fatty matter*, &c. Soubeiran states that one pound of dark-red cinchona bark yields 120 grains of sulphate of quinia and 60 grains of sulphate of cinchonia; while one pound of pale-red cinchona bark yields 90 grains of sulphate of quinia and 60 grains of sulphate of cinchonia. The quantities of cinchonia and quinia obtained from this bark by Van Santen, by Michaelis, by Goebel and Kunze, and by Winckler, varied much in different specimens. Thus, in one pound of bark the amount of cinchonia varied from 20 to 184 grains; and of quinia from 6 to 64 grains. Howard states that the characteristic peculiarity of red-cinchona bark is that it ordinarily contains, and that quite irrespective of the brightness of the colour, a much larger proportion of alkaloids than most other kinds, amounting to as much as 3 to 5 per cent. of the substance of the bark, and this divided amongst the alkaloids quinia, cinchonia, and cinchonidia. In one sample from a new district he chiefly found quinidia.

[§ *Test.*—100 grains of the bark, treated in the manner directed in the test for yellow-cinchona bark, with the substitution of chloroform for ether, should yield not less than 2 grains of alkaloids.]

CINCHONA LANCIFOLIA, *Mutis.* Lance-leaved Cinchona.

Synonym.—Cinchona Condaminea, var. lanceolata, *Weddell.*

Specific Character.—*Leaves* lanceolate or ovate-lanceolate, acute at both ends, without pits. Teeth of the *calyx* short, triangular. *Anthers* usually shorter than the filaments. *Capsules* for the most part lanceolate.—*Hist. Nat. des Quinquinas*, pl. 5.

Habitat.—New Granada, Ecuador, and Peru.

Cinchonæ Lancifoliæ Cortex, *Mutis.* *Lance-leaved Cinchona Bark.*

The bark of Cinchona lancifolia, *Mutis.*

Commerce and Synonyms.—Lancifolia bark used to be brought to England from New Granada, by way of Santa Fé de Bogota down the Magdalena, and from Carthagena on the Atlantic side. In Santa Fé the bark is known by the name of *quina naranjada*, or orange-coloured bark. It is best known to our dealers by the names of Coquetta, and Bogota bark. It is the bark which I formerly designated as *new spurious yellow bark*, and which Guibourt described as spongy Carthagena bark. In English commerce the name of *Carthagena bark* is now applied to a similar bark, chiefly, according to Howard, the bark of *Cinchona Palton*, Pavon, which he considers to be closely allied to *Cinchona lancifolia.* This bark is produced in the district of Cuenca, especially about Gualaquisa, and is shipped from Guayaquil on the Pacific. *Pitayo bark*, supposed by some to be a variety of lancifolia bark, has been shown by Howard to be the produce of a distinct species (*Cinchona Pitayensis*). It is one of the best kinds of bark, and far superior to lancifolia bark, which is now almost entirely neglected by the collectors. Only Pitayo bark is now shipped from the port of Carthagena.

Varieties and General Characters.—The lancifolia barks of commerce vary considerably in appearance. Those obtained from the younger stems and branches would scarcely be identified, by a superficial observer, with those procured from the old stems. But their leading and common peculiarity is an extremely fibrous character, whence they have been called *towy barks* (*quina estoposa*). They may be arranged in two divisions:—1. *Barks of young stems and branches*, mostly quilled, coated usually with a brownish or yellowish epidermis, often covered with whitish crustaceous lichens, which give them a greyish or silvery appearance, as well as with foliaceous and fibrous lichens. The quills vary in size from that of the little finger to an inch and a half in diameter. Some of them are smoothish, others rather rough from numerous short slight cracks (longitudinal and transverse), with slightly everted edges. They are extremely fibrous, and moderately bitter. The smaller quills are not used in the preparation of quinia. 2. *Barks of the trunk, or of old stems* composed of the liber, the cellular coat, and usually a whitish or yellowish-white thin micaceous suberous coat. The larger pieces are semi-cylindrical, or more or less incurved, four or five inches in diameter, and vary in length from one or two to about twenty inches. The liber is extremely fibrous, very slightly bitter, in some pieces almost insipid, and of an orange or red colour. The fracture of the cellular coat is short, of the liber long-fibrous or stringy. Many of the pieces are marked by one or more oblique grooves or depressions apparently produced by a twining plant, and which are almost peculiar to this bark. In general, this bark, as found in commerce, is *trimmed*; that is, part of the outer coat has been removed by rasping. These trimmed pieces are somewhat smooth externally, covered with bark-dust, as if abraded from mutual friction, and present here and there flat and angular marks, the result of the trimming process, and resembling those seen on pieces of Russian rhubarb. In regard to colour there are two sorts of lancifolia bark, one *orange* or *yellow*, the other *red*. *Orange lancifolia bark* is the standard sort, and to which the name of *Coquetta bark* is exclusively applied. It is Guibourt's *quinquina orangé de Mutis*. The *red lancifolia bark* is known in commerce as *red Carthagena bark*. It is Guibourt's *quinquina rouge de Carthagène*. It is a New Granada bark, gathered from a tree growing side by side with that which yields the orange lancifolia bark, and is employed by chemical manufacturers in the preparation of quinidia.

Composition.—This bark yields *quinia*, *quinidia*, and *cinchonia*, but in very variable proportions. In some sorts (e.g. the red Carthagena sort) the *quinidia* greatly predominates; and hence they are sometimes called '*quinidia barks*.'

Pharmaceutical Use.—The bark of Cinchona lancifolia is only official in the British Pharmacopœia as one of the barks directed to be used in the preparation of sulphate of quinia.

Composition of the Official Cinchona Barks.

The principal organic constituents of the official cinchona barks, as determined by Pelletier and Caventou, and subsequently by other chemists, are *volatile oil*, *quinia*, *quinidia*, *cinchonia*, *tannic*, *kinic*, and *kinovic acids*, and *cinchona red*. Puttfarcken found that, by incineration, the cinchona barks yielded from 0·58 to 3·4 per cent. of ashes, the chief constituent of which was carbonate of lime. Puttfarcken's results favour the opinion that with the increase of the alkaloids in the barks, the proportion of lime diminishes. *Volatile Oil of Cinchona Bark* (*Odorous*, *Aromatic Principle*).—By submitting bark with water to distillation, the product has the peculiar odour of the bark, and a bitterish acrid taste; and the oil which floats on the water is thick and butyraceous. From 20 pounds of bark, Trommsdorff obtained two grains of oil. *Tannic Acid*, *Cincho-tannic Acid; Astringent Principle; Soluble Red Colouring Matter*).—Cinchotannic acid differs from the tannic acid of galls in being less astringent, in yielding a green colour or precipitate with the salts of the peroxide of iron, and in the remarkable facility with which its solution absorbs the oxygen of the air, especially under the influence of alkalies, and the compounds which it forms with acids are more soluble than those of gallo-tannic acid. The products of the oxidation of this acid are, cinchona red, carbonic acid, and water. *Cinchona Red* (*Red Cinchonic*).—This is an inodorous, insipid, reddish-brown substance, insoluble, or nearly so, in cold water, somewhat more soluble in hot water, but readily soluble in alcohol and alkalies. As obtained by Schwartz, it is also dissolved easily by ether. Acids favour its solution in water. Its alkaline solution is intensely red. Pelouze and Frémy assert that 'the tannin contained in cinchona is nothing else than catechuic acid, and that red cinchonic is a product of its oxidation which precedes the formation of rubinic acid.' *Kinic Acid* (*Quinic Acid*); $C_7H_{12}O_6$.—Exists in cinchona barks in combination probably with the cinchona alkaloids and with lime. It crystallises from its aqueous solution in large hard transparent prisms with rhombic bases. *Kinovic Acid* (*Kinova Bitter*).—This is a white amorphous substance, almost insoluble in water, but readily soluble in alcohol and ether. A solution of the kinovate of magnesia yields precipitates (*kinovates*) with solutions of acetate of lead, perchloride of mercury, and the salts of cinchonia.

Cinchona Alkaloids.—Three alkaloids obtained from cinchona barks have been more especially used in medicine; viz. *Quinia*, *Quinidia*, and *Cinchonia.* The cinchona alkaloids exist in cinchona bark in combination with one or more acids; according to Henry fils and Plisson, with kinic acid and cinchona red. They reside chiefly in the liber. *Quinia*, *Quinine*; $C_{20}H_{24}N_2O_2$.—Discovered in 1820 by Pelletier and Caventou. It is a probable constituent of all genuine cinchona barks, but especially of the yellow-cinchona bark (*Cinchona Calisaya*), from which it is chiefly obtained. It is also procured by chemical manufacturers from the cheaper but inferior cinchona barks of Carabaya, Bolivia, and New Granada. The simplest, readiest, and cheapest mode of procuring quinia is by adding ammonia to a solution of the sulphate and collecting and drying the precipitated hydrate of quinia. This is usually in the form of a whitish porous mass. Pelletier crystallised it by dissolving it in alcohol of sp. gr. 0·815, and setting the solution aside to evaporate spontaneously in a dry place. Liebig obtained it from a somewhat ammoniacal watery solution, in the form of fine silky needles. Quinia crystallised from its aqueous solution is a *hydrate.* Quinia is inodorous, very bitter, and fusible at about 300° F. The fused mass, when cold, is yellow, translucent, friable, and somewhat like resin in appearance. One part of quinia requires about 400 parts of cold water, or 250 parts of boiling water, or 2 parts of boiling alcohol, and 60 parts of cold ether to dissolve it. The aqueous and alcoholic solutions react as an alkali. Dissolved in either alcohol or acidulated water it possesses the property of left-handed rotatory polarisation. At a temperature above 72° F. this rotatory power decreases. Dilute solutions of quinia (especially an acidulated aqueous solution of the sulphate) exhibit in certain aspects a peculiar azure-blue colour. This property has been denominated by Professor Stokes *fluorescency*, and he has shown that, in this process of true internal dispersion, the chemical or invisible rays of the spectrum, which are more refrangible than the violet rays, change their refrangibility, thereby becoming visible, and producing the blue superficial light in question. There are two sulphates of quinia,—one *neutral* and sparingly soluble in water ($2C_{20}H_{24}N_2O_2.H_2SO_4.7H_2O$); the other *acid* and freely soluble ($C_{20}H_{24}N_2O_2.H_2SO_4.7H_2O$). They are more bitter than the corresponding salts of cinchonia. They yield precipitates on the addition of tannic acid, ammonia, perchloride of mercury, and perchloride of platinum. Hyposulphite of soda causes a white crystalline precipitate when added to a solution of hydrochlorate of quinia. According to Winckler, neither amorphous quinia nor amorphous cinchonia, when saturated with hydrochloric acid, yields any precipitate with the hyposulphite of soda. If chlorine water be added to a solution of a salt of quinia and then ammonia, a green colour is produced. *Amorphous Quinia.*—An uncrystallisable form of quinia contained in the mother liquors from which sulphate of quinia has crystallised, and which is usually found in the substance called *quinoidine.* Winckler states that ordinary quinia may be rendered amorphous by the action of acids, and that the amorphous cinchona alkaloids may be distinguished and separated from the crystalline alkaloids quinia and cinchonia by hyposulphite of soda, which precipitates the latter, from their hydrochloric solution, in the form of crystalline hyposulphites, but occasions no precipitate with corresponding solutions of the amorphous alkaloids. Roder, however, declares that amorphous quinia is merely ordinary quinia combined with a resin.

Quinidia or *Quinidine*; *β Quinine*; $C_{20}H_{24}N_2O_2$.—In 1833, Henry and Delondre discovered this alkaloid, to which they gave the name of *quinidine*; but, in the following year, they declared it to be identical with quinia. In 1848, Van Heijningen recognised it as a peculiar base which possessed the same composition as quinia. He, therefore, called it *β quinine* to distinguish it from ordinary quinia, which he termed *α quinine.* It is found in many, perhaps in most, of the genuine *Cinchona* barks; as in *pale*, *yellow*, and *lancifolia* barks. Howard has also found it in a specimen of *red* bark. It is obtained from them by the same process as that by which quinia is procured from the quinia-yielding barks; but its sulphate, being more soluble than sulphate of quinia, is left in the mother waters. Quinidia readily crystallises by the spontaneous evaporation of its solution in alcohol. The crystals are anhydrous, colourless, hard prisms, with a vitreous lustre. Their taste is bitter, but less so than that of quinia. When heated in a platinum crucible over the flame of the spirit lamp, they at first retain their shape and lustre, and at 347° F. fuse, without either decomposing or giving out water, and form a clear wine-yellow liquid, which, by cooling, congeals into a whitish-grey crystalline mass. If the heat be raised above 347°, the liquid takes fire and burns with a very sooty flame. One part of quinidia is soluble in 2,580 parts of water at 62° F., or in 1,858 parts of boiling water, or in 12 parts of alcohol, sp. gr. 0·835 at 62° F. (in boiling spirit it is freely soluble), or in about 142 parts of ether at 62° F. From both its alcoholic and ethereal solutions it readily crystallises. A solution of quinidia in acidulated water differs from one of quinia, in possessing the property of right-handed polarisation. If the solution of quinidia be treated first with chlorine water, and then with ammonia, it becomes green like a solution of quinia. The salts of quinidia are, for the most part, more soluble in water than those of quinia. They readily dissolve in spirit of wine, but scarcely at all in ether.

Cinchonia; Cinchonine; $C_{20}H_{24}N_2O$. Its presence was inferred in 1803 by Dr. Duncan, jun.; but Gomes first succeeded in obtaining it in 1810. It is a probable constituent of all genuine Cinchona barks. Howard, however, informed Dr. F. J. Farre that, contrary to the general belief, it is rarely found in pale-cinchona bark. It is obtained from the sulphate of cinchonia in the same way that quinia is procured from its sulphate. Cinchonia readily crystallises from its alcoholic solution. The crystals are anhydrous, colourless, inodorous, and bitter, though less so than quinia. Their shape is that of a four-sided prism, with oblique terminal facets. It fuses, but with more difficulty than quinia, and, by the cautious application of heat, it is volatilised, and yields a crystalline sublimate. During its sublimation it evolves an aromatic odour (by which, according to Liebig, it is distinguished from quinia). It is less soluble in water, alcohol, and ether, than quinia. Thus cold water scarcely dissolves any of it, and boiling water takes up only $\frac{1}{2500}$th part of its weight. It is somewhat soluble in spirit of wine, and the more so in proportion as the spirit is stronger and its temperature higher. According to Duflos, strong spirit of wine dissolves only 3 per cent. of its weight of cinchonia. In ether it is insoluble, and by this property it is both distinguished and separated from quinia. Cinchonia dissolved either in alcohol or in acidulated water possesses the property of right-handed rotatory polarisation, and is thereby distinguished from quinia whose rotation is left-handed. Cinchonia and its salts dissolve in solution of chlorine without undergoing any obvious change. In this respect it agrees with quinia and quinidia. But if ammonia be added to the solution, a white precipitate is produced. By this latter character cinchonia is distinguished from both quinia and quinidia. Of the salts of cinchonia, those which are interesting in a medicinal point of view are the sulphate and hydrochlorate.

Table showing the amount of Alkaloids in the official Cinchona Barks.

	Quinia	Quinidia	Cinchonia	Total	Authority
100 parts of *Pale Bark*					
Crown bark, large quills (Chahuarguera, var.)	2·07	0·35	1·43	3·85	Howard.
Red Crown bark, finest	+	+	0·37	1·94	Howard.
HO Crown bark, fine sample . . .	+	+	0·	1·31	Howard.
Rusty Crown bark	0·75	0·58	0·	1·33	Howard.
Fine Crown bark, best	1·00	0·50	0·	1·50	Howard.
Fine Crown bark	+	+	0·03	0·43	Howard.
100 parts of *Yellow Bark*					
Calisaya, large quills, finest . . .	5·00	0·64	0·06	5·66	Howard.
Calisaya, medium	2·5	+	+	..	Riegel.
Calisaya, average produce . . .	2·2 to 2·6	.. ..	.. ..	..	Pelletier & Soubeiran.
Calisaya, flat, with epidermis . . .	2·3 to 2·5	.. ..	0·4 to 0·6	..	Delondre.
Calisaya, quills	1·1 to 1·5	.. ..	0·6 to 0·7	..	Delondre.
100 parts of *Red Bark*					
Red bark, best	2·65	+	1·51	4·16	Riegel.
Red bark, broad, and flat . . .	+	+	+	3·85	Riegel.
Red bark, from Guyaquil . . .	1·5 to 1·9	.. ..	0·7 to 0·9	..	Delondre.
Red bark, bright	1·1 to 1·2	.. ..	0·6 to 0·7	..	Pelouze.
100 parts of *Bark of Cinchona lancifolia*					
Carthagena bark, orange bark of Mutis.	1·15 to 1·2	.. ..	0·46 to 0·62	..	Delondre.
Carthagena bark, fibrous . . .	1·04	.. ..	1·04	2·08	Riegel.
Coquetta bark	0·76	0·15	0·44	1·35	Hindsley.
Lancifolia bark, trimmed . . .	0·34	0·25	0·35	0·94	Hindsley.
Lancifolia bark, uncoated quills . .	0·62	0·23	1·26	2·11	Hindsley.

+ indicates the presence of alkaloids, the amount of which is not stated.

Physiological Effects.—Before I proceed to describe the effects of the cinchona barks, it appears to me desirable to notice the separate effects of those principles on whose combined operation the activity of the bark depends.

Effects of the Active Principles of Cinchona Barks.—The essential or tonic and antiperiodic or specific effects of the bark reside in the cinchona alkaloids; but these are aided by some of the other constituents. The astringent and aromatic qualities of the bark reside in other principles. *Cincho-tannic Acid.*—Like other varieties of tannic acid this acid possesses astringent qualities, and promotes the tonic operation of the alkaloids. *Kinovic Acid.*—Recent investigations have shown that this bitter principle possesses well-marked tonic properties. It has been successfully used in intermittent fevers. *Kinic Acid.*—Nothing positive is known of the effects of kinic acid. *Cinchona Red* or *Red Cinchonic* may perhaps slightly contribute to the astringent and tonic effects of the barks. *Volatile Oil and Resin.*—The aromatic flavour depends on these principles. *Cinchona Alkaloids.* — Quinia, quinidia, and cinchonia, are the alkaloids with whose operation we are more especially acquainted. The effects of the alkaloid cinchonidia appear to be similar to those of cinchonia.

Quinia.—In *small doses* quinia promotes the appetite, and assists digestion. It possesses in a pre-eminent degree the properties of a pure or simple bitter. In *large doses* (as ten to twenty or more grains), sulphate of quinia has produced three classes of effects:—*Gastro-enteritic irritation*, marked by pain and heat in the gastric region, nausea, griping, and purging. *Excitement of the vascular system*, manifested by increased frequency and fulness of pulse and augmented respiration. Fur red tongue, and other symptoms of a febrile state, are also observed. *Disorder of the cerebro-spinal functions*, indicated by headache, giddiness, contracted, in some cases dilated, pupils, disorder of the external senses, agitation, difficulty of performing various voluntary acts (as writing), somnolency, in some cases delirium, in others stupor. Sulphate of quinia has even produced fatal effects, causing, in such cases, violent agitation, followed by furious delirium and death in a few hours. But in many instances no ill effects have resulted from the use of large doses. Sulphate of quinia when taken into the stomach becomes absorbed in the blood, and is eliminated by the urine, the sweat, and the milk.

Quinidia.—But few observations have hitherto been made on the effects of this alkaloid. Bauduin declares it to be as effective a febrifuge as quinia. The *sulphate of quinidia* is the only salt of quinia whose effects have been examined. I have used it at the London Hospital as a substitute for sulphate of quinia, and have found it equally serviceable both as a tonic and febrifuge. Dr. Peacock has administered it as an antiperiodic, in doses of three to six grains, with perfect success. In some cases a dose of fifteen grains was given at first. Dr. Peacock considers quinidia as efficacious as quinia, while it possesses the advantage of not giving rise to the disagreeable nervous effects occasionally observed when quinia is administered in large doses.

Cinchonia.—When cinchonia and quinia were first submitted to examination, cinchonia and its salts were thought, principally on the evidence of Chomel, to be much inferior in activity to quinia and its salts. But subsequent observations have appeared to prove that the sulphates of these alkaloids may be substituted for each other. As cinchonia and its salts are less bitter than quinia and its salts, we might expect that the former would possess somewhat less medicinal activity than the latter; and this inference is doubtless correct. Moreover, I have been informed that large doses of sulphate of cinchonia are more apt to create nausea and vomiting than similar doses of quinia. I must confess, however, that I have been unable to verify this. I have extensively used in hospital practice sulphate of cinchonia, in doses not exceeding ten grains, and have not met with the nausea and vomiting I expected would have followed its employment. I have found the sulphate of cinchonia valuable both as a tonic and as a febrifuge or antiperiodic. Bouchardat, Delondre, and Gerault have made numerous experiments, comparing the effects of cinchonia with quinia, and they assert, that though the action of cinchonia on a healthy man presents considerable resemblance to that of quinia, still there exist differences which are not merely in degree. Thus, the sulphate of cinchonia does not cause noises in the ears and disturbances of vision, so readily as sulphate of quinia ; but in smaller doses, and more frequently than the latter, it causes a severe headache, which affects the forehead in particular, and is accompanied by a remarkable feeling of compression. These symptoms are observed after a dose of from 9 to 15 grains, which quantity of cinchonia is followed by precordial pain, and a very evident debility (which may even bring on syncope) more often, and to a greater degree, than would occur after a similar dose of quinia. Sulphate of cinchonia appears to be equal to sulphate of quinia in the treatment of the milder cases of intermittent fever when time is not important, and there is no reason to dread a severe attack ; but in the more severe cases the sulphate of quinia ought to be preferred. The salts of cinchonia, except the sulphate, have been imperfectly examined.

The opinion of the author of the relative value of cinchonia and quinia is here given at length : but the question is still undecided, as will be seen from the opposite conclusions arrived at by Dr. Daniel and Dr. Macpherson. Dr. Daniel, after administering cinchonia, in the doses in which sulphate of quinia is usually given to European and Negro soldiers in Sierra Leone and Jamaica, while suffering from the milder forms of remittent and intermittent fever, was obliged to discontinue the medicine in consequence of the headache and cerebral disturbance induced ; and he concludes that in tropical diseases cinchonia can never be resorted to as an efficient substitute for quinia. Dr. Macpherson, Presidency-Surgeon in Bengal, after long observation found that cinchonia in the state of sulphate produced effects precisely similar to those of quinia, the same cerebral disturbance, and the same amount of irritation of the digestive organs ; only its power was less by about one-third ; and he concludes that it is absolutely certain that cinchonia is as good a febrifuge as quinia. These results of Dr. Macpherson are generally in accordance with those now more commonly obtained by medical practitioners.

Effects of the Cinchona Barks.—The *topical effects* are astringent and slightly irritant. The astringency depends on tannic acid and red cinchonic : hence those barks whose infusions are most powerfully affected by gelatine and the persalts of iron possess the greatest astringent power. The *constitutional effects* vary with the condition of the patient. In some conditions of system cinchona bark operates as an *irritant* or *stimulant*; in others as a *stomachic*, *tonic*, or *corroborant*. If a man in a state of perfect health take a small or moderate dose of bark, no obvious effects are produced,—or perhaps a little thirst, with some slight disorder of stomach; or a temporary excitement of appetite may be brought on. An increased dose occasions a dry tongue, nausea, vomiting, loss of appetite, thirst, constipation, and even purging, a quick pulse, a throbbing headache, and giddiness. The disturbance of the stomach is produced not only when the bark is given in the more nauseating form of powder, but also in the form of infusion, extract, decoction, or tincture. These symptoms indicate a stimulant operation, which is still more manifest when the bark is given to a person suffering with gastro-enteritic irritation, accompanied with fever. All the morbid phenomena are exasperated, the febrile disorder is increased, and symptoms of gastritis come on. None of the effects now enumerated include those to which the term *tonic* is properly applicable. These are to be sought for in patients suffering from debility, without symptoms of local irritation. In such we find cinchona barks improve the appetite, promote the digestive functions, and increase the strength of the pulse. The muscular system acquires more power, and the individual is capable of making greater exertion, both mental and bodily, than before; the tissues acquire more firmness to the touch, and lose their previous flabbiness: moreover, it has been asserted (and with great probability of truth) that the quality of the blood improves.

Comparison of the Cinchona Barks with each other.—Those barks are the most active which contain the largest proportion of the cinchona alkaloids, especially of quinia. In this point of view *yellow-cinchona bark* stands pre-eminent. *Red-cinchona bark* is also a very valuable sort. The experiments and observations of Saunders, Rigby, and Skeete, seem to have established its superiority to *pale-cinchona bark.* But in adopting this statement we ought, if possible, to ascertain what kind of pale-cinchona bark was used in making the above experiments and observations; and also to determine whether the red-cinchona bark referred to be identical with that now found in commerce. Howard has shown that the *original* or *old Loxa bark*, the sort probably which was originally employed under the name of pale or Crown bark, is as rich in cinchona alkaloids as many specimens of Calisaya bark. As an astringent yellow-cinchona bark is inferior to pale-cinchona bark, on account of its containing a smaller proportion of tannic acid.

Comparison of the Effects of the Cinchona Barks with their Alkaloids.—It has been asserted, that the cinchona alkaloids possess all the medicinal properties of the barks, and may be substituted for them on every occasion; but I cannot subscribe to either of these statements; for, in the first place, the alkaloids are deficient in the aromatic quality possessed by the barks, and which assists them to sit easily on the stomach; and it is to this circumstance that I am disposed to refer a fact which I have often observed, that sulphate of quinia will sometimes irritate the stomach, occasion nausea and pain, and give rise to febrile symptoms, while the infusion of bark is retained without the least uneasiness. Moreover, we must not overlook the tannic acid, which confers on bark an astringent property. So that, while we admit that the essential tonic operation of the barks depends on the alkaloids which they contain, yet the latter are not always equally efficacious.

Therapeutics.—As a general or constitutional remedy, the indications for the use of cinchona bark are, debility with atony and laxity of the solids, and profuse discharges from the secreting organs. I have observed that it proves less successful, and often quite fails, when the complexion is chlorotic or anæmic: in such cases chalybeates often succeed where cinchona bark is useless or injurious. As contra-indications for its employment, may be enumerated acute inflammation, inflammatory fever, plethora, active hemorrhages, and nervous and vascular irritation. To these may be added, an extremely debilitated condition of the digestive and assimilative organs. Thus patients recovering from protracted fever are at first unable to support the use of bark, which acts as an irritant to the stomach, and causes an increase of the febrile symptoms. But the diseases in which this remedy manifests the greatest therapeutic power, are those which assume an intermittent type.

In periodic or intermittent diseases.—In such cases cinchona barks and sulphate of quinia stand pre-eminent for their success, and are usually resorted to. There are two modes of attempting the cure of an intermittent by cinchona bark: one is, to put an immediate stop to the disease by the use of very large doses of the remedy given a few hours prior to the recurrence of the paroxysm; the other is to extinguish the disease gradually by the exhibition of moderate doses at short intervals during the whole period of the intermission, so that the violence of every succeeding paroxysm is somewhat less than that of the preceding one. It has been asserted that cinchona bark is admissible in the interval only of an intermittent fever; and that if it be exhibited during the paroxysm it has a tendency to prevent the subsidence of the latter. But this statement is much overcharged. Morton and others have given it in almost every stage without injury. It is, however, more efficacious during the interval, though it may not be absolutely hurtful in the paroxysm. Dr. Cullen was strongly of opinion that the nearer the exhibition of the cinchona bark is to the time of accession, the more certainly effectual will it be. Dr. Elliotson and others gave one large dose, fifteen grains, immediately after the fit. Dr. F. J. Farre says, 'I commonly give one large dose, say ten grains, an hour *before* the fit is expected, and find it succeed.' A very necessary condition to its perfect success is, that it should sit well on the stomach; for if it occasion vomiting or purging it is much less likely to act beneficially. Hence an emetic and a purgative are recommended to precede its employment. A senna draught, with a calomel pill, forms a good purgative. To enable it to sit well on the stomach, cinchona bark or the sulphate of quinia is frequently given in conjunction with aromatics. The infusion or decoction of cinchona bark though much less effective, is, however, less liable to disturb the stomach than the powder of cinchona bark or the sulphate of quinia. Opium is sometimes a necessary adjunct to cinchona bark to prevent its running off by the bowels. Both cinchona bark and sulphate of quinia are often better borne by the stomach after a meal. In some cases where the stomach was too irritable to admit of the administration of cinchona bark or sulphate of quinia by the *mouth*, these agents have been otherwise introduced into the system in the form of enemas. Cinchona bark and its preparations prove most successful in the simple or uncomplicated form of intermittents; that is, where the disease appears to be purely nervous. But when agues are accompanied with inflammatory excitement or with visceral disease, cinchona bark generally proves either useless or injurious. In remittents it proves much less successful than in regularly-formed intermittents. It has been supposed that quinia cured ague by diminishing the volume of the spleen. Intermittent fevers are not the only periodical diseases in which cinchona bark has been found beneficial. It is a remedy which has proved serviceable in several other cases in which a paroxysm of pain, spasm, inflammation, hemorrhage, or fever returns at stated periods. Thus intermittent neuralgia, rheumatism, headache, amaurosis, catarrh, ophthalmia, stricture, &c., have been greatly benefited by its use. When periodical diseases recur at uncertain periods, as in the case of epilepsy, no particular advantage can be expected from the use of cinchona bark.

In continued fever.—In the latter stage of continued fever, when the vital powers are beginning to sink, and when there are no marked and decided symptoms of inflammatory disease of the brain or digestive organs, cinchona bark or sulphate of quinia sometimes proves highly beneficial. If the tongue be dry, as well as furred, and the skin hot and dry, no advantage, but the reverse, can be anticipated from its employment. It is most applicable to the low forms of fever occurring in debilitated constitutions. When exacerbations or remissions, however indistinct, occur at regular periods, the administration of cinchona bark is more likely to be followed by good effects. Under the preceding circumstances there can scarcely be two opinions as to the admissibility of the bark. But on the general propriety of administering this remedy in continued fever, considerable difference of opinion has prevailed. Dr. Heberden cautiously observes, 'I am not so sure of its being useful, as I am sure of its being innocent.' In order to avoid offending the stomach, it is frequently advisable to begin with the infusion, for which, afterwards, first the decoction, or fluid extract, and then the sulphate of quinia may be substituted. Dr. F. J. Farre says: 'I am in the habit of treating typhus fever, as soon as the alvine evacuations have become tolerably natural, with three or four grains of sulphate of quinia every three or four hours, and find its effect very beneficial, and free from any disturbance of the head, stomach, or bowels. In typhoid fever, in consequence of the frequent ulceration of the bowels, this remedy is not so well borne. It is said to produce deafness when given in these doses; but deafness is an ordinary consequence of fever, and I never find that quinia occasions it, until the patient's improvement renders such doses unnecessary. I need hardly add, that I do not adopt this treatment with any expectation of *stopping* the fever.'

In inflammatory diseases.—As a general rule, stimulants and tonics, as cinchona bark, are improper in inflammatory diseases. Yet to this statement, which applies principally to the first stage, to acute and active cases, and to the disease when it occurs in strong and vigorous habits, many exceptions exist. Thus when it takes place in old and debilitated constitutions; when it is of a mild or atonic character, and has existed for some time without giving rise to any obvious organic changes; cinchona bark is sometimes admissible and advantageous after evacuations have been made proportioned to the activity of the disease and the vigour of the system. *In scrofulous inflammation* (as of the eye) its value, especially in combination with bicarbonate of soda, is fully appreciated. *In rheumatism*, and in *erysipelas*, it is also much esteemed. *Erythema nodosum*, which chiefly occurs in persons of a rheumatic constitution, or who have rheumatic fever, rapidly subsides under its use.

In maladies characterised by atony and debility.—Cinchona bark is useful in a great variety of diseases dependent on, or attended by, a deficiency of tone or strength, as indicated by a soft and lax condition of the solids, weak pulse, incapability of great exertion, impaired appetite, and dyspeptic symptoms. Thus, *in chronic atonic affections of the alimentary canal*, it proves very serviceable, especially in some forms of dyspepsia and anorexia. In these it should be given half an hour or an hour before meal-times. *In some chronic maladies of the nervous system*, as chorea, when it occurs in delicate girls; also in the neuralgia of weakly subjects. *In mortification*, it is useful in those cases in which tonics and astringents are obviously indicated; but it has no specific power of checking the disease, as was formerly supposed. It may also be employed *in passive hemorrhages*, from relaxation of vessels, as in some cases of profuse menstruation, or uterine hemorrhage consequent on miscarriage; *in profuse mucous discharges*, with great debility, as in leucorrhœa, excessive bronchial secretion, old diarrhœas, &c.; *in cachectic diseases*, as enlargements and indurations of the absorbent glands, of a scrofulous nature, ophthalmia, obstinate ulcers, &c. Also in venereal diseases, when the secondary symptoms occur in shattered and broken-down constitutions, and after the full use of mercury. Likewise in some of the chronic skin diseases, which are seen in cachectic habits. *In the convalescence* of either acute or chronic lingering diseases, as fever, inflammation, hemorrhage, profuse suppuration, &c.; also after important surgical operations, when the strength is greatly reduced. In no class of cases is the efficacy of cinchona bark or its alkaloids more manifest than in these.

As a topical astringent and antiseptic.—The efficacy of cinchona bark as an astringent and antiseptic depends on tannic acid. But as many vegetable substances exceed cinchona bark in the quantity of this acid which they contain, so they surpass it in astringency. Hence the topical uses of the bark are comparatively unimportant; and, for the most part, are nearly obsolete. Powdered red-cinchona bark is frequently employed as a tooth-powder. The decoction, with or without hydrochloric acid, is applied as a gargle in putrid sore-throat.

Administration.—In the form of *powder*, cinchona bark is now rarely administered. The bulk of a full dose, its disagreeable taste, its tendency to cause nausea and vomiting, and the quantity of inert woody fibre which it contains, form great objections to its employment. Yet of its great efficacy, as a febrifuge or anti-periodic, in intermittents, and of its superiority in these cases to the decoction, or infusion, no doubt can exist; but sulphate of quinia has almost entirely superseded it. The dose of the powder of cinchona bark is from 20 to 60 grains, or even more than this when the stomach can bear it.

Official Preparations of Yellow-Cinchona Bark.

[§ **Decoctum Cinchonæ Flavæ.** *Decoction of Yellow-Cinchona.* Take of

Yellow-Cinchona Bark, in coarse powder . $1\frac{1}{4}$ ounce.
Distilled Water . . . . 1 pint.

Boil for ten minutes in a covered vessel. Strain the decoction, when cold, and pour as much distilled water over the contents of the strainer as will make the strained product measure one pint.

Dose.—1 to 2 fluid ounces.]

By boiling, water extracts from yellow-cinchona bark the kinates of quinia, cinchonia, and lime, gum, tannic acid, starch, and a portion of the compound of the red cinchonic with the cinchona alkaloids. While hot, the liquor is transparent; but, as it cools, it becomes turbid,—owing partly to the deposition of the tannate of starch when the temperature falls below 88° F., and partly because the red cinchonic compound, being more soluble in hot than in cold water, is deposited on cooling. If the deposit, with a portion of the supernatant liquor, be poured off and gently heated, it is dissolved. The perchloride of iron almost blackens it: a few drops of sulphuric acid and a few drops of tincture of iodine render it bluish-black,—indicative of the presence of starch. Of 146 parts of the deposit from decoction of yellow-cinchona, Soubeiran found 60 parts (principally tannate of starch) were insoluble in alcohol, and the remaining 86 parts were readily soluble in alcohol, and yielded the cinchona alkaloids. The same author also found that, by decoction, yellow-cinchona bark lost two-thirds of its weight; whereas, by infusion, it merely lost one-third. If the water employed in preparing the decoction or infusion be acidulated (with sulphuric or hydrochloric acid), the medicinal value of the preparation is greatly increased; for the acid decomposes the insoluble red cinchonic salt, and forms with the cinchona alkaloids a soluble combination. Decoction of yellow-cinchona is stomachic, tonic, and febrifuge.

[§ **Extractum Cinchonæ Flavæ Liquidum.** *Liquid Extract of Yellow-Cinchona.*

Take of

Yellow-Cinchona Bark, in coarse powder	1 pound.
Distilled Water	a sufficiency.
Rectified Spirit	1 fluid ounce.

Macerate the cinchona bark, in two pints of the water, for twenty-four hours, stirring frequently; then pack in a percolator, and add more water, until twelve pints have been collected, or until the water ceases to dissolve anything more. Evaporate the liquor at a temperature not exceeding 160° to a pint; then filter through paper, and continue the evaporation to three fluid ounces, or until the specific gravity of the liquid is 1·200. When cold, add the spirit gradually, constantly stirring. The specific gravity should be about 1·100.

Dose.—10 to 30 minims.]

This preparation is similar to the *Infusum Cinchonœ spissatum* (*Lond.*). [The latter preparation was the *Liquor Cinchonœ* of Mr. Battley, the formula for which was furnished by that gentleman to the London College of Physicians. Percolation is now employed (as it was by Mr. Battley, though not by the London College), and a larger quantity of water, by which the bark is more thoroughly exhausted, and the evaporation is conducted at a lower temperature. —F. J. F.] Four fluid ounces represent one pound of the bark. In a general way, 1 fluid drachm may be considered equal to 8 fluid ounces of the infusion.

[§ **Infusum Cinchonæ Flavæ.** *Infusion of Yellow-Cinchona.*

Take of

Yellow-Cinchona Bark, in coarse powder	$\frac{1}{2}$ ounce.
Boiling Distilled Water . . .	10 fluid ounces.

Infuse in a covered vessel, for two hours, and strain.

Dose.—1 to 2 fluid ounces.]

The water extracts from yellow-cinchona bark, the gum and a portion of the kinates of quinia, cinchonia, and lime, tannic acid, and a little starch. The greater part of the cinchona alkaloids remains in the marc, as a very small quantity only of the compound of red cinchonic and the cinchona alkaloids is extracted. The infusion of yellow-cinchona is stomachic and tonic, but is scarcely energetic enough to be febrifuge. It is a light preparation, applicable as a tonic where the stomach is very delicate, and cannot support the more active preparations of this medicine.

[§ **Tinctura Cinchonæ Flavæ.** *Tincture of Yellow-Cinchona.*

Take of

Yellow-Cinchona Bark, in moderately fine powder	4 ounces.
Proof Spirit	1 pint.

Macerate the cinchona bark for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

Spirit extracts all the bitter and astringent principles of yellow-cinchona bark, the kinates of the alkaloids, as well as the combinations of these substances with the red cinchonic. If the spirit be too concentrated, the kinates are less readily dissolved by it. This tincture is about two-thirds of the strength of the London tincture, in consequence of the additional spirit used to replace the tincture which is retained in the marc. Tincture of yellow-cinchona is stomachic, tonic, and stimulant. It is usually employed as an adjuvant to the infusion or decoction of yellow-cinchona, or to the solution of the sulphate of quinia.

Pharmaceutical Uses.—Yellow-cinchona bark is also used in the preparation of sulphate of quinia.

Official Preparation of Pale-Cinchona Bark.

[§ **Tinctura Cinchonæ Composita.** *Compound Tincture of Cinchona.*

Take of

Pale-Cinchona Bark, in moderately fine powder	2 ounces.
Bitter-Orange Peel, cut small, and bruised	1 ounce.
Serpentary Root, bruised	$\frac{1}{2}$ ounce.
Saffron	60 grains.
Cochineal, in powder	30 grains.
Proof Spirit	1 pint.

Macerate the cinchona bark, and the other solid ingredients, for forty-eight hours, in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

This is usually sold as *Huxham's Tincture of Bark.* It is a more agreeable and more stimulant, though less powerful, tonic than the tincture of yellow-cinchona, and is less apt to disturb the stomach. It contains only half as much pale-cinchona bark as the simple tincture contains of yellow-cinchona bark. It is employed as a tonic and stomachic.

Pharmaceutical Use.—Pale-cinchona bark is also an ingredient in aromatic mixture of iron.

[§ **Quiniæ Sulphas.** *Sulphate of Quinia.*

$C_{40}H_{24}N_2O_4,HO,SO_3 + 7HO$, or $\mathbf{(C_{20}H_{24}N_2O_2)_2H_2SO_4.7H_2O}$.

The sulphate of an alkaloid, prepared from Yellow-Cinchona bark, and from the bark of *Cinchona lancifolia*, Mutis.]

Preparation and Source.—Sulphate of quinia was for some years prepared exclusively from yellow-cinchona bark, but the monopoly of the trade of this bark established in Bolivia has forced the manufacturers of quinia to use as substitutes the generally inferior, but cheaper, quinia-yielding barks of New Granada. The barks so employed are chiefly the produce of *Cinchona lancifolia*, Mutis, and *C. Pitayensis*. The process given in the Pharmacopœia for preparing sulphate of quinia from yellow-cinchona bark, will succeed equally well with the lancifolia barks of New Granada.

[§ It may be obtained by the following process:—

Take of

Yellow-Cinchona Bark, in coarse powder	1 pound.
Hydrochloric Acid	3 fluid ounces.
Distilled Water	a sufficiency.
Solution of Soda	4 pints.
Diluted Sulphuric Acid	a sufficiency.

Dilute the hydrochloric acid with ten pints of the water. Place the cinchona bark in a porcelain basin, and add to it as much of the diluted hydrochloric acid as will render it thoroughly moist. After maceration, with occasional stirring for twenty-four hours, place the bark in a displacement apparatus, and percolate with the diluted hydrochloric acid, until the solution which drops through is nearly destitute of bitter taste. Into this liquid pour the solution of soda, agitate well, let the precipitate completely subside, decant the supernatant fluid, collect the precipitate on a filter, and wash it with cold distilled water, until the washings cease to have colour. Transfer the precipitate to a porcelain dish containing a pint of distilled water, and applying to this the heat of a water-bath, gradually add diluted sulphuric acid until very nearly the whole of the precipitate has been dissolved, and a neutral liquid has been obtained. Filter the solution while hot through paper, wash the filter with boiling distilled water, concentrate till a film forms on the surface of the solution, and set it aside to crystallise. The crystals should be dried on filtering paper without the application of heat.]

In this process the salts of quinia are dissolved out of the bark by the diluted hydrochloric acid; and the solution is decomposed by soda. The impure alkaloid is precipitated, and afterwards washed, to remove the saline matters; and the quinia is gradually treated with very dilute sulphuric acid, until nearly the whole of it is dissolved, that the solution may remain neutral. It is then filtered, evaporated, and crystallised. If other alkaloids are present, they will remain in solution after the crystallisation of the sulphate of quinia.

General Characters and Tests.—[§ Filiform silky snow-white crystals, of a pure intensely bitter taste, sparingly soluble in water, yet imparting to it a peculiar bluish tint. The solution gives with chloride of barium a white precipitate insoluble in nitric acid, and when treated first with solution of chlorine and afterwards with ammonia it becomes of a splendid emerald-green colour. Dissolves in pure sulphuric acid with a feeble yellowish tint, and undergoes no further change of colour when gently warmed. Ten grains with ten minims of diluted sulphuric acid and half a fluid ounce of water form a perfect solution, from which ammonia throws down a white precipitate. This redissolves on agitating the whole with half a fluid ounce of pure ether, without the production of any crystalline matter floating on the lower of the two strata, into which the agitated fluid separates on rest. 25 grains of this salt should lose 3·6 grains of water by drying at 212°.] Sulphate of quinia is odourless, and the filiform crystals have a flexibility like asbestos. Exposed to the air, they effloresce slightly. When heated they become luminous; friction promotes this phosphorescence. At 240° F. they melt like wax; at a more elevated temperature the salt assumes a fine red colour, and when ignited in the air burns, leaving at first a carbonaceous residuum, which is subsequently dissipated. One part of this salt requires 80 parts of cold alcohol (sp. gr. 0·850) or 740 parts of cold, or 30 parts of boiling water to dissolve it: as the saturated solution cools, part of the salt separates. A remarkable property of this salt is to give a blue tinge to the surface of water. By exposure to the air the crystals lose 4 (Soubeiran says 6) equivalents of water, equal to about 8 per cent. When fused they evolve two more equivalents. 100 grains of the crystals dissolved in water, acidulated with hydrochloric acid, yield, by the addition of chloride of barium, a quantity of sulphate of baryta, which when ignited weighs 26·6 grains.

Adulterations.—Various foreign bodies (as earthy and alkaline salts, gum, sugar, starch, fatty matters, sulphate of cinchonia and of quinidia, and salicine) are, it is said, occasionally intermixed with sulphate of quinia. The following are the tests by which the presence of these bodies is ascertained:—By digesting sulphate of quinia in alcohol, this salt is dissolved, leaving any alkaline or earthy sulphates, gum, or starch, that may be present. Gum is soluble in cold water; starch is coloured blue by solution of iodine. When heated in the open air the sulphate of quinia is burned and dissipated: the earthy salts, on the other hand, are left. The sulphate is soluble in water acidulated with sulphuric acid, whereas fatty matters are insoluble. To detect sugar, add to a solution of the sulphate, carbonate of potash: quinia is precipitated, while sulphate of potash and sugar are left in solution: the latter may be detected by its sweet taste, or by evaporating the liquor to dryness, and digesting the residue with spirit, which dissolves the sugar but leaves the sulphate. Ammoniacal salts are detected by the ammoniacal odour emitted on the addition of caustic potash. Salicine may be recognised by oil of vitriol, which turns it red. Sulphate of cinchonia may be made to crystallise, in a pulverulent form, by stirring the solution, and in this state it may be readily intermixed with sulphate of quinia. To detect it, precipitate a solution of the suspected salt in water by potash; collect the precipitate, and boil it in alcohol. The cinchonia crystallises as the liquor cools, while the quinia remains in the mother liquor. Or Schweitzer's ether test may be used by precipitating the suspected specimen by solution of ammonia and then adding ether, when the quinia will be dissolved, but the cinchonia will float undissolved between the two liquids. This test is recommended by the French Government, who refuse to allow the sale of sulphate of quinia containing more than 3 per cent. of cinchonia. The same test will indicate the presence of quinidia, but this is partly soluble in ether. Howard states that the admixture of quinidia with quinia may be detected by boiling 100 grains of the suspected salt in two ounces of water: it will not be entirely dissolved if it is all sulphate of quinia; but on adding two ounces more water, and again boiling, a clear solution will be obtained, from which, after cooling for six hours, only 10 grains of pure sulphate of quinia will remain in solution, but of sulphate of quinidia no less than 46 grains: hence the crystals in one case will weigh 90, in the other 54 grains.

Dose.—1 to 10 grains.

Pharmaceutical Use.—It is used in the preparation of citrate of iron and quinia.

[§ **Pilula Quiniæ.** *Pill of Quinia.*

Take of

Sulphate of Quinia	60 grains.
Confection of Hips	20 grains.

Mix them to a uniform mass.

Dose.—2 to 10 grains.]

[§ **Tinctura Quiniæ.** *Tincture of Quinia.*

Take of

Sulphate of Quinia	160 grains.
Tincture of Orange Peel . . .	1 pint.

Dissolve the sulphate of quinia in the tincture with the aid of a gentle heat; then allow the solution to remain for three days in a closed vessel, shaking it occasionally; and afterwards filter.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

A fluid drachm contains about one grain of the sulphate of quinia.

[§ **Vinum Quiniæ.** *Wine of Quinia.*

Synonym.—Quinine Wine.

Take of

Sulphate of Quinia	20 grains.
Citric Acid	30 grains.
Orange Wine	1 pint.

Dissolve, first the citric acid, and then the sulphate of quinia, in the wine; allow the solution to remain for three days in a closed vessel, shaking it occasionally; and afterwards filter.

Dose.—½ to 1 fluid ounce.]

A fluid ounce contains one grain of the sulphate of quinia.

UNCARIA GAMBIR, *Roxburgh.* **The Gambir Plant.**

Botanical Character.—A stout climbing *shrub*, with round branches. *Leaves* ovate-lanceolate, acute, shortly petiolate, smooth; *stipules* ovate. *Peduncles* axillary, opposite, bracteolated about the middle; the lowest ones sterile, and ultimately converted into hooked spines. *Flowers* in loose heads, green and pink. *Calyx* adherent, short, urceolate, 5-cleft. *Corolla* funnel-shaped; throat naked, *lobes* 5, spreading, oval-oblong. *Stamens* 5. *Style* filiform, protruded; *stigma* tumid, undivided. *Fruit* capsular, stalked, clavate, 2-celled, 2-valved. *Seeds* numerous, winged.—*Trans. Linn. Soc.* vol. ix. pl. 22 (*Nauclea Gambir*).

Habitat.—Islands of East Indian Archipelago. Extensively cultivated; especially so on the island of Bintang.

[§ **Catechu Pallidum.** *Pale Catechu.*

An extract of the leaves and young shoots of Uncaria Gambir, *Roxburgh.* Prepared at Singapore and in other places in the Eastern Archipelago.]

Commercial Kinds of Catechu.—The term *catechu*, from *cate* a tree, and *chu* juice, is applied to various astringent extracts. Three of these are more especially known in commerce as follows:—1. *Gambir Catechu*, which is the substance we are now describing, under the official name of *Catechu pallidum*; 2. *Cutch, Catechu of the Acacia Catechu*, which will be afterwards described under the name of *Catechu nigrum* (see *Acacia Catechu*); and 3. *Ceylon Catechu*, or *Betel-nut Catechu*, which is obtained from the seeds of *Areca Catechu.*

Preparation of Pale Catechu.—Dr. Roxburgh describes its manufacture as practised eastward to the Bay of Bengal. The process consists in 'boiling the leaves and young shoots; evaporating the decoction by fire and the heat of the sun. When sufficiently inspissated, it is spread out thin, and cut into little square cakes, and dried.' Mr. Bennett has given a very full account of the method of making it as practised at Singapore. The leaves are boiled, and the decoction thus obtained is evaporated to the consistence of a very thick extract, of a light yellowish-brown colour, like clay, which is placed in oblong moulds. The pieces thus obtained are divided into squares, and dried in the sun. Hunter says, sago is often intermixed with the extract, but Bennett denies that this is done at Singapore. *Gambier* or *Gambir* is the Malay name for this extract. The best gambir is made at Rhio, in the island of Bintang; the next best is that of Lingin.

Commerce.—Pale Catechu or Gambir is principally imported from Singapore. Its chief use here is for tanning; and among dealers it is distinguished from black catechu, cutch, &c., by the name of *terra japonica.* (See *Acacia Catechu.*)

General Characters.—Pale Catechu occurs in cubes, whose faces are about one inch square. When thrown into water these cubes float. They are externally of a deep reddish or yellowish-brown colour; their fracture is dull and porous, and internally their colour is paler than that of their surface, being yellowish-cinnamon brown. The cubes are frequently combined together so as to form masses of variable size. Catechu has no odour; its taste at first is powerfully astringent and bitter, but subsequently sweetish. It melts entirely in the mouth. It is partially soluble in cold water. When boiled in water it is almost completely dissolved, and yields a decoction which, while hot, is of a clear reddish-brown colour, but, on cooling, becomes turbid, owing to the deposition of catechine. The cool decoction is not rendered blue by iodine. Examined by the microscope, gambir is found to consist in great part of myriads of minute crystals (*catechine*) intermixed with a kind of mucous tissue.

Varieties.— There are several other varieties of Pale Catechu known in commerce, but these are all more or less impure, and are chiefly used for tanning. No other variety of catechu but that answering to the characters given above should be used in the preparations of the Pharmacopœia, as none of them are official.

Composition.—Gambir essentially contains from 36 to 40 per cent. of tannic acid and catechine. *Tannic Acid.*—The properties of this acid have been before described. That extracted from gambir is readily soluble in water, alcohol, and slightly so in ether. It gives a green colour to the salts of iron. *Catechine; Catechuic Acid.*—When gambir is treated with cold water, an insoluble residuum is left; this is *impure catechine,* and was termed by Nees, *Resinous Tannin.* When obtained quite pure, catechine is a white light powder, composed of silky needles, and having a peculiar sweet taste. It is very slightly soluble in cold water, but more so in boiling water. Ether, and especially alcohol, are better solvents for it. It produces a green colour with salts of iron, but does not cause a precipitate with solution of gelatine. The sweet taste of pale catechu depends on catechuic acid.

Physiological Effects.—Catechu produces the local and remote effects of astringent medicines generally. When of good quality it is more powerful than kino. In its operation it is closely allied to rhatany.

Therapeutics.—It is employed as an astringent in the following cases: *In affections of the mouth and throat.*—In various affections of the mouth and throat it will be found a convenient and efficacious astringent. Thus, in relaxed uvula, and in that slight chronic inflammatory affection of the throat usually denominated relaxed sore-throat, and which is especially observed in delicate females, catechu, chewed or sucked, is a most useful remedy. Catechu lozenges may be also employed. Pale Catechu is sweeter and more agreeable than black catechu. To public speakers or singers it is very useful; as it prevents or diminishes the hoarseness consequent on a too frequent use of the vocal organs. In slight ulcerations of the mouth it is also beneficial. *As a stomachic in dyspeptic complaints.*—I have known catechu chewed with advantage in dyspeptic complaints, especially when accompanied with pyrosis. It should be used just before taking food: in which case it promotes the appetite, and assists digestion. *As an alvine astringent* it may be employed in old-standing diarrhœas and dysenteries, when there are no inflammatory symptoms present. It is often conjoined with chalk mixture, and not unusually with opiates.

Administration.—Dose 10 to 40 grains. It may be administered in the form of bolus, or of mixture with sugar and gum Acacia, or may be allowed to dissolve in the mouth.

[§ **Infusum Catechu.** *Infusion of Catechu.*

Take of

Pale Catechu, in coarse powder . .	160 grains.
Cinnamon Bark, bruised . . .	30 grains.
Boiling Distilled Water . . .	10 fluid ounces.

Infuse in a covered vessel, for half an hour, and strain.

Dose.—1 to 2 fluid ounces.]

Frequently given in diarrhœa in conjunction with opiates. Sometimes used in the form of an enema.

[§ **Pulvis Catechu Compositus.** *Compound Powder of Catechu.*

Take of

Pale Catechu, in powder		4 ounces.
Kino, in powder	of each	2 ounces.
Rhatany Root, in powder		
Cinnamon Bark, in powder	of each	1 ounce.
Nutmeg, in powder		

Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle.

Dose.—20 to 40 grains.]

Employed in chronic diarrhœa and dysentery. It may be conveniently given in the form of confection, made by adding gradually (as in the Dublin Pharmacopœia) a fluid ounce of syrup to an ounce of the compound powder.

[§ **Tinctura Catechu.** *Tincture of Catechu.*

Take of

Pale Catechu, in coarse powder	$2\frac{1}{2}$ ounces.
Cinnamon Bark, bruised	1 ounce.
Proof Spirit	1 pint.

Macerate for seven days in a closed vessel, with occasional agitation ; strain, press, filter, and add sufficient proof spirit to make one pint.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

Astringent. Usually employed as an adjunct to chalk mixture in chronic diarrhœa and dysentery; or taken with port wine and some aromatic as nutmeg or cinnamon.

[§ **Trochisci Catechu.** *Catechu Lozenges.*

Take of

Pale Catechu, in powder	720 grains.
Refined Sugar, in powder	25 ounces.
Gum Acacia, in powder	1 ounce.
Mucilage of Gum Acacia	2 fluid ounces.
Distilled Water	a sufficiency.

Mix the catechu, sugar, and gum, and add the mucilage and water to form a proper mass. Divide into 720 lozenges, and dry these in a hot-air chamber with a moderate heat.

Each lozenge contains one grain of catechu.

Dose.—1 to 6 lozenges.]

CAPRIFOLIACEÆ, *Jussieu.* The Honeysuckle Order.

SAMBUCUS NIGRA, *Linn.* Common Elder.

Botanical Character.—Stem shrubby, somewhat arboreous, much and irregularly, though always oppositely, branched. *Leaves* (fig. 77) pinnate, smooth; *leaflets* ovate or ovate-lanceolate, pointed, serrate, usually 2-pairs, with an odd leaflet. *Flowers* cymose, white or cream-coloured. *Cymes* (fig. 77) 5-branched, terminal. *Calyx* adherent; *limb* 5-cleft, small. *Corolla* rotate, 5-lobed. *Stamens* 5. *Stigmas* 3, sessile. *Berry* globular, black, 3–4-seeded. —*Woodv.* pl. 76.

Fig. 77.

Leaf and Cyme of Sambucus nigra.

Habitat. — Indigenous; common in hedges, coppices, and woods.

[§ **Sambuci Flores.** *Elder Flowers.*

The fresh flowers of Sambucus nigra, *Linn.* From indigenous plants.]

General Characters.—Elder flowers are white when fresh, but by drying become yellow, and retain an agreeable odour. Their taste is feebly bitter.

Composition.—Their principal constituent is *volatile oil*, to which they owe their properties.

Effects and Uses.—The flowers are mildly stimulant, and perhaps sudorific. They are only employed in the preparation of *elder-flower water* and *elder-flower ointment.* The latter is popularly used as a cooling application to irritable surfaces; but it is not official.

[§ **Aqua Sambuci.** *Elder-Flower Water.*

Take of

Fresh Elder Flowers, separated from the stalks	10 pounds.
(Or an equivalent quantity of the flowers preserved while fresh with common salt)	
Water	2 gallons.

Distil one gallon.]

Elder-flower water is used as a perfume, and as a menstruum in lotions.

Sub-class III.—Calycifloræ.

UMBELLIFERÆ, *Jussieu.* THE UMBELLIFEROUS ORDER.

EURYANGIUM SUMBUL, *Kauffman.* The Sumbul Plant.

Botanical Character.—The botanical source of the official Sumbul was unknown when the British Pharmacopœia was published, but it has since been ascertained; and the plant yielding it has recently flowered and fruited at Moscow, and has been named and described by M. Kauffman, who considers it the type of a new genus belonging to the Umbelliferæ. (See 'Nouveaux Mémoires de la Société impériale des Nat. de Moscou.')

Habitat.—Bucharia.

[§ **Sumbul Radix.** *Sumbul Root.*

The dried transverse sections of the root of a plant, the botanical history of which is unknown. Imported from Russia and also from India.]

General Characters, Varieties, and Commerce.—Two varieties of Sumbul have appeared in English commerce,—Russian and Indian. *Russian Sumbul Root.*—The Sumbul imported from Russia occurs in nearly circular pieces, formed by transverse sections of the root: these pieces, which have a dirty, somewhat worn appearance, are from about $2\frac{1}{2}$ to 5 inches in diameter, and from $\frac{3}{4}$ to $1\frac{1}{2}$ inch in thickness at the margin, which, owing to unequal contraction in drying, is thicker than the central portion. On the outer surface they are covered with a dusky brown rough bark, which is frequently beset with short bristly fibres; the interior consists of a spongy, coarsely fibrous, dry, yellowish-white mass, of a somewhat farinaceous appearance. Some pieces, constituting the crown portion of the root, are covered with a papery bark. The root has a pure musky odour. Its taste is rather bitter, and very slightly acrid. *Indian Sumbul Root.*—This variety of Sumbul root is imported from Bombay. It is of closer texture, firmer, denser, and of a redder tint than Russian Sumbul. Some of the pieces bear a slight resemblance to inferior rhubarb. In odour it is perhaps less powerful than the Russian. This variety has also been brought to England *viâ* China, and has been called China Sumbul. Both varieties of Sumbul are official.

Composition.—Sumbul contains a *volatile oil; two balsamic resins,* one soluble in ether, the other in alcohol; *wax, starch,* and a crystallisable acid called *Sumbulic acid.*

Effects and Uses.—Sumbul in its action is a nervine stimulant like valerian; it also possesses antispasmodic properties. It has been tried as a remedy in low typhoid fevers, cholera, delirium tremens, various nervous affections, as epilepsy, chorea, hysteria, chronic pulmonary affections, &c.

Administration.—Sumbul may be administered in powder, in doses of from 10 to 20 grains; in the form of tincture, in doses of from 10 to 30 minims; or the *resin* may be given in doses of from ½ to 1 grain.

[§ **Tinctura Sumbul.** *Tincture of Sumbul.*

Take of

Sumbul Root, in coarse powder . .	2½ ounces.
Proof Spirit	1 pint.

Macerate the Sumbul for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

Dose.—10 to 30 minims.]

PETROSELINUM SATIVUM, *Hoffm.* Parsley.

Botanical Character.—*Root* biennial. *Stem* annual, round, about 2 feet high. *Leaves* tripinnate, shining; *leaflets* of the lower leaves ovate-cuneate, trifid, and toothed, of the upper leaves ternate-lanceolate, entire. *Partial involucre* filiform, of 6–8 bracts; *general involucre* of 1–2 bracts. *Flowers* small, pale yellow. *Calyx* adherent, minute. *Petals* roundish, entire, with a narrow incurved point. *Fruit* ovoid; *mericarps* with 5 filiform equal ridges; *carpophore* bipartite.

Habitat.—Southern Europe. Cultivated everywhere in gardens.

Apiol. *Apiol.*

An oily liquid prepared from the seeds of Petroselinum sativum.

(*Not official.*)

Composition of the Seeds.—Joret and Homolle found the seeds to contain a *volatile oil, pectine* (*apiine* of Braconnot), *tannic acid, crystallisable fatty matter*; and by acting on the alcoholic extract by sulphuric ether, then evaporating the ether, and purifying the oil obtained by litharge and animal charcoal, they obtained a peculiar substance, to which they gave the name of *Apiol.*

General Characters.—*Apiol* is a pale yellow or nearly colourless oily liquid, of a peculiar smell, and a disagreeable taste. Sp. gr. 1,078. It is not volatile, does not boil at 528° F., but burns with a bright flame, leaving no residue. It is soluble in ether, alcohol, and chloroform, but not at all in water. It is coloured red by sulphuric acid. It contains no nitrogen.

Physiological Action.—In small doses, apiol seems principally to act on the nervous system, causing a slight excitation; but in larger doses it produces headache, giddiness, &c., like quinia.

Therapeutics.—In intermittent fevers, apiol was administered by Drs. Joret and Homolle in 116 cases, of which 66 were cured by it. The French commission, however, found only 42 per cent. temporarily cured, and in many of those the ague returned; and that its unpleasant flavour prevented its administration except in the form of capsules. It has likewise been used with good success in intermittent neuralgias, in the nocturnal sweats of phthisis, and as an emmenagogue.

Dose.—For adults, 5 to 15 minims, in capsules, in mucilage, or in the form of a syrup.

CARUM CARUI, *Linn.* Common Caraway.

Botanical Character.—*Biennial. Stem* branched, about two feet high. *Leaves* (fig. 78) bipinnate; *leaflets* cut into linear segments. *Involucre* none, or of 1 leaf; *involucel* none. *Umbels* (fig. 78) numerous, dense. *Calyx* adherent; *limb* obsolete. *Petals* obcordate, with a narrow acute inflexed point, white or pale flesh-coloured. *Fruit* oblong. *Carpels* or *mericarps* laterally compressed, with 5 equal filiform ridges; *channels* with single vittæ; *commissure* bivittate; *stylopodium* depressed.—*Woodv.* pl. 45, p. 125.

Fig. 78.

Leaves and Umbels of Carum Carui.

Habitat.—In meadows and pastures all over Europe; naturalised in England. Largely cultivated in Essex.

[§ Carui Fructus. *Caraway Fruit.*

The dried fruit of Carum Carui, *Linn.* Cultivated in England and Germany.]

General Characters.—Fruit usually separating into two parts (*mericarps*), which are commonly called *caraway seeds*. These are about two lines long, slightly curved, tapering at each end, brown, with five lighter coloured longitudinal ridges, having an agreeable aromatic odour, and a warm spicy taste.

Composition.—Its properties depend on a *volatile oil.* (See *Oleum Carui.*)

Physiological Effects. — Caraway is an aromatic stimulant and condiment.

Therapeutics and Pharmaceutical Uses.—Its medicinal employment is not extensive. It is more frequently employed in substance than the *oil* or *water.* It is given to relieve the flatulent colic of children, and enters as an adjuvant or corrective into several official preparations, as confection of opium, confection of pepper, compound opium powder, compound tincture of cardamoms, and tincture of senna. Caraway is chiefly consumed by the cook and confectioner as a flavouring agent.

[§ **Aqua Carui.** *Caraway Water.*

Take of

Caraway Fruit, bruised	1 pound.
Water	2 gallons.

Distil one gallon.]

This water is employed as a carminative vehicle for purgatives (as saline purgatives, magnesia, &c.) ; and in the flatulent colic of children.

[§ **Oleum Carui.** *Oil of Caraway.*

The oil distilled in Britain from caraway fruit.]

General Characters.—When fresh prepared it is colourless ; but it becomes yellow and subsequently brown by keeping. It is limpid, and has the aromatic odour of the fruit, and a spicy, somewhat acrid taste. Its specific gravity is 0·950. The quantity obtained from a given weight of fruit varies from about 4·7 to about 5·4 per cent.

Uses.—Oil of caraway is used to impart flavour, to correct the nauseating and griping qualities of some medicines, and to relieve flatulence. It is used with these objects in confection of scammony and pill of Barbadoes aloes. It is frequently added to cathartic pills and powders.

Dose.—1 to 5 minims.

PIMPINELLA ANISUM, *Linn.* The Anise.

Botanical Character.—Annual. Stem erect, smooth, about 1 foot high. *Radical leaves* cordate, lobed, incised, serrate ; *stem-leaves* :—*middle ones* pinnate, lobed, the lobes cuneate or lanceolate ; the *upper leaves* trifid. *Umbels* on long stalks, without involucres or involucels. *Flowers* small, white. *Calyx* adherent; *limb* obsolete. *Petals* obcordate, with an inflexed point. *Fruit* laterally compressed, ovate, with a few scattered hairs; *carpels* or *mericarps* with 5 equal filiform ridges; *channels* with 3 or more vittæ; *stylopodium* tumid; *styles* recurved.—*Woodv.* pl. 180, p. 490.

Habitat.—Island of Scio, Egypt, and some parts of Asia. Largely cultivated for its fruit in Malta, Spain, and various parts of Germany.

Anisi Fructus. *Anise Fruit.*

The dried fruit of Pimpinella Anisum, *Linn.*
(*Not official.*)

Commerce.—Aniseed is principally imported from Alicant and Germany; but some is obtained in this country, (the first is preferred.)

General Characters.—The fruit, called *aniseed*, is slightly compressed at the sides. The separated mericarps are ovate, of a greyish-green colour, with five paler thin filiform primary ridges (there are no secondary ones), and covered with downy hairs. In each channel are three or more vittæ. The odour is aromatic, and similar to that of the fruit of *Illicium anisatum.* (See *Illicium anisatum.*) The taste is sweetish and aromatic.

Composition.—Its properties depend on a *volatile oil.* (See *Oleum Anisi.*)

Physiological Effects.—Anise fruit is an aromatic stimulant. Its effects are similar to those of dill. Its odour is said to be recognisable in the milk and urine of those who have taken it. Hence it would appear that the oil of anise becomes absorbed. It has been supposed to promote the secretion of milk, urine, bronchial mucus, and of the menses, though without sufficient evidence.

Therapeutics.—In medicine it is principally employed to relieve flatulence and colicky pains, especially of children, and to prevent the griping effects of some cathartics. It has also been employed in pulmonary affections. It is frequently used as a horse medicine; and is also employed by the cook and confectioner as a flavouring agent.

[§ **Oleum Anisi.** *Oil of Anise.*

The oil distilled in Europe from the fruit of Pimpinella Anisum, *Linn.* And the oil distilled in China from the fruit of *Illicium anisatum*, Linn.]

General Characters.—The oil, when carefully prepared, is transparent and nearly colourless, having only a slightly yellow tinge. It has the odour and taste of the fruit from which it is obtained. Its specific gravity increases with its age: when fresh distilled, it is about 0·980. It concretes at 50° F., and does not liquefy again under 62°. It is soluble in all proportions in alcohol. By exposure to the air it forms resin, and becomes less disposed to concrete. It is composed of two volatile oils—one solid at ordinary temperatures (*stearoptene*), the other liquid (*eloptene*), in the following proportions :—eloptene 75, stearoptene 25. (See *Illicium anisatum.*)

Adulterations.—Spermaceti, which is said to be sometimes added to oil of anise, to promote its solidification, may be distinguished by its insolubility in cold alcohol. Camphor, said to be added for the same purpose, is recognised by its odour.

Physiological Effects.—Aromatic, stimulant, and carminative.

Therapeutics.—Similar to those of the fruit.

Dose.—2 to 5 minims on sugar, or rubbed up with sugar in camphor water.

Pharmaceutical Uses.—It is an ingredient in camphorated tincture of opium, and ammoniated tincture of opium.

[§ **Essentia Anisi.** *Essence of Anise.*

Take of

Oil of Anise	1 fluid ounce.
Rectified Spirit	4 fluid ounces.

Mix.

Dose.—10 to 20 minims.

This is double the strength of the preparation of the same name in the Dubl. Pharm.]

FŒNICULUM DULCE, *D.C.* Sweet Fennel.

Botanical Character.—*Stem* slightly compressed at the base. *Radical leaves* somewhat distichous ; *segments* capillary, elongated. *Umbels* of 6–8 rays. *Calyx* adherent; *limb* obsolete. *Petals* roundish, entire, with a broad obtuse inflexed point. *Fruit* oblong; *mericarps* or *carpels* with 5 prominent bluntly-keeled ridges ; *channels* univittate ; *commissure* bivittate ; *stylopodium* conical.

Habitat.—Italy, Portugal, &c. It is cultivated in gardens in this country, &c., as a pot-herb, and for garnishing.

[§ **Fœniculi Fructus.** *Fennel Fruit.*

The fruit of Fœniculum dulce, *D.C.* Imported from Malta.]

General Characters and Varieties.—The fruits, commonly termed *sweet fennel seeds*, are about three lines long, and one line broad; elliptical, slightly curved, beaked, having eight pale brown longitudinal ridges, the two lateral being double; taste and odour aromatic. They have a more agreeable odour and flavour than those of the common or wild fennel-fruits. Two kinds are known in trade, *shorts* and *longs*; the latter are most esteemed, and are occasionally nearly five lines in length.

Composition.—The peculiar properties of the fruit depend on a *volatile oil*, but the oil of fennel is not official.

Physiological Effects.—Sweet fennel is an aromatic stimulant; its effects are similar to those of caraway.

Therapeutics.—Seldom employed in substance; more frequently as a carminative in the form of the official fennel water.

[§ **Aqua Fœniculi.** *Fennel Water.*

Take of

Fennel Fruit, bruised	1 pound.
Water	2 gallons.

Distil one gallon.]

Carminative. Employed to relieve flatulent colic of infants, and as a vehicle for other medicines.

Dose.—For an adult, 1 to 3 fluid ounces; for an infant, 1 to 2 fluid drachms.

ANETHUM GRAVEOLENS, *Linn.* Common Garden Dill.

Botanical Character.—*Annual. Stem* 1 to 2 feet high, smooth, finely striated. *Leaves* tripinnate, with fine capillary leaflets, and broad sheathing petioles. *Umbels* long, stalked, without involucres or involucels. *Calyx* adherent; *limb* obsolete. *Petals* roundish, yellow, entire, involute. *Fruit* lenticular, compressed dorsally, and surrounded by a flattened border. *Carpels* or *mericarps* with equidistant filiform ridges, the 3 dorsal acutely keeled, the 2 lateral more obsolete, losing themselves in the border; *vittœ* broad, solitary in the channels, the whole of which they fill, 2 on the commissure.—*Woodv.* pl. 159, p. 439.

Habitat.—South of Europe, Egypt, Cape of Good Hope, &c. Cultivated in England.

[§ **Anethi Fructus.** *Dill Fruit.*

The fruit of Anethum graveolens, *Linn.* Cultivated in England, or imported from middle and southern Europe.]

General Characters.—The fruit, commonly called *dill seed*, is oval, flat, dorsally compressed, about a line and a half long, and from half to one line broad, brown and surrounded by a lighter-coloured membranous margin. Each mericarp has five primary ridges, but no secondary ones. In each channel is one vitta, and on the commissure are two vittæ. These vittæ contain the aromatic oil. The odour of the fruit is strongly aromatic; the taste warm, and somewhat bitter.

Composition.—Dill owes its peculiar properties to a *volatile oil.* (See *Oleum Anethi.*)

Physiological Effects.—Aromatic, stimulant, carminative, and condimentary.

Therapeutics.—In medicine it is principally employed in the diseases of children. It is a common domestic remedy among nurses, to relieve the flatulence and griping of infants. Medical practitioners generally use dill as a vehicle for the exhibition of purgative and other medicines to children, the griping of which it assists in preventing. The whole fruits may be given to adults in doses of 10 to 60 grains.

[§ **Aqua Anethi.** *Dill Water.*

Take of

Dill Fruit, bruised	1 pound.
Water	2 gallons.

Distil one gallon.]

Carminative.

Dose.—For adults, 1 to 3 fluid ounces; for infants, 1 to 3 fluid drachms. It is generally given to infants with their food.

[§ **Oleum Anethi.** *Oil of Dill.*

[The oil distilled in Britain from dill fruit.]

General Characters.—This oil is pale yellow. Its sp. gr. is 0·881. Its odour is peculiar and penetrating, analogous to that of the fruit; its taste is hot and sweetish. Alcohol and ether readily dissolve it. Two hundredweights of the fruit yield 8 pounds 5 ounces of oil.

Use.—Principally used to prepare dill water, but the Pharmacopœia, as just noticed, directs this to be prepared from the fruit. May be taken in the dose of a few minims on sugar, or dissolved in spirit.

CUMINUM CYMINUM, *Linn.* **The Cumin Plant.**

Botanical Character. — *Root* annual. *Stem* slender, branched, about a foot high. *Leaves* many-cleft: *lobes* linear, setaceous, acute. *Bracts* of the *involucre* 2 to 4, simple or divided. *Involucel* halved, 2–4-leaved, equalling the pubescent fruit, ultimately reflexed. *Umbels* 3–5-rayed. *Flowers* white or pinkish. *Calyx* adherent, with 5 lanceolate, setaceous, unequal, persistent teeth. *Petals* oblong, emarginate, erect, spreading, with an inflexed point.

Fruit contracted at the side. *Mericarps* with wingless ridges; the primary ones 5, filiform, minutely muricated, the laterals forming a border; the secondary ones 4, more prominent, and prickly. *Channels* under the secondary ridges 1-vittate.

Habitat. — Egypt. Extensively cultivated in Sicily, Malta, and other parts of Europe.

Cumini Fructus. *Cumin Fruit.*

The dried fruit of Cuminum Cyminum, *Linn.*

(*Not official.*)

Commerce.—Cumin is imported from Sicily and Malta.

General Characters.—The fruit commonly termed *cumin seed*, is larger than anise, and of a light brown or greyish-yellow colour. It has some resemblance to, though it is larger than, caraway. Each mericarp has five primary ridges, which are filiform, and furnished with very fine prickles. The four secondary ridges are prominent and prickly; and under each there is one vitta. The odour of the fruit is strong and aromatic. Both odour and taste are somewhat analogous to, but less agreeable than, caraway.

Composition.—The peculiar properties of cumin reside in a *volatile oil.* Sixteen hundredweights of the fruit yield about 44 pounds of oil. This oil, as usually met with, is pale yellow and limpid. Its smell is disagreeable; its taste very acrid.

Physiological Effects.—Cumin agrees with the other aromatic umbelliferous fruits in its mildly stimulant and carminative qualities.

Therapeutics.—Internally cumin is rarely used; caraway being an equally efficient and a much more agreeable medicine. As a discutient and resolvent, it is sometimes employed externally, in the form of a plaster. The dose of cumin is from 15 to 30 grains. It is principally used in veterinary medicine.

CORIANDRUM SATIVUM, *Linn.* **The Coriander.**

Botanical Character.—*Annual.* *Stem* erect, round, striated, smooth, from 1 to 2 feet high. *Leaves* scarcely stalked, bipinnate, cut; *leaflets* of some of the lowermost leaves wedge- or fan-shaped, of the others in fine linear segments. *Calyx* adherent, with 5 acute teeth. *Petals* white or with a reddish tinge, obcordate, with an inflexed point, the exterior ones radiating, bifid. *Fruit* globose; *mericarps* without evident primary ridges, but with 4 more prominent, keeled, secondary ridges; *channels* without vittæ; *commissure* with 2 vittæ.—*Woodv.* pl. 181, p. 492.

Habitat.—Grows wild about Ipswich and some parts of Essex, but is not really indigenous. Native of the south of Europe. Cultivated in Essex.

[§ **Coriandri Fructus.** *Coriander Fruit.*

The dried ripe fruit of Coriandrum sativum, *Linn.* Cultivated in Britain.]

General Characters.—The fruit, commonly termed *coriander seed*, is globular, about the size of white pepper, finely ribbed, and of a yellowish-brown colour. It consists of two hemispherical mericarps, adherent by their concave surfaces. Each mericarp is without evident primary ridges; but the four secondary ridges are more prominent and keeled. The channels are without vittæ, but the commissure has two. Coriander fruit has a peculiar agreeable aromatic odour and taste.

Composition.—The odour, taste, and medicinal qualities of the fruit depend on a *volatile oil.* (See *Oleum Coriandri.*)

Physiological Effects.—Aromatic, and stimulant.

Therapeutics.—It is said to correct the odour and taste of senna better than any other aromatic. It is only employed in medicine as an adjuvant or corrective.

Pharmaceutical Uses.—It is a constituent of the confection of senna, mixture of gentian, tincture of rhubarb, tincture of senna, and syrup of rhubarb.

Dose.—From 30 to 60 grains.

[§ **Oleum Coriandri.** *Oil of Coriander.*

The oil distilled in Britain from coriander fruit.]

General Characters.—Oil of coriander is colourless or pale yellow. It has a similar odour to the fruit. Its specific gravity varies from 0·859 to 0·871. It is soluble in alcohol, ether, and glacial acetic acid.

Pharmaceutical Use.—It is an ingredient in syrup of senna.

Dose.—2 to 5 minims.

DAUCUS CAROTA, *Linn.* Common or Wild Carrot.

Botanical Character.—*Biennial. Root* slender, yellowish, aromatic, and sweetish. *Stem* hispid, 2–3 feet high. *Leaves* bi- or tri-pinnatisected; the segments pinnatifid, the lobes lanceolate, cuspidate, almost equal to the umbel. *Involucre* (fig. 79, *b*) of many trifid or pinnatifid bracts; *partial involucre* of many entire or trifid bracts. *Flowers* white or yellow; the central one neutral and blackish-purple. *Calyx* adherent, 5-toothed. *Petals* obovate, emarginate, with an inflexed point; the outer (fig. 79, *a*) generally radiating. *Fruit* somewhat compressed from the back, ovate or oblong. *Mericarps* with 5 primary filiform and bristly ridges; and 4 secondary ones, equal, more prominent, winged, split into a simple row of spines. *Channels* beneath the secondary ridges 1-vittate.

Fig. 79.

Daucus Carota.

a. Flower of the ray. *b.* An umbel of fruit.

Habitat.—Indigenous; in pastures and the borders of fields, in a gravelly soil, common. Europe, Crimea, and the Caucasus; from thence, probably, carried to China, Cochin-China, and America.

Dauci Fructus. *Carrot Fruit.*

The dried fruits of Daucus Carota, *Linn.*

(*Not official.*)

General Characters.—The *fruits*, usually called *carrot seeds*, are brownish, from one to one and a half line long, with a peculiar and aromatic odour, and a bitter and warm taste. Their other characters have been already noticed in the botanical description above.

Composition.—Carrot fruits owe their properties to a *volatile oil.*

Physiological Effects and Uses.—The fruit of the carrot is an aromatic stimulant and carminative, like the other aromatic umbelliferous fruits. It is also reputed to possess diuretic properties. It has been employed in suppression of urine and painful micturition, and also in dropsies.

DAUCUS CAROTA, *var.* **SATIVA,** *Linn.* **Cultivated Carrot.**

Dauci Sativæ Radix. *Carrot Root.*

The root of the Cultivated Carrot.

(*Not official.*)

General Characters.—Carrot root is more or less conical in form, now and then branched, reddish or pale straw-coloured, succulent, of a peculiar not unpleasant odour, and a sweet mucilaginous agreeable taste. *Carrot juice* is reddish, turbid, and with the odour and taste of the root. It coagulates at a temperature under 212° F. The coagulum is yellow.

Composition.—The principal constituents of the expressed juice, evaporated to dryness, are a *volatile oil*, a crystallisable substance called *carotin*, of a fine red colour, and *pectin*.

Uses.—Raw scraped carrot is sometimes applied to chapped nipples: it is a stimulant, and occasionally proves a painful application. Boiled carrots are only employed in the form of poultice to ill-conditioned sloughing sores. The boiled root is a well-known article of food.

NARTHEX ASSAFŒTIDA, *Falconer*: The Assafœtida Plant.

Botanical Character.—*Perennial. Root* fleshy, about 3 inches in diameter at the top, the summit invested above the soil with dark hair-like fibres, dark grey and transversely corrugated on the outside, internally white or ash-coloured, and abounding in a white, milky, opaque, excessively fetid juice. *Leaves* collected into a tuft above the root, numerous, large, and spreading, about 18 inches in length when fully grown, 3-parted, with bi-pinnatifid segments, and oblong-lanceolate, obtuse, decurrent lobes. *Stem* rising from the midst of the leaves, erect, herbaceous, 6 to 9 feet high, about 2 inches in diameter at the base, round, smooth, striated, solid, and terminating in a luxuriant head of compound umbels. *Umbels* without involucres or involucels, 10–20-rayed, each terminated by a roundish partial umbel, barren or fertile. *Calyx* adherent; *limb* obsolete. *Petals* oblique, acute. *Stylopodium* urceolate, plaited; *styles* filiform, ultimately reflexed. *Fruit* oval, thin, flat, foliaceous, and reddish-brown.—Pl. 20, 21, vol. xxii. *Edinb. Roy. Soc. Trans.*

Habitat.—Persia, Affghanistan, and the Punjaub.

[§ Assafœtida. *Assafœtida.*

A gum-resin, obtained by incision from the living root of Narthex Assafœtida, *Falconer*. In Affghanistan and the Punjaub.]

Extraction.—Assafœtida is obtained by making incisions into the upper part of the root; the earth around it, the footstalks of the leaves, and the fibres at the top of the root having been previously removed (fig. 80). According to Kæmpfer the collection commences on the 25th of May. Each collector is provided with a sharp knife to cut the root, a broad iron spatula to scrape off the juice, a cup fixed to his thigh to receive it, and two baskets hung over his shoulders upon a pole. The top of the root is cut off transversely, and two days afterwards the juice is scraped off and put into the cups. A fresh incision is then made, and the juice removed after the same interval, when the roots are again cut. The cups are from time to time emptied into large vessels. The juice is exposed to the sun to become harder, and is conveyed home in the baskets. These operations are repeated in June and early in July. Except after the last operation, the roots are carefully defended from the sun after each incision, by covering them with leaves. The quantity of assafœtida obtained from each root varies according to its size, from a few

Fig. 80.

Extraction of Assafœtida.

ounces to two pounds. The mode of obtaining assafœtida varies in some unimportant particulars in different localities.

Commerce.—Assafœtida is exported from the Persian Gulf, or conveyed principally by way of the Indus to Bombay, whence it is sent to Europe.

General Characters and Varieties.—Two varieties are met with in English commerce, namely, *Tear* and *Lump*. *Assafœtida in Tear.*—This kind, which was formerly rare, is now more frequently met with. It occurs in distinct, roundish, flattened, or oval tears, and also in irregular pieces, varying from the size of a pea to that of a walnut, of a yellow or brownish-yellow colour externally, and white internally. *Lump Assafœtida.*—This variety is the one usually met with in commerce. It occurs in variable-sized moist or dry masses of irregular form, made up of tears agglutinated together by a reddish-brown substance. Hence this assafœtida, from its almond-like appearance, is sometimes denominated *amygdaloid assafœtida.* In some lump assafœtida scarcely any tears are observable, and the amygdaloid appearance is not then evident. The colour of a freshly cut or broken piece is opaque white, but it gradually becomes purplish-pink or reddish-pink, and ultimately dull-yellowish or pinkish-brown. Its taste is bitter and acrid; its odour fetid, alliaceous, and persistent. The odour is especially evident when a small portion is heated on the point of a knife. Heated with sulphuric acid it is blackened, yields a dark blood-red liquid, and developes sulphurous acid gas: if the liquid be diluted with water, and saturated with caustic potash, it becomes blue, especially on the surface, by reflected light, similar to that observed when sulphate of quinia is dissolved in water. It dissolves almost entirely in rectified spirit. Assafœtida is fusible and inflammable, burning in the air with a white flame and the evolution of much smoke.

Source of the Varieties.—It was thought by the author that *Assafœtida in Tear* was probably obtained from a different plant to that of *Lump Assafœtida*, for its colour externally is more yellow, its odour much feebler, and its fresh-fractured surface becomes less intensely red by exposure to the air; but there is no real foundation for such an opinion. A recent observer, Dr. Bellew, as reported by Mr. Cooke, states positively, that both *tear* and *lump* assafœtida are obtained from the same plant; that 'the "tear" sort is the gum-resin that exudes, and dries drop by drop, from incisions around the top of the root;' and that 'the "lump" sort is the gum-resin as it exudes from a broad surface, as when the top of the root is sliced off.' Guibourt says, that the reason why the 'tear' sort does not become so red by exposure to the air as the 'lump' variety is owing to its containing less volatile oil. It is probable, however, that although the ordinary assafœtida of commerce is derived from *Narthex Assafœtida*, other varieties, which are rarely met with, may be obtained from different species.

Adulterations.—Assafœtida is frequently more or less mixed, intentionally or otherwise, with impurities, such as sand, stones, &c. It is said that the commercial assafœtida from Candahar is always adulterated, the common adulterants being wheat or barley-flour, or powdered gypsum, to the extent of one-fifth to one-third.

Composition.—Assafœtida contains a variable quantity of *volatile* *oil*, usually from about 3·5 to 4·5 per cent., to which its properties are essentially due; *resin*, *gum*, and other unimportant substances. *Volatile Oil.*—This is obtained by distilling assafœtida with either water or alcohol. It is on this oil that the odour of assafœtida depends. It is lighter than water, and is at first colourless, but by exposure to the air it acquires a yellow tinge. It dissolves in all proportions in alcohol and ether, but requires more than 2,000 times its weight of water to dissolve it. Its taste is at first mild, then bitter and acrid. Its odour is very strong, and as it evaporates very quickly, it is soon perceptible even in a large room. Sulphur, and probably phosphorus, are among its elementary constituents. The presence of sulphur in assafœtida is shown in various ways: thus, if chloride of barium be added to water distilled from assafœtida, and likewise a little chlorine, the sulphur becomes gradually acidified, and after some time a precipitate of sulphate of baryta is formed. If the oil be rubbed with mercury, it forms sulphuret of mercury. Moreover, if pills made of assafœtida be rolled in silver leaf, the latter, after a few days, is blackened by the formation of a sulphuret of silver. According to Hlasiwetz the oil is composed of two sulphurets of the hydrocarbon C_6H_{11}, and when fresh distilled, like the essential oil of black mustard and horseradish, it contains no oxygen. It becomes acid by exposure to air, and on boiling the oil sulphuretted hydrogen is disengaged. *Resin.*—The resinous matter of assafœtida is soluble in alcohol. When the alcoholic solution is mixed with water, a milky fluid is formed, owing to the deposition of the *hydrated resin*. Oil of turpentine and oil of almonds also dissolve the resin, but less readily than alcohol.

Physiological Effects.—Assafœtida is usually placed, by pharmacological writers, among those remedies denominated antipasmodics or stimulants. It is the most powerful of the fetid gum-resins. Its local effects are moderate: it is devoid of the acrid and irritating properties possessed by gamboge, scammony, and many other resinous and gum-resinous substances. In the mouth it causes a sensation of heat, and the same effect, accompanied by eructations, is experienced in the stomach, when it is swallowed. In Professor Jörg and his pupils (male and female), who endeavoured to elucidate the effects of this medicine by experiments made on themselves, doses of assafœtida, not exceeding 20 grains, caused uneasiness and pain of the stomach, increased secretion of the gastro-intestinal membrane, and alvine evacuations. The pulse was increased in frequency, the animal heat augmented, the respiration quickened, and the secretions from the bronchial membrane and skin promoted. A very constant effect was headache and giddiness. The urino-genital apparatus appeared to be specifically effected, for in the males there was an increase of the venereal feelings, with irritation about the glans penis, while in the females the catamenial discharge appeared before its usual period, and uterine pain was experienced. These stimulant effects of assafœtida were observed in a greater or less degree in all the nine persons experimented on; and it should be borne in mind that the dose did not, in any one case, exceed 20 grains. These results are in accordance with those generally obtained, but very opposite results to these have been noticed, and hence it would seem probable that different individuals are most unequally susceptible of the influence of this remedy. In convulsive and spasmodic diseases the effects of assafœtida seem indisputable. As in these cases the functions of the excito-motory system are the functions principally or essentially involved, it is not assuming too much to suppose that the influence of assafœtida is principally directed to the excito-motory nerves. To paraphrase the words of Dr. M. Hall, assafœtida acts through the *excitor* nerves; while its effects are manifested through the *motor* nerves. Assafœtida, or its odorous principle, becomes absorbed by the veins, though slowly. We are told that the transpiration of Asiatics who use assafœtida daily, is extremely fetid. The stimulant influence of assafœtida over the organs of circulation and of secretion (as the bronchial membrane and skin), depends apparently on the topical action of the oily and resinous particles on the vessels in their passage through the latter.

Therapeutics.—From the foregoing remarks it will be readily gathered, that assafœtida is contra-indicated in febrile and inflammatory diseases, on account of its stimulant properties; as also in vascular irritation, or inflammation of the stomach, because of its topical influence on this viscus. On the other hand, it is found highly useful in spasmodic or convulsive diseases not dependent on disease of the nervous centres, but of the kind called by Dr. Hall eccentric. *In spasmodic and convulsive diseases.*—Few remedies have acquired such celebrity in *hysteria* as assafœtida. When the circulation is very languid, ammonia may with advantage be conjoined. In *infantine convulsions*, enemas of assafœtida are often used with good effect. Even in the *epilepsy* of adults they are not always without value. In purely *spasmodic asthma*, I have never seen relief from the use of assafœtida. This observation does not, however, agree with the statements of others; for some declare they have found it produce good and undoubted effects. But in old chronic catarrhs, with occasional spasmodic difficulty of breathing and spasmodic cough, I have procured the most marked relief by the combined use of assafœtida and ammonia. I have no experience of the use of this gum-resin in the disease called *laryngismus stridulus*, in which it is said to be beneficial. In *hooping cough*, it has been found most useful. It promotes expectoration, and diminishes both the violence and frequency of the attacks. The repugnance which children manifest to its use is, however, a great drawback to its employment. *As a stimulating expectorant and antispasmodic in chronic catarrh*, it is of considerable benefit. It is adapted for old persons, and where the disease is of long standing. I have found it most beneficial in those cases where the cough and difficulty of breathing assume at intervals a spasmodic form, and where the wheezing is considerable. In such I have seen full doses of assafœtida with ammonia give great relief. In delicate females, subject to repeated attacks of catarrh, attended with wasting, sweating, and other constitutional symptoms of phthisis, I have also noticed that assafœtida is frequently useful. In *flatulent colic* of hysterical and dyspeptic individuals, or of infants, few remedies are more efficacious, when the disease is unaccompanied by any marks of inflammatory action, and is attended with constipation. Of its efficacy in the flatulent colic of infants, I can speak from repeated observation; it is given with great benefit in the form of enema. In affections of the alimentary canal it is often of considerable value, as noticed above, in relieving flatulence in old persons, especially in hypochondriacal and hysterical subjects, and when accompanied with constipation, as it has a laxative effect. It provokes the expulsion of the gaseous matter, and appears to aid in preventing its reproduction. It is beneficially used in the form of enema, to relieve a tympanitic condition of the abdomen and flatulent distension of the bowels in low fevers. In *constipation with flatulence*, it is a useful addition to purgative mixtures or enemas. Dr. Garrod regards assafœtida 'as one of the most valuable remedies of the Materia Medica; far above all other ordinary antispasmodics;' and he thinks 'the value of the drug is chiefly due to the sulphur oil contained in it.'

Administration.—The *dose* of assafœtida is from 5 to 20 or even 30 grains. It may be given in substance, in the form of pill, or made into an emulsion. In hysteria and flatulent colic, where we want an immediate effect, it is best administered in a liquid form; or used as an *enema*.

Pharmaceutical Uses.—Assafœtida is an ingredient in the pill of aloes and assafœtida, and of fetid spirit of ammonia.

[§ **Enema Assafœtidæ.** *Enema of Assafœtida.*

Synonym.—Enema Fœtidum, *Edin.*, *Dubl.*

Take of

Assafœtida	30 grains.
Distilled Water	4 fluid ounces.

Rub the assafœtida in a mortar with the water added gradually, so as to form an emulsion.]

The enema of assafœtida is a valuable stimulant, antispasmodic, and carminative purgative, which may be used with most beneficial results in hysteria, flatulent colic, infantine convulsions, and worms in the rectum.

[§ **Pilula Assafœtidæ Composita.** *Compound Pill of Assafœtida.*

Synonym.—Pilula Galbani Composita, *Lond.*

Take of

Assafœtida, Galbanum, Myrrh	of each	2 ounces.
Treacle, by weight	. . . .	1 ounce.

Heat all together by means of a water-bath, and stir the mass until it assumes a uniform consistence.

Dose.—5 to 10 grains.]

This compound is stimulant and antispasmodic. It is used in hysteria, chlorosis, &c.

[§ **Tinctura Assafœtidæ.** *Tincture of Assafœtida.*

Take of

Assafœtida, in small fragments . .	$2\frac{1}{2}$ ounces.
Rectified spirit	a sufficiency.

Macerate the assafœtida in fifteen fluid ounces of the spirit for seven days in a closed vessel, with occasional agitation, then filter, and add sufficient rectified spirit to make one pint.

Dose.—$\frac{1}{2}$ to 1 fluid drachm.]

Stimulant and antispasmodic. Used in hysteria and flatulent colic. When mixed with aqueous liquids, it becomes milky, owing to the deposition of the hydrated resin.

Sagapenum. *Sagapenum.*

A gum-resin derived from an unascertained umbelliferous plant.

(*Not official.*)

Botanical Source.—Nothing of a definite nature is known as to the plant yielding sagapenum. It is imported from the Levant, and as it is known to be in some cases sent from Bombay, it is supposed to be derived from an umbelliferous plant, a native of Persia. It is much more rare and costly than the other umbelliferous gum-resins.

General Characters and Varieties.—The finest sagapenum, sometimes, although incorrectly, called *sagapenum in the tear*, consists of masses made up of agglutinated brownish-yellow semitransparent tears, and resembling galbanum, but having a darker colour, and more alliaceous odour. It differs from assafœtida, which in some respects it resembles, in not becoming pink by exposure to the air, and by its less alliaceous odour. A commoner kind (*soft sagapenum*) occurs in soft tough masses, in which no evident tears are distinguishable. When heated on the point of a knife in the candle, sagapenum gives out a much more aromatic and agreeable odour than galbanum. It has a hot and acrid taste.

Composition.—Sagapenum contains a *volatile oil*, having an alliaceous odour and taste, *resin*, and *gum*.

Effects and Uses.—Its effects and uses are the same as those of assafœtida. It is usually considered to hold an intermediate rank between assafœtida and galbanum; but it is rarely employed.

Administration.—It is given in substance, in the form of pill, in doses of from 5 to 30 grains, or more.

DOREMA AMMONIACUM, *Don.* **The Ammoniacum Plant.**

Botanical Character.—*Perennial herb. Stem* 7 to 9 feet high, glaucous green. *Leaves* large, petiolate, about 2 feet long, somewhat bipinnate; *petioles* downy, sheathing at the base. *Umbels* proliferous, racemose; *umbellules* globose, on short stalks, often arranged in a spiked manner; *involucres* and *involucels* none; *pedicels* woolly. *Calyx* adherent, 5-toothed. *Petals* white. *Ovaries* densely woolly; *stylopodium* cup-shaped. *Fruit* elliptical, slightly compressed from the back; *mericarps* with 3 distinct filiform primary ridges near the middle, and alternating with them, 4 obtuse secondary ridges (2 of the primary ridges confluent with the margin), the whole enveloped in wool; *vittœ*, 1 to each secondary ridge, 1 to each primary marginal ridge, and 4 to the commissure.

Habitat.—Persia, in the province of Irak; and near Bameean in the Punjaub.

[§ **Ammoniacum.** *Ammoniacum.*

A gum-resinous exudation from Dorema Ammoniacum, *Don.* Collected in Persia and the Punjaub.]

Extraction.—The whole plant is abundantly pervaded with a milky juice, which oozes forth upon the slightest puncture being made, even at the end of the leaves. This juice, when hardened, constitutes ammoniacum. It does not appear that artificial incisions are ever made in the stem. Lieut.-Col. Kennet says, 'When the plant has attained perfection, innumerable beetles, armed with an anterior and posterior probe of half an inch in length, pierce it in all directions; it (ammoniacum) soon becomes dry, and is then picked off and sent, *viâ* Bushire, to India and various parts of the world.' According to Dr. Grant, the drug is collected in the Punjaub, like assafœtida, from the root of the plant.

Commerce.—Ammoniacum is usually imported from Bombay, but occasionally it comes from the Levant. It is brought over in chests, cases, and boxes.

General Characters and Varieties.—Ammoniacum occurs in two forms; in the *tear* and in the *lump*. *Ammoniacum in the Tear* occurs in distinct dry tears, which are usually more or less spheroidal, though frequently of irregular forms, and varying in size from the fruit of coriander (or even smaller), to that of a walnut. Externally the tears are of a yellow (pale reddish or brown) colour, with a waxy lustre; internally they are white or opalescent, opaque, or only feebly translucent at the edge of thin films. At ordinary temperatures they are hard and brittle, but soften like wax in the hand, or by the application of moderate heat. *Lump Ammoniacum.*—This occurs in masses, generally composed of agglutinated tears, whose properties it possesses. It is sometimes met with in soft plastic masses of a darker colour, and mixed with various impurities. To separate these, it is melted and strained. Both kinds have a faint unpleasant peculiar odour, by which this gum-resin may be readily distinguished from all the others. This odour is best detected by heating the ammoniacum on the point of a pen-knife. They have a bitter, acrid, and mucilaginous taste. Rubbed with water ammoniacum forms an emulsion. Umbelliferous fruits are not unfrequently found intermixed with both varieties.

Composition.—Ammoniacum, like the other fetid umbelliferous gum-resins, is essentially composed of a *volatile oil*, *resin*, and *gum*. *Volatile Oil.*—This is transparent, lighter than water, with a strong disagreeable odour, and ultimately a bitter and nauseous taste. It does not, like the volatile oil of assafœtida, contain sulphur. *Resin.*—Reddish-yellow, tasteless, has the odour of the gum-resin. Soluble in alkalies and alcohol; partly soluble in ether and the oils (fixed and volatile).

Physiological Effects.—The effects of ammoniacum are similar to, though less powerful than, those of assafœtida. Its stimulant influence is also less than that of galbanum; this is due to its containing much less volatile oil. Full doses of it readily disturb the stomach.

Therapeutics.—Though applicable to all the same cases as assafœtida, its internal use is principally, or almost solely, confined to chronic pulmonary affections. It is not fitted for irritation or inflammation of the bronchial membrane; but in chronic coughs, with deficient expectoration, or in chronic catarrhs and asthmatic cases of old persons with profuse secretion, it sometimes gives slight relief. As a topical discutient, or resolvent application, in the form of plaster, to glandular enlargements and indolent affections of the joints, it occasionally proves useful.

Administration.—The dose of ammoniacum is from 10 to 30 grains. It may be given in the form of pill or mixture.

Pharmaceutical Uses.—It is a constituent of the compound squill pill, pill of ipecacuanha with squill, and of galbanum plaster.

[§ **Emplastrum Ammoniaci cum Hydrargyro.** *Ammoniacum and Mercury Plaster.*

Take of

Ammoniacum	12 ounces.
Mercury	3 ounces.
Olive Oil	1 fluid drachm.
Sublimed Sulphur	8 grains.

Heat the oil, and add the sulphur to it gradually, stirring till they unite. With this mixture triturate the mercury until globules are no longer visible ; and, lastly, add the ammoniacum, previously liquefied, mixing the whole carefully.]

Employed as a stimulant discutient to indolent tumours, &c. A very useful application to the housemaid's swollen knee.

[§ **Mistura Ammoniaci.** *Ammoniacum Mixture.*

Take of

Ammoniacum, in coarse powder .	$\frac{1}{4}$ ounce.
Distilled Water	8 fluid ounces.

Triturate the ammoniacum with the water, gradually added, until the mixture assumes a milky appearance, then strain through muslin.

Dose.—$\frac{1}{2}$ to 1 fluid ounce.]

The resinous constituent of ammoniacum is more effectually suspended in water by the aid of the yolk of an egg. This mixture operates as a stimulant to the bronchial membrane, and is used as an expectorant in chronic coughs, humoral asthma, &c. It is a convenient and useful vehicle for squill or ipecacuanha.

FERULA GALBANIFLUA, *Buhse.* The Galbanum Plant.

[§ **Galbanum.** *Galbanum.*

A gum-resin, derived from an unascertained umbelliferous plant. Imported from India and the Levant.]

Botanical Source.—Although the Pharmacopœia states that galbanum is derived from an unascertained umbelliferous plant, its source has recently been determined. It is the *Ferula Galbaniflua* of Buhse. The botanical source of galbanum was referred by Lindley to *Opoïdia galbanifera*; and by Don to a plant named by him *Galbanum officinale.*

Extraction.—Geoffroy says, though I know not on whose authority, that galbanum is generally obtained by making an incision into the stalks about three fingers' breadth above the root, from which it issues in drops, and in a few hours becomes dry, and hard enough to gather.

Commerce.—It comes to England principally by way of Bombay; but it is said to reach Russia by way of Astrachan, in large quantities.

General Characters and Varieties.—Galbanum is found in commerce in the two forms of *tear* and *lump. Galbanum in the tear* occurs in distinct, round, yellow or brownish-yellow, translucent tears; rarely exceeding the size of a pea. Their fracture is feebly resinous, and the fractured surface has a yellow colour. *Lump galbanum* is the more common kind. It consists of large irregular masses of a brownish or dark brownish-yellow colour, and composed of agglutinated tears, some few of which, when broken, are observed to be translucent, and bluish or pearl-white. The fruit, pieces of the stem, &c., are generally found intermixed amongst the agglutinated tears. To separate these, galbanum is melted and strained. The odour of both kinds is the same—strong, peculiar, and disagreeable. The taste is acrid and bitter. When exposed to cold, galbanum becomes brittle, and may be reduced to powder. In many of its other properties it agrees with the fetid gum-resins already described. Galbanum varies so much in its characters, that it seems probable it is derived from different plants.

Composition.—Galbanum contains a *volatile oil, resin, gum,* &c. *Volatile oil.*—This is colourless and limpid. Its specific gravity is 0·912; its odour is like that of galbanum and camphor; its taste is hot, afterwards cooling and bitterish. It does not contain sulphur. It is soluble in spirit, ether, and the fixed oils. *Resin.*—This is the residue obtained by boiling the alcoholic extract of galbanum in water. It is dark yellowish-brown, transparent, brittle, and tasteless; soluble in ether and alcohol, scarcely so in spirit containing 50 per cent. of water, or in almond oil. Very slightly soluble in oil of turpentine, even when aided by heat. It dissolves in oil of vitriol, forming a dark yellowish-brown liquid. According to Pelletier, galbanum-resin has the remarkable property of yielding an indigo-blue oil when heated to 248° F. or 266° F.

Physiological Effects.—The general effects of galbanum are those of the fetid antispasmodic gum-resins already described. It is usually ranked between assafœtida and ammoniacum, being weaker than the former but stronger than the latter. As it yields, by distillation, more volatile oil than assafœtida does, it has been supposed that it must exceed the latter in its stimulant influence over the vascular system; but as an antispasmodic, it is decidedly inferior to assafœtida. A specific stimulant influence over the uterus has been ascribed to it.

Therapeutics.—Galbanum is principally adapted for relaxed and torpid habits, and is objectionable in inflammatory or febrile disorders. It is employed in the same cases as assafœtida, with which it is generally given in combination. It is principally used in chronic mucous catarrh, in which it oftentimes proves serviceable. It has also been employed in amenorrhœa and chronic rheumatism. Externally it is applied as a mild stimulant, resolvent, or suppurant, in indolent swellings.

Administration.—It may be given in substance, in the form of pill, in doses of from 10 to 30 grains; or in the form of emulsion.

Pharmaceutical Use.—It is an ingredient in compound pill of assafœtida.

[§ **Emplastrum Galbani.** *Galbanum Plaster.*

Take of

Galbanum Ammoniacum Yellow Wax	of each	1 ounce.
Lead Plaster		8 ounces.

Melt the galbanum and ammoniacum together, and strain. Then add them to the lead plaster, and wax, also previously melted together, and mix the whole thoroughly.]

This plaster, spread upon leather, is applied to indolent tumours, to promote their suppuration, and to disperse them. Its operation appears to be that of a mild stimulant. It is also applied to the chest in chronic pulmonary complaints. In weakly, ricketty children, with weakness of the lower extremities, it is applied to the lumbar region.

OPOPONAX CHIRONIUM, *Koch.* The Opoponax.

Botanical Character.—Perennial *herb.* *Root* thick. *Stem* from 6–7 feet high, rough. *Leaves* bipinnatisected; *segments* unequally cordate, crenate, obtuse. *Umbels* many rayed. General and partial *involucres* few-leaved. *Flowers* yellow. *Calyx* adherent; *limb* obsolete. *Petals* roundish, entire, rolled inward, with a rather acute lobe. *Stylopodium* broad, thick. *Styles* very short. *Fruit* flattened at the back, with a dilated convex margin. *Mericarps* with 3 dorsal filiform very thin ridges, and no distinct lateral ones. *Vittæ* 3 to each channel, 6 to 10 to each commissure. *Seed* smooth.

Habitat.—Sunny parts of the south of France, Italy, Sicily, Croatia, Greece, and Asia Minor.

Opoponax. *Opoponax.*

A gum-resin, supposed to be derived from Opoponax Chironium.

(*Not official.*)

Extraction.—According to Dioscorides, whose account is probably correct, this gum-resin is obtained by incisions into the root; a milky juice then exudes, which, by drying, forms the opoponax of commerce. We have, however, no certain knowledge of its place of production, or of its mode of collection.

General Characters and Varieties.—Opoponax occurs in irregular yellowish-red lumps (*lump opoponax*), or in reddish tears (*opoponax in the tear*). It has an acrid bitter taste, and an unpleasant odour. Rubbed with water it forms an emulsion.

Composition.—Opoponax contains a *volatile oil*, *resin*, and *gum.*

Effects and Uses.—Similar to the other fetid antispasmodic gum-resins. It is, perhaps, more allied to ammoniacum than to any other of these substances. Opoponax is rarely employed. It is adapted to the same cases as the other umbelliferous gum-resins.

CONIUM MACULATUM, *Linn.* Spotted Hemlock.

Botanical Character.—*Root* biennial. *Stem* from 2 to 6 feet high, round, smooth, glaucous, shining, hollow, spotted with dark purple. *Leaves* tripinnate with lanceolate pinnatifid leaflets, or decompound, of a dark and shining green colour, smooth, fetid when bruised, with long furrowed petioles, sheathing at their base. *Umbels* (fig. 81) of many general as well as partial rays: *general involucre* of several (usually 3 to 7) bracts; *partial involucre* of 3 bracts on one side, ovate-lanceolate. *Calyx* adherent; *limb* obsolete. *Petals* 5, obcordate, white, with inflexed points. *Stamens* 5. *Styles* 2, filiform, spreading; *stigma* round. *Fruit* (fig. 81, *a*, *b*) ovate, compressed laterally; *mericarps* with 5 prominent primary ridges, which are undulated-crenate; the *channels* have many striæ, but no vittæ. *Seed* with a deep hollow groove in front.—*Flor. Lond.*, fasc. ii. pl. 17.

Fig. 81.

Conium maculatum.
a. Fruit. *b.* Transverse section of fruit.

Diagnosis.—In distinguishing *Conium maculatum* from other Umbelliferæ, the following characters should be attended to:—The large round smooth spotted *stem*, which is not swollen at the nodes; the smooth dark and shining green colour of the lower *leaves*; the *general involucre* of from 3 to 7 bracts; the *partial involucre* of 3 unilateral bracts; the *fruit* with undulated-crenate primary ridges. To these must be added, that the whole *herb*, when bruised, has a disagreeable smell (compared by some to that of mice, by others to that of fresh cantharides, or of cats' urine).

Habitat.—Indigenous; hedges and waste ground, especially near towns and villages. Also in other parts of Europe, the east of Asia, and in the cultivated parts of North America and Chili, into which it has been introduced.

History.—This plant is usually supposed to be the κώνειον of the Greek writers,—the celebrated *Athenian state poison*, by which Socrates and Phocion died. Various reasons contribute to give the common opinion on this point a high degree of probability.

[§ **Conii Folia.** *Hemlock Leaves.*

The fresh leaves and young branches of Conium maculatum, *Linn.*; also the leaves separated from the branches and carefully dried; gathered from wild British plants when the fruit begins to form.]

General Characters.—[§ Fresh leaves decompound, smooth, arising from a smooth stem with dark purple spots; dried leaves of a full green colour and characteristic odour. The leaf rubbed with solution of potash gives out strongly the odour of conia.] To these characters of the Pharmacopœia, should be added those already given in the botanical description.

Drying and Preservation.—The leaves should be dried quickly in baskets by the gentle heat of a proper stove. Exclusion from solar light contributes greatly to the preservation of their colour. If properly dried, the leaves should have a fine green colour, and their characteristic odour; and when rubbed with solution of potash they should evolve the odour of conia. They should be preserved in cool, closed, perfectly opaque, and dry vessels. Tin canisters possess these properties. However, little reliance can be placed on the dried leaves, even when most carefully prepared, for they sometimes yield no conia, though they possess the proper hemlock odour and a fine green colour. The recent experiments of Dr. John Harley also confirm this statement of the author, for he found the dried plant almost inert, and he also proved that the odour test by solution of potash was exceedingly fallacious, for he ascertained that preparations of hemlock containing conia only in such proportions as to render them quite useless in a therapeutical point of view, gave out a distinct odour of the alkaloid when rubbed with that substance.

[§ **Conii Fructus.** *Hemlock Fruit.*

The dried ripe fruit of Conium maculatum, *Linn.*]

General Characters.—The fruit commonly termed *hemlock seed*, is broadly ovate and compressed laterally; the half-fruit presents five wavy crenated ridges. (See fig. 81, *a*, *b*.) It has but a very little odour, and a slight somewhat bitterish taste. Reduced to powder and rubbed with a solution of potash, hemlock fruits give out strongly the odour of conia. The fruit retains its active principle unchanged for a much longer time than the leaves (see *conia*). On this account it has been introduced into the British Pharmacopœia; the recent experiments of Dr. John Harley, however, show that the dried *ripe* fruit is almost inert.

Composition.—All parts of the plant contain a peculiar liquid volatile alkaloid, termed *conia*, to which their active properties are essentially due, and a trace of *volatile oil*. *Volatile Oil* (*Odorous principle*).—The distilled water of hemlock possesses, in a high degree, the characteristic odour of hemlock, but is scarcely, if at all, poisonous. Hence it is obvious that the volatile oil is not the active principle, and that the characteristic odour of hemlock, in the different preparations of this plant, is not to be taken as a necessary indication of their activity. Bertrand isolated the odorous matter, and found it to be a volatile oil of an acrid taste and peculiar smell. *Conia* (*Coniin*, *Cicutine*), $C_8H_{15}N$, exists in hemlock in combination with an acid (*coniic acid*, Peschier); so that it cannot be recognised by its odour, nor obtained by distillation, without the assistance of an alkali. It is more abundant in the fruit than in the leaves. Geiger procured from 6 pounds of fresh, and 9 pounds of dried fruits, about 1 ounce of conia; whereas from 100 pounds of the fresh herb he obtained only a drachm of this alkaloid. Conia, free from all impurity but water, may be obtained by distilling the alcoholic extract of the fruit with its own weight of water and a little caustic potash. The conia passes over readily, and floats on the surface of the water, which contains conia in solution. When pure, conia is at ordinary temperature an oily-looking, transparent, volatile liquid, lighter than water, its specific gravity being 0·89, but according to Blyth 0·878. Its odour is strong, penetrating, and stupefying, somewhat like that of hemlock, or more analogous to a combination of the odours of tobacco and mice. Its vapour excites a flow of tears. Its taste is acrid, somewhat resembling that of tobacco. Conia is volatile, and when dropped on paper produces a transparent greasy-looking stain like an essential oil. By a gentle warmth the stain entirely disappears; if slowly evaporated, there is a brown colour produced. The boiling point of conia is between 340° and 413° F. In close vessels it passes over without decomposition, and when mixed with water, its vapour may be distilled over at 212°. These differences in the boiling point have probably arisen from the variable degrees of purity of the conia. It burns with a bright smoky flame. It combines with one-fourth of its weight of water, forming *hydrate of conia.* At common temperatures it is soluble in 100 parts of water, in 6 of ether, and in all proportions in alcohol. The aqueous solution becomes turbid when warmed; but if exposed to the air it becomes brown, and deposits a brown resinous-looking mass. The alcoholic solution of conia combines with water more readily than the pure alkaloid; and one part of conia dissolved in four parts of alcohol is not rendered turbid by the addition of water. Anhydrous conia has no alkaline reaction, but on the addition of a small quantity of water its alkalinity is strongly and permanently manifested. Conia produces copious white fumes with the vapours of nitric, hydrochloric and acetic acids, and completely neutralises these acids. It coagulates albumen, acquires a blood-red colour on the addition of a small quantity of nitric acid, and when sulphuric acid is added, evolves much heat, and acquires a purple-red colour, which changes subsequently to olive-green. Dry hydrochloric acid gas at first produces with it a purple-red tint, and afterwards an indigo blue. Conia, when exposed to the air, is resolved into ammonia, and a bitter extractive matter possessed of no poisonous properties. This tendency to spontaneous change, which is materially increased by temperature, may account for the variable proportion of the active principle found in some preparations of hemlock, as also for the conflicting accounts of authors regarding their medicinal action. Conia is a strong base, and resembles ammonia in many of its reactions. It precipitates oxide of silver from the nitrate, and redissolves it when added in excess. Chloride of silver is almost as soluble in it as in ammonia.

Physiological Effects.—Under the continued use of small and repeated doses of hemlock, glandular and visceral enlargements have frequently subsided; hence has arisen the opinion, entertained in all ages, of the *resolvent* and *discutient* powers of this remedy, and of the stimulus which it communicates to the absorbing vessels. The mammæ and the skin are the parts in which these powers have been supposed to be more especially manifested; and the asserted effects (wasting of the breast, profuse sweating, and eruptions) of hemlock on these parts, in healthy individuals, lend support to this opinion. But the influence of hemlock over the organic functions does not appear to be limited to this resolvent operation. In foul ulcers the quality of the discharge has been greatly improved, while pain has been alleviated, and the tendency of the sores to spread has apparently been greatly diminished. If, then, these effects be really referable to hemlock (and they have been asserted by so many writers, in all ages, that we can scarcely refuse to admit them), they prove that this plant exercises a most profound influence over nutrition and the other organic functions, and which we have no better term to indicate than that of *alterative.* That hemlock has some influence of the kind referred to, I do not doubt; but it has been greatly exaggerated, and thereby much unmerited discredit has been brought on the remedy: for practitioners, finding that it would not do all that had been ascribed to it, have frequently dismissed it as altogether useless. Whether the failures ought, in part at least, to be ascribed to imperfect modes of preparing and administering this plant, we are, as yet, unable positively to affirm. One fact, however, is certain—that many of the preparations of hemlock in ordinary cases are inert, or nearly so; and others, probably, have had their properties greatly changed in the process of their preparation. The remark made by Sir R. Christison, with respect to the physiological effects of this plant, applies well to the point under discussion. 'If,' says this writer, 'physicians or physiologists would acquire definite information as to the physiological effects of hemlock, in small or medicinal doses, they must begin the enquiry anew. Little importance can be attached to anything already done in this field, as I have no doubt whatever that by far the greater proportion of the preparations of hemlock hitherto employed have been of very little energy, and, in the doses commonly used, is absolutely inert.' The investigations of Dr. John Harley show that the only trustworthy preparations of hemlock are the succus conii and the alkaloid conia.

In *large* or *poisonous doses* the symptoms are those indicating disorder of the cerebro-spinal functions. In some of the best recorded cases the leading symptom was coma; the effects being altogether analogous to those of opium. In other instances, convulsions or violent delirium, or both, were the prominent symptoms. But we have no well-detailed cases in which *delirium* was the leading symptom. General *paralysis* has also been observed in this form of poisoning. A case in which this was a most prominent symptom is mentioned by Alderson. The patient recovered by the use of stimulants. As illustrations of the *convulsions* caused by hemlock, I may refer to the cases mentioned by Limprecht and Ehrhard. The first states that an old woman suffered for three months with abdominal pain and convulsive movements of the limbs, in consequence of eating hemlock root. Ehrhard mentions trismus as one of the symptoms in another case. Sir Thomas Watson has related two cases in which giddiness, coma, and convulsions occurred. These statements, as well as others of a like tendency which might be quoted, do not agree with the (as yet) ascertained effects of conia. The *post-mortem* appearances throw but little light on the *modus operandi* of hemlock. Venous congestion, especially of the cerebral vessels, a fluid condition of the blood, and in the lower animals, redness of the alimentary canal, are occasional appearances. According to Dr. John Harley, the first effect of hemlock is a depression of the motor function, and its last the entire obliteration of all muscular movement derived from the cerebro-spinal motor tract; and it exerts its power chiefly, if not exclusively, upon the motor centres of the cord situated within the cranium. It exerts no direct action upon the cranium, and is no true anodyne. It lessens muscular irritability.

Effects of Conia.—The following are the symptoms produced, as detailed by Sir R. Christison:—'It is, in the first place, a local irritant. To whatever texture or part it is applied, expressions of pain are immediately excited. But these local effects are soon overwhelmed by the indirect or remote action which speedily follows. This consists essentially of swiftly-spreading palsy of the muscles, affecting first those of voluntary motion, then the respiratory muscles of the chest and abdomen, lastly the diaphragm, and thus ending in death by asphyxia.' Convulsive tremors, and twitches of the limbs, sometimes, though not invariably, are observed. The external senses do not appear to be affected until respiration is impaired. The primary seat of the action of conia is probably the spinal cord. In this, conia and strychnia agree; but in the nature of the effect they seem, as Sir R. Christison has observed, to be the counterparts of each other. Conia exhausts the nervous energy of the cord and causes muscular paralysis; strychnia irritates it, and produces permanent spasm of the respiratory muscles. These effects of conia suggest its employment in convulsive or spasmodic diseases; as tetanus, poisoning by strychnia or nux vomica, hydrophobia, &c. I have tried it on two rabbits under the influence of strychnia, and found that it stopped the convulsions, but hastened rather than prevented death. It was tried in a case of hydrophobia, in a middle-aged man, at the London Hospital. Two minims of conia, dissolved in thirty drops of acetic acid, were applied endermically to the præcordium (the cuticle having been previously removed by a blister). The relief was instantaneous but transitory, and in about seven minutes the symptoms began to reappear, and shortly assumed their previous urgency. Three minims of conia were afterwards injected into the rectum without benefit. The remedy was not repeated, and the man died in a few hours.

Therapeutics.—In the present state of uncertainty with respect to the real physiological operation of hemlock, it is obviously impossible to lay down indications or contra-indications for its use, which can be much relied on. Acute inflammation, fever, apoplexy, or tendency to it, and paralysis, are among the circumstances which oppose the employment of hemlock. The uses of hemlock may be reduced to two heads: those which depend on its influence over the organic functions; and, secondly, those which have reference to its influence over the cerebro-spinal system. The resolvent or discutient and alterative uses come under the first head; the antispasmodic and anodyne under the second.

As a resolvent and alterative. The diseases in which the discutient and alterative properties of hemlock are likely to be serviceable are, *enlargements and indurations of the absorbing and secreting glands* and *of the viscera*, *scrofula*, *obstinate chronic skin diseases*, and *foul ulcers*. I am not prepared to offer any opinion as to whether the diseases to which the terms *scirrhus* and *cancer* are strictly applicable, have ever been cured by hemlock. One fact is undoubted—that diseases, supposed to have been scirrhous and cancerous, have been greatly alleviated, and, in some cases, apparently cured by this remedy. In *scrofula*, it seems to be occasionally useful as a palliative in irritable constitutions. It allays the pain, and assists in reducing the volume of enlarged lymphatic glands, and in scrofulous ulcerations improves the quality of the discharge, and disposes the sores to heal. Even *enlargements of the liver*, *spleen*, and *pancreas*, have been, at times, apparently, benefited by hemlock. In *mammary tumours* and *profuse secretion of milk*, a trial of it should never be omitted. In *bronchocele* it has been found efficacious. In *syphilis* it is useful, by alleviating nocturnal pains, and in diminishing the tendency to spread of irritable sores. In *chronic skin diseases* (lepra, herpes, &c.) it is now but rarely employed.

As a cerebro-spinal agent (*antispasmodic and anodyne*). The power possessed by conia of paralysing the motor nerves, suggests the employment of hemlock as an *antispasmodic*. Hitherto, however, trials of it have been made in a few spasmodic diseases only, and those have not proved favourable to its reputation. In some spasmodic affections of the respiratory organs, it has gained a temporary celebrity only. In *hooping cough*, Dr. Butter spoke favourably of it, as having the advantage over opium of not being liable to check expectoration. But though the violent and periodic fits of coughing are obviously of a spasmodic nature, and, therefore apparently adapted for the use of hemlock, experience has fully proved that the disease is one which will run through a certain course. At the best, therefore, hemlock can prove a palliative only. In other forms of *spasmodic cough*, as well as in *spasmodic asthma*, hemlock deserves farther trial. In *tetanus*, conia or hemlock held out some hopes of doing good. Mr. Curling has kindly furnished me with the notes of a case which occurred in the London Hospital. A tincture of hemlock fruit was exhibited on the eighth day of the disease, at first in doses of 20 minims every hour, which were increased in the course of the three following days to 2 fluid drachms every quarter of an hour, until the patient (a man aged 46) had taken, in all, two pints! but without any decided effect on the spasms or brain. Morphia and laudanum were afterwards given, but the man died. A small quantity of conia, obtained from three ounces of the same tincture used in this case, killed a cat in less than four minutes. In a case of *chorea*, treated by Mr. Curling, no relief was obtained by the use of the above-mentioned tincture, given to the extent of three ounces in twelve hours. The patient (a young man) ultimately died, exhausted from the long-continued and violent convulsions of nearly all the voluntary muscles. Hemlock has been frequently employed as an *anodyne* and often with apparent relief. As conia does not appear to have the same paralysing influence over the sensitive, that it has over the motor nerves, some doubt has been raised as to the real anodyne influence of hemlock. However, *in tender glandular enlargements*, *in painful ulcers*, *in scirrhus* and *cancer*, *in rheumatism*, and *in neuralgia*, hemlock has, at times, evidently mitigated pain; and its power of *allaying troublesome cough* is, in some instances, referable to its diminishing the preternatural sensibility of the bronchial membrane. Dr. F. J. Farre has seen marked advantage from its use in reflex paraplegia, arising from irritation of the kidneys.

Administration.—Hemlock is used in the form of powder, tincture, juice, extract, inhalation, and poultice. Dose of the powder 3 to 10 grains, or more.

Antidote.—No chemical antidote is known for hemlock, though it is not improbable that an infusion of galls might be serviceable.

The first object, therefore, is to evacuate the poison from the stomach; this is to be effected by the same means as directed for poisoning by opium. If the poison be suspected to have passed into the bowels, a purgative is to be administered, unless diarrhœa have come on. The subsequent treatment will depend on the symptoms: blood-letting is frequently required to relieve the congested state of the cerebral vessels. Opium is generally prejudicial. Artificial respiration should not be omitted in extreme cases. As strychnia and nux vomica appear to produce a condition of the spinal cord opposite to that of conia, it is a question whether either of these agents might not be serviceable in the treatment of a case of poisoning by hemlock.

Official Preparations of Hemlock Leaves.

[§ **Cataplasma Conii.** *Hemlock Poultice.*

Take of

Hemlock Leaf, in powder . .	1 ounce.
Linseed Meal	3 ounces.
Boiling Water	10 fluid ounces.

Mix the hemlock and linseed meal, and add them to the water gradually, with constant stirring.]

This is sometimes employed as a soothing anodyne application to cancerous, scrofulous, venereal, and other foul ulcers.

[§ **Extractum Conii.** *Extract of Hemlock.*

Take of

The fresh Leaves and young Branches of Hemlock	112 pounds.

Bruise in a stone mortar, and press out the juice; heat it gradually to 130°, and separate the green colouring matter by a calico filter. Heat the strained liquor to 200° to coagulate the albumen, and again filter. Evaporate the filtrate by a water-bath to the consistence of a thin syrup; then add to it the green colouring matter previously separated, and stirring the whole together assiduously, continue the evaporation at a temperature not exceeding 140°, until the extract is of a suitable consistence for forming pills.

Dose.—2 to 6 grains.]

It has been given by Dr. F. J. Farre in still larger doses in obstinate acute rheumatism, increasing the dose gradually from 5 to 20 grains three or four times a day. This extract is of good quality only when a strong odour of conia is disengaged by degrees on its being carefully triturated with solution of potash.

Pharmaceutical Uses.—There are two official preparations of this extract, as follows:—

[§ **Pilula Conii Composita.** *Compound Pill of Hemlock.*

Take of

Extract of Hemlock	$2\frac{1}{2}$ ounces.
Ipecacuanha, in powder . . .	$\frac{1}{2}$ ounce.
Treacle	a sufficiency.

Mix the extract of hemlock and ipecacuanha, and add sufficient treacle to form a pill-mass.

Dose.—5 to 10 grains.]

[§ **Vapor Coniæ.** *Inhalation of Conia.*

Take of

Extract of Hemlock . . .	60 grains.
Solution of Potash . . .	1 fluid drachm.
Distilled Water	10 fluid drachms.

Mix. Put 20 minims of the mixture on a sponge, in a suitable apparatus, so that the vapour of hot water passing over it may be inhaled.]

Instead of this preparation, Dr. John Harley recommends a solution of 2 grains of conia in 3 fluid drachms of alcohol and 5 fluid drachms of water: 20 minims of this contain $\frac{1}{12}$th of a grain of conia, and if dropped into water, form a suitable amount for inhalation.

[§ **Succus Conii.** *Juice of Hemlock.*

Take of

Fresh Leaves of Hemlock . . .	7 pounds.
Rectified Spirit	a sufficiency.

Bruise the hemlock in a stone mortar; press out the juice, and to every three measures of juice add one of the spirit. Set aside for seven days, and filter. Keep it in a cool place.

Dose.—$\frac{1}{2}$ to 1 fluid drachm.]

This is an excellent preparation, and keeps well. According to Dr. John Harley, this is the only trustworthy official preparation of hemlock.

Official Preparation of Hemlock Fruit.

[§ **Tinctura Conii.** *Tincture of Hemlock.*

Synonym.—Tinctura Conii Fructus, 1864.

Take of

Hemlock Fruit, bruised	$2\frac{1}{2}$ ounces.
Proof Spirit	1 pint.

Macerate the hemlock fruit for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

Dose.—20 to 60 minims.]

The Tinctura Conii of the London Pharmacopœia was made from hemlock leaves. The present tincture is at least twice as strong. Good tincture of hemlock should evolve a strong odour of conia on the addition to it of solution of potash. Dr. Garrod gave large doses of this tincture as also of the tincture of the London Pharmacopœia, from half to one fluid ounce, with impunity. Dr. John Harley obtained similar results, and believes this tincture to be completely inert, except so far as it possesses the stimulant properties of the alcohol employed in its preparation.

CUCURBITACEÆ, *Jussieu.* THE GOURD ORDER.

CITRULLUS COLOCYNTHIS, *Schrad.* The Bitter Cucumber or Colocynth.

Botanical Character.—*Annual herb. Stem* branched, procumbent, somewhat hispid, angular. *Leaves* (fig. 82) cordate-ovate, many-lobed; *lobes* obtuse, bright green on the upper side, paler, and clothed with whitish hairs beneath; *petioles* as long as the laminæ; *tendrils* short, opposite each leaf, filiform, branching. *Flowers* (fig. 82) monœcious, axillary, solitary, stalked. *Calyx* 5-toothed. *Corolla* yellow, with greenish veins; *petals* small, scarcely adherent to each other, and to the calyx. *Males: Stamens* 3, short, two of which have doubly-bent anthers, or consist of two anthers, in which case the number of stamens is really 5. *Females: Calyx* adherent, globose, and somewhat hispid. *Ovary* inferior, smooth; *style* short; *stigmas* 3. *Fruit* globose, smooth, about the size of an orange, yellow when ripe, with a thin firm rind, 6-celled; *pulp* very bitter. *Seeds* ovate.—*Woodv.* p. 476, pl. 175 (*Cucumis Colocynthis*).

Fig. 82.

Leaf and Flower of Citrullus Colocynthis.

Habitat.—Japan, Coromandel, Cape of Good Hope, Syria, Nubia, Egypt, Turkey, and the islands of the Grecian Archipelago. Cultivated in France and Spain.

[§ **Colocynthidis Pulpa.** *Colocynth Pulp.*

The dried decorticated fruit, freed from seeds, of Citrullus Colocynthis, *Schrad.* Imported chiefly from Smyrna, Trieste, France, and Spain.]

Preparation of the Fruit.—The fruit is gathered in autumn, when ripe and yellow, and in most countries is peeled, and dried either by exposure to the sun or by stoves.

General Characters.—The fruit called *colocynth* is generally imported *peeled*, but sometimes *unpeeled.* Its *pulp* (the official part) is nearly white, light, spongy, inodorous, tough, and nauseously bitter. The *seeds* are smooth, either white, yellowish-white, or brownish, bitter, especially the dark-coloured ones, and inodorous. These are directed to be removed in making the official preparations of colocynth.

Varieties.—Two varieties of colocynth are known in commerce—the *peeled* and the *unpeeled.* 1. *Peeled Colocynth* : *Turkey*, *French*, and *Spanish Colocynth.*— The *Turkey* is imported from Smyrna, Alexandretta, Constantinople, and the Italian seaports. The fruit of this kind is not only larger, but contains a much greater proportion of the pulp than the *Spanish*, which fetches a much lower price in the market. The usual size of each fruit is about two or three inches in diameter ; the shape is more or less globular, according to the evenness with which the rind has been removed, and the degree of contraction in drying ; the colour is white or pale brownish-white. One hundred parts by weight consist of about 28 parts pulp, and 72 parts seed. *French Colocynth* is white or pale yellow, of good quality and handsome appearance, but somewhat less powerful than *Turkey Colocynth* in its medicinal effects. The above kinds of colocynth are alone official. 2. *Unpeeled Colocynth; Mogadore Colocynth.*—This kind is larger than the preceding, and is covered with a yellowish, smooth, firm rind. It is inferior to peeled colocynth, and as we have seen, not official. It is imported from Mogadore in small quantity only, and is principally used by pharmacists for show-bottles.

Composition.—The principal constituent of colocynth pulp is colocynthin. *Colocynthin : Bitter* or *Purgative Principle of Colocynth.* —By digesting the watery extract of colocynth in alcohol, and evaporating the tincture thus procured, we obtain a mass, composed, according to Vauquelin, of a bitter principle and acetate of potash. A little water readily dissolves the latter, leaving the bitter resinoid matter, to which the name of *colocynthin* has been applied. It is a yellowish-brown, translucent, brittle substance, dissolving in water, but much more readily in alcohol. It is said to be insoluble in ether. By boiling with acids it is decomposed into glucose and resin.

Physiological Effects.—Colocynth taken in *small or moderate doses* acts as a very safe and useful purgative. Its operation is not limited to the acceleration of the vermicular movements, but is extended to the secreting and exhaling vessels of the alimentary canal, whose functions it promotes. Moreover, it stimulates the other abdominal organs; and after the absorption of its bitter acrid principle, it not unfrequently proves diuretic. *In full doses*, it operates as a very active or drastic cathartic and hydragogue; but I have never seen any ill effects from its use. It would appear that colocynth is one of the purgatives which exert a specific stimulant influence over the large intestine. *In excessive doses*, colocynth, both in powder and decoction, has on several occasions operated as a mortal poison, causing violent vomiting and purging, griping pain, and other symptoms of gastro-intestinal inflammation. A tea spoonful and a half of the powder (about 90 grains) has proved fatal. Considered in relation to other cathartics, colocynth will be found to rank near gamboge, from which it is distinguished by at least two circumstances; first, its cathartic effect is not the mere result of its topical acrid operation, but, in part, of its specific influence over the bowels; secondly, its action on the large intestine is more manifest than that of gamboge. In the latter respect, colocynth approximates to aloes; but while it greatly exceeds this in its cathartic and hydragogue effects, it is devoid of the tonic influence possessed by aloes, when used in small doses.

Therapeutics.—Besides being useful as an ordinary purgative, colocynth is adapted for acting as a stimulus to the abdominal and pelvic vessels and nerves in cases of torpor or inactivity, and on the principle of counter-irritation for determining from other organs. The objections to its use are acute inflammatory affections of the alimentary canal, diseases of the large intestine, &c. The following are the principal cases in which it is employed: *In habitual constipation.*—As an ordinary purgative for keeping the bowels regular, the compound extract of colocynth is in common use both among the public and medical men. It operates mildly, certainly, and effectually. *In alvine obstruction.*—In some cases of obstinate constipation, with sickness and other symptoms of an extremely irritable stomach, the compound extract of colocynth occasionally proves invaluable. Occupying but a small bulk, it is retained on the stomach, and succeeds in producing alvine evacuations, where the ordinary liquid purgatives fail in consequence of being thrown up by vomiting. Doubtful cases of intussusception and hernia, even with stercoraceous vomiting, I have seen completely relieved by it. More than once have I known an operation averted by its use, in those who, in addition to the above symptoms, had old herniæ, which led the surgeon to suspect strangulation. A slight degree of abdominal tenderness is not to be considered as absolutely prohibiting its use. Occasionally the extract is rubbed down with soap and water, and administered as an enema. *In diseases of the brain.*—In apoplexy, or a tendency thereto, in paralysis, insanity, violent headache, &c. colocynth is sometimes employed with good effect, on the principle of revulsion and counter-irritation. *In dropsy.* — In dropsical affections, colocynth has been used as a *hydragogue.* But in this country it is less frequently employed for this than for other purposes: various other hydragogues (especially elaterium and jalap) being usually preferred. *In amenorrhœa and chlorosis.*—In some cases of obstructed menstruation, benefit is obtained by the use of drastic purgatives, like colocynth, which act on the rectum, and, by contiguous sympathy, affect the uterus.

Administration.—The *powder*, which is rarely used alone, may be administered in doses of from 2 to 8 grains, intimately mixed with some mild powder (gum, or starch).

Antidotes.—See *Elaterium.*

[§ **Extractum Colocynthidis Compositum.**

Compound Extract of Colocynth.

Take of

Colocynth Pulp	6 ounces.
Extract of Socotrine Aloes . . .	12 ounces.
Resin of Scammony	4 ounces.
Hard Soap, in powder	3 ounces.
Cardamom Seeds, in fine powder . .	1 ounce.
Proof Spirit	1 gallon.

Macerate the colocynth in the spirit for four days: press out the tincture, and distil off the spirit; then add the aloes, scammony, and soap, and evaporate by a water-bath until the extract is of a suitable consistence for forming pills, adding the cardamoms towards the end of the process.

Dose.—3 to 10 grains.]

The British Pharmacopœia has restored the original Compound Extract of Colocynth, to which the London Pharmacopœia gave the name of Pilula Colocynthidis Composita after substituting extract of colocynth for a tincture of the pulp. In the present extract the ingredients are said to be more intimately blended than in the London Compound Pill. It is a powerful and sure, yet safe cathartic.

[§ **Pilula Colocynthidis Composita.** *Compound Pill of Colocynth.*

Take of

Colocynth Pulp, in powder . .		1 ounce.
Barbadoes Aloes, in powder	of each	2 ounces.
Scammony, in powder		
Sulphate of Potash, in powder . .		$\frac{1}{4}$ ounce.
Oil of Cloves		2 fluid drachms.
Distilled Water.		a sufficiency.

Mix the powders, add the oil of cloves, and beat into a mass with the aid of the water.

Dose.—5 to 10 grains.]

This is the Pilula Colocynthidis, *Edin.*, excepting that Barbadoes aloes is substituted for Socotrine, and water for spirit. It differs materially from the Pilula Colocynthidis Composita, *Lond.*, and from the present compound extract, in containing Colocynth in powder instead of an extract or tincture of Colocynth, Barbadoes aloes instead of extract of Socotrine aloes, more than twice as much scammony, and oil of cloves and sulphate of potash instead of cardamoms and soap, besides the ingredients being combined by means of water instead of spirit. Used in similar cases to the preceding.

[§ **Pilula Colocynthidis et Hyoscyami.** *Pill of Colocynth and Hyoscyamus.*

Take of

Compound Pill of Colocynth . . .	2 ounces.
Extract of Hyoscyamus	1 ounce.

Beat them into a uniform mass.

Dose.—5 to 10 grains.]

Extract of hyoscyamus diminishes the pain and griping frequently experienced from the use of colocynth, but does not injure its evacuant properties.

ECBALIUM OFFICINARUM, *Richard.* Squirting Cucumber.

Botanical Character.—Annual. Stem without tendrils, trailing, hispid, scabrous. *Leaves* cordate, somewhat lobed, crenate-toothed. *Flowers* axillary, monœcious. *Males:—Calyx* 5-toothed. *Corolla* yellow, 5-parted. *Stamens* 5, 1 being distinct and 4 united in pairs; *anthers* sinuous. *Females:—Filaments* 3, sterile. *Ovary* inferior, 3-celled; *style* trifid; *stigma* bifid; *Fruit* (pepo) (fig. 83, *a*) muricated, elliptical, pedunculated, about $1\frac{1}{2}$ inch long, when ripe separating from its stalk, and expelling, with violence, its juice and seeds from the aperture at the insertion of the stalk. *Seeds* brown, compressed.—*Steph. and Church.* pl. 34.

Habitat.—South of Europe. Common on rubbish in the villages of Greece and the Archipelago. A few acres of it are annually cultivated at Mitcham, Hitchin, Market Deeping, &c.

[§ **Ecbalii Fructus.** *Squirting Cucumber Fruit.*

The fruit, very nearly ripe, of Ecbalium officinarum, *Richard.*]

General Characters.—(See *Botanical Character.*) The stalk should remain attached to the fruit; otherwise the fruit may have burst and expelled its juice.

[§ **Elaterium.** *Elaterium.*

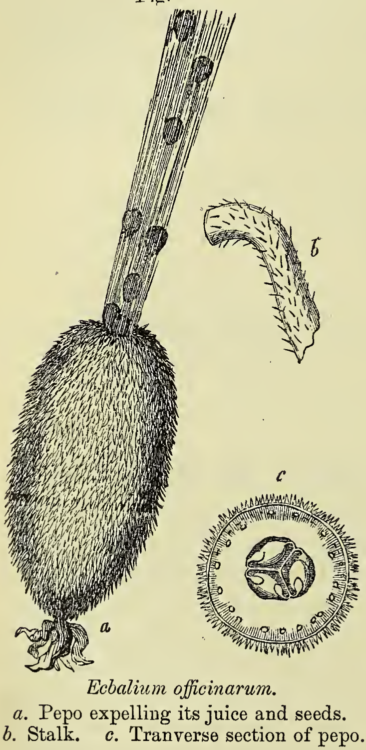
Synonym.—Extractum Elaterii, *Lond.*

A sediment from the juice of the Squirting Cucumber fruit.

Take of

Squirting Cucumber Fruit, very nearly ripe . . . . . . 1 pound.

Fig. 83



Ecbalium officinarum.
a. Pepo expelling its juice and seeds. *b.* Stalk. *c.* Tranverse section of pepo.

Cut the fruit lengthwise, and lightly press out the juice. Strain it through a hair sieve; and set it aside to deposit. Carefully pour off the supernatant liquor; pour the sediment on a linen filter; and dry it on porous tiles with a gentle heat. The decanted fluid may deposit a second portion of sediment, which can be dried in the same way.]

Seat of Elaterium. — Some years since, Dr. Clutterbuck ascertained that the active substance, elaterium, is not found in any quantity in the body of the fruit itself, or in the seeds contained within it; but only in the juice around the seeds. The precise situation of it will be readily comprehended by inspecting a transverse section of the pepo (see fig. 83, *c*). The centre of the fruit is divided into three cells, by projections of the three parietal placentas to which the seeds are attached. Between these projections, and surrounding the seeds, is the *pulp*, which constitutes the *juicy matter around the seeds*, and the active part of the fruit. As this juice is more liquid than any other part of the fruit, it alone runs out to any extent when the fruits are simply sliced, and therefore Dr. Clutterbuck's experiments have shown that the finest elaterium is obtained without pressure from the fruits when nearly as ripe as possible. In practice, however, some pressure must be employed; because the cucumbers must not be too ripe when gathered, otherwise they are apt to burst when picked or carried away; and in this imperfectly ripe state the juice does not flow from them until lightly pressed.

General Characters, Varieties, and Commerce.—Elaterium of commerce is a very variable article. Two kinds are distinguished, namely, —*English* and *Maltese*. 1. *English Elaterium* is prepared at Mitcham, Hitchin, Market Deeping, and some other places. The *finest* occurs in light, friable, thin, very slightly curled flakes, or flat cakes, or fragments, which frequently bear the impression of the paper or muslin on which the elaterium was dried. Its fracture is finely granular; its colour when fresh pale greyish-green, which by keeping, and exposure to the air, becomes yellowish. Its taste is acrid and bitterish; it has a faint animal odour, not very dissimilar to that of ergot, but combined with a fragrance which reminds me of senna or tea. Thrown into water it floats. It does not effervesce in dilute hydrochloric acid, and, if it be boiled in water, the decoction, when cold, gives but slight traces of starch, by the blue colour developed on the addition of iodine. It yields half its weight to boiling rectified spirit; and this solution, concentrated and added to warm solution of potash, yields on cooling not less than twenty per cent. of colourless crystals (elaterine). *Inferior kinds* are sometimes hard, break with difficulty, or with a resinous fracture, are much curled, gummy, and dark coloured (brown or olive-green). 2. *Maltese Elaterium.*—This is imported from Malta. It is in much larger flakes than the best English elaterium, and frequently has some adherent paper on which it has been dried; it has no odour, and its colour is much paler, sometimes with hardly a trace of green. Examined by the microscope, it is generally found to contain granules of wheat starch. Some specimens are softer and more friable, and occasionally are rather chalky to the touch. These are commonly mixed with chalk as well as starch; hence they effervesce with dilute hydrochloric acid, and their cooled decoctions become blue with iodine. It is said that Maltese elaterium is sometimes mixed in this country with buckthorn juice, to deepen its colour. Some Maltese elaterium of better quality than that above described may be occasionally found in commerce, but usually it is very inferior to English elaterium.

Composition.—Elaterium contains *elaterine, green soft resin, bitter matter, starch,* &c. **Elaterine, Momordicine*, $C_{20}H_{28}O_5$.—This may be obtained, as stated above, by boiling elaterium in rectified spirit. The tincture concentrated and added to a warm solution of potash, yields the elaterine on cooling. Elaterine occurs in colourless silky prisms, is very bitter, but odourless; neither acid nor alkaline; nearly insoluble in water and in ether, moderately soluble in cold and much more so in hot alcohol, from which, however, the greater part separates on cooling. It forms from 20 to about 30 per cent.

of well prepared elaterium. It is a very powerful purgative, and on it the activity of elaterium essentially depends. *Green Resin* (*Chlorophyll ?*).—This is insoluble in water, but dissolves in alcohol, ether, and caustic potash. *Bitter matter.*—This is soluble both in water and alcohol. Its taste is intensely bitter; its colour is brownish-yellow.

Physiological Effects.—The acridity of elaterium in its local operation is well shown by various facts. Pliny truly observes that the juice of the elaterium apple is dangerous when applied to the eye; and Dr. Clutterbuck mentions that some of it 'getting accidentally into the eye in one instance, it occasioned severe pain and inflammation, with an erysipelatous swelling of the eyelids, that continued till the following day.' A similar effect has been occasionally produced at Hitchin, on boys employed in collecting the fruits. We have a further proof of its irritant properties in the inflammation and ulceration of the fingers it produces in those employed in its preparation. When swallowed, it irritates the gastro-intestinal membrane, and occasions vomiting and violent purging; hence it is called a *drastic purgative.* Fine elaterium, in the dose of one-eighth of a grain, seldom fails to purge violently, and sometimes causes vomiting. Even one-sixteenth of a grain will generally excite considerable purging. Elaterium powerfully excites the secreting and exhaling vessels of the alimentary canal, and thereby occasions very watery stools; hence the term *hydragogue* applied to it. In some dropsical cases I have known a single dose discharge several pints of water by the bowels. Under the influence of a full dose, the pulse is excited, the tongue becomes dry, and sometimes furred, and great thirst is produced. Occasionally the skin becomes damp under the operation of elaterium. Considered with respect to other cathartics, we find it pre-eminently distinguished by the violence of its purgative effect. Croton oil alone approximates to it. Its hydragogue operation exceeds that of most, if not all other drastic purgatives.

Therapeutics.—The principal use of elaterium is to excite watery evacuations *in dropsy*, by which a twofold effect is to be hoped for: viz., *first*, absorption of the effused fluid; *secondly*, the stoppage of any further effusion in consequence of the metastasis of vital action from the seat of the dropsy to the intestinal membrane. In dropsies dependent on, or accompanied with, disease of the kidney, the evacuation of water from the bowels is much to be preferred to the employment of stimulating diuretics, which may add to the severity of the renal malady. Of the violent hydragogue purgatives, elaterium I believe to be the most useful in dropsy. It evacuates more watery fluid than the others; while, if it be good, its operation may be relied on. It is inadmissible where there is great debility, where there is a febrile condition of system, and where any inflammatory or other disease of the bowels exists. I have seen the fatal termination of dropsy apparently accelerated by the use of elaterium. It is least adapted for cold phlegmatic constitutions. Where no contra-indication to its employment exists, one or two doses of it should be given every other day, for a week or ten days, or even longer in some cases. *In cerebral affections*, such as apoplexy, or a tendency to it (manifested by sleepiness, stupor, or giddiness), mania, &c., elaterium, as a drastic purgative, sometimes proves serviceable on the principle of counter-irritation or revulsion. *In obstinate constipation* from sluggishness of the intestinal tube, elaterium is occasionally useful. But care must be taken to ascertain that the constipation does not depend on any mechanical impediment (as hernia, or intus-susception), to the passage of the fæces. *In gout.*—A combination of elaterium and opium has been found serviceable in gout.

Administration.—The dose of good elaterium is from $\frac{1}{16}$th to $\frac{1}{2}$ a grain. I hear and read of practitioners giving this substance to the extent of 1, 2, or even 3 grains; but this can only be from the bad quality of the drug. It is usually given in the form of a pill. The basis of the pill may be extract of gentian.

Antidotes.—In the event of a case of poisoning by elaterium, the remedies would be demulcent drinks and enemas, opium, the warm bath, and fomentations to the abdomen; stimulants (such as ammonia and brandy) if the circulation fail; and bloodletting to subdue the inflammatory symptoms, should the state of the system not contra-indicate it.

MYRTACEÆ, *R. Brown.* The Myrtle Order.

MELALEUCA MINOR, *D.C.* The Cajuput Tree.

Botanical Character.—Small tree, with an erect, though crooked trunk. *Leaves* shortly petiolate, alternate, elliptical-lanceolate, somewhat acute, slightly falcate, 3–5 ribbed. *Spikes* short, terminal. *Rachis* and *calyx* downy, terminating ultimately in a leafy twig. *Bracts* solitary, 3-flowered, downy, lanceolate. *Calyx* urceolate, 5-parted. *Petals* 5, white. *Stamens* from 30 to 40; *filaments* united at the base into 5 bundles. *Ovary* ovate, more or less adherent; *style* longer than the stamens. *Fruit* capsular, enclosed within the tube of the calyx, 3-celled, 3-valved.—*Steph. and Church.* pl. 84 (*M. Cajuputi*).

Habitat.—Moluccas, and the South of Borneo.

[§ **Oleum Cajuputi.** *Oil of Cajuput.*

The oil distilled from the leaves of Melaleuca minor, *D.C.* Imported from Batavia and Singapore.]

Extraction.—Rumphius states that the leaves are gathered on a warm day, and placed in a sack, where they become hot and damp. They are then macerated in water, and left to ferment for a night, and afterwards submitted to distillation. Two sackfuls of the leaves yield scarcely three fluid drachms of oil. Lesson has thus described the method of obtaining the oil at Bourou, one of the Molucca islands. 'The leaves are gathered in the latter end of September, and put into the cucurbit of a copper alembic, surmounted by a neck, terminated by a capital without a refrigeratory, and a sufficient quantity of water is then added. By distillation, this liquid is made to traverse a worm immersed in a hogshead filled with water, and is collected in a vessel; the oil which floats is very light, and of an herbaceous green colour, which is owing to chlorophylle, or perhaps a somewhat different resinous principle.' Oil of Cajuput is usually imported in long-necked green glass bottles.

General Characters.—*Oil of Cajuput* has usually a pale bluish- or myrtle-green colour. It is transparent, limpid, of a strong penetrating agreeable odour, resembling that of camphor, rosemary, and cardamoms combined, and of a warm aromatic camphoraceous taste, succeeded by a sensation of coldness in the mouth. The specific gravity has been found to vary from 0·914 to 0·930. Oil of cajuput is soluble in alcohol. Its boiling point is 343°.

Adulteration.—M. Guibourt detected oxide of copper in several samples of oil, derived as he supposed from the copper vessels in which it had been distilled, and he ascribed the green colour to its presence. Neither Mr. Brande nor myself has ever found copper in the samples of oil we have examined. The green colour must be therefore, natural to the oil. At the present time the oil met with in this country is, I believe, pure as imported.

Composition.—According to Blanchet, the composition is $C_{10}H_{18}O$.

Physiological Effects.—Cajuput oil is a powerful antispasmodic, diffusible stimulant, and sudorific. From the ordinary distilled oils (as those of the labiate plants and umbelliferous fruits) it is distinguished by its stronger influence over the nervous system (evinced by its antispasmodic qualities), and by the greater diffusibility of its stimulant operation. It is allied to valerian, between which and camphor it ought to be placed, in a physiological classification; but in large doses it does not disorder the mental faculties as these two medicines do.

Therapeutics.—By British practitioners it has until lately been little employed, but it is now becoming much more esteemed. *As a diffusible stimulant* it is useful where we wish promptly to raise the energy of the vital powers, especially when at the same time any spasmodic movements are to be allayed. With these views it has been employed in low fevers, paralytic affections, and cholera. *As an antispasmodic*, it is a very efficacious remedy, in painful spasmodic affections of the stomach, and in flatulent colic. *As a stimulating sudorific*, it proves occasionally useful in chronic rheumatism, painful affections, and local paralysis. It has been found beneficial, when mixed with olive oil, as an external application in chronic rheumatism, &c.

Administration.—Dose from 2 to 10 minims. It may be taken on sugar, or in the form of an emulsion.

Pharmaceutical Use.—It is an ingredient in liniment of croton oil.

[§ **Spiritus Cajuputi.** *Spirit of Cajuput.*

Take of

Oil of Cajuput	1 fluid ounce.
Rectified Spirit	49 fluid ounces.

Dissolve.

Dose.—$\frac{1}{2}$ to 1 fluid drachm.

This is one-fifth the strength of the preparation of the same name in the *Brit. Pharm.* 1864.]

CARYOPHYLLUS AROMATICUS, *Linn.* **The Clove Tree.**

Botanical Character.—Evergreen *tree; trunk* from 12 to 30 feet high. *Leaves* (fig. 84) petiolate, opposite, obovate-oblong, or ovate-lanceolate, acuminate at both ends. *Cymes* many-flowered. *Flowers* corymbose (fig. 84). *Calyx* at first green, afterwards purplish-red. *Petals* 4, larger than the calyx, imbricated into a globe in bud, at length spreading, roundish, concave, yellowish-red, caducous. In the centre of the calyx, and on the top of the ovary, is a quadrangular disk surrounding, but not embracing, the base of the shortish, obtusely subulate *style*. *Stamens* numerous; *filaments* much longer than the petals, yellow, in 4 bundles; *anthers* ovate-cordate, yellow, 2-celled. *Ovary* inferior, oblong, or almost cylindrical, 2-celled. *Fruit* baccate, pur-

Fig. 84.

Caryophyllus aromaticus.

plish, elliptical, 1-celled, 1-seeded. *Seed* with a thin soft integument. —*Bot. Mag.* vol. liv. pl. 2,749, 2,750.

Habitat.—Molucca Islands; where, as well as at Sumatra, Mauritius, Bourbon, Martinique, and St. Vincent's, it is now extensively cultivated.

[§ **Caryophyllum.** *Cloves.*

The dried unexpanded flower buds of Caryophyllus aromaticus, *Linn.* Cultivated in Penang, Bencoolen, and Amboyna.]

Collection.—Cloves are collected by the hand, or beaten with reeds, so as to fall upon cloths placed under the tree, and dried by fire, or, what is better, in the sun.

General Characters and Varieties.—The clove of commerce is the unexpanded flower, the corolla forming a ball or sphere at the top, between the four teeth of the calyx, and thus with the tapering, nearly cylindrical somewhat angular tube of the calyx, giving the appearance of a nail (whence the word *clove*, from the French *clou*, a nail). The length of the clove is from five to ten lines; its thickness from one to one-and-a-half line. Its colour is dark brown with a yellowish-red tint; the corolla somewhat deeper. Good cloves should be plump, of a dark brown colour, entire, have a strong fragrant odour, and a spicy, pungent, bitter taste, and, when slightly pressed with the nail, give out oil. Cloves are distinguished in commerce by the name of their place of growth. The varieties known as *Penang*, *Amboyna*, and *Bencoolen cloves* are the best: they are the largest, plumpest, and most oily. Cloves produced in the French possessions (*Bourbon* and *Cayenne cloves*) are smaller, more shrivelled, contain less oil, and are of inferior value.

Mother Cloves.—Under the name of Mother Cloves, the dried fruits of the clove tree have occasionally been introduced as articles of commerce (fig. 85). They have the shape of an olive, but are smaller. Superiorly they are crowned with the four teeth of the adherent calyx, with the remains of the style in the centre. Their colour is similar to that of the clove: their odour and flavour similar, but much weaker.

Fig. 85.

Mother Clove.

Composition and Chemical Characteristics. — Cloves owe their properties to a *volatile oil* (see p. 799). They also contain *tannic acid*, *resin*, *extractive*, &c. Nitric acid reddens infusion of cloves. Tincture of perchloride of iron renders it blue. The oil of cloves also undergoes similar changes to the infusion. These facts deserve especial attention in relation to opium and morphia (see Opium), on account of the analogous phenomena presented by morphia when acted on by nitric acid and perchloride of iron. The infusion and oil of pimento are similarly affected.

Physiological Effects.—Cloves have a very agreeable flavour and odour, and are devoid of the fiery taste and acridity which distinguish pepper and ginger : in other respects their effects agree with those of the spices generally. Though the volatile oil is by far the most important of their active principles, yet the tannic acid, extractive, and resin, must contribute something to their operation.

Therapeutics.—Cloves are rarely employed alone, or as the basis or principal medicine, but usually as an addition to other medicines, the flavour of which they improve, or whose operation they correct. When, however, they are given alone, it is merely as a stomachic and carminative, to relieve nausea, vomiting, flatulence, or some allied stomach disorder.

Administration.—In substance cloves may be taken in doses of from 5 to 10 grains, or *ad libitum.*

Pharmaceutical Uses.—Cloves are a constituent of compound infusion of orange peel, wine of opium, and aromatic mixture of iron.

[§ **Infusum Caryophylli.** *Infusion of Cloves.*

Take of

Cloves, bruised	$\frac{1}{4}$ ounce.
Boiling Distilled Water . . .	10 fluid ounces.

Infuse in a covered vessel, for half an hour, and strain.

Dose.—1 to 4 fluid ounces.]

Aromatic, stimulant, and stomachic. Employed in dyspepsia, flatulent colic, and gout, generally in combination with other medicines. Ammonia increases its efficacy.

[§ **Oleum Caryophylli.** *Oil of Cloves.*

The oil distilled in Britain from cloves.]

General Characters.—Colourless when recent, but gradually becoming reddish-brown, having the odour of cloves and a pungent spicy taste. It is soluble in alcohol and ether, and the fixed oils. Its specific gravity is 1·034 to 1·055. It sinks in water.

Extraction and Composition.—To extract the whole of the oil from cloves, they must be subjected to repeated cohobations. On an average cloves yield from 17 to 22 per cent. of volatile oil. By distillation with water, they yield two volatile oils—one lighter, the other heavier, than water. The oil of cloves of commerce is a mixture of these two oils. To separate it into the two oils, Ettling mixed it with potash ley, and distilled. *A light oil* passed over, while a compound of the *heavy oil* (*caryophyllic acid*) and potash remained in the retort, and, by distillation with phosphoric or sulphuric acid, gave out the heavy oil. *Light Oil of Cloves* ($C_{10}H_{16}$) is isomeric with oil of turpentine, which it resembles in its odour. It is colourless, and has a specific gravity of 0·9016.

It is incapable of combining with bases, but absorbs hydrochloric acid gas without yielding a crystalline compound. *Heavy Oil of Cloves; Caryophyllic Acid; Eugenic Acid* ($C_{10}H_{12}O_2$). It is colourless when recently prepared, but becomes coloured by age. Its specific gravity is 1·079. It combines with alkalies to form crystalline salts (*alkaline caryophyllates* or *eugenates*). If a salt of iron be added to one of these, it yields a blue, violet, or reddish compound (*a ferruginous caryophyllate*), varying somewhat according to the nature of the ferruginous salt used: thus the protosulphate of iron yields a lilac, the persulphate a red, which becomes violet and afterwards blue; while the perchloride gives a vinous tint, which turns to red. Nitric acid reddens caryophyllic acid.

Uses.—The oil of cloves is sometimes placed in the hollow of a carious tooth, to relieve toothache; but its more frequent medicinal use is as an addition to purgatives to check nausea and griping. It is employed for this purpose in confection of scammony, compound pill of colocynth, and pill of colocynth and hyoscyamus.

Dose.—From 2 to 5 minims.

EUGENIA PIMENTA, *D.C.* The Allspice Tree.

Botanical Character.—*Tree* about 30 feet high, evergreen; *branches* round; *twigs* compressed, pubescent. *Leaves* shortly petiolate, oblong or oval, pellucid-dotted, smooth, about 4 inches long. *Peduncles* axillary and terminal, trichotomously-paniculate, pubescent. *Flowers* numerous. *Sepals* roundish. *Petals* reflexed, greenish-white. *Stamens* numerous. *Ovary* inferior, 2–3-celled. *Fruit* baccate, succulent, crowned by the calyx, black or dark purple when ripe, 2-seeded.—*Woodv.* pl. 26, p. 77 (*Myrtus Pimenta*).

Habitat.—West Indies. It is cultivated in Jamaica, in regular walks called 'Pimento Walks.'

[§ **Pimenta.** *Pimento.*

The dried unripe berries of Eugenia Pimenta, *D.C.* West Indies.]

Collection.—When the fruit has attained the full size, but is yet green, it is gathered and sun-dried. It is afterwards put in bags of one hundredweight each, for the European market. Some planters kiln-dry it.

Commerce.—Pimento is imported almost entirely from Jamaica.

General Characters.—*Pimento*, sometimes also called *Jamaica Pepper*, but more commonly *allspice* (because its flavour is considered to approach that of cinnamon, cloves, and nutmeg), is about the size of, or somewhat larger than, a peppercorn, or small pea. It is round, brown, dull, roughish but not wrinkled, crowned with the teeth of the calyx, and occasionally, though rarely, has a short pedicel. It consists of an external, somewhat hard but brittle shell (*pericarp*), which is paler within, and encloses two dark brown seeds. Pimento has an aromatic agreeable odour (intermediate between pepper and cloves), and a hot, aromatic, clove-like taste. The odour and taste chiefly reside in the shell.

Composition.—The principal constituents are *volatile oil, green oil,* and *tannin. Volatile oil.* (See *Oleum Pimentæ.*) *Green oil* (*Resin ?*)—This substance, which has an acrid burning taste, contributes to the activity of pimento. Its odour is rancid, but somewhat clove-like. It dissolves readily in alcohol and ether, to which it communicates a green colour. *Tannin.*—Is soluble in alcohol, strikes a green colour with the persalts of iron, and precipitates tartarated antimony.

Physiological Effects.—Pimento is a stimulant, carminative, and stomachic, holding an intermediate rank between pepper and cloves.

Therapeutics.—It may be taken with advantage by those troubled with relaxed or atonic conditions of the stomach. Its uses are similar to those of cloves ; viz. to relieve flatulency, to cover the flavour of nauseous remedies, to promote the operation of tonics and stomachics, and to prevent the griping of purgatives.

Administration.—In substance, pimento may be taken in doses of from 10 to 60 grains.

Pharmaceutical Use.—It is an ingredient in syrup of buckthorn.

[§ **Aqua Pimentæ.** *Pimento Water.*

Take of

Pimento, bruised	14 ounces.
Water	2 gallons.

Distil one gallon.]

Employed for its flavouring, carminative, and stomachic properties, as a vehicle for stimulant, tonic, and purgative medicines.

Dose.—1 to 2 fluid ounces.

[§ **Oleum Pimentæ.** *Oil of Pimento.*

The oil distilled in Britain from Pimento.

Characters.—Colourless or slightly reddish when recent, but becoming brown by age, having the odour and taste of pimento. Sinks in water.]

Extraction and Composition.—Mr. Whipple informs me that from 8 hundredweight of pimento he procured 41 pounds, 6 ounces of oil (heavy and light). This is nearly 5 per cent. The oil of pimento of the shops is a mixture of these two oils. Except in odour, its properties are identical with those of oil of cloves. By distillation with caustic potash, the *light oil* is separated : the residue, mixed with sulphuric acid and submitted to distillation, gives out the *heavy oil*. *Light Oil of Pimento* has not, to my knowledge, been hitherto examined. Its properties appear to be similar to the light oil of cloves. It floats on water and on solution of potash, and is slightly reddened by nitric acid. Potassium sinks in, and is scarcely, if at all, acted on by it. *Heavy Oil of Pimento* (Pimentic Acid) is very similar to caryophyllic acid. It forms with the alkalies, crystalline compounds (*alkaline pimentates*), which become blue or greenish on the addition of the tincture of perchloride of iron (owing to the formation of a *ferruginous pimentate*). Nitric acid acts violently on and reddens it.

Therapeutics.—The medicinal uses of the oil of pimento are very limited. It is sometimes employed to relieve toothache, and to correct the operation of other medicines, as purgatives and tonics.

Dose.—2 to 5 minims.

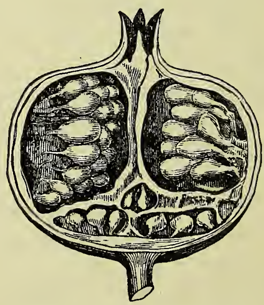
PUNICA GRANATUM, *Linn.* The Pomegranate.

Botanical Character.—Small *tree*, with a brownish bark. *Leaves* (fig. 86) lanceolate, entire, on short stalks, smooth. *Flowers* (fig. 86) terminal on the young branches. *Calyx* adherent, thick, fleshy, red. *Petals* 5–7, much crumpled, membranous, rich scarlet. *Stamens* numerous, inserted on the calyx; *anthers* yellow. *Ovary* roundish; *style* filiform, simple; *stigma* globular. *Fruit* (fig. 87) called a *balausta*, larger than an orange, with a thick leathery rind, and

Fig. 86.

Punica Granatum.
a. Branch with flowers.
b. Transverse section of fruit.

Fig. 87.



Vertical section of the fruit, showing the two strata of cells.

crowned by the teeth of the calyx; cells several, arranged in two strata, one upper, the other lower, separated by an irregular transverse diaphragm; lower stratum of 3, upper one of from 5 to 9 cells. *Seeds* (figs. 86, *b*, and 87) numerous, imbedded in pellucid pulp.—*Steph. and Church.* pl. 75.

Habitat.—Northern Africa, from whence it has been introduced into Europe, where it is now naturalised. Syria, Northern India, &c.

[§ **Granati Radicis Cortex.** *Pomegranate Root Bark.*

The dried bark of the root of Punica Granatum, *Linn.* Obtained from the South of Europe.]

General Characters and Adulterations.—In quills or fragments of an ash-grey or greyish-yellow colour externally, yellow internally, having a short fracture, little or no odour, and an astringent, slightly bitter taste. By its almost entire want of bitterness this bark may be distinguished from that of the box-tree, which is said to be sometimes substituted for it. Moistened with water, and rubbed on paper, it leaves a yellow stain, which becomes deep blue by the contact of sulphate of iron. Barberry bark, which is sometimes mixed with, or substituted for it, is very bitter, and its infusion is not affected by solution of sulphate of iron like that of pomegranate root bark.

Rind of the Fruit, Flowers, and Seeds.—Besides the root bark, the rind of the fruit was official in the last London Pharmacopœia. The flowers were also formerly official in the Dublin Pharmacopœia; and the seeds are still official in the Paris Codex. The dried *rind of the fruit* occurs in irregularly-arched, hard, brittle, odourless, very astringent, and slightly bitter fragments, which are brownish (more or less yellow or reddish) externally, and paler within. The *flowers*, called *balaustine flowers*, are odourless, of a fine red colour, and slightly astringent taste. They communicate a reddish colour to the saliva.

Composition.—Pomegranate root bark contains about 20 per cent. of *tannic acid*, some *gallic acid*, *resin*, *mannite*, and other unimportant substances. A peculiar acrid principle called *punicine*, has also been found in the fresh bark.

Physiological Effects.—The root bark possesses astringency, owing principally to the presence of tannic acid, and in some slight degree also, to a minute quantity of gallic acid. To these two substances, and more especially to the tannic acid, its medicinal properties are doubtless essentially due. Taken *in small quantities*, it occasions no remarkable effects. *In full doses* however, it causes nausea, vomiting, and purging, and occasionally giddiness and faintness. The substance called punicine is also probably possessed of active properties. The fresh root bark is by many practitioners much preferred to that in a dried state.

Therapeutics.—The root bark has been occasionally used from a very early period, as a vermifuge; for Celsus, Dioscorides, Pliny, and other ancient writers, speak of its anthelmintic qualities. Of late years attention has been again drawn to this bark as a remedy for tape-worm, by the recommendations of Dr. Fleming, Dr. Buchanan, Mr. Breton, and others.

[§ **Decoctum Granati Radicis.** *Decoction of Pomegranate Root.*

Take of

Pomegranate Root Bark, sliced . . .	2 ounces.
Distilled Water	2 pints.

Boil down to a pint, and strain, making the strained product up to a pint, if necessary, by pouring distilled water over the contents of the strainer.]

The *dose* is a wine-glassful every half hour till the whole is taken. It usually occasions slight sickness, but seldom fails to destroy the tape-worm. The patient should be prepared for the remedy by the use of a dose of castor oil and a strict regimen the day previously.

ROSACEÆ, *Jussieu.* The Rose Order.

AMYGDALUS COMMUNIS, *Linn.* The Common Almond.

Botanical Character.—A small *tree.* *Leaves* on glandular petioles, oblong-lanceolate, serrulate, when *young* conduplicate. *Flowers* solitary or in pairs, nearly sessile, appearing before the leaves. *Calyx* campanulate, 5-cleft. *Petals* 5, ovate, irregularly notched. *Stamens* numerous, perigynous, shorter than the petals. *Ovary* superior; *style* simple; *stigma* round. *Fruit* a dry drupe, ovoid, compressed, bursting when ripe; *epicarp* greenish-grey, tomentose; *mesocarp* or *sarcocarp* fibrous; *endocarp* or *putamen* woody or almost osseous. Within the putamen there is usually but 1 seed (rarely 2), which is the almond of commerce.

Varieties.—There are several varieties of this species, two of which are official in the British Pharmacopœia, namely,—Amygdalus communis, *var.* dulcis, *D.C.*; and Amygdalus communis, *var.* amara, *D.C.* Their characters are as follows:—

α. amara. Bitter Almond.—*Styles* almost as long as the stamens, tomentose below. *Seeds* bitter. *Flowers* larger; *petals* white, roseate at the base. *Putamen* hard or brittle.

β. dulcis. Sweet Almond.—*Leaves* ash-green. *Flowers* earlier. *Styles* much longer than the stamens. *Fruit* ovate, compressed, acuminate. *Seeds* sweet. *Putamen* hard.—*Woodv. Med. Bot.* pl. 83, p. 230.

Habitat.—Barbary, Persia, and Syria; and largely cultivated in the southern parts of Europe.

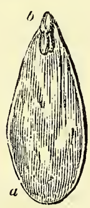
[§ **Amygdala Dulcis.** *Sweet Almond.*

The seed of the sweet almond tree, Amygdalus communis, *var.* dulcis, *D.C.* Cultivated about Malaga.]

General Characters.—The seed (*almond*) is of an oval-lanceolate form, compressed, rounded at one end, somewhat pointed at the other, and above an inch in length. Sweet almonds are odourless, and have a bland, sweetish, agreeable taste. They do not evolve any marked odour when rubbed with water. The outer covering (*testa*) is of a clear yellowish-brown colour. By soaking almonds in warm water, the seed-coats are easily removed, and the kernels alone remain. These are then termed *blanched almonds*, and consist of the *embryo* (fig. 88) only, composed of the two large fleshy *cotyledons*, between which, at the pointed extremity, we observe the *plumule* and *radicle*. Sweet almonds are rarely employed for pressing, on account of their cost being greater than that of bitter almonds, and their residual cake being of less value than the corresponding cake of bitter almonds. *Almond powder* is the ground almond cake; it is employed as a soap for washing the hands, and as a lute.

Varieties and Commerce.—Six varieties of almonds have been distinguished in commerce, namely:—1. *Jordan almonds*, which are the finest, and come from Malaga. Of these there are two kinds: the one above an inch in length, flat, and with a clear yellowish-brown seed-coat, sweet, mucilaginous, and rather tough; the other more plump and pointed at one end, brittle, but equally sweet with the former. Although Jordan almonds are not mentioned by name in the British Pharmacopœia, the characters there given, and the statement that they come from Malaga, clearly indicate that these are alone official. Jordan almonds are selected evidently, not only on account of their superior quality, but because their size and elongated form make it very improbable that bitter almonds should be mistaken for them; while bitter almonds, though generally somewhat smaller, sufficiently resemble the other varieties of sweet almonds in form to allow of their unintentional commixture or substitution.—2. *Valentia almonds* are about three-eighths of an inch broad, not quite an inch long, round at one end and obtusely pointed at the other, flat, of a dingy-brown colour, and with a dusty epidermis.—3 and 4. *Barbary* and *Italian almonds* resemble the latter, but are generally smaller, and less flattened.—

Fig. 88.



Section of an Almond.

a. One of the cotyledons.
b. Radicle and plumule.

5. *Portugal almonds* are smaller than the Valentia, and somewhat ovate, and less broad at the lower part: this variety is usually termed the *Oporto almond*, and is sold in Provence.—6. *Canary almonds* resemble the Sicily almonds, but are somewhat smaller.

Composition.—The principal constituents of sweet almonds are *fixed oil*, *emulsin*, *sugar* and *gum*. *Fixed Oil of Almonds* (see p. 811). *Emulsin* (*Vegetable Albumen*).—This remarkable constituent of almonds is white; and soluble in cold water, hence it is a constituent of almond emulsion. From its watery solution it is precipitated in thick white flocks by alcohol. These flocks dissolve in water, even if they have been previously dried. If the watery solution be heated to 212° F. the emulsin coagulates, and the liquor becomes thick, like starch mucilage. From ordinary vegetable albumen, emulsin is distinguished by its producing the decomposition of amygdalin in bitter almonds, and giving rise, among other products, to the volatile oil of bitter almonds and hydrocyanic acid. When, however, emulsin has been coagulated by heat, it loses its power of acting on amygdalin.

Physiological Effects and Uses.—Sweet almonds are nutritive and emollient; but on account of the quantity of oil which they contain they are somewhat difficult of digestion, at least if taken in large quantities or by persons whose digestive powers are weak. When rancid they are still more apt to disorder the stomach. They sometimes occasion nausea and urticaria. For *dietetical* purposes, almonds are employed as a dessert, for puddings, cakes, &c. On account of the irritant qualities of the husk, almonds for the table should always be blanched.

[§ **Pulvis Amygdalæ Compositus.** *Compound Powder of Almonds.*

Synonyms.—Confectio Amygdalæ, *Lond.*; Conserva Amygdalarum, *Edin.*)

Take of

Sweet Almonds	8 ounces.
Refined Sugar, in powder . . .	4 ounces.
Gum Acacia, in powder	1 ounce.

Steep the almonds in warm water until their skins can be easily removed; and, when blanched, dry them thoroughly with a soft cloth, and rub them lightly in a mortar to a smooth consistence. Mix the gum and the sugar; and, adding them to the pulp gradually, rub the whole to a coarse powder. Keep it in a lightly-covered jar.]

Pharmaceutical Use.—The only use of this powder is in the preparation of almond mixture.

[§ **Mistura Amygdalæ.** *Almond Mixture.*

Take of

Compound Powder of Almonds . . .	$2\frac{1}{2}$ ounces.
Distilled Water	1 pint.

Rub the powder with a little of the water into a thin paste, then add the remainder of the water, and strain through muslin.

Dose.—1 to 2 fluid ounces.]

Almond mixture agrees in many of its properties with animal milk. Thus it is white; when examined by the microscope it is seen to consist of myriads of oleaginous globules, suspended in water by the aid of an albuminous principle (emulsin) and sugar; and, lastly, it possesses nutritive and emollient properties. It is used as a demulcent and emollient in pulmonary affections, to appease cough and allay irritation; and in inflammatory affections of the alimentary canal or of the urinary organs. It is an excellent vehicle for other remedies: as for the saline refrigerants (nitre, for example) in febrile cases; for expectorants and paregorics (squill, ipecacuanha, opiates, &c.) in pulmonary affections; for sudorifics (as tartarated antimony), in febrile and inflammatory cases; for alkalies and their carbonates in affections of the urino-genital organs; and for hydrocyanic acid in gastrodynia and pulmonary disorders. Acids and alcohol (hence tinctures) coagulate the emulsin, and cause almond mixture to separate into a kind of curd and whey; a change which also takes place spontaneously when the mixture has been kept, and which is accompanied with the development of free acid.

[§ **Amygdala Amara.** *Bitter Almond.*

The seed of the bitter almond tree, Amygdalus communis, *var.* Amara, *D.C.* Brought chiefly from Mogadore.]

General Characters.—In external appearance bitter almonds resemble sweet almonds, but they are distinguished from the finer varieties of sweet almonds, such as the Jordan, by their smaller size and more ovate form; and from all varieties by their bitter taste, and, when rubbed with a little water, by their remarkable odour. They are extensively used for pressing. Their *cake* after the fixed oil of almonds has been obtained by pressing, is distilled with water to yield the *volatile oil of bitter almonds*, and is afterwards employed to fatten pigs, and for other purposes.

Varieties and Commerce.—There are two varieties, Barbary and French. The former is the one chiefly found in commerce. They are principally obtained from Mogadore. The French bitter almonds are paler coloured and somewhat larger than the Barbary variety.

Composition.—The principal constituents of bitter almonds, like those of sweet almonds, are *fixed oil* (see p. 811), *emulsin*, *sugar*, and *gum*, but they also contain a crystallisable substance called *amygdalin*, which is not found in sweet almonds. *Amygdalin.*—From four pounds of bitter almonds Liebig obtained one ounce of pure amygdalin. It is white, odourless, has at first a sweet, then a bitter taste, is very soluble in boiling alcohol and water, but is insoluble in ether. Crystallised out of an alcoholic solution it is in pearly scales, and is anhydrous. The crystals obtained from a watery solution are colourless, transparent, and prismatic, and contain six atoms of water of crystallisation. The watery solution has a feebly bitter taste. Submitted to distillation with nitric acid, it yields hydrocyanic acid, oil of bitter almonds, formic acid, and some benzoic acid. Heated with an alkaline solution it evolves ammonia, and yields an alkaline salt, which contains a peculiar acid called *amygdalic acid*, composed of $\mathbf{C_{20}H_{26}O_{12} + Aq.}$; hence, perhaps, amygdalin is *an amide of amygdalic acid* (i.e. an amygdalate of ammonia, minus an atom of water). By the action of a solution of emulsin on a solution of amygdalin, we obtain, among other products, hydrocyanic acid and the volatile oil of bitter almonds (see *Oleum Amygdalœ Amarœ*). According to Wöhler and Liebig the composition of amygdalin is $\mathbf{C_{20}H_{27}NO_{11}}$. In the crystallised state it consists of 1 atom of *Amygdalin* = 457, and 6 atoms of *Water* = 54.

Physiological Effects.—*In small doses* bitter almonds sometimes act as irritants to the digestive organs, and occasion nausea, vomiting, and purging. Owing to idiosyncrasy, some individuals are remarkably affected by them. On the late Dr. Gregory they caused, 'first, sickness, generally tremors, then vomiting, next a hot fit, with an eruption of urticaria, particularly on the upper part of the body. At the same time the face and head swelled very much, and there was a general feeling like intoxication. The symptoms lasted only a few hours. The rash did not alternately appear and disappear, as in common nettle-rash' (Christison). *In large doses* bitter almonds have caused serious, or even fatal consequences; their poisonous effects are similar to those of hydrocyanic acid.

Therapeutics.—By medical practitioners in this country, bitter almonds are rarely prescribed. They are applicable, however, to all the uses of hydrocyanic acid; as pulmonary affections, gastrodynia, and hooping-cough; but the objection to their use is their varying and uncertain strength. They have also been successfully administered against intermittent fever; to expel tape-worm, and to relieve painful menstruation. The emulsion has been employed as a wash to relieve irritation in various skin diseases; as herpes, prurigo, acne, impetigo, &c. The principal consumption of bitter almonds is for pressing, flavouring, and scenting. (See *Oleum Amygdalæ, and Essence of Bitter Almonds.*)

Oleum Amygdalæ Amaræ. *Oil of Bitter Almonds. Volatile or Essential Oil of Almonds.*

(*Not official.*)

Preparation and Production.—Obtained by submitting bitter almond cake (left after the expression of the fixed oil from bitter almonds) to distillation with water, either alone, or more usually with salt. To increase the quantity of volatile oil, Geiger recommended the cake to be macerated in the water for twenty-four hours before distillation. The volatile oil does not exist in the bitter almond nor in the almond cake, but results from the decomposition of *amygdalin*, contained in the cake, under the influence of *emulsin* or *synaptase* and water, the emulsin acting as a ferment. The reaction is shown by the following equation:—

$$\underset{\text{Amygdalin.}}{2C_{20}H_{27}NO_{11}} = \underset{\text{Hydride of benzoyl.}}{4C_7H_6O} + \underset{\text{Hydrocyanic acid.}}{2HCN} + \underset{\text{Glucose.}}{C_6H_{12}O_6} + \underset{\text{Formic acid.}}{4CH_2O_2} + \underset{\text{Water.}}{4H_2O}.$$

Hydride of benzoyl, the principal constituent of volatile oil of almonds, readily absorbs oxygen, and is thus converted into benzoic acid, $C_7H_6O + O = C_7H_6O_2$. This change takes place if the oil be much exposed to the atmosphere, and hence benzoic acid is generally present in small quantity, and sometimes to a sufficient extent to form a crystalline deposit, in commercial oil of bitter almonds.

Commercial Oil of Bitter Almonds.—Oil of bitter almonds, as usually met with in commerce, is a mixture or compound of *hydride of benzoyl, hydrocyanic acid, benzoic acid, benzoine*, and *benzimide*. This, which may be termed *crude oil of bitter almonds*, has a golden-yellow colour, and a sp. gr. ranging from 1·052 to 1·082. This difference in specific gravity appears to depend on the temperature used in its production, the heaviest oil being produced at the highest temperature, and containing the largest proportion of benzoine. It is soluble in alcohol and ether, and oil of vitriol forms with it a crimson-red thick liquid, which, on the addition of water, yields a yellow emulsion. The crude oil is highly poisonous on account of the hydrocyanic acid it contains, the proportion of which appears to vary from 8 to 10 or even, in some instances, to 14 per cent. Schrader got 8·5 per cent. from an old sample, and 10·75 per cent. from a new sample; and Göppert obtained as much as 14·33 per cent. in one instance.

Hydride of Benzoyl.—Purified Oil of Bitter Almonds.—Oil of Bitter Almonds free from Hydrocyanic Acid.—C_7H_6O. Obtained by distilling crude oil of bitter almonds made into a thin paste with slaked lime, chloride of iron, and water, keeping the lime in excess. Or by agitating the crude oil with three or four times its volume of a strong solution of acid sulphite of soda, sp. gr. 1·23, separating the crystals that form after some hours, pressing these on a porous tile, purifying the product by re-crystallisation, then decomposing it with a strong solution of carbonate of soda, and distilling the oily liquid that separates over chloride of calcium. In the latter process the hydride of benzoyl forms with acid sulphite of soda and water, the crystalline compound $2(C_7H_5NaSO_3).3H_2O$, which, by double decomposition with carbonate of soda, Na_2CO_3, gives $2C_7H_6O + 2Na_2SO_3 + CO + 2H_2O$. Pure hydride of benzoyl is a limpid colourless oil, whose sp. gr. is 1·043, and whose odour and taste are scarcely different from those of the crude oil. It possesses the ordinary stimulating properties of other essential oils, but is not poisonous. On exposure to the air it becomes converted into benzoic acid by the absorption of oxygen, as already explained, and this change appears to occur more readily in the purified than the crude oil. Dr. Tilden has shown, however, that if the hydride of benzoyl be perfectly anhydrous, its oxidation takes place but slowly, if at all. *Benzoine*, one of the usual constituents of crude oil of bitter almonds, is a crystalline substance, having the same composition as, or being isomeric with, hydride of benzoyl. It is usually represented by the formula $C_{14}H_{12}O_2$. It is soluble in boiling alcohol. It dissolves in oil of vitriol, forming a violet-coloured compound. *Benzimide* separates from oil of bitter almonds under certain circumstances, as a curdy flocculent substance. It is soluble in alcohol, and assumes an indigo blue colour when treated with oil of vitriol.

Essence of Bitter Almonds.—Almond Flavour.—These names are applied to an alcoholic solution of oil of bitter almonds, which is used by cooks for imparting the flavour of bitter almonds. It is sometimes prepared with the crude oil, and is then a dangerous poison on account of the hydrocyanic acid it contains; but there is no longer any occasion to supply the poisonous preparation, as the purified oil, free from hydrocyanic acid, is now a commercial article, and ought to be always used for this purpose. One volume of the purified oil to three volumes of rectified spirit are the proportions in which the essence is usually prepared.

[§ **Oleum Amygdalæ.** *Almond Oil.*

The oil expressed from bitter and sweet almonds.]

General Characters.—Although both sweet and bitter almonds are mentioned as sources of Almond Oil in the Pharmacopœia, the oil of commerce is usually expressed from bitter almonds on account of their cheapness, as well as of the greater value of their residual cake. The average produce is from 48 to 52 pounds of oil from one hundredweight of almonds. When recently expressed it is turbid, but by rest and filtration becomes quite transparent. It usually possesses a slightly yellow tinge, which becomes somewhat paler by exposure to solar light. It is inodorous, or nearly so, and has a purely oleaginous bland taste. It congeals less readily by cold than olive oil. Its specific gravity has been found to vary from 0·911 to 0·920. Ether dissolves it. Six parts of boiling, or twenty-five parts of cold alcohol, are required to dissolve one part of this oil.

Physiological Effects.—It possesses the dietetic and medicinal properties of the other fixed oils. Its local action is emollient. Swallowed in moderate doses it is nutritive, but difficult of digestion. In large doses it acts as a mild laxative.

Therapeutics.—Almond oil may be employed for the same purposes as olive oil. Mixed with an equal volume of syrup of violets, or syrup of roses, it is given to new-born infants as a laxative. It is sometimes used with gum (in the form of mucilage), alkalies, or yolk of egg, to form an emulsion, which is used in the same cases as almond mixture. To assist in allaying troublesome cough it is not unfrequently administered in the form of linctus, with confection of hips, and syrup of poppies.

Dose.—1 to 4 fluid drachms.

Pharmaceutical Uses.—It is used in the preparation of ointment of spermaceti, simple ointment and the preparations containing it, ointment of red oxide of mercury, and compound ointment of subacetate of lead.

PRUNUS, *Linn.*

Generic Character.—*Young leaves* rolled-up (*convolute*), or folded flat (*conduplicate*). *Pedicels* umbellato-fasciculate, 1-flowered; *flowers* opening before or after the leaves. *Drupe* roundish, ovate or oblong, fleshy, destitute of, or covered with, a bloom. *Putamen* (stone) compressed, round or acute on both sides, smooth or furrowed.

PRUNUS DOMESTICA, *Linn.* The Plum.

Specific Character.—A small *tree; branches* without spines. *Leaves* elliptical or lanceolate-ovate; *when young* convolute. *Flowers* white. *Calyx* inferior, bell-shaped, deciduous. *Petals* 5, oblong-ovate, perigynous. *Stamens* numerous, perigynous. *Ovary* superior. *Drupe* fleshy, roundish-ovate or oblong, smooth, covered with a bloom; *putamen* (stone) compressed, acute on both sides, somewhat furrowed at the edge, otherwise smooth.—*Woodv.* pl. 85, p. 234.

Varieties.—Numerous varieties have been described by De Candolle; the var. *Juliana* is the source of the official prune.

Habitat.—Apparently wild in various parts of Europe, but supposed to have been originally derived from Asia. It is extensively cultivated in the South of Europe; especially in France.

[§ PRUNUM. *Prune.*

The dried drupe of the Plum, Prunus domestica, *Linn.* From southern Europe.]

Preparation and Commerce.—The dried fruits are called *prunes.* In warm countries they are dried on hurdles by solar heat; but in colder climates artificial heat is employed. In France both methods are adopted; the fruit being exposed to the heat of an oven and to that of the sun on alternate days. The official Prunes are principally imported from Bordeaux.

General Characters.—They are about an inch long, ovate, wrinkled, black, sweet and somewhat austere. The *pulp* is alone employed in medicine.

Composition.—The principal constituents are *sugar*, *malic acid*, *gum*, and *pectin.*

Therapeutics.—Prunes are employed as an agreeable and mild laxative for children, and during convalescence from febrile and inflammatory disorders. They are sometimes added to cathartic decoctions or infusions (as infusion of senna), to improve the flavour, and promote the purgative effect.

Pharmaceutical Use.—Prune enters into the composition of the confection of senna.

PRUNUS LAUROCERASUS, *Linn.* The Common or Cherry-Laurel.

Synonym.—Cerasus Lauro-Cerasus, *Loisel.*

Specific Character.—A small *tree* or evergreen *shrub* with smooth branches. *Leaves* with short petioles, oval-lanceolate, remotely serrate, with 2 or 4 glands beneath, acute, coriaceous, smooth, shining; *when young* conduplicate. *Flowers* in axillary racemes, which are commonly shorter than the leaves. *Calyx* inferior, deciduous. *Corolla* with 5 roundish, white, spreading petals. *Stamens* about 20, perigynous. *Drupe* round, without bloom, quite smooth, black, about the size of a small cherry; *putamen* (stone), somewhat globose, smooth.—*Steph. and Church.* pl. 117.

Habitat.—Originally a native of Asia Minor, from whence it was introduced into Europe in 1576, where it is now common in gardens and shrubberies everywhere.

[§ Laurocerasi Folia. *Cherry-Laurel Leaves.*

The fresh leaves of Prunus Laurocerasus, *Linn.*]

General Characters.—Cherry-Laurel leaves are oval-lanceolate or elliptical, acute, remotely serrate, furnished with glands at the base on the under side, smooth and shining, deep green, on strong short petioles. They have scarcely any odour until bruised, when, if fresh, they give out the characteristic or bitter almond odour of the plant. Their taste is bitter, aromatic, and slightly astringent. By drying they lose their odour, but retain their flavour. Their watery infusion is rendered green by the perchloride of iron.

Composition.—No complete analysis of cherry-laurel leaves has been hitherto made. The most important constituent is supposed to be *amygdalin*, but this is rather inferred than proved. *Volatile Oil of the Cherry-Laurel.*—By distillation with water, cherry-laurel leaves yield a volatile oil and a distilled water. As the oil, like the volatile oil of bitter almonds, contains both hydrocyanic acid and hydride of benzoyl, it is natural to suppose that the two oils are produced in a similar manner. And though they did not succeed in procuring amygdalin, MM. Wöhler and Liebig think its presence in cherry-laurel leaves highly probable; but what substance effects its decomposition has not yet been ascertained. Cherry-laurel oil is of a pale yellow colour, and heavier than water. When exposed it attracts oxygen from the air, and deposits benzoic acid. Sulphuric acid colours it red. It contains hydrocyanic acid, which may be detected by an alkali and a ferruginous salt. The quantity, according to Schrader, is 7·66 per cent.; but Göppert declares it to be only 2·75 per cent. It appears, therefore, to be a weaker poison than the oil of bitter almonds, with which, according to Robiquet, it agrees in all its chemical properties.

Physiological Effects.—Most parts of the plant, but more especially the leaves and seeds, possess poisonous properties. The effects of *medicinal doses* of cherry-laurel water are stated to be similar to those of small doses of hydrocyanic acid. *Large and poisonous doses* have also occasioned symptoms similar to those caused by hydrocyanic acid; viz. painful sensation of the stomach, sudden insensibility, and death within a few minutes. Convulsions, however, have not been frequent. In the case referred to by Dr. Madden, in which brandy, mixed with a fourth part of cherry-laurel water, proved fatal, there was no vomiting, purging, or convulsions. But in the instances mentioned by Fodéré, the individuals expired in convulsions.

Therapeutics and Administration.—The powdered leaves have been sometimes administered in doses of 4 to 8 grains as a sedative, and have been applied, mixed with linseed meal or flour, as a poultice to painful ulcers; but laurel water is the common form of administration.

[§ **Aqua Laurocerasi.** *Laurel Water.*

Take of

Fresh Leaves of Common Laurel . .	1 pound.
Water	$2\frac{1}{2}$ pints.

Chop the leaves, crush them in a mortar, and macerate them in the water for twenty-four hours; then distil one pint of liquid. Shake the product, filter through paper, and preserve it in a stoppered bottle.

Dose.—5 to 30 minims.]

It is applicable to all the cases for which hydrocyanic acid has been employed. It has been used as a sedative narcotic in tic-douloureux, phthisis, spasmodic cough, and palpitation of the heart. The preparation is, however, of uncertain strength, being strongest when fresh made, or prepared from moderately young leaves; hence the dose is liable to great variation.

PRUNUS VIRGINIANA, *Mill.* Wild Cherry.

Synonyms.—Cerasus virginiana, *Michx*; Cerasus serotina, *De Cand.*

Specific Character.—*Tree* varying in height from 25 to 80 or more feet. *Leaves* somewhat coriaceous, oval-oblong or lanceolate-oblong, 2–4 inches long, acuminate, glabrous, or bearded along the midrib beneath, smooth and shining above, finely serrated with adpressed or incurved callous teeth; *petioles* (or base of the leaf) mostly with two or more glands; young leaves *conduplicate.*

Racemes elongated, 2–5 inches in length, nodding at their extremities. *Flowers* small, fragrant. *Calyx* inferior, bell-shaped, deciduous, 5-partite. *Petals* 5, spreading, broadly ovate. *Stamens* 15–30. *Ovary* superior. *Drupe* globose, purplish-black and shining when quite ripe, and about the size of a pea; fleshy and without bloom; *stone* (*putamen*) somewhat globose, smooth.

Habitat.—This species is found more or less plentifully distributed in nearly all the States of North America, more especially abounding in the Middle Atlantic States, and in those which border on the Ohio.

Prunus Virginiana. *Wild Cherry Bark.*

(*Not official.*)

General Characters.—Wild cherry bark is official in the United States Pharmacopœia. As found in commerce, it consists essentially of the inner layers (*derm*) of the bark only, but varying-sized portions of the outer bark (*periderm*) are commonly attached to these inner layers. It occurs in nearly flat, or slightly curved, or arched pieces, which vary much in length, breadth, and thickness. The colour and other characteristics externally, are also liable to variation according to the size of the pieces, and the presence or absence of periderm. Thus, those which are principally composed of inner bark present a reddish-brown colour, and are generally but slightly rough to the touch; but when the periderm is attached, the pieces are of a rougher character, and in such parts the colour is redder, and sometimes spotted at intervals with portions of greyish, silvery-white, or brownish patches; while some of the smaller pieces present a uniform reddish-yellow appearance, and are nearly smooth externally. Internally, the bark has a deep yellowish-brown or reddish-brown colour, and a more or less roughened character. The fracture of both longitudinal and transverse pieces is close. The bark is readily powdered, and the powder has a deep fawn colour. It has a bitter, somewhat aromatic, and rather agreeable taste; but scarcely any perceptible odour.

Composition.—The principal constituents, as shown by the analysis of Professor William Procter, are *tannic acid*, *gallic acid*, *volatile oil*, and *hydrocyanic acid.* The volatile oil and hydrocyanic acid, however, do not exist ready formed in the bark, but are products of the decomposition of *amygdalin*, which he proved to be one of its constituents. Hence it seems clear, that another principle analogous to, if not identical with *emulsin*, must be also present in the bark, as some such substance is necessary for the above decomposition to take place. The sedative action which the bark exerts on the heart depends essentially upon the hydrocyanic acid which it yields. The essential oil of wild cherry, when deprived of hydrocyanic acid by distillation with a mixture of protochloride of iron, potash, and water, is without any poisonous properties. Wild cherry bark was at one time supposed to contain *phloridzin*, a bitter principle found in the bark of the apple, pear, and of some other allied trees, but Mr. Perot failed completely to detect any indications whatever of this principle. It is still a question, however, whether the bark does or does not contain a bitter principle distinct from amygdalin, and to which its tonic properties are essentially due. Dr. Wood believes that it does, and his opinion is borne out by the experiments of Professor Procter, who found that an extract of the bark retained its bitterness after the whole of the amygdalin had been removed.

Effects and Uses.—The following extracts from American writers on materia medica and therapeutics will show the estimation in which wild cherry bark is held in North America. Dr. Wood thus speaks of its properties and uses:—'This bark is among the most valuable of our indigenous remedies. Uniting with a tonic power the property of calming irritation and diminishing nervous excitability, it is admirably adapted to the treatment of diseases in which debility of the stomach, or of the system, is united with general or local irritation. When largely taken it diminishes the action of the heart, an effect ascribable to the hydrocyanic acid. Dr. Eberle found copious draughts of the cold infusion, taken several times a day, and continued for nearly two weeks, to reduce his pulse from seventy-five to fifty strokes in the minute. The remedy is highly useful, and has been much employed in this country in the hectic fever of scrofula and consumption. In the general debility which often succeeds inflammatory diseases, it is also advantageous; and it is well adapted to many cases of dyspepsia. It has been given successfully in intermittent fever, but is much inferior to cinchona.' It is also regarded as a valuable remedial agent in the treatment of *functional and organic disease of the heart*, when attended with a frequent, irregular, and rather feeble pulse, and an anæmic or otherwise debilitated state of the system; but if anæmia exist, it should be combined with the use of chalybeates.

Administration.—Wild cherry bark has been administered in the form of powder, infusion, fluid extract, resinoid extract (*prunin*), tincture, wine, syrup, &c. Numerous preparations of wild cherry bark are in use in the United States; for an account of which, see an article on 'Cerasus (Prunus) virginiana,' by Professor Bentley, (*Pharm. Journ.*, 2 ser. vol. v. p. 97.)

POTENTILLA TORMENTILLA, *Sibthorp*. The Tormentilla.

Botanical Character.—*Stem* procumbent or ascending, dichotomous. *Leaves* somewhat hairy, the cauline ones ternate, sessile, the lower quinate, and on long stalks; *lobes* obovate-wedge-shaped, more or less deeply toothed. *Stipules* 0- or 3-toothed, adnate to the petioles. *Flowers* axillary, yellow, solitary, on long peduncles. *Tube of the calyx* concave; *limb* 4- or 5-cleft; *segments* lanceolate-linear, as long as the corolla, with 4–5 bracts on the outside. *Petals* 4 or 5. *Stamens* numerous. *Carpels* numerous, superior, rugose. *Styles* lateral. *Fruit* of many small achenia placed upon a flattish dry thalamus.

Habitat.—Indigenous; growing on barren pastures, heaths, and bushy places.

Tormentillæ Rhizoma. *Tormentilla Rhizome.*

The dried rhizome of Potentilla Tormentilla, *Sibthorp*.

(*Not official.*)

General Characters.—The rhizome commonly called *tormentilla root*, is large as compared with the size of the plant. Its external form is very irregular: sometimes being more or less cylindrical, at others tuberculated and knobby. Its colour externally is dark red-brown, and internally flesh-red or brownish. Its taste is astringent. Its watery infusion is coloured blackish-green by the perchloride of iron. A solution of gelatine also causes a precipitate in it.

Composition.—It contains a trace of *volatile oil* and about 1·8 per cent. of *tannic acid*, to which its properties are essentially due.

Effects and Uses.—Astringent and tonic. It is rarely employed in this country, but it is a useful remedy in chronic diarrhœa and dysentery, passive hemorrhages, and intermittents. The decoction is also used as an astringent wash and injection.

Administration.—Dose from 30 to 60 grains in powder three or four times a day. A decoction may be made by boiling 20 ounces of the bruised rhizome in $1\frac{1}{2}$ pint of distilled water to a pint, and straining. This may be used internally in chronic diarrhœa, &c. in doses of from 1 to 2 fluid ounces. It may also be employed as a wash and injection in leucorrhœa, &c.

ROSA, *Linn.*

Generic Character.—*Shrubs* or small *trees*. *Leaves* pinnate usually with an odd leaflet; *leaflets* serrate; *stipules* adnate. Apex of the tube formed by the combined *calyx* and *thalamus*, contracted, ultimately succulent, the limb 5-parted: *segments* during æstivation somewhat spirally imbricated at the apex, often pinnatisected. *Petals* 5. *Stamens* numerous, perigynous. *Carpels* many, inserted into, and inclosed within, the fleshy tube formed by the calyx and thalamus, dry, indehiscent, somewhat crustaceous, bearing the style on their inner side; *styles* exserted, free, or united so as to form a column. *Fruit* consisting of a number of achenia and forming what has been called a *cynarrhodum.*

ROSA CANINA, *Linn.* The Dog Rose.

Specific Character.—*Shoots* more or less arched, or erect; *prickles* uniform, hooked. *Leaves* naked or slightly hairy, without glands. *Calyx-segments* pinnate, deciduous. *Styles* hairy, not united. *Fruit* coral-red or scarlet, usually oblong, elliptical, or ovate, rarely somewhat globose, soft and pulpy when ripe.—*Woodv.* pl. 139, p. 377.

Habitat.—Indigenous. Thickets, hedges, &c.; very common.

[§ Rosæ Caninæ Fructus. *Fruit of the Dog-Rose. Hips.*

The ripe fruit of the Dog Rose, Rosa canina, *Linn.*, and other indigenous allied species.]

General Characters.—The fruit (*cynarrhodum*), commonly known under the name of the *hip*, is somewhat oval or ovate, and an inch or more in length. It is composed externally of the persistent calyx attached to the concave thalamus, whose sides have become thick, fleshy, beautifully red or scarlet, smooth, and shining; and internally of numerous, hard, hairy achenia (commonly called seeds, but which, in fact, are the real fruits). The pulp or fleshy matter is sweet, acidulous, and pleasant to the taste, especially when mellowed by the frost.

Composition. — The pulp contains *citric* and *malic acids*, with *citrates*, *malates*, *sugar*, a little *tannin*, &c.

Physiological Effects and Uses.—The pulp is slightly refrigerant and astringent. It is only employed in medicine in the preparation of the confection. The hairs surrounding the achenia act as mechanical irritants, like the hairs of the pods of the cowhage, and when swallowed are apt to occasion gastric uneasiness, vomiting, and pruritus about the anus. The seeds (achenia), are therefore directed in the Pharmacopœia, to be removed.

[§ Confectio Rosæ Caninæ. *Confection of Hips.*

Take of

Hips deprived of their seeds . . .	1 pound.
Refined Sugar	2 pounds.

Beat the hips to a pulp in a stone mortar, and rub the pulp through a sieve, then add the sugar, and rub them well together.]

This confection, being saccharine and acidulous, is usually employed as a convenient and agreeable vehicle for other remedies; as for a pill-basis, or for the making of linctuses. A very agreeable linctus is made with confection of hips 16 parts, tragacanth 1, syrup of poppies 6, tincture of squill 6, boiling water 48, acidulated with dilute sulphuric acid. A drawback to the use of the confection is its tendency to candy or concrete by keeping.

Pharmaceutical Use.—It is employed in the preparation of pill of quinia.

ROSA GALLICA, *Linn.* Red Rose.

Specific Character.—A small *shrub* with the *shoots* armed with nearly uniform *prickles* and *glandular bristles* intermixed. *Leaflets* stiff, elliptical, rugose. *Flowers* several together, large, erect, with leafy bracts. *Sepals* ovate, leafy, compound. *Fruit* oblong.—*Woodv.* pl. 141, p. 382.

Habitat.—South of Europe. Common in gardens. For medicinal purposes it is cultivated principally at Mitcham, where it is termed, though incorrectly, the Damask rose.

[§ Rosæ Gallicæ Petala. *Red-Rose Petals.*

The fresh and dried unexpanded petals of Rosa gallica, *Linn.* From plants cultivated in Britain.]

Preparation and General Characters.—The dried petals of the unexpanded flowers deprived of their white claws, constitute the *red-rose leaves* of the shops. The flower-buds are brought to market when about the size of a large nutmeg. The calyx and white claws being cut off, the petals are dried as rapidly as possible. At Mitcham this is affected in a stove. Slow desiccation impairs both their astringency and colour. The petals of the flower-buds are much more astringent than those of the full-blown flowers; hence they are preferred for medicinal use. When dried, they are sifted to remove the stamens and insects. 2,000 flowers yield about 100 pounds of fresh, or 10 pounds of dried petals. The dried petals have a fine velvety appearance: their colour is purplish-red, their odour, which is principally developed during desiccation, is agreeable; their taste is bitterish, feebly acid, and astringent. As they lose their fine colour when exposed to light and air, and are apt to become mouldy or worm-eaten, they should be carefully preserved in bottles or canisters.

Composition.—The petals contain *red colouring matter*, *tannic* and *gallic acids*, a *trace of volatile oil*, &c. *Astringent Matter* (*tannic and gallic acids*).—The presence of astringent matter is shown by the very dark colour (*tannate and gallate of iron*) produced in an infusion of red rose petals by the ferruginous salts, and by the slight precipitate (*tannate of gelatine*) caused on the addition of a solution of gelatine. *Colouring Matter.*—Has not yet been isolated. A watery infusion of red-rose petals has a pale yellowish-red colour: the alcholic tincture is also pale-coloured. On the addition of sulphuric acid an intense bright red colour is produced. Alkalies communicate a greenish tint to the watery infusion (probably by neutralising the free acid, to which, with the colouring matter, the red tint is owing). Sulphurous acid destroys the colour of the infusion.

Physiological Effects and Uses.—Red-rose petals are mild astringents and tonics; but their power is exceedingly slight, and scarcely deserves notice. They are principally used for their colour and flavour.

[§ **Confectio Rosæ Gallicæ.** *Confection of Roses.*

Take of

Fresh Red-Rose Petals . . .	1 pound.
Refined Sugar	3 pounds.

Beat the petals to a pulp in a stone mortar, add the sugar, and rub them well together.]

This preparation is slightly astringent. Over the confection of hips, it has the advantage of having no tendency to candy. Furthermore, it does not ferment or become mouldy. Its principal use is as a vehicle for the exhibition of other medicines; thus it is a common pill-basis for calomel, sulphate of quinia, &c.

Pharmaceutical Uses.—It is a constituent in the pill of Barbadoes aloes, pill of Socotrine aloes, mercurial pill, pill of carbonate of iron, pill of aloes and myrrh, pill of aloes and assafœtida, pill of aloes and iron, and pill of lead and opium.

[§ **Infusum Rosæ Acidum.** *Acid Infusion of Roses.*

Take of

Dried Red-Rose Petals, broken up	$\frac{1}{4}$ ounce.
Diluted Sulphuric Acid . .	1 fluid drachm.
Boiling Distilled Water . .	10 fluid ounces.

Add the acid to the water, infuse the petals in the mixture in a covered vessel, for half an hour, and strain.

Dose.—1 to 2 fluid ounces.]

This was the Dublin process; the infusion is rather stronger than that made by the London or Edinburgh process, which were alike. Infusion of roses is a mild, but very agreeable, refrigerant and astringent drink in febrile disorders, hemorrhages, diarrhœa, and colliquative sweats. It forms a very elegant vehicle for other medicines; as for saline purgatives (especially sulphate of magnesia, the unpleasant taste of which it serves greatly to cover), for sulphate of quinia, the mineral acids, bitter tinctures and infusions, alum, &c. It serves as a very useful gargle; for which purpose acids, nitre, alum, or tincture of capsicum, are usually conjoined. Of course the alkalies and the earths, as well as their carbonates, are incompatible with it; they neutralise the acid, and change the colour of the preparation to greenish or brownish green. Sulphate of iron communicates a deep olive colour, and after some hours causes a precipitate. The sulphuric acid of infusion of roses decomposes the activity of acetate of lead, by forming sulphate of lead. They cannot, therefore, be given at the same time.

[§ **Syrupus Rosæ Gallicæ.** *Syrup of Red Roses.*

Take of

Dried Red-Rose Petals	2 ounces.
Refined Sugar	30 ounces.
Boiling Distilled Water	1 pint.

Infuse the petals in the water for two hours, squeeze through calico, heat the liquor to the boiling point, and filter. Dissolve the sugar in the liquor by means of heat. The product should weigh two pounds fourteen ounces, and should have the specific gravity 1·335.

Dose.—1 fluid drachm.]

This syrup is slightly astringent; it is sometimes added to infusions, decoctions, mixtures, and electuaries.

ROSA CENTIFOLIA, *Linn.* The Hundred-Leaved or Cabbage Rose.

Specific Character.—A bushy *shrub* with erect *shoots*, which are rather thickly covered with nearly straight *prickles*, intermixed with *glandular hairs*. *Leaflets* oblong or ovate, glandular at their margins, hairy beneath. *Flowers* several together, drooping. *Sepals* leafy, spreading, not deflexed, more or less pinnate. *Peduncles* and *sepals* glandulose. *Fruit* ovate.—*Woodv.* pl. 140, p. 379.

Habitat.—Asia. Cultivated at Mitcham, and other places in England, for medicinal purposes.

[§ **Rosæ Centifoliæ Petala.** *Cabbage-Rose Petals.*

The fresh petals, fully expanded, of Rosa centifolia, *Linn.* From plants cultivated in Britain.]

General Characters and Preparation.—These petals are commonly termed in the shops *Cabbage-Rose leaves.* They should be gathered when the flowers are full-blown, and before the petals begin to fall. The odour is strongest when they are of a fine pale red, and previous to their beginning to fade. When freed from the calyx and stamens, they are to be dried in the air. Unlike the petals of *R. gallica*, desiccation diminishes their fragrance. Their taste is sweetish, bitter, and faintly astringent, their odour roseate; both of which properties are readily imparted to water. To preserve these petals they are frequently pickled or salted.

Composition.—The principal constituent is *volatile oil.* They also contain *saccharine matter*, and a trace of *astringent matter. Volatile oil, Attar* or *Otto of Roses.*—Obtained in the East, by distilling roses with water. The attar concretes and floats on the distilled water when cold. It is also obtained by exposing the rose-petals in water to the sun, when the oil floats out. 100,000 flowers yield only about 180 grains of otto. It varies somewhat in colour, and below 80° F. is a crystalline solid. Its specific gravity at 90° F. is 0·832. It is soluble in alcohol, and a little is taken up by water. It consists of two volatile oils, a *solid* and a *liquid oil.* When properly diluted it has a most delicious odour. On account of their delightful fragrance, cabbage-rose petals are employed for the distillation of rose water.

[§ **Aqua Rosæ.** *Rose Water.*

Take of

Fresh Petals of the Hundred-leaved Rose, (or an equivalent quantity of the petals preserved while fresh with common salt)	10 pounds.
Water	2 gallons.

Distil one gallon.]

During the distillation a solid volatile oil comes over with the water and floats on it in the receiver (*English otto of roses*). To prevent the water from becoming sour, it should be preserved in well-corked bottles, kept in cool places. Spirit of wine ought not to be mixed with it, for if a sufficient quantity be added to preserve the water, it renders it unfit for some medicinal purposes. Rose water is employed, on account of its odour only, as an addition to lotions and collyria.

Pharmaceutical Uses.—It is an ingredient of compound mixture of iron, and of bismuth lozenges.

BRAYERA ANTHELMINTICA, *D.C.* The Kousso Tree.

Botanical Character.—A *tree* twenty feet high. *Leaves* crowded, alternate, interruptedly impari-pinnate and sheathing at the base (fig. 89, A); *leaflets* oblong or elliptical-lanceolate, acute, serrate, villose at the margin and on the veins of the under surface; *stipules* adnate to the petiole. *Flowers* (fig. 89, B, C, D), diœcious, small, greenish at first, ultimately purple; repeatedly dichotòmous; the *pedicels* with an ovate bract at their base. *Calyx* turbinate; *throat* constricted internally by a membranous ring; *limb* 10-partite; the segments in two series (fig. 89, D), the five outer ones much larger, oblong-lanceolate, obtuse, reticulate-veined, stellately patent, the five inner ones alternate, smaller, spathulate. *Petals* 5, inserted in the throat of the calyx, small, linear. *Stamens* from 15 to 20, inserted along with the petals; *filaments* free, unequal in length; *anthers* bilocular, dehiscing longitudinally. *Carpels* 2, placed at the bottom of the calyx, free, unilocular, containing one or two pendulous ovules; *styles* terminal, thickened upwards; *stigmas* subpeltate dilated, crenato-oblong. The *so-called male flowers* may be regarded as hermaphrodite, inasmuch as the carpels are well developed. The *female flowers* are somewhat different in their structure. The outer segments of the *calyx* are much more developed than in the *male flowers*; and are four or five times larger than those of the inner row, and are placed somewhat below them (fig. 89, D); the *petals* are entirely wanting; the *stamens* are rudimentary and sterile. —*Hook. Journ. Bot.* 3rd ser. vol. ii. pl. 10.

Habitat.—It is found abundantly throughout the entire tableland of north-eastern Abyssinia.

[§ Cusso. *Kousso.*

The flowers and tops of Brayera anthelmintica, *D.C.* Collected in Abyssinia.]

History.—Kousso has been in use as an anthelmintic in Abyssinia for more than two centuries, and it is very highly valued in that country. It was introduced into Europe about the year 1847, and when first tried in England, France, Germany, and Switzerland, great expectations were raised as to its valuable medicinal properties. More recent trials, however, do not tend to confirm the extravagant notions then formed, and hence this remedy must be regarded as still upon its trial.

Collection.—Mr. Johnson states that the kosso, or kousso, is gathered for medicinal purposes before the seeds are quite ripe. The bunches are suspended in the sun to dry, and if not required for immediate use are deposited in a jar.

General Characters.—Commercial kousso occurs in compressed, more or less broken bunches of flowers; or in unbroken bunches, which are sometimes from one to one foot and a half or more long. The flowers are small, reddish-brown, on hairy stalks, outer limb of calyx 5-parted, the segments oblong or oblong-lanceolate, reticulated.

Fig. 89.

Brayera anthelmintica.

A. Flowering branch.
B. Bunch of female flowers.
C. Flowers seen laterally.
D. Female flower. *a*, *b*, *c*, *d*, *e*, the five outer segments of the calyx.

They have a fragrant balsamic odour, and but a slight taste at first, although ultimately somewhat acrid and disagreeable. The botanical characters may be readily determined by soaking the dried flowers in water (fig. 89, D).

Composition.—Kousso contains a small quantity of a *peculiar* *volatile oil, bitter acrid resin, two kinds of tannin,* &c. The medicinal properties appear to be essentially due to the bitter acrid resin, and also probably, to some extent, to the volatile oil and tannin. M. Pavesi, and subsequently M. Vée, have obtained a principle from kousso which they have termed *koussine*, and which they describe as yellow, bitter, and uncrystallisable. This may be the active principle. An infusion or decoction of kousso strikes a dark green olive tint with a solution of the perchloride of iron.

Physiological Effects.—The physiological effects of *kousso* are not in general very great. Sometimes it excites a slight sensation of heat, nausea, or even vomiting, creates thirst, and frequently, perhaps usually, causes a gentle action on the bowels. But the latter is commonly so slight, that in a considerable number of cases it is necessary to follow its administration by a mild purgative. It is obvious, therefore, that the efficacy of kousso as an anthelmintic does not depend on its purgative or evacuant influence, but on its poisonous or toxic action on the worm; in fact, it is a true *vermicide.* In one case, that of a woman in France, it brought away ten worms, of which one only manifested evidences of vitality, and that for a few minutes only.

Therapeutics.—Kousso is said to be an effective anthelmintic in both kinds of tape-worm, viz. the *Tænia solium*, and *Bothriocephalus latus*. In most of the reported successful cases, the *Tænia solium* was the parasite expelled; but in one of Chomel's cases, the worm which was evacuated was the *Bothriocephalus latus*, and I am informed that kousso has proved most effectual in Switzerland, where, as is well known, the *Bothriocephalus* is the prevailing tape-worm. No ill effects have been caused from the use of kousso in this country; and the conflicting results which have been experienced from the employment of kousso are doubtless in part due to its varying age when administered, as its properties appear to be sensibly depreciated by keeping.

[§ **Infusum Cusso.** *Infusion of Kousso.*

Take of

Kousso, in coarse powder . . .	$\frac{1}{2}$ ounce.
Boiling Distilled Water . . .	8 fluid ounces.

Infuse in a covered vessel, for fifteen minutes, without straining.

Dose.—4 to 8 fluid ounces.]

The best mode of taking the infusion is as follows: The infusion being stirred up, the whole is taken, liquid and powder, at two or three draughts, at short intervals, being washed down by cold water and lemon-juice. To promote the operation, tea (without sugar or milk) may be taken. In three or four hours, if the remedy has not operated, a dose of castor oil or a saline purgative should be administered. The kousso should be taken in the morning fasting. The only preparation necessary is, that the last meal of the previous evening should be slight. The evacuation of the bowels by a mild purgative or an enema is also desirable.

CYDONIA VULGARIS, *Persoon.* The Common Quince.

Botanical Character.—A small, much-branched, usually crooked *tree. Leaves* ovate, oblong, or oval, entire; their lower surface tomentose. *Calyx* 5-cleft, tomentose. *Petals* somewhat orbicular, pale rose-colour or white. *Stamens* erect. *Styles* 5. *Pome* varying in form, closed, yellow, covered with a thin fine down, very austere in taste, but having a peculiar fragrance, 5-celled; *cells* many-seeded, cartilaginous. *Seeds* enveloped in a mucilaginous pulp.

Habitat.—South of Europe. Cultivated in gardens.

Cydoniæ Semina. *Quince Seeds.*

The seeds of Cydonia vulgaris, *Persoon.*

(*Not official.*)

General Character.—Quince seeds are ovate-acute, flat on one side, convex on the other, and of a reddish-brown colour. The external coat is composed of very fine cells, in which is lodged a large quantity of mucilage. When, therefore, these seeds are thrown into water, the mucilage swells up, distends, and ultimately bursts the walls of the cells. They have no odour, but a mucilaginous slightly bitter taste.

Composition.—The *seeds* contain *tannic acid*, a large quantity of a *peculiar gummy matter* (*cydonin*) in their outer coat, probably *amygdalin* (as Stockman obtained hydrocyanic acid from the seeds by distillation), *emulsin*, and some other unimportant substances.

Effects and Uses.—The *mucilage of quince seed* is nutritive, demulcent, and emollient. Quince seeds are employed in medicine only on account of the mucilage which they yield. The decoction (*mucilage of quince seed*) is thus prepared: quince seeds, 120 grains; distilled water, 1 pint. Boil with a gentle heat for ten minutes, and strain. Only employed externally as an emollient and sheathing application to cracked lips and nipples; to the inflamed conjunctiva; to the skin when affected with erysipelas; and to painful hemorrhoidal tumours. Hair-dressers use it, as a cement, for dressing the hair in braids, &c., under the name of *bandoline.*

LEGUMINOSÆ, *Jussieu*. The Leguminous Order.

MYROXYLON PEREIRÆ, *Klotzsch*. The Balsam of Peru Tree.

Synonym.—Myrospermum Pereiræ, *Royle*.

Botanical Character.—*Branches* terete, warty, ash-coloured. *Leaves* alternate, petiolate, impari-pinnate; *leaflets* 5 to 11, alternate, on short petiolules, oblong or ovate, abruptly acuminate, emarginate; *petiolules* and *midribs* covered with microscopic hairs. *Fruit* a winged legume, 1-celled, 1-seeded; *fruit-stalk* winged above; *fruit* with *stalk* about $3\frac{1}{4}$ inches long; rounded and unequal-sided at the peduncular extremity, enlarged and rounded at the summit; *mesocarp* fibrous. *Seed* solitary; *cotyledons* yellowish, oily, with an agreeable odour.—*Pharm. Journ.* vol. x. 1st ser. p. 282, plate (*Myrospermum of Sonsonate*).

Habitat.—Near Sonsonate, in the state of Salvador, Central America.

[§ **Balsamum Peruvianum.** *Balsam of Peru.*

A balsam obtained from Myroxylon Pereiræ, *Klotzsch.* It exudes from the trunk of the tree after the bark has been scorched and removed. From Salvador in Central America.]

Collection and Preparation.—The mode of obtaining balsam of Peru has been variously stated at different times by pharmacologists. Dr. Dorat, in a letter to Mr. Hanbury (*Pharm. Journ.* vol. v. 2nd ser. p. 242) has described the mode in which it is now obtained at Juisnagua, near Sonsonate, as follows :—

'Early in the month of November or December, or after the last rains, the balsam-trees are beaten on the four sides of their stems with the back of an axe, a hammer, or other blunt instrument, until the bark is loosened, four intermediate strips being left untouched that the tree may not be injured for the next year. Five or six days after, men with resinous torches, or bundles of lighted wood, apply heat to the beaten bark, which becomes charred. It is left eight days, during which the burnt pieces of bark either fall or are taken off. As soon as they perceive that the bare places are moist with the exuding balsam, which takes place in a few days, pieces of rag are placed so as entirely to cover the bare wood. As these become saturated with the balsam which is of a light yellowish colour, they are collected and thrown into an earthenware boiler, three-quarters filled with water, and stirred and boiled gently until the rags appear nearly clean, and the now dark and heavy balsam sinks to the bottom. Fresh rags belonging to the same owner are continually being put into the boiler until sun-down, when the fire is extinguished; when cold the water in the boiler is poured off, and the impure balsam set aside. During this process the rags that appear to have been cleared of balsam are taken out of the boiler at different times and given to a man to be pressed, by which means much balsam is still obtained. The press consists of a small open bag about fourteen inches long, made of stout rope fixed together with twine, open at the middle and looped at both ends to receive two sticks. The rags are placed inside, and the whole is twisted round by means of the sticks and the balsam thus squeezed out. A washerwoman wringing out a wet cloth, fairly represents the process. The balsam thus procured is added to that in the boiler. The next day, the cold balsam is weighed and put into *tecomates* or gourds of different sizes, and sent to market. If it is wished to purify it, the boiler is left standing for several days, when the impurities float to the surface and are skimmed off. A little water is also left to float at the mouth of the tecomate when brought for sale. These *tecomates* are tied up in plantain leaves, with a stopper of the same. A healthy tree will produce balsam well for about thirty years, after which, if allowed to remain untouched for five or six years, it will again produce.'

M. Victor le Nouvel, who has been engaged in collecting this balsam since 1836, gives the following as the process used by the Indians to obtain it:—An incision is made into the tree of about two or three inches broad, and three to four inches long. They then raise the bark from the wood, and apply cotton rags to it; a fire being lighted round the tree to liquefy the balsam. Fresh incisions are made higher and higher up the tree, till the cotton rags are quite saturated. It takes from ten to twelve days to effect this. The rags are next boiled; and when the liquor is cold, the balsam collects below.

Commerce.—Balsam of Peru is exclusively the produce of the state of Salvador. Sometimes it comes direct to Europe by way of Acajutla, at other times indirectly by Lima, Valparaiso, and other ports of the Pacific, or by Belize or Honduras on the Atlantic side of Central America. The balsam was originally supposed to be the produce of Peru, hence its name. This error arose from its originally coming to Europe by way of Peru.

General Characters and Tests.—Balsam of Peru, called also *black* or *liquid balsam of Peru*, is a reddish-brown or nearly black liquid, translucent in thin films; having the consistence of treacle, a warm acrid slightly bitter taste, and a powerful but agreeable odour, somewhat similar to that of vanilla and benzoin, and which is increased by dropping the balsam on a red-hot coal. It is inflammable, and burns with a smoky flame. It is soluble in five parts of rectified spirit. Its specific gravity varies from 1·150 to 1·160. When newly imported it generally contains a varying proportion of water, and in some cases other impurities; hence it is purified by allowing it to stand until these have separated. The characters to be attended to in judging of its genuineness are, the purity of its odour, its complete solubility in, or miscibility with, alcohol (by which the absence of fixed oil is shown), and its undergoing no diminution of volume when mixed with water (by which the absence of alcohol is proved). Another sign of its purity is, that 1,000 parts of it saturate 75 parts of pure crystallised carbonate of potash.

Adulteration.—The demand for the balsam being small, the supply quite equal to, or even exceeding, that demand, and the price being moderate, are circumstances which appear to remove all motive for adulteration, which I do not think is at present practised in this country. It is said, however, to be sometimes adulterated with castor oil and copaiva. Ulex states that the adulteration with castor oil may be detected by adding concentrated sulphuric acid, and subsequently water to it, when a brittle resin is formed, if the balsam be pure; but it becomes softer in proportion to the amount of fixed oil mixed with it. Copaiva is shown to be present by distilling a few drops, and adding iodine, when an explosion results, if copaiva has been added.

White Balsam and *Balsamito.*—White balsam has been sometimes confounded with balsam of Tolu. It is obtained at Sonsonate, by pressure without heat, from the fruit of the Balsam of Peru tree, after removing the outer fibrous portions of the epicarp and mesocarp. It closely resembles strained Bordeaux turpentine. It is semi-fluid, and somewhat granular. By standing it separates into a white opaque crystalline resinous deposit, and a superior more translucent thinner portion. Its odour is agreeable, but unlike that of balsam of Peru, or of balsam of Tolu. It is partly soluble in alcohol, but more in ether. From this white balsam, Dr. Stenhouse has obtained broad, thin, prismatic, colourless crystals, which he has termed *Myroxocarpin.* They are hard, destitute of taste, insoluble in water, but soluble in hot alcohol or ether; their solution is neutral to test paper. *Balsamito.*—This is a tincture made by digesting the fruit in rum. It is a clear liquid, the colour of sherry wine, having an odour like the tonquin bean, and a bitter taste. It is considered to be stimulant, diuretic, and anthelmintic. It is used in doses of a fluid drachm in fainting fits, dyspepsia, colic, hysteria, and worms. Also externally as an application to sloughing sores, especially those the chigoe.

Composition.—The principal constituents of balsam of Peru are *volatile oil, cinnamic acid,* and *resin.* *Volatile oil of Balsam of Peru;*

Cinnamein.— If an alcoholic solution of potash be added to an alcoholic solution of balsam of Peru, a compound of resin and potash is precipitated, while cinnamate of potash and cinnamein are left in solution. On the addition of water the latter separates, and floats on the surface. It is to be purified by solution in rectified petroleum. Cinnamein is a colourless, strongly refracting oil, neutral, having a sharp taste, and a slightly aromatic odour, heavier than water, specific gravity 1·092, soluble in alcohol and ether, insoluble in water, and inflammable. Its composition is $C_{18}H_{16}O_2$. *Cinnamic Acid.*—This constituent has been mistaken for benzoic acid. It is obviously formed in the balsam by the oxidation of the volatile oil. In some specimens of balsam of Peru, the cinnamein has been entirely converted into cinnamic acid. *Resin of Balsam of Peru.*—The quantity of resin in balsam of Peru continually increases. It is formed by the union of cinnamein with the elements of water, and gradually acquires different degrees of viscosity. Soft resin differs from the hard only in its smaller proportion of the elements of water.

Physiological Effects.—Stimulant, slightly tonic, expectorant, and detergent. Topically it operates as a stimulant and mild acrid; and when applied to foul or indolent ulcers, often cleanses them and promotes their cicatrisation. Taken internally its stimulant influence is directed to the secreting organs, especially the bronchial mucous membrane.

Therapeutics.—It proves serviceable in some old asthmatic cases, chronic pulmonary catarrhs, winter coughs, &c. It seems to be principally adapted to *old-standing chronic affections of the mucous membranes* (especially the bronchial mucous membrane), particularly in persons of a cold and torpid habit. Its stimulant influence is calculated only to aggravate acute cases. As a topical remedy, balsam of Peru is a very useful application. It is applied either alone, or in the form of ointment, to indolent ill-conditioned ulcers, and bed sores. I have used it in some obstinate ulcerations about the nose. Dr. Ainslie speaks very highly of its powers of arresting the progress of sphacelous and phagedenic affections, so common and destructive in India. He recommends lint, soaked in the balsam, to be applied night and morning. In offensive discharges from the ear, it is now and then dropped in after syringing.

Administration.—Dose, 20 minims to 1 fluid drachm. It may be taken on sugar, or made into pills with some absorbent powder, or diffused through water by means of sugar, honey, gum, or yolk of egg.

MYROXYLON TOLUIFERA, *H.B.K.* **Balsam of Tolu Tree.**

Synonym.—Myrospermum Toluiferum, *Richard.*

Botanical Character.—A *tree* with warty although otherwise smooth branches. *Leaves* smooth; *leaflets* equal-sided, from 7 to 8, thin, membranous, ovate-oblong, acuminate, rounded at the base. *Calyx* campanulate, slightly 5-toothed. *Petals* 5, the upper one largest. *Stamens* 10, free. *Ovary* superior, stalked, oblong, membranous, with 2–6 ovules; *style* towards the apex, filiform, lateral. *Legume* indehiscent, 1-celled, oblique, with winged expansions and a winged stalk, which is very broad at the apex.

Habitat.—Mountains of Tolu, Turbaco, and on the banks of the Magdalena, between Garapatas and Monpox, in New Granada.

[§ **Balsamum Tolutanum.** *Balsam of Tolu.*

A balsam obtained from Myroxylon Toluifera, *H.B.K.* It exudes from the trunk of the tree after incisions have been made into the bark. From New Granada.]

Collection.—Balsam of Tolu is procured by making incisions into the bark of the tree, and receiving the liquid balsam as it exudes, in vessels made of a black wax. It is afterwards transferred into proper vessels. It only exudes from the tree during the heat of the day.

Commerce.—Balsam of Tolu is sometimes brought direct from Carthagena, Santa Martha, and Savanilla; more commonly, however, it comes by way of New York or Jamaica. It is usually imported in cylindrical tin canisters; now and then in earthen pots or jars; still more rarely in small calabashes.

General Characters.—Balsam of Tolu, when first brought over, is generally a soft and tenacious solid, but by age it becomes hard and brittle, like resin, and has a granular or somewhat crystalline appearance. Formerly it was imported in this hardened condition, but it is now usually met with in the soft state. It is transparent, has a reddish or yellowish-brown colour; a most fragrant balsamic odour, though less powerful than that of storax or Peruvian balsam; and a pleasant sweetish taste. It softens under the teeth; when heated, it readily melts, takes fire, and burns with an agreeable odour. It is very soluble in alcohol and ether. The soft balsam contains more oil but less acid than the dry brittle balsam, the acid and the resin being formed at the expense of the oil.

Adulteration.—Ulex states that common resin is present, if the balsam, instead of dissolving in sulphuric acid, swells up, blackens, and disengages sulphurous acid. When pure, the same author states, that if heated in sulphuric acid, it dissolves without disengagement of sulphurous acid, and yields a cherry-red liquid. I do not think it is adulterated in this country.

Composition.—According to Frémy, the composition of balsam of Tolu is similar to that of balsam of Peru, its constituents being *cinnamein, cinnamic acid* and *resin.* They differ, according to the same chemist, from those of balsam of Peru by the greater facility with which they become resinified. *Resin of Balsam of Tolu.*—This is essentially the same as that of balsam of Peru, and, like it, also forms a fine red colour with sulphuric acid; but it is less fusible than the resin of the last-mentioned balsam.

Physiological Effects and Uses.—The effects of balsam of Tolu are similar to those of balsam of Peru, and the other balsamic substances. It is employed as a stimulating expectorant in chronic bronchial affections, unaccompanied with inflammatory action. It is, however, more frequently used as an agreeable flavouring adjunct to pectoral mixtures. The vapour of the ethereal solution of the balsam has been inhaled in chronic affections with benefit. *Tolu lozenges* form a popular and pleasant remedy for appeasing troublesome cough.

Administration.—Dose 10 to 30 grains. It may be taken in the form of an *emulsion* made with mucilage of gum acacia, or some other viscid liquor.

Pharmaceutical Use.—Balsam of Tolu is a constituent of compound tincture of benzoin.

[§ **Syrupus Tolutanus.** *Syrup of Tolu.*

Take of

Balsam of Tolu . . .	$1\frac{1}{4}$ ounce.
Refined Sugar . . .	2 pounds.
Distilled Water . . .	1 pint, or a sufficiency.

Boil the balsam in the water for half an hour in a lightly covered vessel, stirring occasionally. Then remove from the fire, and add distilled water, if necessary, so that the liquid shall measure sixteen ounces. Filter the solution when cold, add the sugar, and dissolve with the aid of a steam or water bath. The product should weigh three pounds, and should have the specific gravity 1·330.

Dose.—1 fluid drachm.]

Employed as an agreeable flavouring adjunct to pectoral mixtures.

[§ **Tinctura Tolutana.** *Tincture of Tolu.*

Take of

Balsam of Tolu	$2\frac{1}{2}$ ounces.
Rectified Spirit	a sufficiency.

Macerate the balsam of tolu in fifteen fluid ounces of the spirit, in a closed vessel, with occasional agitation, for six hours, or until the balsam is dissolved; then filter, and add sufficient rectified spirit to make one pint.

Dose.—20 to 40 minims.]

A stimulating expectorant, principally used as a flavouring adjunct to other pectorals. Its use is, of course, objectionable in inflammatory cases. When mixed with water the resin is precipitated; hence it should be rubbed with mucilage, or some other viscid liquor, before adding the water, to keep the resinous precipitate in suspension.

Pharmaceutical Use.—Tincture of Tolu is contained in several of the official lozenges.

SAROTHAMNUS SCOPARIUS, *Wimmer.* Common Broom.

Botanical Character.—A *shrub* from 3–8 feet high. *Branches* angular, without spines. *Leaves* ternate, except towards the upper part, where they are generally simple; *leaflets* oblong. *Flowers* yellow, axillary, solitary, stalked, papilionaceous. *Calyx* free, bilabiate, the upper lip with 2, the lower with 3 teeth. *Standard* large, ovate; *keel* obtuse. *Stamens* 10, monadelphous. *Style* long, curved, thickened upwards, channelled within; *stigma* terminal, capitate. *Legume* flat, dark brown.—*Woodv.* pl. 89, p. 243 (*Spartium Scoparium*).

Habitat.—Indigenous; growing on dry hills and bushy places.

[§ Scoparii Cacumina. *Broom Tops.*

The fresh and dried tops of Sarothamnus Scoparius, *Wimmer.* From indigenous plants.

Characters.—Straight angular dark green smooth tough twigs, of a bitter nauseous taste, and of a peculiar odour when bruised.]

Composition.—Dr. Stenhouse has noted the existence of two peculiar principles in the broom; *one* a neutral principle (*Scoparin*); and the *other* a volatile liquid alkaloid (*Sparteine* or *Spartia*). *Scoparin*, $C_{10}H_{11}O_5$, when pure, is a yellow substance which crystallises in needles. It is obtained by purifying the gelatinous matter, which is formed in a concentrated watery extract of broom, after it has stood for one or two days in a cold place. It is soluble in water and alcohol, and is without any bitter taste. The experiments of Stenhouse lead to the belief that scoparin is the diuretic principle of broom tops. The dose of scoparin required to produce a decidedly diuretic effect is five grains, repeated at intervals. It does not appear to be at all poisonous or injurious. *Spartia*, $C_{15}H_{26}N_2$, was obtained by distillation from the mother waters or the scoparin. It is a colourless oily liquid at first, but becomes brown by exposure to light. It forms crystalline salts with bichloride of platinum, terchloride of gold, &c., and these, as well as spartia itself, have a very bitter taste. It is regarded by Stenhouse as a narcotic principle. It is not quite so poisonous as conia or nicotia, but it produces in small doses a species of violent intoxication, followed by a profound slumber, from which an animal to which it has been given, cannot be roused for a long time without great difficulty. Further experiments are, however, required upon these two principles, not only as regards their physiological effects, but likewise upon their composition and properties.

Physiological Effects.—In large doses broom tops are emetic and purgative. *In small doses* they are diuretic and mildly laxative. As a diuretic they have been highly spoken of by Mead and Cullen; and having very frequently employed broom tops, I can add my testimony to their powerful effects; for, according to my experience, they are more certain than any other diuretic in dropsies.

Therapeutics.—They have been principally or solely employed in dropsies, and, as already mentioned, sometimes with great benefit. Of course their chance of cure depends on the nature of the cause of the dropsical effusion. In acute inflammatory cases, as well as in diseased kidney, their use might be objectionable.

Administration.—Broom tops are usually given in the form of *decoction.* To promote the operation of broom, diluents should be freely used.

[§ **Decoctum Scoparii.** *Decoction of Broom.*

Take of

Broom Tops, dried	1 ounce.
Distilled Water	1 pint.

Boil for ten minutes in a covered vessel, then strain and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint.

Dose.—2 to 4 fluid ounces.]

Diuretic.

[§ **Succus Scoparii.** *Juice of Broom.*

Take of

Fresh Broom Tops	7 pounds.
Rectified Spirit	a sufficiency.

Bruise the broom tops in a stone mortar, press out the juice, and to every three measures of juice add one of the spirit. Set aside for seven days, and filter. Keep in a cool place.

Dose.—1 to 2 fluid drachms.]

Diuretic.

INDIGOFERA TINCTORIA, *Linn.* Common East Indian Indigo.

Botanical Character.—A small *shrubby plant.* *Stem* erect, branched, pubescent; *branches* round. *Leaves* (fig. 90), pinnate; *leaflets* 4–5 pairs, oval, nearly smooth beneath. *Flowers* (fig. 90) in axillary racemes, which are shorter than the leaves. *Calyx* 5-cleft, with acute lobes. *Standard* roundish, emarginate; *keel* at length bending back with elasticity. *Stamens* 10, diadelphous. *Style* filiform, smooth. *Legume* nearly cylindrical, curved, deflexed. *Seeds* about 10, truncated.—*Wight, Icon. Pl. Ind. Or.* vol. ii. p. 365.

Fig. 90.

Indigofera tinctoria.

Habitat.— East and West Indies, and tropical Africa. Extensively cultivated in India.

[§ **Indigo** (Appendix I.). $C_{16}H_5NO_2$ or C_8H_5NO.

A blue pigment prepared from various species of Indigofera, *Linn.*]

Preparation.—In the East Indies *Indigofera tinctoria* is commonly cultivated for the purpose of preparing indigo. Indigo is formed from the plants by fermentation. During the fermentation, the indigo is deposited as a feculent matter. Lime water promotes its separation. Blue indigo does not exist in the plants previous to fermentation: it is, therefore, a product, not an educt of them.

Commerce.—Commercial indigo is principally brought from the East Indies, but a considerable quantity is imported from Guatemala, and other places.

General Characters.—Indigo usually occurs in cubical cakes of an intensely blue colour. Rubbed with a smooth hard body (as the nail), it assumes a coppery or bronze hue. It is insoluble in water, cold alcohol, ether, diluted sulphuric or hydrochloric acids, weak alkaline solutions, and cold oils (both fixed and volatile). When heated to about 550° F. it evolves a reddish-violet vapour (vapour of *indigotin*), which condenses in minute crystals. This distinguishes it from Prussian blue. Deoxidising agents (as protosulphate of iron, sesquisulphuret of arsenic, the process of fermentation, &c.) destroy its blue colour by abstracting oxygen from the indigotin, and converting it into *indigogen* or *white indigo*; which, by exposure to the air, attracts oxygen, and again becomes blue. Chlorine and the hypochlorites destroy the blue colour of indigo. Heated with sulphuric acid it yields a deep blue liquid, commonly termed *sulphate of indigo.*

Use.—Indigo has been introduced into the Pharmacopœia, solely for testing.

[§ **Solution of Sulphate of Indigo** (Appendix II.).

Take of

Indigo, dry and in fine powder . .	5 grains.
Sulphuric Acid	10 fluid ounces.

Mix the indigo with a fluid drachm of the sulphuric acid in a small test tube, and apply the heat of a water-bath for an hour. Pour the blue liquid into the remainder of the acid, agitate the mixture, and, when the undissolved indigo has subsided, decant the clear liquid into a stoppered bottle.]

Employed to indicate the presence of free chlorine.

GLYCYRRHIZA GLABRA, *Linn.* Common Liquorice.

Botanical Character.—*Root* perennial, round, running to a considerable distance. *Stem* herbaceous, erect, smooth, 4–5 feet high, *Leaves* (fig. 91) impari-pinnate, with stipules; *leaflets* about 13, oval or somewhat ovate, slightly retuse, viscid beneath. *Racemes* axillary (fig. 91), erect, shorter than the leaves. *Flowers* papilionaceous, bluish or purplish, distant. *Calyx* tubular, 2-lipped. *Stamens* 10, diadelphous. *Style* filiform. *Legume* smooth, compressed, 3–4-seeded. *Steph. and Church.* pl. 134.

Fig. 91.

Glycyrrhiza glabra.

Habitat.—South of Europe. Cultivated at Mitcham in Surrey, and at other places, for medicinal use.

[§ **Glycyrrhizæ Radix.** *Liquorice Root.*

The root or underground stem, fresh and dried, of Glycyrrhiza glabra, *Linn.* Cultivated in England.]

General Characters. — The underground stem is denominated *liquorice-root.* It is in long cylindrical branched pieces, an inch or less in diameter, tough and pliable; of a greyish-brown colour externally, and yellow internally. It has no perceptible odour in a dried state, but when fresh it is rather sickly and earthy; its taste is remarkably sweet, mucilaginous, and slightly acrid. The acridity resides in the epidermis; hence for medicinal use the root would be better *decorticated.*

Composition.—The principal constituents of the fresh root are *glycyrrhizin*, *resinous oil*, *gum*, &c. *Glycyrrhizin* (Liquorice Sugar). —Belongs to the uncrystallisable sugars which are not susceptible of vinous fermentation. It is characterised by its affinity for acids, with which it unites to form compounds which are very slightly soluble only in water. It is yellow and transparent, and has the sweet taste of the root. It is soluble in both water and alcohol. Acids precipitate it from its solution. It combines also with bases, as well as with salts. It causes precipitates with many metallic solutions. *Resinous Oil.*—To this constituent, liquorice root owes the slight degree of acridity which it possesses.

Physiological Effects.—Liquorice root and its extract are emollient, demulcent, and nutritive.

Therapeutics and Pharmaceutical Uses.—It is employed as an emollient and demulcent in catarrhal affections of the mucous membranes. It is also used as a flavouring adjunct to other medicines. Its powder is employed in the preparation of pills, either to give them a proper consistence, or to prevent their adhesion. It is used for these purposes as an ingredient in confection of turpentine, compound decoction of sarsaparilla, infusion of linseed, mercurial pill, and pill of iodide of iron.

[§ **Extractum Glycyrrhizæ.** *Extract of Liquorice.*

Take of

Liquorice Root, in coarse powder . .	1 pound.
Distilled Water	4 pints.

Macerate the liquorice root with two pints of the water for twelve hours, strain and press; again macerate the pressed marc with the remainder of the water for six hours, strain and press. Mix the strained liquors, heat them to 212°, and strain through flannel; then evaporate by a water-bath until the extract is of a suitable consistence for forming pills.]

Extract of liquorice is extensively imported from Spain, Italy, France, &c., under the name of *liquorice juice*, or, according to the countries from whence it is brought, *Spanish* or *Italian juice*. *Solazzi juice* is most esteemed. The Spanish extract is prepared in Catalonia from *G. glabra*; while the Italian extract is obtained in

Calabria from *G. echinata.* It is usually imported in the form of cylindrical rolls or sticks, enveloped in bay leaves, but occasionally in masses or '*blocks*,' the latter being generally superior to the stick. When pure it is black and dry, with a glossy fracture and a sweetish taste; and is completely soluble in water. As met with in commerce, it is rarely pure. None of these extracts, however, are equal to the official extract when properly prepared, and they ought not to be substituted for it. Extract of liquorice is dissolved slowly in the mouth, to appease tickling cough. It is a very agreeable flavouring adjunct to other medicines. As it easily becomes soft by warmth, it does not answer well as a pill basis.

Dose.—10 to 60 grains.

Pharmaceutical Uses.—It is employed as a flavouring ingredient in compound decoction of aloes, confection of senna, compound mixture of senna, tincture of aloes, and opium lozenges.

ASTRAGALUS VERUS, *Olivier.* The Tragacanth Plant.

Botanical Character.—A small *shrub.* *Branches* covered with imbricated scales and spines, the remains of former petioles. *Leaves* pinnate; *leaflets* 8–9 pairs, linear, hispid. *Flowers* axillary, in clusters of 2–5, sessile, yellow, papilionaceous. *Calyx* obtusely 5-toothed, tomentose. *Corolla* with an obtuse keel. *Stamens* 10, diadelphous. *Legume* 2-celled, or half 2-celled by the turning inwards of the dorsal suture.—*Nees*, *Plant. Med.*, pl. 329.

Habitat.—Anatolia, Armenia, and Northern Persia. According to Olivier, the tragacanth of these countries, forming the greater part of the tragacanth of Europe, is yielded by this species.

[§ Tragacantha. *Tragacanth.*

A gummy exudation from the stems of Astragalus verus, *Olivier*; and possibly other species. Collected in Asia Minor.]

Botanical Source.—Nothing certain is known as to the species of Astragalus yielding commercial tragacanth; it is, however, quite clear, that other species besides the one mentioned above produce a similar gum, but the official flaky tragacanth appears to be derived, as stated in the Pharmacopœia, from more especially *Astragalus verus.* According to Labillardière, the white or best tragacanth is yielded by *Astragalus gummifer*, which grows in Lebanon and Kurdistan; but no flaky tragacanth is imported into this country from Syria, Persia, or Bombay.

Production.—Tragacanth exudes naturally from the stem of the species of Astragalus, and a portion of the inferior commercia tragacanth is thus derived, but the finest tragacanth is obtained, according to Mr. Maltass, as follows : 'In July and August the peasants clear away the earth from the lower part of the stem of the shrub, and make several longitudinal incisions with a knife in the bark ; the gum exudes the whole length of the incision, and dries in flakes ; three or four days are sufficient for this purpose, and the gum is then collected. In some places also the peasants occasionally puncture the bark with the point of the knife. If the weather be hot and dry, the gum is white and clean ; but if the atmosphere be damp and the heat but moderate, the gum requires a longer time to dry, and assumes a yellow or brown tinge.' At the same time the peasants pick off the gum which exudes naturally, and this chiefly constitutes the commoner sorts of tragacanth of English commerce.

Commerce.—Tragacanth is imported from Smyrna and other parts of the Levant. The best comes from Smyrna. The several kinds of tragacanth are mixed together when they arrive at Smyrna, and are then separated by picking and sorting.

General Characters and Varieties.—Tragacanth is commonly called *gum dragon.* It is white, yellowish, or yellowish-brown, odourless and tasteless, hard, tough and elastic, but rendered more pulverisable by a heat of 120° Fahr. ; very sparingly soluble in cold water, but swelling into a gelatinous mass, which is tinged violet by tincture of iodine. After maceration in cold water, the fluid portion is not precipitated by the addition of rectified spirit. Two varieties are more especially known. 1. *Flaky Tragacanth : Smyrna Tragacanth* (Martius). This is the tragacanth usually found in English commerce, and which alone corresponds to the official description. It occurs in moderately large, white or yellowish, broad, thin, slightly curved pieces, which are marked with arched or concentric elevations. According to Mr. Maltass the white broken fragments of this constitute what is termed *vermicelli* or *old tragacanth.* 2. *Vermiform Tragacanth : Morea Tragacanth* (Martius). —This variety is rarely met with in this country, but is common on the Continent. It occurs in small, twisted, filiform, spiral pieces. A third kind of tragacanth is also distinguished as *common* or *sorts.*

Adulterations.—Maltass states that tragacanth is mixed with two other gums, collected in Caramania and Armenia, and termed Caramania and Moussul gums respectively. These gums are previously broken into irregular pieces and whitened with carbonate of lead. They are easily detected in flaky tragacanth (in which, however, they rarely occur) by their appearance, as neither of them occur in flaky pieces.

Composition.—Two distinct principles have been found in tragacanth, namely, *tragacanthin* and *bassorin.* It also contains a little starch. *Tragacanthin : soluble gum* or *arabin of tragacanth.*—The soluble gum of tragacanth is usually regarded as similar to gum arabic, and hence it is called *arabin*; but is distinguished by silicate of potash and perchloride of iron producing no change in it, and by the peculiar appearance of the precipitate produced with alcohol (the precipitate is flocculent, and collects in a similar opaque and mucous mass). In common with arabin, it produces precipitates with subacetate of lead, chloride of tin, and protonitrate of mercury. *Bassorin* or *insoluble gum.*—Is distinguished by its insolubility in water, both hot and cold. It however absorbs water and swells up. It is soluble in alcohol. 100 parts treated by 1,000 of nitric acid furnished 22·61 of mucic acid, with a little oxalic acid.

Physiological Effects.—Tragacanth is emollient and demulcent.

Pharmaceutical Uses.—Tragacanth, in powder, is used rather as a vehicle for active and heavy medicines (as calomel), than on account of its own proper effects. It is an ingredient in compound powder of opium and confection of opium.

[§ **Mucilago Tragacanthæ.** *Mucilage of Tragacanth.*

Take of

Tragacanth, in powder . . .	60 grains.
Distilled Water	10 fluid ounces.

To the water contained in a pint bottle add the tragacanth, agitate briskly for a few minutes, and again at short intervals, until the tragacanth is perfectly diffused and finally has formed a mucilage.]

Employed in making pills and lozenges; also to suspend heavy powders, as the metallic oxides, in water. It has also been recommended as an application to burns.

Dose.—1 fluid drachm or more.

[§ **Pulvis Tragacanthæ Compositus.** *Compound Powder of Tragacanth.*

Take of

Tragacanth, in powder	of each . .	1 ounce.
Gum, in powder .		
Starch, in powder .		
Refined Sugar, in powder		3 ounces.

Rub them well together.

Dose.—20 to 60 grains.]

Employed as a vehicle for the exhibition of active and heavy powders to children, and as a demulcent agent in irritation of the mucous membranes.

MUCUNA PRURIENS, *De Cand.* **Common Cowhage or Cow-itch.**

Botanical Character.—*Root* perennial. *Stem* twining, herbaceous. *Leaves* trifoliate; *leaflets* hairy beneath, acute, the middle one somewhat rhomboidal, the lateral ones oblique at the base. *Flowers* in axillary racemes: with a disagreeable alliaceous odour. *Calyx* campanulate, 2-lipped. *Vexillum* flesh-coloured, ascending, shorter than the alæ and keel; *alæ* purple or violet, oblong, as long as the keel; *keel* greenish-white, oblong, straight, acute. *Stamens* diadelphous; *anthers* 10, of which 5 are oblong-linear, and 5 ovate, hirsute. *Legume* oblong, knotted, 2-valved, which are somewhat keeled, with cellular partitions, hispid and stinging. *Seeds* roundish, surrounded by a circularly linear hilum.—*Steph. and Church.* vol. iii. pl. 179.

Habitat.—West Indies. *Mucuna prurita*, Hooker, which is common throughout the East Indies, is now regarded as identical with *M. pruriens*, D.C.

Mucuna. *Cowhage or Cow-itch.*

The hairs obtained from the legume of Mucuna pruriens, *De Cand.*

(*Not official.*)

General Characters.—The legume which is imported with the hairs attached, has a brownish colour, and is shaped like the letter *ſ*. It is about four or five inches long, contains from four to six seeds, and is clothed with strong, brown, bristly, stinging hairs, which, examined by the microscope, are seen to be finely pointed, and slightly notched or serrated towards their ends.

Composition.—The hairs contain *tannic acid.*

Physiological Effects.—A decoction of the roots or of the legumes is said to be diuretic, and was formerly used in dropsy. The hairs applied to the skin produce intolerable itching, and, in some persons, pain, redness, swelling, and even an eruption. These effects, which are increased by rubbing, but diminished by the application of oil, are referable to the mechanical action of cowhage.

Uses.—The hairs have been celebrated for their vermifuge properties. Their action is mechanical; that is, they are supposed to pierce and torment intestinal worms, and thereby oblige them to let go their hold. Cowhage has been principally celebrated for expelling the large round worm (*Ascaris lumbricoides*), and the small thread-worm (*A. vermicularis*). It has not proved equally serviceable against the tape-worm (*Tænia solium*).

Administration.—The best mode of exhibiting cowhage is in treacle, syrup, or honey. The quantity of hairs should be sufficient to give the syrup or treacle, the consistence of honey, or of an electuary; and of this mixture a tea spoonful may be given to children, and a table spoonful to adults: this dose should be taken twice a day—namely, at going to bed, and in the morning an hour before breakfast. After continuing the electuary for three or four days, a brisk purgative of jalap, or senna, should be taken, which will in general bring away the worms.

PHYSOSTIGMA VENENOSUM, *Balfour.* **The Calabar Bean.**

Botanical Character.—A large twining *shrubby* plant. *Root* fibrous, often with small white tubercules. *Stem* 2 inches in diameter at its thickest part, often fifty feet long, cylindrical; *branches* twisted; *wood* very porous. *Leaves* alternate, petiolate, stipulate, pinnately-trifoliate; *leaflets* ovate, acuminate. *Flowers* in axillary racemes about an inch in length; *peduncle* zigzag. *Calyx* campanulate, 4-cleft. *Corolla* papilionaceous, beautifully veined, of a pale pink colour with a purplish tinge; *vexillum* large, 2-lobed, and recurved at the apex; *alœ* large. *Stamens* 10, diadelphous. *Pistil* $1\frac{1}{2}$ inch long; *style* curved, with a line of hairs on its concave side; *stigma* obtuse, with a remarkable sac or hood, which extends along the upper part of the convexity of the style. *Legume* stalked, dehiscent, green and curved when young, brown and straight when ripe; *apex* curved, about seven inches in length. *Seeds* 2–3. *Balfour, Trans. Royal Soc. Edin.* vol. xxii. p. 305.

Habitat.—Western Africa.

[§ **Physostigmatis Faba.** *Calabar Bean.*

The seed of Physostigma venenosum, *Balfour.* Western Africa.]

History.—About thirteen years ago, Sir R. Christison received from Old Calabar some large leguminous seeds, which were stated to be in use under the name of *Eseré*, by the natives of Old Calabar in the trial by ordeal. The botanical source of this ordeal bean was then unknown, and Sir R. Christison nearly lost his life by trying its effects upon himself. Dr. Balfour afterwards received some specimens of the plant, which flowered and fruited in the Botanic Gardens, Edinburgh, and which he described and named *Physostigma* (φυσάειν to inflate, and στίγμα), from the peculiar headed appendage to its stigma. Calabar bean was introduced into the British Pharmacopœia in 1867.

General Characters.—The seeds are about 1 inch long, and $\frac{3}{4}$ inch broad, about the size of a very large horse bean; and weighing about 60 grains. In form they are oblong or somewhat reniform, the convex margin being marked by a long longitudinal furrow. They are covered by a somewhat rough shining integument, which is very firm, hard, and brittle, and of a brownish-red, pale chocolate, or ash-grey colour. Within this integument or shell is the kernel, consisting of two hard white pulverisable cotyledons, which weigh about 46 grains, and have a taste like that of the ordinary edible leguminous seeds, without bitterness, acrimony, or aromatic flavour. Calabar beans yield their virtues to alcohol, and imperfectly to water.

Composition.—*Physostigmia*, the alkaloid contained in Calabar bean, and its active constituent, may be obtained from the extract by dissolving this in a small quantity of water, adding calcined magnesia to saturation, evaporating nearly to dryness, and treating the still moist residue with ether as long as it takes up any of the base. The ethereal solution is agitated with a few drops of very dilute sulphuric acid, which combines with the alkaloid and subsides as a dark red liquid. This is again shaken up with magnesia, and afterwards treated with ether as before. The ethereal solution is now left to evaporate spontaneously. The alkaloid, thus obtained, is in the form of a brownish-yellow amorphous mass, sparingly soluble in water, but more soluble in ether, alcohol, and benzol. The aqueous solution has a slight burning taste, and a distinct alkaline reaction. Its composition has been represented by the formula $C_{15}H_{21}N_3O_2$.

Physiological Effects.—Sir R. Christison, Dr. Thomas R. Fraser, and Dr. Argyll Robertson have very fully investigated the properties of the Calabar bean. The paper of Dr. Thomas R. Fraser on the subject is a very able one, and the principal results have been thus summarised in Dr. Macdonald's edition of Dr. Scoresby Jackson's *Note Book of Materia Medica.* 1. The Calabar bean, when acting as a poison, may produce death either, 1st, by paralysis of respiration—*asphyxia*; or 2nd, by first diminishing the frequency of the heart's action, and then finally stopping its contractions—*syncope.* 2. The paralysis resulting seems to be due to an action upon the spinal cord as a *reflex centre.* 3. Its cardiac effect is most probably due, not to any increase of the inhibitory power of the vagus, but to its paralysing the exciting ganglia of the heart. 4. Physostigma, however, after a time paralyses the motor or efferent spinal nerves, its action in so doing commencing in their peripheral extremities, like conium and curare. It does not seem to exert any paralysing action upon afferent or sensory nerves. 5. The effect on the smaller blood-vessels is, first, contraction, and afterwards dilatation. Large doses at once arrest cardiac movements; smaller doses make them grow less quickly feeble. Immediately after the administration of the poison, there usually occurs a slight fall in the arterial tension. This is followed by a distinct rise in both arterial and venous pressure, but subsequently a rapid diminution of pressure in both arterial and venous systems supervenes. 6. The pupil is found alternately to dilate and contract; at the moment of death it is contracted, but immediately afterwards it is dilated.

Locally, Calabar bean destroys the contractility of striped and non-striped muscles. It paralyses first afferent and then efferent nerves. Applied to the eyeball it produces a somewhat painful sensation of tension in the ciliary region, contraction of the pupil, myopia, and astigmatism, with frequently congestion of the conjunctival vessels, pain in the supra-orbital region, and twitches of the orbicularis palpebrarum muscle.

Therapeutics.—The Calabar bean has been found beneficial in *erysipelas*, *various neuralgic affections*, *rheumatic fever*, *acute bronchitis*, *delirium tremens*, *tetanus*, *epilepsy*, *chorea*, as an *antidote* in *poisoning by strychnia*, and in other diseases when administered internally. Its principal use, however, is as an external application in ophthalmic surgery, as it possesses the power of contracting the pupil when applied to the eye; producing an equally certain, although exactly the reverse effect to that of belladonna. It diminishes presbyopia produced by dilated pupil.

Dose.—Of powder, 1 to 4 grains, gradually increased.

Antidotes.—Evacuate the stomach promptly by emetics, and administer strong coffee and diffusible stimulants. Atropia has been found useful; and from the very beneficial effects of hydrate of chloral upon rabbits which had been poisoned with Calabar bean, this substance will probably be found useful to counteract the effects of poisonous doses in man.

[§ **Extractum Physostigmatis.** *Extract of Calabar Bean.*

Take of

Calabar Bean, in coarse powder . .	1 pound.
Rectified Spirit	4 pints.

Macerate the bean for forty-eight hours with one pint of the spirit in a closed vessel, agitating occasionally, then transfer to a percolator, and when the fluid ceases to pass, add the remainder of the spirit so that it may slowly percolate through the powder. Subject the residue of the bean to pressure, adding the pressed liquid to the product of the percolation; filter, distil off most of the spirit, and evaporate what is left in the retort by a water-bath to the consistence of a soft extract.]

Chiefly employed as a local application, for which purpose a drop of a spirituous solution of the extract may be applied to the conjunctiva, or minute squares of paper or gelatine impregnated with it, may be introduced by means of a fine moistened camel's hair pencil between the eyelids. Solutions, one minim of which contains the active properties of 2 or 4 grains of the bean, are usually employed. When administered internally, the dose of the extract is from $\frac{1}{16}$th to $\frac{1}{4}$th of a grain. For subcutaneous injection in tetanus, a watery solution, of which 10 minims contain $\frac{1}{3}$rd of a grain of extract, may be employed.

PTEROCARPUS, *Linn.*

Generic Character.—Unarmed *trees* or *shrubs*. *Leaves* unequally pinnate. *Sepals* 5, cohering to form a 5-toothed calyx. *Petals* 5, forming a papilionaceous corolla. *Stamens* 10; the *filaments* variously combined. *Legume* indehiscent, irregular, somewhat orbicular, surrounded by a wing, 1-seeded.

PTEROCARPUS SANTALINUS, *Linn. fil.* The Red Sandal Wood Tree.

Specific Character.—A lofty *tree*. *Leaflets* 3 (rarely 4 or 5?), roundish, retuse, glabrous. *Racemes* axillary, simple or branched. *Flowers* yellow, with red veins. *Petals* long-clawed, all waved or curled on the margins. *Stamens* combined into a sheath, split down to the base on the upper side, and half way down on the lower. *Legume* long-stalked, surrounded by a broad membranous wing, obtuse at the base, 1 or rarely 2-seeded.—*Woodv.* pl. 254.

Habitat.—Mountains of Coromandel and Ceylon.

[§ Pterocarpi Ligni. *Red Sandal-Wood.*
The wood of Pterocarpus santalinus, *Linn.* From Ceylon.]

General Characters.—*Red Sandal* or *red Sanders Wood* is imported in roundish or somewhat angular billets. These are dense, heavy, externally dark reddish- or blackish-brown, internally blood-red, variegated with dark and lighter red rings, if cut transversely. Red Sandal wood is usually found in the pharmacies in the form of small chips or raspings, which have a similar colour to the billets; the powder is blood-red. Red Sandal wood has a slightly astringent taste, and is almost inodorous, except when rubbed, when it emits a feeble peculiar smell. It communicates scarcely any colour to water; but alcohol and alkaline solutions readily extract its colouring matter. The alkaline solution is violet-red, and forms a precipitate (santalin) on the addition of acids. The alcoholic solution produces precipitates with several metallic solutions: thus, violet with solutions of lead, scarlet with corrosive sublimate, and deep violet with sulphate of iron.

Composition.—Red sandal wood contains a peculiar colouring matter, called *santalin*, and *gallic acid*. *Santalin* or *santalic acid*, is a dark red crystalline substance, almost insoluble in water, but soluble in alcohol, alkaline solutions, ether, acetic acid, and slightly so in some of the volatile oils (as those of lavender and rosemary). It has an acid reaction and is without taste or odour. The effects produced on its alcoholic and alkaline solutions by salts, &c. are similar to those above mentioned as produced on the tincture of the wood.

Pharmaceutical Uses.—It is employed in medicine solely as a colouring agent. The only official preparation into which it enters is compound tincture of lavender.

PTEROCARPUS MARSUPIUM, *D.C.* The Indian Kino-Tree.

Specific Character.—A leafy *tree*, with the *outer* coat of the bark brown; and the *inner* red, fibrous, and astringent; *branches* smooth. *Leaves* alternate; *leaflets* 5–7, alternate, elliptical, rather emarginate, leathery, smooth. *Panicle* terminal. *Flowers* white, with a tinge of yellow. *Calyx* smooth. *Stamens* monadelphous. *Legume* with the upper side straight, and the under three-fourths round, the whole winged, 1- or 2-celled, smooth. *Seed* kidney-shaped.—*Roxb. Coroman.* vol. ii. pl. 116.

Habitat.—Forests of Ceylon; Madras Peninsula.

[§ Kino. *Kino.*

The inspissated juice obtained from incisions made in the trunk of Pterocarpus Marsupium, *D.C.* Imported from Malabar.]

General Characters.—*Kino*, sometimes called *East Indian* and *Amboyna kino*, occurs in small angular brittle glistening reddish-black fragments, the larger of which appear almost black, the smaller being reddish. When entire they are opaque, but in thin laminæ are translucent and ruby-red. They are brittle between the fingers, soften in the mouth, and stick to the teeth. They are inodorous, but have a very astringent taste; and when chewed, tinge the saliva blood-red. Both water and alcohol acquire, by digestion on kino, a deep red colour. The aqueous decoction becomes turbid on cooling. The alcoholic solution has an acid reaction on litmus. It is quite insoluble in ether. The mineral acids and solutions of gelatine, tartarated antimony, acetate of lead, perchloride of iron, and nitrate of silver, produce precipitates with the watery infusion.

Botany Bay Kino.—The substance called by this name, is the produce of *Eucalyptus resinifera* (Myrtaceæ) and other species of Eucalyptus, natives of Australia and Tasmania. It appears to be a kind of extract, and has similar properties to the official kino.

Composition.—Kino contains *catechine*, a substance already noticed as a constituent of pale catechu (see p. 750), a peculiar kind of *tannin*, *red gum*, &c.

Physiological Effects.—Astringent. Less effective, and less readily dissolved in the alimentary juices, than catechu, to which in its operation it is closely allied.

Therapeutics.—Employed in medicine as an astringent only; principally in obstinate chronic diarrhœa. In this disease it is usually given in combination with chalk, and frequently with opium. It has also been administered as an astringent in leucorrhœa and in other diseases where astringents are useful. As a topical astringent it has been applied to flabby ulcers, and also used as a gargle, injection, and wash.

Dose.—10 to 30 grains.

Pharmaceutical Use.—Kino is a constituent of compound powder of catechu.

[§ **Pulvis Kino Compositus.** *Compound Powder of Kino.*

Synonym.—Pulvis Kino cum Opio, 1864.

Take of

Kino, in powder	$3\frac{3}{4}$ ounces.
Opium, in powder	$\frac{1}{4}$ ounce.
Cinnamon Bark, in powder . . .	1 ounce.

Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle.

Dose.—5 to 20 grains.]

Twenty grains of this powder contain one grain of opium. It is employed as an astringent in chronic diarrhœa and pyrosis.

[§ **Tinctura Kino.** *Tincture of Kino.*

Take of

Kino, in coarse powder	2 ounces.
Rectified Spirit	1 pint.

Macerate for seven days in a closed vessel, with occasional agitation, filter, and add sufficient rectified spirit to make one pint.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

Astringent. Used in diarrhœa and hemorrhages, generally as an adjunct to the chalk mixture.

ACACIA, *D.C.*

Generic Characters.—*Shrubs* or *trees*, unarmed, or provided with stipular thorns or scattered prickles. *Flowers* polygamous; yellow, white, or rarely red; capitate. *Calyx* 4–5-toothed. *Petals* 4–5, either free or cohering to form a 4–5-cleft corolla. *Stamens* varying in number, from 8–200, distinct or united into bundles. *Legume* continuous, 2-valved. *Seeds* without pulp.

ACACIA ARABICA, *Willd.*

Specific Character.—A small *tree.* *Spines* in pairs. *Branches* and *petioles* pubescent. *Pinnœ* 4–6 pairs (fig. 92); *pinnules* 10–20 pairs, oblong-linear, with a gland beneath the inferior and often between the last pinnæ. *Flowers* in globose (fig. 92), stalked, axillary, subternate heads. *Legume* (fig. 92) moniliform. *Flower-heads* yellow.

Fig. 92.

A. arabica.

Habitat. — A native of Senegal, Egypt, Nubia, and Arabia.

ACACIA VERA, *Willd.*

Middling-sized *tree.* *Spines* in pairs. *Branches* and *leaves* smooth. *Pinnœ* 2 pairs; *pinnules* 8–10 pairs, oblong-linear; with a gland between the pinnæ. *Flowers* in globose heads; *heads* about two together, stalked, axillary, bright yellow. *Legume* moniliform.

Habitat.—A native of Arabia, and of Africa from Senegal to Egypt.

[§ **Acaciæ Gummi.** *Gum Acacia.*

A gummy exudation from the stem of one or more undetermined species of Acacia, *Linn.*]

Botanical Source and Commerce.—In the preceding edition of this work, Dr. F. J. Farre says :—' There is still a little uncertainty with respect to the species, but none with respect to the country which produces the official gum arabic. Although this bears the name of Arabic and Turkey gum, "none is collected, and very little produced in Arabia" (*Malcolmson*); and the name of Turkey gum can only have been given to it in consequence of its exportation from Turkish ports. Gum arabic, having the official characters, is not imported unmixed, but arrives in serons from Alexandria mixed with gum which is more or less brown, but agrees with it in all other respects (brown gum arabic), and with other gums, some of which may be the produce of the same tree collected at a different season, while others appear to be specifically distinct. From these the white official gum is separated by picking, and then constitutes the *Gummi electum* of druggists. While, therefore, the Alexandrian gum may be the produce of more than one species, there is every reason to conclude that the official gum, which is very constant and uniform in its characters, is the produce of a single species, which is most probably *A. arabica, Willd.* Adanson, indeed, calls this species, which he found growing by the river Senegal, *Gommier rouge*, and states that it yields a reddish, slightly bitter, transparent, gummy juice; but this difference in the produce of the west and east of Africa may arise from difference of climate, for Ehrenberg states that the characters of gum from the same species of Acacia are liable to considerable variation, and that *the same tree* may yield a transparent or an opaque, a light or a dark-coloured gum. Part of the Alexandrian gum, as imported, is transparent and has a pink tinge, yet, if exposed to a moderate heat, it becomes cracked and opaque and yellowish-brown, and then resembles brown gum arabic. At all events Adanson's name, even if it were given to the same variety of *A. arabica*, cannot outweigh the testimony of Figari and Pallme, who visited the countries where the gum is collected, and whence it is carried to Alexandria for exportation, and saw the trees which produce it. M. Figari, whose collections in middle Egypt, Nubia, and in the provinces of Kordofan and Tarogli, have been described by Mr. Barker Webb, "found *A. nilotica*, Del. (*A. arabica*, Willd.) most abundant throughout all Nubia, where it produces true gum arabic. It grows," he says, "in all the valley of the Nile, but produces no gum in Egypt, on account of the climate." Pallme ("Travels in Kordofan") states that "the gum tree of Kordofan (termed in books *Mimosa nilotica*) differs from the *Mimosa nilotica* (*A. vera*, Willd.) in the shape of the tree, the form of its leaves, and even in its spines; and thus, while the latter yields only ordinary gum, that obtained in Kordofan is of the finest quality. 10,000 to 14,000 hundredweight of gum is annually conveyed on camels from Bara in Kordofan to Dongola on the Nile, whence it is carried to Cairo (and Alexandria) and thence distributed to Europe. Much is also conveyed to Aden and other ports on the Red Sea, whence it is exported to Bombay, and thence brought to this country." This is the most trustworthy information hitherto obtained, being commercial as well as botanical.' According to other authorities, gum arabic is chiefly obtained from *A. tortilis* and *A. Ehrenbergii*, but these species are imperfectly known. Others again, state that the best gum arabic is derived from *Acacia Verek*, Guill. et Perrot, a tree distributed over the northern part of Central Africa from Senegambia to Abyssinia. The gum flows in the liquid state from the trunk and branches, and hardens by exposure to the air. It usually exudes spontaneously, but the discharge is stated to be sometimes facilitated by incisions.

General Characters.—Gum Acacia, Gum Arabic, Turkey or Alexandrian Gum.—This is imported from Leghorn, Malta, Trieste, Gibraltar, Smyrna, Alexandria, Beyrout, Constantinople, &c. *It is the only official kind of gum.* It occurs in rounded or somewhat angular pieces, varying in size from a pea to that of a walnut, or even larger than this; some of the pieces being nearly transparent, others more or less opaque, from inumerable cracks extending through them. It has a glassy lustre, is nearly white, or yellowish-white, has no odour, but a bland mucilaginous sweetish taste. It is brittle, and may be readily broken into small fragments. It is entirely soluble both in hot and cold water. The aqueous solution forms with subacetate of lead an opaque white jelly. Alcohol added in excess precipitates the gum from such a solution. If an aqueous solution of iodine be added to the powder, or to a solution formed with boiling water and cooled, there is no appearance of a violet or blue colour.

Adulterations and Substitutions.—Several inferior and cheaper gums, chiefly obtained from other species of *Acacia*, are sometimes mixed with, or substituted for, gum acacia; as Barbary, Senegal, Cape, East Indian, and Australian gums. These are, for the most part, readily distinguished by their darker colour, the size of the tears, their want of brittleness, or their imperfect solubility in water. In the form of powder they are less easily detected, except by their imperfect solubility. Flour (or starch) is also sometimes mixed with powdered gum acacia; the adulteration is readily recognised by the deep blue colour produced on the addition of a solution of iodine to the cold decoction of suspected gum.

Composition.—The principal ingredient of gum arabic is *arabin*. *Arabin* or *soluble gum* is a colourless, inodorous, insipid, uncrystallisable solid, soluble in both hot and cold water, but insoluble in alcohol, ether, and oils. It combines with alkalies. Sulphuric acid converts it into a saccharine substance. 100 parts of arabin treated with 400 parts of nitric acid yield 16·88 of mucic acid, with a little oxalic acid. From *cerasin* or *prunin* it is distinguished by its solubility in cold water. The characters by which it is distinguished from *tragacanthin* have already been pointed out under tragacanth. (See p. 840.)

Physiological Effects.—The local action of a solution of gum is that of an emollient, and (by its sheathing properties) demulcent. It is supposed to have the power of diminishing irritation in the urinary organs.

Therapeutics.—Gum arabic is sometimes slowly dissolved in the mouth, to allay troublesome cough, and to diminish irritation of the fauces, by diluting the acid secretions, and sheathing the parts from the action of the atmosphere. In inflammatory affections of the intestinal tube, as well as of the respiratory and urinary organs, it is used as an emollient and demulcent. For these purposes it is combined with tragacanth and starch in the compound powder of tragacanth, and with almonds in the compound powder of almonds. As a sheathing substance, a solution of gum may be employed in acrid poisoning; but of course its efficacy is merely mechanical. Powdered gum is occasionally applied to check hemorrhage from leechbites.

Administration.—The dose of powdered gum is from 30 to 60 grains, or *ad libitum.*

Pharmaceutical Uses.—As a vehicle for the exhibition of other medicines, it is employed in several official preparations, as in chalk mixture, guaiacum mixture, all the lozenges, in compound almond powder, and in compound tragacanth powder.

[§ **Mucilago Acaciæ.** *Mucilage of Gum Acacia.*

Take of

Gum Acacia, in small pieces . .	4 ounces.
Distilled Water	6 fluid ounces.

Put the gum and water into a covered earthen jar, and stir them frequently until the gum is dissolved. If necessary strain the solution through muslin.]

This mucilage should not be long kept, as under such circumstances, it readily becomes sour by the development of acetic acid. Mucilage of gum acacia is employed to suspend insoluble powders in water, or to diffuse oily substances through aqueous fluids, and to give form and tenacity to pills, &c. To render different substances miscible with aqueous vehicles, different proportions of mucilage are required. '*Oils* will require about three-fourths of their weight, *balsams* and *spermaceti* equal parts, *resins* two parts, and *musk* five times its weight.'

Pharmaceutical Use.—It is an ingredient in 9 out of the 10 official lozenges.

ACACIA CATECHU, *Willd.* The Catechu Acacia.

Specific Character.—*Tree* from 15–20 feet high. *Bark* brown and scabrous. *Wood* hard and heavy; the *heart-wood* (*duramen*) brown, dark red, or blackish; the *sap-wood* (*alburnum*) whitish, one or two inches thick. *Branches* armed with stipulary thorns, or occasionally unarmed; *young shoots*, *petioles*, and *peduncles*, more or less pubescent. *Leaves* bipinnate; *pinnæ* 10–30 pairs; *pinnules* 30–50 pairs. *Spikes* axillary, shorter than the leaves. *Flowers* numerous, whitish or pale yellow. *Petals* united. *Stamens* distinct, numerous. *Legume* flat, thin, straight, linear, glabrous, 4–8-seeded.—*Woodv.* p. 183, pl. 66 (*Mimosa Catechu*).

Habitat.—Various parts of the East Indies.

Catechu Nigrum. *Black Catechu.*

An extract of the heart-wood of Acacia Catechu, *Willd.* Imported chiefly from Pegu.

(*Not official.*)

General Characters.—This kind of catechu, which is commonly known under the name of *Kutch* or *Cutch*, is distinguished from the official Catechu pallidum by its blackish colour; hence the name. It is imported in large masses, which sometimes weigh a hundredweight each. These masses are made up of layers, composed of prismatic blackish-brown heavy shining pieces, each from six to ten inches long, and two or three inches broad and deep. Each piece is enveloped in roughish leaves. When fractured the pieces present a dark blackish-brown shining surface, free from all impurities; but some have a reddish tint. Black catechu dissolves very slowly in the mouth; and has a bitter and very astringent taste, but no odour. The brown filtered decoction reddens litmus, yields a blackish-green colour and precipitate with the ferruginous salts, and a brownish-white one with acetate of lead. A solution of gelatine renders the cooled decoction turbid; alkalies deepen the colour, but cause no precipitate; sulphuric acid renders it slightly turbid.

Composition.—The essential constituents of this variety of catechu as of pale catechu, are *tannic acid* and *catechine.* These have been already noticed (see *Catechu pallidum*).

Physiological Effects and Therapeutics.— (See *Catechu pallidum*, p. 751.)

HÆMATOXYLON CAMPECHIANUM, *Linn.* The Logwood Tree.

Botanical Characters.—A *tree* from 40 to 50 feet high. *Leaves* pinnate, or somewhat bipinnate by the conversion of the lowest pair of leaflets into two pairs of pinnæ; *leaflets* obovate or obcordate. *Flowers* racemose, yellow. *Calyx* composed of 5 sepals united at the base into a persistent cup; *lobes* deciduous. *Petals* 5, obovate, a little longer than the sepals. *Stamens* 10, hairy at the base. *Style* capillary. *Legume* small, flat, compressed, lanceolate, 1-celled, 2-seeded, the *sutures* indehiscent, the *valves* bursting in the middle longitudinally.—*Woodv.* p. 48, pl. 163.

Habitat.—Campeachy. Introduced into Jamaica, where it now grows in great abundance in a wild state.

[§ Hæmatoxyli Lignum. *Logwood.*

The sliced heart-wood of Hæmatoxylon Campechianum, *Linn.* Imported from Campeachy, Honduras, and Jamaica.]

Preparation and Commerce.—The stems of the log-wood trees are cut into logs of about three feet long, the bark and white sapwood (*alburnum*) of which are chipped off, and the red part or heart-wood (*duramen*), sent to England. That imported from Campeachy is of the best quality.

General Characters.—The logs are dense, having a specific gravity of 1·057. Large crystals (*hæmatin*) are sometimes found in them. They are externally of a dark colour, and internally reddish-brown. Logwood is usually found in *chips*, which have the colour of the wood, a feeble agreeable odour, and a sweetish taste; a small portion chewed imparts to the saliva a dark pink colour. The decoction of logwood is deep red; acids render it paler and brighter coloured; the alkalies give it a purplish or violet-blue colour.

Composition. — Logwood contains *volatile oil*, *hæmatin*, *resin*, *tannic acid*, &c. *Hæmatin* or *Hæmatoxylin* is a red crystalline substance of a slightly bitter, acrid, and astringent taste. It is soluble in alcohol and ether, and slightly so in water. Acids render the solution yellowish or red; alkalies give it a purple or violet colour. Alum causes a violet precipitate, and several metallic solutions (as those of tin and lead) a blue one. Gelatine produces a flocculent reddish precipitate.

Physiological Effects.—Logwood is a mild astringent. It does not constipate nor so readily disorder the digestive organs as some other astringents, and hence its use may be continued for a longer period. Its colouring matter becomes absorbed, and may be detected in the urine and stools. In some cases the long-continued use of logwood has been known to induce phlebitis; hence some caution should be exercised in its employment as a medicine.

Therapeutics.—Logwood is employed as an astringent in old diarrhœas and dysenteries, in hemorrhages (from the uterus, lungs, and bowels). An injection is useful in leucorrhœa. It is well adapted to the diarrhœas of children. Dr. Percival employed it to restrain profuse sweating in phthisis. It has also been employed in diabetes.

[§ **Decoctum Hæmatoxyli.** *Decoction of Logwood.*

Take of

Logwood, in chips	1 ounce.
Cinnamon Bark, in coarse powder . .	60 grains.
Distilled Water	1 pint.

Boil the logwood in the water for ten minutes in a covered vessel, adding the cinnamon towards the end. Strain the decoction, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint]

Employed as an astringent in diarrhœa.

Dose.—For adults, 1 to 2 fluid ounces; for children, 2 to 4 fluid drachms.

[§ **Extractum Hæmatoxyli.** *Extract of Logwood.*

Take of

Logwood, in fine chips	1 pound.
Boiling Distilled Water	1 gallon.

Infuse the logwood in the water for twenty-four hours, then boil down to one half, strain, and evaporate to dryness by a water-bath, stirring with a wooden spatula. Iron vessels should not be used.

Dose.—10 to 30 grains.]

Astringent. Employed in old diarrhœas and dysenteries. By keeping, extract of logwood becomes exceedingly hard, and pills made of it are said to have passed through the bowels undissolved.

TAMARINDUS INDICA, *Linn.* The Tamarind Tree.

Botanical Character.—A *tree* from 30 to 40 feet high. *Branches* crooked and spreading. *Leaves* abruptly pinnate; *leaflets* 10 to 15 pairs, small, oblong, obtuse, smooth. *Flowers* racemose, yellow, variegated with red. *Calyx* with a bilabiate reflexed limb. *Petals* 3. *Stamens* 9 or 10; 7 very short and sterile, the others larger, monadelphous, and fertile. *Style* subulate. *Legume* stalked, pendulous, more or less curved, 1-celled, 3–12-seeded; *sarcocarp* pulpy. *Seeds* compressed, bluntly 4-angled, smooth, hard, brown-coloured. —*Woodv.* p. 454, pl. 166.

Habitat.—East and West Indies.

[§ **Tamarindus.** *Tamarind.*

The preserved pulp of the fruit of Tamarindus indica, *Linn.* Imported from the West Indies.]

General Characters of the Fruit.—*Tamarind* fruits (*pods*) are from three to six inches long, and more or less curved. They are composed of a dry, brittle, brown, external shell (*epicarp*); within which is the acidulous, sweet, reddish-brown pulp (*sarcocarp*), penetrated by strong fibres; and still more internal is a thin membranous coat (*endocarp*), enclosing the oval brown seeds.

Preservation of the Fruit.—Tamarinds are usually imported in a preserved state. The usual mode of preserving them in the West Indies is to remove the shell or epicarp from the ripe fruit, and to place alternate layers of the shelled fruit and powdered sugar in a cask or jar, and pour boiling water over them. The drier and darker-coloured East Indian tamarinds are preserved without sugar. The pulp of the former is alone official.

General Characters of the Preserved Pulp.—[§ A brown sweetish subacid pulp preserved in sugar, containing strong fibres, and brown shining seeds, each enclosed in a membranous coat. A piece of bright iron, left in contact with the pulp for an hour, does not exhibit any deposit of copper.]

Composition.—Tamarind pulp contains *sugar*, *pectin*, *free citric*, *tartaric*, and *malic acids*, *acid tartrate of potash*, &c.

Physiological Effects.—Tamarind pulp allays thirst, is nutritive and refrigerant, and, in small doses, laxative. From this combination of refrigerant and laxative properties it is commonly denominated a *cooling laxative.*

Therapeutics.—Tamarinds are adapted for febrile and inflammatory cases; in the former they are often taken with the double purpose of acting as a refrigerant, and operating gently on the bowels. An infusion of tamarind pulp forms a very pleasant cooling drink, as does also tamarind whey, which may be prepared by boiling about two ounces of tamarind pulp with two pints of milk.

Pharmaceutical Use.—Tamarind pulp is contained in confection of senna.

CASSIA, *Linn.*

Generic Character.—*Shrubs* or *herbs*. *Leaves* alternate, abruptly pinnate; *leaflets* opposite, oblique at the base. *Sepals* 5, scarcely united at the base, more or less unequal. *Petals* 5, unequal. *Stamens* 10, free, unequal; the 3 lower ones longer, the 4 middle short and straight, the 3 upper with abortive anthers; *anthers* dehiscing at the apex. *Ovary* stalked.

Species.—Some confusion still exists as to the species of *Cassia* which yield the different commercial varieties of senna. We can only describe those mentioned in the British Pharmacopœia.

CASSIA LANCEOLATA, *Lamarck.* Lanceolate-leaved Cassia.

Specific Character.—*Stem* suffruticose, about 2 feet high, erect, round, smooth. *Petiole* without glands; *leaflets* 5–8 pairs, shortly petiolate, smooth above, when young slightly pubescent beneath, ovate-lanceolate or lanceolate (fig. 93, *a*), acute. *Flowers* yellow, racemose, rather longer than the leaves. *Ovary* linear, downy, falcate, with a smooth recurved style. *Legume* flat (fig. 94, *a*), but slightly swollen over the seeds, pendulous, with the upper margin a little curved. *Seeds* 5-8 in each legume.—*Nees*, *Plant. Med.* pl. 345.

Habitat.—Egypt, in the valleys of the desert to the south and east of Assouan. The leaves are collected by the Arabs, and sold by them to merchants, who convey them to Cairo.

CASSIA OBOVATA, *Colladon.* Obovate-leaved Cassia.

Specific Character.—Perennial *herb*, 1–2 feet high. *Leaves* smooth; *petiole* without glands; *leaflets* 4–6 pairs, obovate (fig. 93, *b*), obtuse, somewhat mucronate, unequal at the base; *stipules* spreading. *Flowers* yellow, racemose. *Legume* oblong, broad, curved (fig. 94, *b*), smooth, rounded at each end, with an elevated crest along the middle of each valve.—*Nees, Plant. Med.* (*C. Senna*), pl. 347 and 348.

Habitat.—Egypt (Bassà-Tine at the entrance of the valley of Egaremont, two leagues from Cairo; Karnak; Thebes; on the eastern bank of the Nile, opposite Hermonthis; Esneh; Edfou; Daraou; Assouan); Nubia; Desert of Suez; Syria; India.

[§ **Senna Alexandrina.** *Alexandrian Senna.*

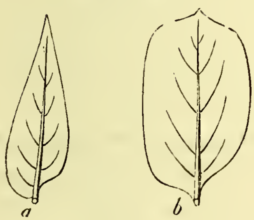
The leaflets of Cassia lanceolata, *Lamarck*, and Cassia obovata, *Colladon.* Imported from Alexandria; carefully freed from the flowers, pods, and leaf-stalks of the same, and from the leaves, flowers, and fruit of Solenostemma Argel, *Hayne.*]

Collection and Commerce.—Alexandrian senna is collected in Nubia and Upper Egypt, and is conveyed down the Nile to the great depôt at Boulak. The Arabs secure two crops annually; the most productive one is that after the rain in August and September, the second takes place about the middle of March. When cut the plants are spread out on the rocks, and dried in the sun. Assouan is the first entrepôt for senna. It receives all that is gathered in the neighbourhood. Esneh is another entrepôt. It receives the lanceolate-leaved senna from Abyssinia, Nubia, and Sennaar, from whence it arrives by the caravans which convey negroes to Egypt, and the obovate-leaved senna, gathered in Upper Egypt. Daraou, between Assouan and Esneh, is also an entrepôt; but the great depôt is at Boulak, the port of Cairo. The senna arrives at Boulak from Assouan, not only by the Nile, but also sometimes by the way of Cosseir, the Red Sea, and Suez. Lastly, some senna is carried to Boulak by the caravans from Mount Sinai. The mixture of the different leaves takes place at the entrepôts. Rouillure says, that at Boulak 500 parts of acute (lanceolate) leaves are mixed with 300 of obtuse (obovate) leaves and 200 of Argel leaves. From Boulak the senna is sent to Alexandria, and from thence is shipped to Europe. To this account of the author taken from Delile, Burckhardt, and others, may be added the more recent statement of Ignatius Pallme, who travelled in the interior of Africa. He says, 'Senna is found in abundance in many parts of Kordofan, but the leaves are not collected on account of the existing monopoly. The Government draws its entire supply from Dongola in Nubia, which is the true native country of senna, and sells it under the denomination of Alexandrian or Egyptian senna, though not one-fiftieth of the leaves are collected in Egypt, as they are first met with at Assouan in Nubia.'

In Alexandrian senna, *as imported*, we also frequently find mixed with the leaflets of the two species of Cassia, a variable proportion of the leaf-stalks, flowers, and legumes of the same plants, and also of the leaves, flowers, and fruits of *Solenostemma* (*Cynanchum*) *Argel*; and rarely, some leaflets and legumes of *Tephrosia Apollinea*; besides other extraneous matters, as date stones, rabbit-dung, &c. The dried *flowers* of cassia may be easily detected; they are dull yellow. The *legumes* of the lanceolate and obovate cassia are distinguished by the botanical characters before described (fig. 94, *a*, *b*). (*See also Adulterations.*) All these are directed in the Pharmacopœia to be carefully removed from the senna leaflets which then constitute what is properly termed *picked Alexandrian senna*, to which the characters given in the Pharmacopœia apply.

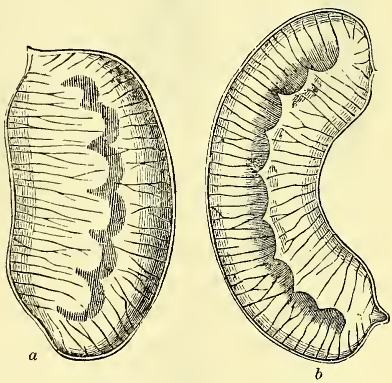
General Characters.—[§ Lanceolate or obovate leaflets, about an inch long, unequally oblique at the base, brittle, greyish-green, of a faint peculiar odour, and mucilaginous sweetish taste. The unequally oblique base, and freedom from bitterness, distinguish the Senna from the Argel leaves, which moreover are thicker and stiffer.] The leaflets always present a more or less broken appearance.

Fig. 93.



a. Leaflet of Cassia lanceolata.
b. Leaflet of C. obovata.

Fig. 94.



a. Legume of Cassia lanceolata.
b. Legume of C. obovata.

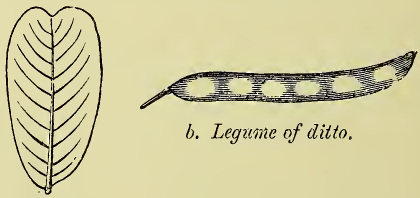
Alexandrian senna varies much in its constitution. When picked according to the directions of the British Pharmacopœia, it is generally composed chiefly of the lanceolate leaflets, mixed with a few obovate leaflets; but sometimes large importations of Alexandrian senna have taken place, composed almost entirely of obovate leaflets. The senna *leaflets* are readily distinguished by being unequal-sided at the base, and by the veins of their under surface being very conspicuous. The lanceolate leaflets (fig. 93, *a*) are very readily distinguished from those of the obovate (fig. 93, *b*) species, by their shape.

Adulterations.—Alexandrian senna, as imported, always contains, as noticed above, a variable proportion of extraneous matters, which are directed to be removed. The more serious admixture is that of the Argel leaves, flowers, and fruits (*Solenostemma Argel*), and of the leaflets and legumes of *Tephrosia Apollinea. Argel leaves, flowers, and fruit.*—The Argel plants are collected by the Arabs in the valleys of the desert to the east and south of Assouan. The *leaves* found in Alexandrian senna are distinguished from the senna leaflets by their being equal-sided (fig. 95, *a*), by the absence or imperfect development of their lateral veins, by their paler colour, thicker and more coriaceous texture, by a yellowish exudation frequently found on them, and generally, though not invariably, by their greater length. By careful picking the *flowers* may be detected; they are white, and in small corymbs. The *fruit* (fig. 95, *b*), as found in Alexandrian senna, a little exceeds in size a large orange-pip. It is ovate-shaped, tapering superiorly, brown, shrivelled, and

Fig. 95.

a. Leaf of Solenostemma Argel.
b. Fruit of ditto.

Fig. 96.



b. Legume of ditto.

a. Leaflet of Tephrosia Apollinea.

contains several seeds.* *Tephrosia leaflets and legumes.*—The *Tephrosia Apollinea* grows in cultivated fields near the Nile, at Hermonthis, at Edfou, and in the Elephantine Islands, opposite Assouan. The *leaflets* have a silky or silvery aspect; they are obovate-oblong (fig. 96, *a*), somewhat cuneiform, emarginate, equal-sided, tapering towards the base, lateral veins parallel, regular, and oblique to the midrib. These leaflets are usually folded longitudinally, and are very apt to be overlooked. The *legume* (fig. 96, *b*) is from an inch to an inch and a half long, not exceeding two lines broad, linear, slightly ensiform, and contains six or seven brownish seeds. The admixture of Tephrosia leaflets and legumes very rarely occurs at the present time, but it was more common formerly.

Fig. 97.

Leaf of Coriaria myrtifolia.

As a rule, Alexandrian senna is not adulterated in this country, all admixtures of foreign leaves and other extraneous substances taking place abroad; but should any other leaves be intermixed, they may readily be distinguished from senna leaflets by the characters already given. On the

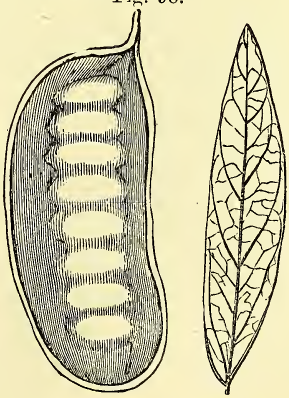
Continent, however, the leaflets of *Colutea arborescens* or Bladder Senna, have been occasionally intermixed. They are elliptical, regular, and obtuse. Their regularity at the base at once distinguishes them from true senna leaflets. Another serious adulteration has been sometimes practised on the Continent, by the substitution of the leaves of *Coriaria myrtifolia* (fig. 97) for those of senna leaflets. These are ovate-lanceolate, equal-sided at the base, greyish-green with a bluish tinge, 3-ribbed, with a strongly-marked midrib; the two lateral ribs disappearing towards the apex of the leaves.

CASSIA ELONGATA, *Lemaire.* Long-leaved Cassia.

Specific Character.—Dr. Lindley has thus described this plant:—'An *annual*, but with care it may be made to live through the year, and to assume a suffruticose habit. *Stem* erect, smooth. *Leaves* narrow, equally pinnated: *leaflets* 4–8 pairs, lanceolate (fig. 98, *b*), nearly sessile, slightly mucronate, smooth above, rather downy beneath, with the veins turning inwards, and forming a flexuose intramarginal line; *petioles* without glands; *stipules* softly spinescent, semi-hastate, spreading, minute. *Racemes* axillary and terminal, erect, stalked, rather longer than the leaves; *pedicels* without bracts. *Sepals* linear, obtuse. *Petals* bright yellow. Of the *stamens*, the five lowest are sterile and small; the two next large, curved, and perfect; the three uppermost minute, and gland-like. *Ovary* linear, downy, falcate, with a smooth recurved *style*. *Legume* pendulous, oblong (fig. 98, *a*), membranous, about an inch and a half long, and five-eighths broad, quite straight, tapering abruptly to the base, and rounded at the apex, deep brown, many-seeded.'—*Royle, Bot. Himal.* pl. 37.

Habitat.—Grows in India, but probably only naturalised. Yields *Tinnivelly*, and *Common East Indian* or *Mecca Senna.* The plants yielding Tinnivelly senna were raised from seeds picked out of common East Indian senna legumes.

Fig. 98.



a. Legume of Cassia elongata.
b. Leaflet of ditto.

[§ Senna Indica. *Tinnivelly Senna.*

The leaflets of Cassia elongata, *Lemaire.* From plants cultivated in Southern India.]

General Characters.—Tinnivelly senna is a very fine variety, being free from stalks, legumes, and any adulteration. It consists of large, thin, entire leaflets, from 1 to 2 or more inches long, and sometimes half an inch broad at their widest part. These leaflets are lanceolate (fig. 98, *b*), acute, flexible, unequal-sided or oblique at the base. They have a green colour, but when exposed to a damp atmosphere, they are apt to become yellow, or even blackish. They have a similar odour and taste to those of Alexandrian senna.

East Indian Senna.—Besides the above official variety of Indian senna, common Indian senna, which is not official, is also imported into England from India, under the name of East Indian senna; it is also known as Bombay senna and Mecca senna. It is the produce of Arabia, and is imported from the Arabian Gulf, and finds its way into the interior of India by the ports of Surat and Bombay. It consists of long narrow leaflets, of from an inch to an inch and a half long, narrower than those of Tinnivelly senna, and usually of a yellowish-green or pale green colour, although some of the leaflets are brownish or even blackish. This change of colour is probably the result of the action of a moist atmosphere. We generally find intermixed with the leaflets a variable proportion of legumes and stalks.

Composition.—The principal constituents of senna appear to be a *volatile oil* and *cathartin.* A yellow resin (*chrysoretin*) has also been found in senna. *Volatile Oil; Odorous Principle.*—This is obtained by submitting the leaves, with water, to distillation. It has a nauseous odour and taste. The distilled water of senna, which contains some oil in solution, acts as a mild purgative only. *Cathartin; Purgative Principle?*—Yellowish-red, uncrystallisable, with a peculiar odour, and a bitter nauseous taste; it is very soluble, both in water and alcohol, but insoluble in ether; it attracts water from the air. Its aqueous solution is precipitated by infusion of galls and subacetate of lead. The persulphate of iron and alkalies deepen the colour of the infusion; chlorine decolorises it; iodine, acetate of lead, gelatine, and tartarated antimony cause no precipitates with it. The carbonated alkalies, lime water, nitrate of silver, the acetates of lead, sulphate of iron, &c., form precipitates with the infusion of senna.

Physiological Effects.—Taken by the stomach senna acts as a sure and safe purgative. Its ill effects are nausea, griping, flatulence, and, at first, depression, afterwards excitement of the pulse. It appears to stimulate the abdominal and pelvic vessels, thereby having a tendency to promote the hemorrhoidal and menstrual discharges. It is one of the mildest of the drastic purgatives. Unlike scammony, gamboge, jalap, and most other drastic cathartics, it does not rank among poisons, even when given in large doses. It is distinguished from the saline purgatives by its stronger and more irritant operation, by the heat, gripings, and increased frequency of pulse, which attend its purgative action. From rhubarb it differs in being more powerful and irritant in its action, and in being nearly or quite devoid of any tonic operation. It acts more speedily and powerfully than aloes, and in a less marked manner on the large intestines. In its operation it appears to rank between jalap and aloes. The legumes and stalks possess similar properties to the leaflets. Formerly the griping quality of senna was ascribed to the stalks, but both Bergius and Schwilgué have proved the error of this notion. The legumes are much milder in their operation than the leaflets. Tinnivelly or good East Indian senna is almost, if not quite, as active as the Alexandrian. The obovate senna appears to be milder than the lanceolate-leaved. Part of the acrid and griping qualities of Alexandrian senna are said, although on no well-ascertained authority, to be referable to the Argel leaves, which possess greater activity than the true senna leaflets. If infusion of senna be given to the nurse, the suckling infant becomes purged, a satisfactory proof that the cathartic principle of senna becomes absorbed, and is thrown out of the system by the excretories. Furthermore, as purging results from the injection of infusion of senna into the veins, this cathartic would appear to exercise a specific influence over the bowels, independent of its local action when it is swallowed.

Therapeutics.—Senna is well adapted for those cases which require an active and certain purgative, with a moderate stimulus to the abdominal and pelvic viscera. Thus, *in constipation* and *inactivity of the alimentary canal*, requiring the continued or frequent use of purgatives; *in worms; in determination of blood to the head*; and many other cases which readily suggest themselves, senna answers very well. The circumstances contra-indicating its use are, an inflammatory condition of the alimentary canal, a tendency to hemorrhoids or menorrhagia, threatening abortion, and prolapsus of the uterus and rectum. The objections to its use are, the large dose required, its nauseous and disgusting flavour, its tendency to gripe, and its irritant and stimulant operation. Thus, in inflammation of the mucous membrane of the bowels, the irritant action of senna makes it an objectionable purgative; while its tendency to increase the frequency of the pulse renders it less fit for exhibition in febrile disorder than the saline purgatives. It is a very safe purgative, and may be given to children, females, and elderly persons, with great security. Though it is not the most appropriate purgative to be employed after delivery, and operations about the abdomen or pelvis (as hernia and lithotomy), yet I have repeatedly seen it used, and rarely with any unpleasant consequences.

Administration.—Powder of senna may be given in doses of from 30 to 120 grains for adults. There are two objections to the use of the powder—the great bulk of the necessary dose, and the uncertainty of its operation, arising from its liability to decompose by keeping. The official preparations (especially the infusion and compound mixture) are the best forms for administering senna. To cover the unpleasant flavour, senna is sometimes given with coffee or black tea. Aromatics (especially coriander and ginger) are also frequently added to prevent griping, and to improve the flavour.

Official Preparations.—Either Alexandrian or Tinnivelly senna may be employed in the preparations of senna ordered in the British Pharmacopœia.

[§ **Confectio Sennæ.** *Confection of Senna.*

Take of

Senna, in fine powder	7 ounces.
Coriander Fruit, in fine powder	3 ounces.
Figs	12 ounces.
Tamarind	9 ounces.
Cassia Pulp	9 ounces.
Prunes	6 ounces.
Extract of Liquorice	$\frac{3}{4}$ ounce.
Refined Sugar	30 ounces.
Distilled Water	a sufficiency.

Boil the figs and prunes gently with twenty-four ounces of distilled water in a covered vessel for four hours, then, having added more distilled water to make up the quantity to its original volume, mix the tamarind and cassia pulp, digest for two hours, and rub the softened pulp of the fruits through a hair sieve, rejecting the seeds and other hard parts. To the pulped product add the sugar and extract of liquorice, and dissolve them with a gentle heat; while the mixture is still warm, add to it gradually the mixed senna and coriander powders, and mix the whole thoroughly, making the weight of the resulting confection seventy-five ounces either by evaporation or by the addition of more distilled water.

Dose.—60 grains to 120 grains.]

When properly prepared, it is a pleasant, mild, and very effectual purgative, and is frequently employed by pregnant women, and persons afflicted with hemorrhoids or diseases of the rectum. When given alone in a full dose it is apt to gripe. It is frequently employed as a vehicle for the exhibition of other cathartics; for example, acid tartrate of potash.

[§ **Infusum Sennæ.** *Infusion of Senna.*

Take of

Senna	1 ounce.
Ginger, sliced	30 grains.
Boiling Distilled Water	10 fluid ounces.

Infuse in a covered vessel, for one hour, and strain.

This corresponds in strength with *Infusum Sennæ Compositum, Lond.* It is double the strength of *Infusum Sennæ Brit. Pharm.* 1864, and *Dubl.*

Dose.—1 to 2 fluid ounces.]

An ordinarily used purgative, employed frequently in the maladies of children as well as of adults. A saline purgative is usually given in conjunction with it; as in the compound mixture of senna or *Black Draught*, a formula for which is now introduced in the Pharmacopæia.

Pharmaceutical Use.—It is used in the preparation of compound mixture of senna.

[§ **Mistura Sennæ Composita.** *Compound Mixture of Senna.*

Take of

Sulphate of Magnesia . . .	4 ounces.
Extract of Liquorice . . .	½ ounce.
Tincture of Senna . . .	2½ fluid ounces.
Compound Tincture of Cardamoms	10 fluid drachms.
Infusion of Senna . . .	a sufficiency.

Dissolve the sulphate of magnesia and extract of liquorice in 14 fluid ounces of the infusion of senna, with the aid of a gentle heat, then add the tinctures, and sufficient infusion of senna to make one pint.

Dose.—1 to 1½ fluid ounce.]

[§ **Syrupus Sennæ.** *Syrup of Senna.*

Take of

Senna, broken small . .	16 ounces.
Oil of Coriander . . .	3 minims.
Refined Sugar . . .	24 ounces.
Distilled Water . . .	5 pints, or a sufficiency.
Rectified Spirit . . .	2 fluid ounces.

Digest the senna in seventy ounces of the water for twenty-four hours at a temperature of 120°; press out the liquor and strain it. Digest the marc in thirty ounces of the water for six hours, at the same temperature; again press out the liquor and strain it. Evaporate the mixed liquors in a water-bath to ten fluid ounces, and, when cold, add the rectified spirit, previously mixed with the oil of coriander. Clarify by filtration, and wash what remains on the filter with distilled water, until the washings make up the filtrate to sixteen fluid ounces. Then add the sugar, and dissolve by means of a gentle heat. The product should weigh two pounds ten ounces, and should have the specific gravity 1·310.]

An efficient cathartic, given to children in doses of 1 to 2 fluid drachms.

[§ **Tinctura Sennæ.** *Tincture of Senna.*

Take of

Senna, broken small	. . . .	$2\frac{1}{2}$ ounces.
Raisins, freed from seeds	. . .	2 ounces.
Caraway Fruit, bruised; Coriander Fruit, bruised	of each . .	$\frac{1}{2}$ ounce.
Proof Spirit	. . . . . .	1 pint.

Macerate the solid ingredients for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.]

Carminative, cordial, stomachic, and purgative. Useful in costiveness attended with flatulence. Usually employed as an adjunct to the infusion of senna. If given alone as a purgative, the dose should be 1 to 4 fluid drachms.

Pharmaceutical Use.—It is an ingredient in the compound mixture of senna.

CASSIA FISTULA, *Linn.* Purging Cassia.

Specific Character.—A showy *tree* from 20 to 30 feet high. *Leaves* alternate, pinnate, from 12 to 18 inches long; *leaflets* 4 to 8 pairs, opposite, ovate, somewhat acute, smooth, from 2 to 6 inches long, and from $1\frac{1}{2}$ to 3 inches broad; *petioles* without glands: *stipules* minute. *Racemes* 1 to 2 feet long, lax, without bracts, straight, smooth. *Flowers* large, bright yellow, fragrant, on long pedicels. *Legume* cylindrical, ligneous, 1 to 2 feet long, externally blackish-brown; with three longitudinal bands or seams extending the whole length, two of which by their contiguity appear to form a single one, the third being on the opposite side of the legume; internally divided into numerous cells by thin transverse dissepiments. *Seed* 1 in each cell, surrounded by a soft blackish pulp, which appears to be a secretion of the endocarp or inner coat of the pod or legume.—*Woodv.* pl. 163.

Habitat.—India, Egypt. Introduced into the West Indies.

[§ **Cassiæ Pulpa.** *Cassia Pulp.*

The pulp obtained from the pods of the Purging Cassia, Cassia Fistula, *Linn.* Imported from the East Indies; or recently extracted from pods imported from the East or West Indies.]

General Characters.—The characters of the pods or legumes have been given above in the botanical description. Those pods yield the most pulp which are heavy, and do not rattle when shaken. The pulp, which is the official part, is blackish-brown or blackish-red, viscid, sweet in taste, and somewhat sickly in odour. The seeds and dissepiments are usually contained in the pulp. This pulp, by exposure to the air, becomes acid, in consequence of undergoing the acetous fermentation. The West Indian cassia generally contains more pulp, and is accordingly of higher value than the East Indian.

Composition.—It contains *sugar*, *pectin*, *gum*, a substance analogous to *tannin*, &c.

Physiological Effects.—Cassia pulp in small doses is a mild laxative; in large doses a purgative; but it is apt to occasion nausea, flatulence, and griping.

Therapeutics.—It is rarely or never given alone; but the cases for which it is well adapted are febrile and inflammatory affections. On account of its pleasant taste it would be a convenient purgative for children.

Administration.—Dose, for an adult, as a mild laxative, 60 to 120 grains; as a purgative, 1 to 2 ounces.

Pharmaceutical Use.—It is contained in confection of senna.

COPAIFERA.

Generic Character.—*Trees* or *shrubs*. *Leaves* equally or unequally pinnate; *leaflets* coriaceous, somewhat unequal, ovate. *Flowers* paniculate; ebracteolate. *Calyx* of 4 spreading small equal sepals, which are united at the base. *Petals* 0. *Stamens* 10, distinct, declinate, nearly equal; *anthers* oblong. *Ovary* free, compressed. *Style* filiform. *Legume* stalked, obliquely elliptical, coriaceous, somewhat compressed, 2-valved, 1-seeded. *Seed* elliptical, enclosed in a 1-sided aril; *embryo* straight; *radicle* somewhat lateral.

Species.—The following are the more important species from which copaiva is obtained:—

COPAIFERA MULTIJUGA, *Hayne.*

Specific Character.—*Leaflets* 6 to 10 pairs, ovate-lanceolate, acuminate, unequal-sided, with pellucid dots; *petiole* slightly hairy. In the province of Para the greatest quantity of the copaiva is said to be furnished by this species.

COPAIFERA LANGSDORFII, *Desf.*

Specific Character.—*Leaflets* 3 to 5 pairs, ovate or oval, blunt, equal-sided, with pellucid dots. *Petioles* and *peduncles* slightly downy (fig. 99). This and the following species furnish the copaiva collected by the natives of Santa Paulo.

Fig. 99.

Fig. 100.

COPAIFERA CORIACEA, *Mart.*

Specific Character.— *Leaflets* 2 to 3 pairs, elliptical, equal-sided, emarginate, coriaceous, not dotted, reticulated, smooth on both sides, somewhat glaucous beneath. *Petioles* and *peduncles* almost smooth (fig. 100).

Habitat.—Bahia. It yields copaiva in Santa Paulo.

Fig. 101.

COPAIFERA OFFICINALIS, *Linn.*

Synonym.—Copaifera Jacquini, *Desf.*

Specific Character.—*Leaflets* 2 to 5 pairs, incurved, ovate, unequal-sided, obtusely acuminate, with pellucid dots (fig. 101).

Habitat.—Venezuela, near Calaboso, West Indies. An inferior kind of copaiva is said to be obtained from this species.

[§ Copaiba. *Copaiva.*

The oleo-resin obtained from incisions made in the trunk of Copaifera multijuga, *Hayne*; and other species of Copaifera. Chiefly from the valley of the Amazon.]

Botanical Source and Commerce.—Copaiva is principally derived from the valley of the Amazon, and imported from Para and Maranham. This is probably yielded, for the most part, by *C. multijuga.* Carthagena, Maracaibo, and Savanilla also furnish some. Is this from *C. officinalis*? Occasionally it is brought from Rio Janeiro, and is supposed to be procured from *C. Langsdorfii* and *C. coriacea*. Some is imported from the West Indies, which appears to be obtained from *C. officinalis*; and a considerable quantity, indirectly, from New York.

Extraction.—Copaiva is obtained by making incisions into the stems of the trees. It exudes so abundantly after incisions have been made, that, at the proper season, as much as twelve pounds are sometimes procured in the space of three hours. If, however, none should flow, the wound is immediately closed with wax or clay, and reopened in a fortnight, when an abundant discharge takes place. Old trees sometimes furnish copaiva two or three times in the year.

General Characters and Varieties.—Copaiva (improperly termed balsam of copaiva) is a transparent liquid, about the consistence of olive oil when freshly imported, of a light yellow colour, with a peculiar, not disagreeable odour, and an aromatic, somewhat acrid taste. Its specific gravity is less than that of water, being about 0·95 or 0·96, but is not constant. By keeping, it becomes considerably denser, owing to the loss of volatile oil. Copaiva is not fluorescent in appearance. It is insoluble in water, but is completely soluble in alcohol, ether, and the oils, both fixed and volatile; and in an equal volume of benzol. When acted on by alkalies it yields a kind of soap, which is insoluble in water. Considerable variation exists in the colour and consistence, as well as in the relative quantities of volatile oil and resin yielded by different specimens of copaiva. Even the odour and taste vary somewhat. The differences doubtless depend in great part upon the copaiva being procured from different species. The smaller species, which grow in the interior of the Brazils, as in Bahia and Minas, yield, as we are told, less copaiva, but of a more resinous and sharper character. *Brazilian Copaiva* is thin, clear, and pale-coloured. *West Indian Copaiva* is thick, golden-yellow, not transparent, and has a less agreeable smell, being somewhat like that of turpentine.

Substitution.—Many years since a substance very much resembling copaiva, but of very dark colour, was offered for sale in London under this name. Upon investigation, it was found to have been imported from India, where it is known under the name of *Wood Oil* or *Gurjun Balsam*, and used for similar purposes as copaiva. It is the product of *Dipterocarpus turbinatus*, and other species of *Dipterocarpus*. It may be distinguished from copaiva by the application of heat, as when heated in a close phial to about 270° Fahr. it coagulates so that the phial may be inverted without altering the position of its contents. This consistence is retained upon cooling, but it liquefies again by applying a gentle heat with agitation, but coagulates again when the temperature is raised to 270°. Copaiva displays no such changes. Another test is the following, first suggested by Dr. De Vry:—When equal volumes of wood oil and benzol are mixed together, a turbid mixture is produced, from which, ultimately, a resinous flocculent matter is deposited; but when benzol is mixed in like proportion with copaiva the result is a transparent solution.

Adulteration.—Castor oil and other fixed oils and turpentine have been used to adulterate copaiva; but there is no evidence that it is subject to adulteration in this country at the present time. Turpentine may be at once recognised by its odour, especially if heat be applied, as by dropping the suspected copaiva on a heated spatula. Castor oil and other fixed oils may be detected as follows:—copaiva is perfectly soluble in rectified spirit; and dissolves one-fourth of its weight of carbonate of magnesia by the aid of heat, and remains transparent. The latter test will at once detect the presence of castor and other fixed oils if employed for adulterating copaiva; and the first test as well as the latter that of most fixed oils except castor oil. Carbonate of magnesia will also distinguish between copaiva and wood oil.

Composition.—Copaiva is an oleo-resin, although usually characterised as a balsam. It contains neither benzoic nor cinnamic acid, the presence of one or the other of which is necessary to constitute a balsam. *Volatile oil.* (See *Oleum Copaibæ.*) *Resin.*—After copaiva has been deprived of its volatile oil by distillation, a brownish resinous mass is left behind. This, when gently heated to expel the residual water, is sold as *resin of copaiva.* It is the least active part of copaiva. It consists of two resins—one called *copaivic acid*, the other, *viscid resin of copaiva.* They are separated by rectified spirit, which dissolves the acid resin, but leaves the viscid one. *Copaivic Acid; Yellow brittle resin of copaiva.*—One hundred parts of copaiva yield, on an average, fifty parts of this acid. Copaivic acid is an amber-coloured, brittle, crystallisable resin, soluble in alcohol, rectified spirit, ether, and the volatile and fixed oils. It is decomposed by sulphuric and nitric acids. Its acid properties are proved by its alcoholic solution reddening litmus, and by the definite compounds which it forms with bases. *Viscid resin of copaiva; Brown soft resin of copaiva.*—When a hot alcoholic solution of copaiva cools, it retains in solution the acid resin already described, but deposits a brown viscid substance, which is termed the *viscid resin of copaiva.* As it is more abundant in old than in recent copaiva, Gerber regards it as produced by some alteration of the acid resin. It is soluble in anhydrous alcohol and ether, and in the volatile and fixed oils. It has very little affinity for basic substances. One hundred parts of copaiva contain from 1·65 to 2·13 per cent. of this resin.

Physiological Effects.—Copaiva produces the general and topical stimulant effects of the oleo-resins already described. Taken in *moderate* doses it creates a sensation of warmth in the stomach, gives rise to eructations having the odour of the copaiva, and not unfrequently occasions nausea, or even actual vomiting. The continued use of it often impairs the appetite, and disorders the digestive functions. These may be regarded as the local effects on the stomach. The constitutional effects, or those which result from the absorption of the copaiva, or of its active constituent, the oil, are those of a stimulant whose influence is principally directed to the secreting organs, more especially to the mucous membranes and to the urino-genital apparatus. The oil passes out of the system in part by the lungs, and the odour of its vapour is readily detectable in the breath of persons taking it. The urine is increased in quantity and altered in quality: thus its colour is heightened, it acquires an odour of copaiva, and a bitter taste; moreover, not unfrequently it is turbid, as if containing mucus. The influence of copaiva over the mucous membrane lining the urethra is shown, even in the healthy state, by the warmth and tickling sometimes experienced in this part, both before and after evacuating the urine, and also by the marked influence which this oleo-resin has in mucous discharges from this membrane. It also acts as a stimulant, but in a less marked manner, to other mucous membranes; namely, the bronchial and gastro-intestinal membranes. Not unfrequently it gives rise to an eruption, usually of a scarlet colour, referable to either urticaria or erythema. *Large doses* of copaiva irritate the gastro-intestinal canal, and occasion a sensation of heat at the pit of the stomach, nausea, vomiting, loss of appetite, and purging, with, not unfrequently, griping pains of the bowels. The whole system becomes powerfully stimulated; the pulse is fuller and more frequent, the skin hotter, and thirst and headache are produced. Occasionally, hæmaturia and dangerous ischuria are brought on. When we compare the operation of copaiva with that of other agents possessing powers of a somewhat similar kind, we observe that both in local and constitutional effects it is more powerful than the balsams properly so-called, while its operation on the urino-genital organs is much more marked. It forms an intermediate substance between the balsams and the turpentines, being less powerful, but more aromatic than the latter; yet the turpentines are less successful in gonorrhœa.

Therapeutics.—The principal employment of copaiva is in *mucous discharges from the urino-genital organs*, more especially in gonorrhœa. There are two methods of treating this disease by copaiva: one is, not to exhibit this remedy until the inflammatory symptoms have subsided; the other is, to give it at the very outset, in order to cut short or suppress the disease. The *first* method is that followed by the best English and German surgeons. It consists in employing, during the violence of the inflammatory stage, antiphlogistic and soothing measures; and when the inflammation has quite or nearly subsided, or is of a very mild character, giving copaiva with the view of diminishing or stopping the discharge. This is undoubtedly the safest method of treatment; for although copaiva may sometimes, or even frequently, be exhibited during the acute or inflammatory stage of gonorrhœa, not only with impunity, but even with advantage, there is no denying the fact that it has, occasionally at least, aggravated the symptoms. Many practitioners judge of the propriety of exhibiting copaiva by the quality of the discharge only, and refrain from administering this medicine until the discharge has acquired what is called a gleety character. I believe most prudent surgeons consider the existence of much pain or scalding in passing the water, an irritable condition of bladder, or violent chordee, as contra-indicating the use of copaiva; while the absence of these symptoms may be regarded as permitting or indicating it. The *second* method of treating gonorrhœa by copaiva consists in exhibiting this medicine in large doses at the commencement of the disease; that is, in its acute stage, usually without adopting any preliminary antiphlogistic or soothing measures. In some cases this practice has been found injurious; producing, at times, acute pain, irritable bladder, and discharge of blood by the urethra. The partisans of this second method of treating gonorrhœa say, that both copaiva and cubebs cure more easily and promptly, and with less chance of relapse, the sooner they are exhibited after the commencement of the disease; in other words, old claps are less readily cured by them than recent ones. Copaiva is not so useful in the treatment of the gonorrhœa of females as in that of males. In *chronic inflammation of the bladder* (commonly termed *catarrhus vesicœ*) copaiva has at times been found beneficial. In *leucorrhœa* copaiva has also been employed with some advantage. In *chronic pulmonary catarrh* its employment has been spoken of favourably. It is only adapted for chronic or old-standing cases, and for torpid habits. Its stimulant influence is calculated to be very injurious where there is inflammation or febrile disorder. In *chronic inflammation of the mucous membrane of the bowels*, especially of the colon and rectum, copaiva has been used. Dr. Cullen spoke favourably of its use in *hemorrhoids*.

Administration.—Dose, from $\frac{1}{2}$ to 1 fluid drachm, or even more. It is sometimes taken on sugar, and this is said to be the most efficacious method of giving it, in affections of the urinary organs; but its nauseous taste is a great objection to its employment in this way. Some take it *swimming on half a wine-glassful of water*, to which a few drops of some bitter tincture have been added. Many persons employ it in the form of *emulsion* (made with mucilage, yolk of egg, or alkalies). If mucilage be employed, it should not be very thick, otherwise it will not mix well. Spirit of nitrous ether is frequently added to cover the unpleasant flavour. Opium is sometimes conjoined to counteract purging, and acids (especially the sulphuric) to check nausea. Copaiva has also been taken in the form of a *pill*: various powders (starch, gum, rhubarb, magnesia, &c.) being employed to give it a proper consistence. If magnesia be employed, the copaivic acid unites with it, and thereby forms copaivate of magnesia, which has considerable consistence, and absorbs the volatile oil. A convenient form for administering copaiva is by enclosing it in *gelatine capsules*. The capsules usually sold contain about ten grains of copaiva.

[§ **Oleum Copaibæ.** *Oil of Copaiva.*
The oil distilled from copaiva.]

The following form for distilling the oil was formerly given in the Edinburgh Pharmacopœia:—

'Take of

Copaiva	1 ounce.
Water	$1\frac{1}{2}$ pint.

Distil, preserving the water; when most of the water has passed over, heat it, return it into the still, and resume the distillation; repeat this process so long as a sensible quantity of oil passes over with the water.' Mr. Whipple informs me that from 249 pounds of copaiva he obtained 128 pounds of volatile oil and 120 pounds of resin. The amount of volatile oil obtained in different specimens varies from one-third to one half, or even more, of the copaiva.

General Characters.—When oil of copaiva has been rectified, and afterwards freed from water by digesting it on chloride of calcium, it has a specific gravity of 0·878. It is colourless or pale yellow, and has the taste and peculiar odour of copaiva. Sulphide of carbon and ether dissolve it in all proportions; absolute alcohol dissolves two-fifths its weight of it; ordinary rectified spirit takes up less than this. It dissolves sulphur, phosphorus, and iodine (by the latter it is coloured), and absorbs chlorine, with which it becomes turbid and viscid. When dropped on iodine, heat and hydriodic acid are suddenly produced. Oil of copaiva is isomeric with oil of turpentine —that is, it consists of $\mathbf{C}_{10}\mathbf{H}_{16}$.

Administration.—For medicinal use I prefer the oil of copaiva to any other preparation of copaiba. The usual dose is from 5 to 20 minims, which may be gradually increased; but I have known 2 fluid drachms taken at one dose without any ill effects. It may be taken on a lump of sugar.

AMYRIDACEÆ, *Lindl.* The Myrrh and Frankincense Order.

BALSAMODENDRON MYRRHA, *Ehrenb.* The Myrrh Tree.

Botanical Character.—*Stem* shrubby, arborescent; *branches* squarrose, spinescent; *bark* pale ash-grey, approaching white; *wood* yellowish-white, both it and the bark having a peculiar odour. *Leaves* (fig. 102, *a*) on short stalks, ternate; *leaflets* obovate, obtuse. *Flowers* unknown. *Fruit* (fig. 102, *b*) ovate, acuminate, smooth, brown, somewhat larger than a pea, and supported on a very short stalk. *Nees, Plant. Med.* pl. 357.

Fig. 102.

Balsamodendron Myrrha.
a. A leaf. *b.* The fruit.

Habitat.—Gison, on the borders of Arabia Felix; and in Abyssinia.

[§ **Myrrha.** *Myrrh.*

A gum-resinous exudation from the stem of Balsamodendron Myrrha, *Ehrenb.* Collected in Arabia Felix and Abyssinia.]

History.—The earliest notice of myrrh occurs in the Old Testament, from which it appears that this gum-resin was an object of trade with the Eastern nations more than 3,500 years ago. Hippocrates employed it in medicine, and Dioscorides describes several kinds of myrrh; but notwithstanding the early knowledge of, and acquaintance with, the uses of myrrh, we had no accurate account of the tree which yielded it until the return of Ehrenberg from his travels with Hemprich, during 1820-25, in various parts of Africa and Asia. Ehrenberg himself collected some very fine myrrh near Gison from the stem of this tree.

Exudation of Myrrh.—Myrrh, according to Ehrenberg, exudes like cherry-tree gum, from the bark of the tree. It is at first soft, oily, and of a pale yellow colour; but by drying becomes darker and redder.

Commerce.—Myrrh is imported, at the present time, solely from the East Indies in chests, each containing from two to four hundredweight. It is originally procured from Arabia and the north-eastern coast of Africa, and carried thence to Bombay. Formerly the finest kind was brought from Turkey, and hence called *Turkey myrrh*, and an inferior sort from the East Indies and termed *East India myrrh.* Sometimes the same chest contains myrrh of all qualities, which is then termed *Myrrh in sorts*; but commonly it is brought over more or less sorted.

General Characters and Varieties.—Myrrh of first quality; Turkey myrrh.—This occurs in pieces, of irregular forms and of variable sizes, consisting of tears (either distinct or agglomerated), and usually covered with a fine powder or dust. In a chest of this kind of myrrh a few pieces of fine quality may sometimes be met with, nearly as large as a man's fist. The colour varies, being pale reddish-yellow, red, or reddish-brown. The pieces are somewhat translucent, and brittle, and when broken the fractured surface presents an irregular, somewhat dull, oily appearance. In consequence of imperfect desiccation the largest and finest pieces often present internally, opaque whitish or yellow striæ or veins, which have been compared to the white marks on the nails. The odour of myrrh is aromatic, balsamic, and peculiar, but to most persons pleasant; the taste is bitter, acrid, and aromatic. The purest, palest, and most odorous pieces are sold as *picked myrrh. Myrrh of second quality; Myrrh in small tears or grains.*—This consists of distinct tears or grains, which are rounded or irregular, and vary in size from that of a pin's head to a pepper-corn, none of them in my specimens being so large as a small pea. They are somewhat shiny, more or less transparent, and vary in colour from pale or whitish-yellow to reddish-brown. This quality of myrrh usually consists of tears of myrrh intermixed with fragments of gum arabic, and of some resin very like mastic, or juniper. (See *Adulterations.*) *Myrrh of third quality; East India myrrh.*—Formerly this was the only kind imported from the East Indies. It occurs in pieces, which are darker coloured than those of the so-called Turkey myrrh, and whose average size does not exceed that of a walnut. It is often mixed with other substances, particularly with *Indian Bdellium*, and with a substance of similar appearance to dark red-coloured Senegal gum. (See *Adulterations.*) Myrrh is only partially soluble in water, alcohol, or ether; the first of these liquids taking up the gum principally, the two latter the resin and oil. Water takes up more of the myrrh than alcohol does. It forms a milky-white emulsion with water, owing to the suspension of the resin by the dissolved gum. Alkaline solutions are good solvents for myrrh. A few drops of nitric acid dropped on a small fragment of myrrh, or on a concentrated tincture, develope a red colour.

Adulterations.—From the careless manner in which myrrh is collected abroad, when it arrives in this country it has frequently intermixed with it various gums, resins, &c. These may be generally distinguished by the transparency of their fractured surface, and by their deficiencies of odour and taste. The most frequent adulteration is, however, the substance called *Indian Bdellium* or *False Myrrh*, which is probably derived from other species of *Balsamodendron*, namely, *B. mukul.*, Hook., and *B. pubes-*

cens, Stocks., or, according to others, from *Amyris Commiphora*. Bdellium has a feeble myrrh-like odour and taste, and has considerable resemblance to myrrh, but may readily be distinguished by its want of brittleness, and by its readily softening, even by the heat of the hand. Some of the pieces have hairs (of the goat?) adhering to them, and also portions of a yellowish birch-like bark; they are also sometimes perforated by spiny branches; all of which characters serve to distinguish bdellium from true myrrh. These intermixtures of Indian Bdellium, &c., only occur commonly in the second and third qualities of myrrh.

Composition.—Myrrh contains a *volatile oil*, *resin*, *gum*, &c.; the proportions are about 2·5 per cent. of volatile oil, 23 of resin, and 58 of gum. *Volatile Oil.*—Colourless, though by age it becomes yellowish. It is a thin fluid, heavier than water, having the odour and taste of myrrh, and being soluble in alcohol, ether, and the fixed oils. It readily distils over with water, but not with spirit. With sulphuric, nitric, and hydrochloric acids, it forms red solutions. *Resin.*—According to Brandes, this is of two kinds, both of which are soluble in alcohol. *α. Soft resin.*—Odorous, soft at ordinary temperatures, and insoluble in ether. Unverdorben regards it as a mixture of hard resin and volatile oil. *β. Hard resin* (*Myrrhic acid*?).—Inodorous, hard, insoluble in ether, soluble in caustic alkalies, forming *myrrhates*? The myrrhate of baryta is soluble in water, but not in alcohol. *Gum.*—Is also of two kinds: *α. Soluble* in water; the solution forming precipitates with alcohol and the salts of lead, silver, the protosalts of tin, and of mercury. *β. Insoluble* in water.

Physiological Effects.—In *small* or *moderate doses*, myrrh promotes the appetite, creates an agreeable warmth in the stomach, and occasions slight constipation. Its continued employment in these quantities assists the assimilative functions, increases the muscular activity, gives greater firmness to the solids, and diminishes excessive secretion from the mucous membranes. In *large doses* (as from 30 to 60 grains) it excites a disagreeable sensation of heat in the stomach, and in irritable conditions of this viscus may even bring on a slight inflammatory state; it accelerates the frequency and increases the fulness of the pulse, gives rise to a febrile condition of the body, and creates a feeling of warmth in the mucous membrane (especially in the membrane lining the air-passages). It has been supposed to have a specific stimulant operation on the uterus, and has, in consequence, been termed emmenagogue; but it does not appear to have any title to this appellation. Its local operation is that of a mild astringent and a moderate stimulant. In its remote effects it partakes of both the tonic and stimulant characters. Myrrh differs from the fetid gum-resins (assafœtida, galbanum,

&c.) in not possessing that influence over the nervous system which has led to the use of the latter in various spasmodic diseases, and to their denomination of antispasmodics.

Therapeutics.—The employment of myrrh is indicated in diseases characterised by feebleness of the vascular action, by weakness of the muscular fibre, and by excessive secretion from the mucous membranes. Relaxed and leucophlegmatic constitutions best admit of its use. It is frequently associated with tonics, especially the chalybeates, or with aloes. Indeed it is rarely used alone. It is contra-indicated in inflammatory diseases, and in plethoric individuals. It is employed in the following cases :—*In disordered conditions of the digestive organs* arising from, or connected with, an atonic condition of the alimentary canal, as in some forms of dyspepsia, apepsia, flatulence, &c. *In disordered states of the menstrual functions*, characterised by a lax and debilitated state of the system, as in many cases of amenorrhœa and chlorosis. *In excessive secretion from the mucous membranes* unconnected with inflammatory symptoms, and accompanied by marks of debility. In chronic pulmonary catarrh, for example, it is sometimes admissible and useful. It has also been used to check puriform expectoration in phthisis, though it is now rarely employed for this purpose, and in most cases it proves either useless or injurious. *As an external application*, myrrh is employed for various purposes. Thus it is used as a *dentifrice*, either alone or mixed with other substances; and in caries of the teeth and in a spongy or ulcerated condition of the gums it is very serviceable. As a *gargle*, in ulcerations of the throat, tincture of myrrh, diluted with water, is frequently employed. In *foul ulcers*, myrrh has been used to destroy unpleasant odour, to promote granulations, and to improve the quality and diminish the quantity of the secreted matters; for these purposes it has been applied in a pulverulent form, as an ointment, or as a wash.

Administration.—It is given in the form of powder, pill, or emulsion. *Dose*, 10 to 30 grains.

Pharmaceutical Uses.—Myrrh is a constituent of the compound decoction of aloes, compound assafœtida pill, compound rhubarb pill, compound mixture of iron, and pill of aloes and myrrh.

[§ **Tinctura Myrrhæ.** *Tincture of Myrrh.*

Take of

Myrrh, in coarse powder	$2\frac{1}{2}$ ounces.
Rectified Spirit	1 pint.

Macerate the myrrh for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient rectified spirit to make one pint.

Dose.—½ to 1 fluid drachm.]

Tonic and stimulant. Seldom employed internally, and then usually as an adjunct. It is applied as a stimulant to foul and indolent ulcers. Diluted with water (which renders it slightly milky by the separation of the resin, without any precipitate being formed), it is used as a wash for the mouth in ulceration and sponginess of the gums, and as a gargle in affections of the throat.

CANARIUM COMMUNE, *Linn.*

Botanical Character.—A small tree. *Leaves* compound; *leaflets* on long stalks, 7–11, ovate-oblong, acute, entire, smooth; *stipules* oval. *Flowers* 2–3 together, in terminal panicles, polygamous. *Calyx* 3-lobed, campanulate; *lobes* unequal, externally silky. *Disk* urceolate. *Petals* 3, inserted under the disk, twice as long as the calyx, oblong, concave. *Stamens* 6, inserted under the disk, shorter than the petals, unequal. *Ovary* sessile, ovate-globose, 3-celled; *stigma* 3-lobed. *Fruit* a drupe, oblong, black.—*Rumph. Amb.* vol. ii. pl. 47.

Habitat.—India, Ceylon, Eastern Archipelago.

[§ **Elemi.** *Elemi.*

A concrete resinous exudation, the botanical source of which is undetermined, but is probably Canarium commune, *Linn.* Chiefly imported from Manilla.]

Botanical Source, Varieties, and Commerce.—The origin of elemi is involved in great obscurity. The resinous products of various trees have been described under this name. Pereira has alluded to three kinds of elemi. 1. *Elemi in flag leaves.* This is imported from Holland in triangular masses, weighing from one to two pounds each, enveloped in a palm leaf. 2. *Elemi in the lump.* 3. *Brazilian elemi.* To these varieties we must add the *Mexican elemi* of Royle. The first two kinds have probably the same source as the present Manilla elemi. The Brazilian is doubtless obtained from *Icica Icariba*, Marcgr; and Mexican elemi appears to be derived from *Elaphrium elemiferum*, Royle. Of late years elemi has been brought entirely, or almost entirely, from Manilla. This is the official elemi, and is supposed to be derived, as mentioned above, from *Canarium commune*, but we have no positive knowledge to this effect. Thus Blanco (*Flora de Filipines*) says that elemi, which distils as a white liquid resin, is yielded by *Canarium album*, and is quite different from the resin of *C. commune*, which is blackish. M. Baup also considers that elemi, or a resin resembling it, is the produce of *C. album*, a tree common in the Philippines.

General Characters.—[§ A soft unctuous adhesive mass, becoming harder and more resinous by age; of a yellowish-white colour, with a rather fragrant fennel-like odour; almost entirely soluble in rectified spirit.]

Composition.—Elemi essentially consists of a *volatile oil*, and *two resins.*

Physiological Effects and Uses.—The physiological effects of elemi are similar to those of the turpentines. It is, however, never employed internally. Its principal or sole use is as a constituent of the ointment of elemi.

[§ **Unguentum Elemi.** *Ointment of Elemi.*

Take of

Elemi	$\frac{1}{4}$ ounce.
Simple Ointment	1 ounce.

Melt, strain through flannel, and stir constantly until the ointment solidifies.]

It is applied as a stimulant to old and indolent ulcers, and to promote the discharge from issues and setons.

BOSWELLIA, *Wight and Arnott.*

Generic Character.—*Trees* producing balsam and resin. *Leaves* deciduous, alternate towards the top of the branches, unequally pinnate; *leaflets* opposite, serrated. *Stipules* 0. *Racemes* terminal or axillary. *Flowers* on short pedicels, white, bisexual. *Calyx* small, free, 5-toothed, persistent. *Petals* 5, obovate-oblong, very spreading, acute at the base, inserted under the margin of the disk; æstivation very slightly imbricative. *Stamens* 10, inserted under the disk, alternately shorter; *filaments* subulate, persistent; *anthers* caducous. *Disk* fleshy, larger than the calyx, crenulated on the margin. *Ovary* cup-shaped, oblong, sessile; *style* 1, the length of the stamens, caducous; *stigma* capitate, 3-lobed. *Fruit* capsular, 3-angled, 3-celled, 3-valved, septicidal; *valves* hard. *Seeds* solitary in each cell, surrounded by a broad membranous wing; *cotyledons* intricately folded, multifid.

Habitat.—Africa, Arabia, India.

Olibanum. *Frankincense.*

A gum-resinous exudation, obtained from species of Boswellia.
(*Not official.*)

Botanical Source and Commerce.—The source of olibanum has been always doubtful. The recent researches of Dr. Birdwood have shown, however, that it is now principally, if not entirely, obtained from Arabia and the Soumali country in Africa. Three species of *Boswellia*, natives of the Soumali country, have been described by Dr. Birdwood as the sources of olibanum, namely, *B. Carterii*, *B. Bhau-Dajiana*, and *B. Frereana*. *B. thurifera*, Colebrooke, the *Boswellia glabra*, Roxb., a native of Central India and the Coromandel coast, has been also supposed to yield olibanum, but on no reliable evidence.

General Characters, Commerce, and Varieties.— Olibanum or frankincense, is imported from India in chests. It consists of round, oblong, or ovate, pale yellowish, semi-opaque, fragile tears, having a pungent slightly aromatic taste, and a balsamic resinous odour, especially when heated. The substance called on the Continent African or Arabian olibanum is rarely met with in this country. It consists of smaller tears than those of the Indian variety; these are yellowish or reddish, and intermixed with crystals of carbonate of lime. Strictly speaking, there does not appear to be any Indian variety of olibanum; but, like gum acacia and myrrh, it reaches Bombay from the Persian Gulf; and, owing to its being thence exported to Europe, the statement has arisen that there is an Indian distinct from the Arabian variety.

Composition.—Olibanum essentially consists of *gum*, *resin*, and a *volatile oil.*

Physiological Effects and Uses. — Olibanum is regarded as a stimulant of the same kind as the resins or oleo-resins. It is rarely employed internally. Formerly it was used to restrain excessive discharges from the mucous membranes. Thus it was given in chronic diarrhœa, old catarrhs, but more especially in leucorrhœa and gleet. It was also administered in affections of the chest, as hemoptysis. It has been used as an ingredient of stimulating plasters. As a fumigating agent it is employed to overpower unpleasant odours, and to destroy noxious vapours. Its principal use, at present, is as an ingredient in the preparation of incense.

Administration.—Dose, from 30 to 60 grains, formed into an emulsion by the aid of the yolk of an egg.

ANACARDIACEÆ, *R. Brown*. The Mastich Order.

PISTACIA, *Linn.*

Generic Character.—*Trees* with pinnate leaves. *Flowers* diœcious, apetalous. *Males: Racemes* amentaceous, with 1-flowered scales [bracts]. *Calyx* 5-cleft. *Stamens* 5; *anthers* almost sessile, 4-cornered. *Females: Racemes* more lax. *Calyx* 3–4-cleft. *Ovary* free, 1–3-celled; *stigmas* 3, rather thick. *Drupe* dry, ovate, with a somewhat osseous nut; usually 1-celled, 1-seeded, but sometimes bearing two abortive cells at the side. *Seeds* solitary in the cells, affixed to the side, exalbuminous; *cotyledons* thick, fleshy, oily; *radicle*, lateral superior.

PISTACIA TEREBINTHUS, *Linn.* The Chian Turpentine.

Specific Character.—A *tree* 20 to 40 feet high. *Leaves* pinnate with an odd leaflet (fig. 103); *leaflets* about 7, ovate-lanceolate, rounded at the base, acute, mucronate. Young *leaves* reddish, old ones dark green. *Racemes* compound. *Fruit* almost round, purplish.

Habitat.—Syria and the Greek Archipelago.

Fig. 103.

Pistachia Terebinthus.
(The female plant.)

Terebinthina Chia. *Chian Turpentine.*

A liquid oleo-resinous exudation obtained by incision into the stem of Pistacia Terebinthus, *Linn.* Produced in the island of Scio.

(*Not official.*)

Extraction.—The turpentine harvest in Scio extends from the end of July to October. The turpentine is obtained by making transverse incisions with a hatchet into the bark of the largest trees. The turpentine as it exudes runs down on to smooth stones placed under the trees close to the trunks, where it hardens. It is then scraped from the surface of these and purified by being melted in the sun and strained into bottles. The quantity yielded by each tree is small, not exceeding eight or ten ounces.

General Characters.—Chian (or Cyprus turpentine, as it is sometimes called), has the general properties of the coniferous turpentines already described. Its consistency is that of honey, but more glutinous. Its colour is greenish-yellow. It has an agreeable turpentine-like odour, combined with that of fennel, or, according to some, of citron and jasmine. Its taste is very mild. By keeping, it resinifies, and acquires a somewhat less agreeable odour. Genuine Chian turpentine is scarce; the coniferous turpentines being usually sold for it.

Composition.—Similar to the coniferous turpentines.

Physiological Effects, Uses, and Administration.—Exactly similar to the coniferous turpentines.

PISTACIA LENTISCUS, *Linn.* The Mastich Tree.

Specific Character.—A *shrub*, from about 10 to 12 feet high. *Leaves* (fig. 104) abruptly pinnate; *leaflets* about 8, lanceolate, somewhat linear, or ovate; *petiole* winged. *Flowers* very small; in axillary racemes. *Fruit* small, roundish, of a brownish-red colour when ripe.—*Steph. and Church*. pl. 130.

Habitat.—South of Europe, North of Africa, Levant.

Fig. 104.

Pistacia Lentiscus.
a. The male plant.
b. The female plant.

[§ Mastiche. *Mastich.*

A resinous exudation obtained by incision from the stem of Pistacia Lentiscus, *Linn.* Produced in the island of Scio.]

Extraction.—Tournefort says that in Scio the extraction of mastich commences on the first of August. The bark is cut crosswise, when the mastich exudes and hardens, partly on the stem, partly on the ground. The same incisions furnish mastich towards the end of September, but in lesser quantities. The mastich which concretes on the stem is called *mastich in the tear*; while that which falls to the earth constitutes *common mastich.*

Commerce.—It is imported from Turkey and the Levant.

General Characters.—Mastich occurs in small, spherical, flattened, or irregular, pale yellow tears, which are externally covered with a light whitish powder, owing to their mutual attrition. Mastich is brittle, and breaks with a vitreous fracture. It becomes soft and ductile when chewed; has an agreeable odour, especially when rubbed or heated; and a mild resinous taste.

Composition.—Mastich consists of a minute portion of *volatile oil*, about 90 per cent. of *resin soluble in alcohol*, and 10 per cent.

of a resinous substance (*masticin*) insoluble in alcohol. *Soluble acid mastich resin; Masticic acid.* This resin is soluble in alcohol. It possesses the properties of an acid, and combines with bases. *Insoluble non-acid mastich resin; Masticin.*—This resin is insoluble in alcohol. It is white, elastic, tenacious, soluble in an alcoholic solution of acid mastich resin, as well as in ether and oil of turpentine. To this resin mastich owes its toughness.

Physiological Effects.—Analogous to common resin and the coniferous turpentines.

Uses.—Mastich is rarely employed as a medicine. Dentists employ it, dissolved in alcohol, ether, or chloroform, for filling up the cavities of carious teeth. From its agreeable odour, which it communicates to the breath, it is frequently employed as a masticatory; hence its name.

RHAMNACEÆ, *Lindl.* THE BUCKTHORN ORDER.

RHAMNUS CATHARTICUS, *Linn.* Common Buckthorn.

Botanical Character.—A spreading *shrub* 8–10 feet high, with terminal *spines.* *Branches* opposite. *Leaves* roundish-oval, acute, sharply toothed, with 4 or 6 strong lateral veins parallel with the margin. *Stipules* linear. *Flowers* diœcious, yellowish-green: the *males* with broader *petals*, 4 *stamens*, and an abortive ovary; the *females* smaller, with 4 *stigmas* projecting beyond the calyx, and rudimentary stamens. *Calyx* pitcher-shaped, 4–5-cleft, valvate. *Petals* 4–5, alternate with the lobes of the calyx, or none. *Stamens* inserted opposite the petals. *Style* 4-cleft. *Fruit* black, baccate, small, round, 4-celled; *cells* 1-seeded. *Seeds* hard, erect, acute, triangular.

Habitat.—Indigenous; in hedges, groves, and thickets. The fruit is ripe in September.

Rhamni Fructus. *Buckthorn Berries.*

The dried ripe fruit of Rhamnus Catharticus, *Linn.*

(*Not official.*)

General Characters.—Buckthorn fruits, commonly called berries, are small, round, about the size of a small pea, black and shining when ripe. When fresh they contain a greenish pulp, which becomes blackish by keeping, and has a nauseous smell, and disagreeable bitter taste. Buckthorn berries may be distinguished from those of the Alder Buckthorn (*Rhamnus frangula*), which are sometimes found mixed with them, by containing four seeds, the latter only containing two.

[§ **Rhamni Succus.** *Buckthorn Juice.*

The recently expressed juice of the ripe berries of Rhamnus Catharticus, *Linn.*]

Composition.—The expressed juice of buckthorn berries contains a *green colouring matter, acetic and malic acids,* and a *bitter substance* which has been termed *cathartin,* which is supposed to be the purgative principle.

Physiological Effects.—The berries, as well as their expressed juice, are powerful hydragogue cathartics; usually griping and causing great thirst, and sometimes operating with considerable violence.

Therapeutics.—Buckthorn berries were formerly employed as cathartics, but their violent operation, and the sickness, griping, and thirst occasioned by them, have led to their almost entire disuse. The syrup of the juice is, however, sometimes given to children.

[§ **Syrupus Rhamni.** *Syrup of Buckthorn.*

Take of

Buckthorn Juice	4 pints.
Ginger, sliced, Pimento, bruised } of each . .	$\frac{3}{4}$ ounce.
Refined Sugar	5 pounds, or a sufficiency.
Rectified Spirit	6 fluid ounces.

Evaporate the juice to two pints and a half, add the ginger and pimento, digest at a gentle heat for four hours, and strain. When cold add the spirit, let the mixture stand for two days, then decant off the clear liquor, and in this dissolve the sugar with a gentle heat, so as to make the specific gravity 1·32.

Dose.—1 fluid drachm.]

Cathartic. It is employed as an adjunct to purgative and occasionally to diuretic mixtures.

Sub-class IV.—Thalamifloræ.

SIMARUBACEÆ, *Lindl.* The Quassia Order.

SIMARUBA AMARA, *Aublet.* **Simaruba or Mountain Damson.**

Botanical Character.—A tall *tree.* *Roots* long and creeping. *Stem* thick; *bark* bitter, internally white, fibrous, and tough, externally blackish and furrowed in the old trees, but smooth andgrey, with yellow spots, in the young ones. *Leaves* stalked, alternate, abruptly pinnate; *leaflets* alternate, somewhat stalked, 2 to 9 on each side, oval, firm, mucronate, pubescent beneath. *Flowers* small, yellowish-white, unisexual, mixed, in panicles. *Calyx* small, cup-shaped, 5-toothed or partite. *Petals* 5, longer, spreading. *Males*:—*Stamens* 10, nearly equal to the petals, arranged around a disk bearing at its apex 5 very minute lobes (rudiments of ovaries), or sometimes none. *Females*:—*Ovaries* 5, placed on the disk, and surrounded at the base by 10 short hairy scales (rudiments of stamens). *Styles* the same number as the ovaries, short, distinct at the base; crowned by a broader 5-lobed *stigma*. *Fruit* consisting of 5 drupes, black.

Habitat.—Jamaica, Guiana, Cayenne.

Simarubæ Radicis Cortex. *Simaruba Bark.*

The root bark of Simaruba amara, *Aublet*. Imported from Jamaica. (*Not official.*)

General Characters.—Simaruba bark occurs in broad, folded, very fibrous pieces, several feet long, which are externally rough, warty, and marked with transverse ridges. The epidermis is of a greyish or whitish-yellow colour; beneath it the bark is darker, and yellowish-brown. On the inner surface the bark is pale yellowish-white. It is odourless, but has a bitter taste.

Composition.—The principal constituents of simaruba bark are, *quassin*, *resin*, and *volatile oil*. *Quassin* (see *Quassiæ Lignum*).

Physiological Effects.—In small doses simaruba acts like the simple bitter tonics, whose effects have been already described. In full doses, however, it causes vomiting and purging, and is said also to promote perspiration and to act as a diuretic.

Therapeutics.—Simaruba bark may be employed in the same cases as the other vegetable bitters. It has been principally celebrated in *dysentery*, whence it has been called *dysentery-bark*. It is, of course, only applicable in the latter stages of the acute and the asthenic and chronic forms of the disease. It has also been employed in the advanced stages of *diarrhœa*. Like other vegetable tonics, it may be administered in *dyspepsia*, *anorexia*, and *intermittents*. It is a remedy, however, which is seldom used.

Administration.—It may be administered in powder, in doses of from 15 to 30 grains. It is best given, however, in the form of an infusion made by macerating and subsequently straining ½ an ounce of the bruised bark in 1 pint of boiling water. This infusion is tonic, and in large doses emetic. *Dose* as a tonic, 1 to 2 fluid ounces.

PICRÆNA EXCELSA, *Lindley.* The Bitter Wood Tree.

Botanical Character.—A *tree* sometimes 100 feet high. *Leaves* unequally pinnate; *leaflets* opposite, 4–8 pairs, stalked, oblong, acuminate, unequal at the base. *Flowers* polygamous, racemose, small, pale yellowish-green. *Sepals* 5, minute. *Petals* 5, longer than the sepals. *Stamens* 5, about as long as the sepals, rather shaggy; *anthers* roundish. *Males*: with a rudimentary pistil. *Females: Carpels* 3, on a round tumid thalamus; *style* 3-cornered, bifid; *stigmas* simple, spreading. *Drupes* 3, globose, 1-celled, only 1 coming to perfection, and this, when ripe, about the size of a pea, black, shining, round.—*Steph. and Church.* pl. 173 (*Quassia excelsa*).

Habitat.—Jamaica, and other West Indian islands.

[§ Quassiæ Lignum. *Quassia Wood.*

The wood of Picræna excelsa, *Lindley.* From Jamaica.]

General Characters.—Quassia wood, sometimes called Jamaica quassia wood, in order to distinguish it from the wood of Quassia amara (the original source of quassia), is imported in billets of various sizes (sometimes a foot in diameter, and several feet in length), and covered externally with a smooth brittle dark grey bark. The wood is dense, tough, and white, but by exposure to the air it becomes yellowish; it has no odour, but an intensely and purely bitter taste. An efflorescence of nitrate of potash is frequently observed on it. It is commonly found in chips or raspings.

Adulteration.—Quassia wood in chips has been adulterated with the chips of other woods; but the intense bitterness of the genuine wood readily distinguishes it.

Composition.—Quassia owes its properties to a peculiar neutral principle, called quassin or quassite. *Quassin: bitter principle of quassia*:—Obtained by adding lime water to a concentrated aqueous decoction of quassia, evaporating and treating the residue with alcohol, which takes up the quassin, a brown colouring matter, and some salts. By repeated solution and evaporation in alcohol, with a little ether, the quassin is obtained pure. Quassin occurs in small, white, prismatic crystals, which are fusible, odourless, intensely bitter, readily soluble in alcohol, but very slightly so in water or ether. Its solubility in water is increased by several salts and vegetable principles. Its watery solution is precipitated white by tannin, but not by iodine, chlorine, corrosive sublimate, salts of iron, acetate or subacetate of lead. It is a neutral body, though soluble in sulphuric and nitric acids.

Physiological Effects.— In the usual medicinal doses, quassia operates as a stomachic and tonic—that is, it is bitter to the taste promotes the appetite, and assists the digestive functions. It is devoid of all irritant, stimulant, and astringent properties; and has been, therefore, sometimes taken as a type of the simple or pure bitters. It is more powerful than, but in other respects analogous to, gentian in its operation. It is supposed by some to possess narcotic properties.

Therapeutics.—Quassia is employed in the same cases as several other simple bitters, some of which have been already noticed. It is principally used in *dyspepsia*, *anorexia*, and other stomach disorders of a functional kind and atonic character, more especially when occurring in a gouty subject.

Administration.—The best mode of administration is in the form of extract, infusion, or tincture. The so-called *bitter-cup*, now sometimes sold, is made from quassia wood.

[§ **Extractum Quassiæ.** *Extract of Quassia.*

Take of

Quassia Wood, rasped . . .	1 pound.
Distilled Water	a sufficiency.

Macerate the quassia with eight fluid ounces of the water for twelve hours; then pack in a percolator, and adding more of the water, allow the liquor slowly to pass until the quassia is exhausted. Evaporate the liquor; filter before it becomes too thick; and again evaporate by a water-bath until the extract is of a suitable consistence for forming pills.

Dose.—3 to 5 grains.]

[§ **Infusum Quassiæ.** *Infusion of Quassia.*

Take of

Quassia Wood, in chips . . .	60 grains.
Cold Distilled Water . . .	10 fluid ounces.

Macerate in a covered vessel, for half an hour, and strain.

Dose.—1 to 2 fluid ounces.]

Tonic. Generally employed in dyspeptic and other stomach affections. It has the advantage over some other vegetable bitter infusions, that chalybeates can be combined with it without changing its colour. It is in common use as a fly-poison.

[§ **Tinctura Quassiæ.** *Tincture of Quassia.*

Take of

Quassia Wood, in chips	$\frac{3}{4}$ ounce.
Proof Spirit	1 pint.

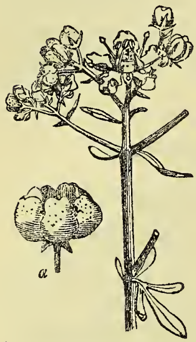
Macerate for seven days in a closed vessel, with occasional agitation; then strain, press, filter, and add sufficient proof spirit to make one pint.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

RUTACEÆ, *D.C.* The Rue Order.

RUTA GRAVEOLENS, *Linn.* Common or Garden Rue.

Fig. 105.



Ruta graveolens.
a. Its fruit.

Botanical Character.—A small branching *undershrub*, with a strong disagreeable odour. *Leaves* alternate, tripinnate or decompound, glaucous or bluish-green, dotted; *lateral leaflets* oblong, the *terminal* one obovate. *Calyx* 4–5-fid, permanent. *Petals* (fig. 105) 4 or 5, entire or somewhat toothed, concave, unguiculate, greenish-yellow. *Stamens* 8 or 10, inserted on a disk beneath the ovary. *Nectariferous pores* as many as the stamens. *Ovary* 4- or 5-lobed; *style* 1. *Fruit* (fig. 105, *a*) roundish, warty, 4–5-lobed.—*Woodv.* pl. 37, p. 108.

Habitat.—South of Europe. Commonly cultivated in gardens.

Rutæ Herbæ. *Rue Herb.*

The fresh and dried herb of Ruta graveolens, *Linn.*

(*Not official.*)

General Characters.—The botanical characters have been given above. It is readily recognised by its strong disagreeable odour, which it owes to a volatile oil. Its taste is bitter and nauseous. The dried herb is greyish-green, and has a less powerful odour.

Composition.—The principal constituents are *volatile oil*, which is official (see *Oleum Rutæ*), and *bitter extractive.*

[§ Oleum Rutæ. *Oil of Rue.*

The oil distilled from the fresh herb of Ruta graveolens, *Linn.*]

Production and General Characters.—From 12 pounds of the leaves, gathered before the plant had flowered, Lewis obtained only about 3 fluid drachms of oil; but the same quantity of herb, with the seeds almost ripe, yielded above 1 fluid ounce. Oil of Rue is pale yellow, has a bitterish acrid taste, a disagreeable odour, and a specific gravity of 0·911. It is somewhat more soluble in water than the other volatile oils.

Physiological Effects.—The topical action of oil of rue is that of an acrid. It causes redness, swelling, and vesication of the skin.

Therapeutics.—Rue formerly enjoyed great celebrity as an antispasmodic and emmenagogue; a celebrity which it still retains among the public, and which it owes to its volatile oil. *In flatulent colic*, especially of children, the oil is an exceedingly valuable remedy, and may be administered either by the stomach, or, in infants, by the rectum, in the form of an enema. It may also be used with benefit in some cases of *infantile convulsions*. It has been employed in *hysteria* and *amenorrhœa*, in which diseases it will probably at times prove serviceable, and in them it deserves further trials. It may be used externally as a rubefacient.

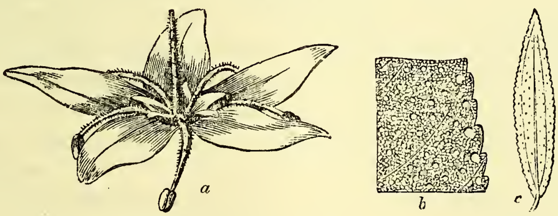
Dose.—From 2 to 6 minims, rubbed down with sugar and water.

An *infusion* (prepared by digesting an ounce of the fresh herb in 1 pint of boiling water), and called *rue tea*, is a popular remedy. It is given in doses of from 1 to 2 fluid ounces.

BAROSMA, *Willd.*

Generic Character. — *Shrubs. Leaves* opposite, smooth, dotted (fig. 106, *b*). *Flowers* stalked, axillary. *Calyx* 5-cleft or 5-partite, dotted. *Disk* lining the bottom of the calyx, generally with a short,

Fig. 106.



a. Flower of Barosma; *b.* a magnified view of a portion of the leaf of B. crenulata; *c.* leaf of B. serratifolia.

scarcely prominent, rim. *Petals* 5 (fig. 106, *a*), with short claws. *Filaments* 10; the 5 opposite the petals sterile, petaloid, sessile, ciliated, obscurely glandular at the apex; the other 5, longer, smooth or hispid, subulate, with the anthers usually furnished with a minute gland at the apex. *Style* as long as the petals; *stigma* minute, 5-lobed; *ovaries* auriculate at the apex, usually glandular and tuberculated. *Fruit* composed of 5 cocci covered with glandular dots at the back.

Species.—The following species are official:—

1. BAROSMA BETULINA, *Bartling.*

Specific Character. — *Leaves* obovate, recurved at the apex, glandulose-serrate at the margin. *Pedicels* solitary, somewhat leafy. *Flowers* pink, terminal.—*Berg u. Schmidt, Off. Gewächse*, pl. 1, *f.*

Habitat.—Cape of Good Hope.

2. BAROSMA CRENULATA, *Hooker.*

Specific Character.—*Leaves* ovate-oblong or oval-lanceolate, obtuse, crenate. *Pedicels* solitary, with two bracts immediately under the flower.—*Bot. Mag.* vol. lxii. pl. 3,413.

Habitat.—Cape of Good Hope.

3. BAROSMA SERRATIFOLIA, *Willd.*

Specific Character.—*Leaves* linear-lanceolate (fig. 106, *c*), serrulate. *Pedicels* solitary, bearing two bracts above the middle. *Flowers* lateral, white.—*Bot. Mag.* vol. xiii. pl. 456 (*Diosma serratifolia*).

Habitat.—Cape of Good Hope.

[§ **Buchu Folia.** *Buchu Leaves.*

The dried leaves of the above species of Barosma. Imported from the Cape of Good Hope.]

General Characters and Varieties.—Commercial buchu consists of the leaves of one of the above described species of *Barosma*, often intermixed with the fruit, flowers, and portions of the stalks. The leaves generally of the different species are smooth, coriaceous, sharply or bluntly serrate or crenate, and beset both on the margins (especially between the teeth), and on the under surface, with glands filled with essential oil (fig. 106, *b*). Their colour is pale yellowish-green; their odour strong and rue-like; and their taste warm, mint-like, and camphoraceous. The shape and some of the other characters of the leaves will vary according to the species from which they have been derived:—thus, those from *B. betulina* (*obovate Buchu*), are about three-quarters of an inch long, obovate, with a recurved truncated apex, and sharp cartilaginous spreading teeth; those of *B. crenulata* (*ovate-oblong Buchu*) are about an inch long, ovate-oblong, obtuse, minutely crenate, five-ribbed; and those of *B. serratifolia* (*linear-lanceolate Buchu*) are from an inch to an inch and a half long, linear-lanceolate, tapering at each end, sharply and finely serrate, and three-ribbed.

Composition.—Buchu leaves owe their properties to a powerfully scented *volatile oil*, and a peculiar bitter principle called *barosmin* or *diosmin*. *Volatile Oil of Buchu.*—Yellowish-brown, lighter than water; odour that of the leaves. The experiments of Mr. Bedford in the United States indicate that the leaves of *B. betulina* yield most volatile oil. *Bitter extractive: Diosmin* or *Barosmin.*—Brownish-yellow, bitter, and somewhat pungent. Soluble in water; but insoluble in alcohol and ether.

Physiological Effects.—Buchu is an aromatic stimulant and tonic. Taken in moderate doses it promotes the appetite, relieves nausea and flatulence, and acts as a diuretic and diaphoretic. Its constitutional effects appear referable, first, to its action on the stomach; and secondly, to the absorption of the volatile oil, which is subsequently thrown out of the system by the secreting organs, on which it appears to act topically in its passage through them. Buchu seems to have a specific influence over the urinary organs.

Therapeutics.—In this country buchu has been principally employed *in chronic maladies of the urino-genital organs.* It appears to be principally adapted to chronic cases attended with copious secretion. *In chronic inflammation of the mucous membrane of the bladder*, attended with a copious discharge of mucus, it frequently checks the secretion and diminishes the irritable condition of the bladder, thereby enabling the patient to retain his urine for a longer period. *In irritable conditions of the urethra*, as spasmodic stricture, and *in gleet*, it has occasionally proved serviceable. In *lithiasis*, attended with increased secretion of uric acid, it has been given with considerable benefit, and has appeared to check the formation of this acid. For the most part it should be given in these cases in combination with alkalies, as solution of potash.

Administration.—The dose of buchu *in powder*, is from 20 to 30 grains. It is usually taken in wine. But the *infusion* and *tincture* are more eligible preparations.

[§ **Infusum Buchu.** *Infusion of Buchu.*

Take of

Buchu Leaves, bruised . . .	$\frac{1}{2}$ ounce.
Boiling Distilled Water . . .	10 fluid ounces.

Infuse in a covered vessel, for one hour, and strain.

Dose.—1 to 4 fluid ounces.]

Tonic, sudorific, and diuretic.

[§ **Tinctura Buchu.** *Tincture of Buchu.*

Take of

Buchu Leaves, in coarse powder . . .	$2\frac{1}{2}$ ounces.
Proof Spirit	1 pint.

Macerate the buchu for forty-eight hours, in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

Dose.—1 to 2 fluid drachms.]

GALIPEA CUSPARIA, *D.C.* Cusparia or Angustura Bark Tree.

Botanical Character.—A *tree* 20–80 feet high. *Leaves* trifoliate, about 2 feet long, fragrant; *petioles* 1 foot long, or nearly so; *leaflets* sessile, unequal, ovate-lanceolate, acute, dotted. *Flowers* racemose. *Calyx* and *corolla* white, with fascicles of hairs seated on glandular bodies on the outside. *Stamens* monadelphous (*Kunth.*), varying in number, 2 fertile; *anthers* with two short appendages. *Stigmas* 5, *Seed* solitary.—*Steph. and Church.* pl. 149 (*Bonplandia trifoliata*).

Habitat.—Tropical South America. The species called by Dr. Hancock *Galipea officinalis*, has been pronounced by the late Professor Don and Dr. F. J. Farre to be identical with this.

[§ **Cuspariæ Cortex.** *Cusparia Bark.*

The bark of Galipea Cusparia, *D.C.* From tropical South America.]

Commerce. — Cusparia bark is imported directly from South America, or indirectly by way of the West Indies.

General Characters.—Cusparia or angustura bark occurs in straight pieces, more or less incurved at the sides, so as in some cases to become quilled. The pieces are from half a line to a line in thickness, generally pared away at the edges; of various sizes, the longest being from six to ten inches, and covered with a brown, yellowish-grey, or greyish-white, spongy mottled epidermis, which is easily scraped off by the nail. The internal surface is brownish or yellowish-brown, not quite smooth, somewhat fibrous or splintery, easily separable into laminæ; the fracture is short and resinous; the odour strong but peculiar; the taste bitter and slightly aromatic. The cut surface examined with a lens usually exhibits numerous white points or minute lines; the freshly fractured surface, when treated with nitric acid, becomes simply deepened in colour, and does not assume a blood-red tint. (See *Substitution.*)

Substitution.—Serious accidents have occurred in consequence of the bark of the nux vomica tree having been substituted, either from ignorance or commercial cupidity, for this bark. Hence arose the distinction into *true* or *West India angustura*, and *false*, *spurious*, or *East India angustura.* This substitution has not, however, occurred recently, but as it is of such a serious nature, and some years since was noticed in Dublin, it may still be useful to tabulate the principal distinctive characters of the two barks, as follows:—

	Cusparia or Angustura Bark	Nux Vomica (False Angustura) Bark
Form . . .	Quills or flat pieces, straight or slightly bent.	Quills or flat pieces, short, often very much twisted like dried horn, arched backwards.
Epidermoid Crust	Whitish or yellowish, insipid, unchanged or rendered only slightly orange-red by nitric acid.	Variable: sometimes a spongy-rust-coloured layer; at other times with whitish, prominent spots, more or less scattered or approximated. Nitric acid makes it intensely dark green or blackish.
Inner Surface .	Separable into laminæ; deepened into a colour resembling that of venous blood, by the application of nitric acid.	Not separable into laminæ; rendered of an arterial blood-red colour by nitric acid.

Composition.—Cusparia bark appears to owe its medicinal properties to the conjoint action of a *volatile oil, bitter principle*, and *resin. Volatile Oil.*—Obtained by submitting the bark to distillation with water. It is yellowish-white, lighter than water, has the peculiar odour of the bark, and an acrid taste. To this, as well as to the resin, the bark owes its acrid and aromatic taste. *Angusturin* or *Cusparin; Peculiar bitter principle.*—A neutral principle obtained by Saladin in the form of tetrahedral crystals, by submitting the alcoholic tincture of the bark (prepared without heat) to spontaneous evaporation. It is insoluble in the volatile oils and in ether; but dissolves slightly in water, and more so in alcohol. Alkaline solutions also dissolve it. Nitric acid renders it greenish-yellow; sulphuric acid reddish-brown. Tincture of galls precipitates it from its aqueous and alcoholic solutions. *Resin.* — There are two resins, the hard and the soft. The *hard* resin is brown, bitter, soluble in potash, alcohol, and acetic ether; but insoluble in sulphuric ether and oil of turpentine. The *soft* resin is acrid, greenish-yellow, soluble in alcohol, ether, oil of turpentine, and almond oil; but insoluble in solution of potash. It is coloured red by nitric acid.

Physiological Effects.—A powerful aromatic or stimulant tonic. Its aromatic or stimulant properties depend on the volatile oil and resin; its tonic operation on the bitter principle. In its tonic and febrifuge powers it approximates to cinchona bark, but is devoid of astringency. It is less likely to irritate the stomach or to cause constipation than cinchona; but usually keeps the bowels gently open. In full doses it is capable of nauseating and purging. In its combination of tonic and aromatic properties it is most allied to cascarilla. In its stomachic qualities it approaches calumba root.

Therapeutics.—Cusparia bark may be administered as a febrifuge *in intermittents and remittents*, especially in the worst forms of the bilious remittents of tropical climates. *In adynamic continued fever*, especially when complicated with great disorder of the digestive organs (manifested by vomiting or purging), it has been used with good effect. As an aromatic tonic and stomachic, *in general relaxation and muscular debility*, and *in atonic conditions of the stomach and intestinal tube* (as some forms of dyspepsia and anorexia), it has been employed with great success. It has also been administered *to check profuse mucous discharges*, as in the latter stages and chronic forms of dysentery and diarrhœa, and in chronic bronchial affections attended with excessive secretion of mucus. In fine, cusparia bark is applicable to any of the purposes for which other vegetable tonics (especially cascarilla, calumba, and cinchona) are commonly employed.

Administration.— It may be given *in powder* in doses of from 10 to 40 grains. But the *infusion* is a more eligible mode of administration.

[§ **Infusum Cuspariæ.** *Infusion of Cusparia.*

Take of

Cusparia Bark, in coarse powder .	$\frac{1}{2}$ ounce.
Distilled Water, at 120° . . .	10 fluid ounces.

Infuse in a covered vessel, for two hours, and strain.

Dose.—1 to 2 fluid ounces.]

Tonic, stomachic, and stimulant. Used in low fever, bilious diarrhœas and dysenteries, muscular debility, dyspepsia, &c. Tincture of cinnamon is an agreeable addition to it.

ZYGOPHYLLACEÆ, *Lindl.* The Guaiacum Order.

GUAIACUM OFFICINALE, *Linn.* Guaiacum Tree.

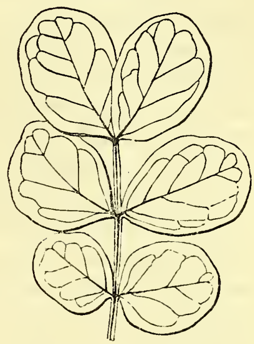
Botanical Character.—A large evergreen *tree* 30 to 40 feet high. *Stem* commonly crooked; *bark* furrowed; *wood* very hard, heavy, the fibres crossing each other diagonally. *Leaves* opposite, equally pinnate; *leaflets* (fig. 107) obovate or oval, obtuse. *Flowers* 6–10 in the axils of the upper leaves. *Peduncles* 1½ inch long, unifloral. *Calyx* 5-partite; *segments* oval. *Petals* 5, pale-blue, oblong. *Stamens* 10. *Style* and *stigma* single. *Fruit* capsular, somewhat stalked, 5-celled, 5-angled, or by abortion 2- or 3-celled. *Seeds* solitary in each cell, pendulous from the axis.—*Steph. and Church.* pl. 90.

Habitat.—West Indian islands, and on the warmer parts of the neighbouring continent.

[§ **Guaiaci Lignum.** *Guaiacum Wood.*

The wood of Guaiacum officinale, *Linn.* Imported from St. Domingo and Jamaica, and reduced by the turning lathe to the form of a coarse powder or small chips.]

Fig. 107.



Guaiacum Leaf.

General Characters. — 1. *Guaiacum Wood.* This is commonly termed *lignum vitæ.* It is imported in large logs or billets, and is extensively used for making pestles, rulers, skittle-balls, and various other articles of turnery ware. On examining the transverse sections of the logs or billets, hardly any traces of pith are observable, while the annual or concentric layers or zones are extremely indistinct. The wood is remarkable for the direction of its fibres, each layer of which crosses the preceding diagonally. The distinction between the young and old wood is remarkable. The young wood (*alburnum* or *sapwood*) is of a pale yellow colour; while the old wood (*duramen* or *heartwood*) which forms the principal part of the stem, is of a greenish-brown colour, in consequence of the deposition in it of guaiacum resin. 2. *Shavings*, *turnings*, or *raspings of guaiacum wood* are distinguished from the similar parts of other woods (1), by consisting of a mixture of yellowish and greenish-brown portions, or of yellowish ones, which become green by exposure to light; and (2), by nitric acid, which communicates to the greenish-brown portions a temporary bluish-green colour.

Composition.—The most important constituent of guaiacum wood is a peculiar resin (*guaiacum resin*), which is also official.

[§ **Guaiaci Resina.** *Guaiacum Resin.*

The resin of Guaiacum officinale, *Linn.* Obtained from the stem by natural exudation, by incisions, or by heat.]

Extraction.—It is obtained from the stem of the tree by the following methods:—1. *By natural exudation.*—Guaiacum resin exudes naturally from the stem, and may be seen on it at all seasons of the year. 2. *By incisions.*—If the tree be incised in different parts, a copious exudation takes place from the wounds, which hardens by exposure to the sun. This operation is performed in May. 3. *By heat.*—The third and ordinary method of obtaining guaiacum resin is as follows:—The trunk and larger limbs being sawn into billets of about three feet long, an auger hole is bored lengthwise in each, and one end of the billet so placed on a fire that a calabash may receive the melted resin which runs through the hole as the wood burns. 4. *By boiling.*—Guaiacum resin is also obtained in small quantities by boiling chips or sawings of the wood in water with common salt. The resin swims at the top and may be skimmed off. The salt is used to raise the boiling point of the water.

Commerce.—Imported from St. Domingo and Jamaica.

General Characters and Varieties.—Guaiacum resin occurs in tears and in masses. *Guaiacum in tears* is found in rounded or oval tears, of varying size, some being larger than a walnut. Externally the tears are covered by a greyish dust. *Lump guaiacum* is the ordinary kind met with in commerce. The masses are of considerable size, and are ordinarily mixed with pieces of bark, wood, and other impurities. They are of a brownish or greenish-brown colour, and have a brilliant shiny resinous fracture. Thin laminæ are nearly transparent, and have a yellowish-green colour. Their odour is balsamic, but very slight, though becoming more sensible by pulverisation and heat. When chewed, guaiacum resin softens under the teeth, but has scarcely any taste, though it leaves a burning sensation in the throat. Its specific gravity is 1·2289. A solution in rectified spirit produces a clear blue colour when applied to the inner surface of a paring of a raw potato.

Adulterations.—*Of the resin.*—Various adulterations are described as being practised on guaiacum resin, but they very rarely occur in this country. The ordinary adulteration is turpentine resin. This may be detected by the peculiar odour evolved when the suspected resin is heated. Another mode of detecting this fraud is to add water to an alcoholic solution of the suspected guaiacum resin, and to the milky liquid thus formed solution of potash is to be added until the liquor becomes clear. If now an excess of potash does not cause a precipitate, no resin is present; for while *guaiacate of potash* is soluble in water, the salt produced by the union of potash and resin is not completely so. *Of the wood.*—When it is suspected that the shavings of other woods are intermixed with guaiacum wood, Heraut recommends that the wood should be treated with a solution of chloride of lime. Guaiacum wood then assumes a green colour in a few seconds; other woods remain unchanged. (See also *Characters of Shavings.*)

Composition.—Guaiacum resin is remarkable for the changes of colour it undergoes by the influence of various agents. Thus its powder and paper moistened with its alcoholic solution, become *green* in air or oxygen gas, but not in carbonic acid gas; gluten, but not starch, gives a *blue* tint to guaiacum resin when in contact with air. Hence powdered guaiacum resin has been proposed as a test for the goodness of wheaten flour (which contains gluten), and of the purity of starch. Gum arabic, dissolved in cold water, has the same effect as gluten. Milk, and various fresh roots and underground stems (for example, those of the horseradish, potato, carrot, and colchicum) also possess this property. Nitric acid colours the alcoholic solution of guaiacum resin green, then blue, and afterwards brown. If a piece of paper moistened with this solution be exposed to the fumes of the acid, its colour is immediately changed to blue. Brande has conjectured, and I think with great probability, that these different coloured compounds are combinations of oxygen with guaiacum resin —the green compound containing the least, the brown the most, while the blue is intermediate. Pagenstecher has shown that an alcoholic solution of guaiacum resin with hydrocyanic acid and sulphate of copper produces an intense blue colour. According to Berzelius, that part only of the resin which is soluble in ammonia undergoes the changes of colour. Other inorganic agents which produce the colours are, ozone, chlorine, hyponitrous ether, chlorides of iron, mercury, copper, and gold, and the alkaline hypochlorites. Dr. Schmidt takes advantage of this latter reaction to detect guaiacum resin, when used for adulterating jalap or scammony. When hypochlorite of soda is added to a solution of the suspected resin, if guaiacum resin be present only in the proportion of $\frac{1}{320}$ part, the liquid, according to him, will assume a green colour. For the detection of this resin under ordinary circumstances, the following plan is recommended. Strips of very clean filtering-paper are soaked in a weak alcoholic solution of the resin, and immediately, while still moist, are introduced into a vessel half filled with solution of chlorine without touching it. The blue and white colours are produced. Guaiacum resin contains *resin of guaiacum*, *guaiacic acid*, and *extractive matter*. About 9 per cent. of it is soluble in water. *Resin of guaiacum* is insoluble in water, in benzin, and in the light coal naphthas, but is readily dissolved by alcohol, and is precipitated from its alcoholic solution by water, sulphuric and nitric acids, and chlorine. Ether dissolves the resin, but not so readily as alcohol. Solutions of the caustic alkalies (potash and soda) also dissolve it. The mineral acids precipitate it from its alkaline solution. Various salts (as acetate of baryta, acetate of lime, acetate of lead, nitrate of silver, and chloride of gold) occasion precipitates with the alkaline solution. Johnson says this resin consists of $\mathbf{C_{20}H_{23}O_5}$. According to Unverdorben the resin of guaiacum is of two kinds: one readily soluble in a solution of ammonia, and another which forms with ammonia a tarry compound. *Guaiacic Acid*, $\mathbf{HC_6H_7O_3}$ forms white shining needles, soluble in alcohol, ether, benzin, and the light coal naphthas, but sparingly soluble in water. It exists only in small quantities in guaiacum resin. Jahn regards it merely as benzoic acid. *Extractive.*—This is extracted from guaiacum resin by the agency of water. The quantity obtained is liable to variation. It is a brown acrid substance.

Physiological Effects.—1. *Of the resin.*—Guaiacum resin is an acrid stimulant. Under the use of *small* and *repeated doses* of guaiacum resin, various constitutional diseases sometimes gradually subside, and a healthy condition of system is brought about with no other sensible effect than perhaps the production of some dyspeptic symptoms, and a slight tendency to increased secretion. We designate this inexplicable, though not less certain influence over the system by the term *alterative*. When we give guaiacum resin in *moderately large doses*, or to plethoric easily excited individuals, we observe the combined operation of an acrid and stimulant. The local symptoms are, dryness of the mouth, sensation of heat at the stomach, nausea, loss of appetite, and a relaxed condition of bowels. The stimulant operation is observed partly in the vascular system, but principally in the exhaling and secreting organs, especially the skin and kidneys. If diluents be exhibited, and the skin kept warm, guaiacum resin acts as a powerful sudorific; whereas, when the surface is kept cool, perspiration is checked, and diuresis promoted. By continued use it has caused a mild salivation. The stimulant influence of guaiacum resin is extended to the pelvic vessels, and thus the hemorrhoidal and menstrual discharges are somewhat promoted by it. In *very large doses* guaiacum resin causes heat and burning in the throat and stomach, vomiting, purging, pyrexia, and headache. In its operation on the system, guaiacum resin is allied to the balsams and turpentines. 2. *Of the wood.*—The operation of the wood is similar to, though milder than, that of the resin. Its continued use occasions heartburn, flatulence, and costiveness.

Therapeutics.—In the employment of guaiacum resin its acrid and stimulant properties are to be remembered. The first unfits it for use in cases of impaired digestion, where there is irritation or great susceptibility of, or inflammatory tendency in, the alimentary canal; the second renders it improper in plethoric individuals, in all states of excitement or acute inflammation, and in persons whose vascular system is easily excited, and who are disposed to hemorrhages. It is admissible and useful, on the other hand, in atonic or chronic forms of disease, with retained secretions, especially in relaxed and phlegmatic constitutions. The following are some of the diseases in which it has been employed:—*In chronic rheumatism*, especially when occurring in scrofulous subjects or in persons affected with venereal disease, guaiacum resin may be administered with considerable advantage under the conditions before mentioned. In cases of great debility, with coldness of surface, and in old persons, the ammoniated tincture may be employed. *In chronic skin diseases*, where sudorifics and stimulants are indicated, guaiacum resin may be serviceable, especially in scrofulous and syphilitic subjects. *In obstructed and painful menstruation* not arising from any plethoric, inflammatory, or congested state of the system, the ammoniated tincture of guaiacum has been employed with advantage. *As a remedy for venereal diseases*, guaiacum wood was at one time in the greatest repute. Experience, however, has taught us the true value of this remedy, and we now know that it has no specific powers of curing or even of alleviating syphilis. It is applicable, as an alterative and sudorific, for the relief of secondary symptoms, especially venereal rheumatism and cutaneous eruptions, more particularly of scrofulous subjects. During its administration the patient should adhere to a sudorific regimen.

Administration.—The *powder* of guaiacum resin may be given in doses of from 10 to 30 grains. But the ammoniated tincture is the best form of administering guaiacum resin.

Pharmaceutical Uses.—*The wood* is used in the preparation of compound decoction of sarsaparilla; and *the resin* is a constituent of compound pill of subchloride of mercury.

[§ **Mistura Guaiaci.** *Guaiacum Mixture.*

Take of

Guaiacum Resin, in powder	of each . .	$\frac{1}{2}$ ounce.
Refined Sugar . .		
Gum Acacia, powdered		$\frac{1}{4}$ ounce.
Cinnamon Water		1 pint.

Triturate the guaiacum with the sugar and the gum, adding gradually the cinnamon water.

Dose.—$\frac{1}{2}$ to 2 fluid ounces.]

[§ **Tinctura Guaiaci Ammoniata.** *Ammoniated Tincture of Guaiacum.*

Take of

Guaiacum Resin, in powder . . .	4 ounces.
Aromatic Spirit of Ammonia . . .	a sufficiency.

Macerate the guaiacum in fifteen fluid ounces of the aromatic spirit of ammonia for seven days in a well-closed vessel, with occasional agitation, and filter, then add sufficient aromatic spirit of ammonia to make one pint.

Dose.—$\frac{1}{2}$ to 1 fluid drachm.]

A powerfully stimulating sudorific and emmenagogue.

VITACEÆ, *Lindley.* The Vine Order.

VITIS VINIFERA, *Linn.* The Grape Vine.

Botanical Character. — A hardy exceedingly variable *shrub*. *Branches* prostrate, climbing, or erect. *Leaves* (fig. 108) lobed, sinuate-dentate, smooth or downy; *tendrils* opposite to each petiole, solitary, spiral. *Flowers* in loose or crowded panicles. *Calyx* obscurely 5-toothed. *Petals* 5, cohering at the apex. *Stamens* 5. *Style* absent. *Fruit* (nuculanium) commonly known as grapes (fig. 108), baccate, red, greenish, or white, globose, ovate, or oblong, sweet, musky, or austere. *Seeds* variable innumber, or altogether wanting.—*Woodv.* pl. 195.

Fig. 108.

Vitis vinifera, in fruit.

Habitat.—Probably originally a native of Persia, but now cultivated extensively in the warmer parts of Europe.

[§ **Uvæ.** *Raisins.*

The ripe fruit of Vitis vinifera, *Linn.* Dried in the sun or with artificial heat; imported from Spain.]

Mode of Drying.—In Granada the finest kinds of raisins (viz. the *Muscatels* and the *Blooms*) are sun-dried; while the *Lexias* (so called from the liquor in which they are immersed) are first dipped in a mixture of water, ashes, and oil, and afterwards sun-dried. By this treatment the juice exudes and candies on the fruit. Dillon states that the sun-dried raisins have their stalk half cut through while the bunch remains on the vine. The raisins of Valentia are prepared by steeping them in boiling water, to which a lye of vine stems has been added. Some raisins are dried by the heat of an oven. Raisins are imported in casks, barrels, boxes, and jars.

General Characters, Varieties, and Commerce.—Raisins are more or less shrivelled in appearance, compressed, smooth, and free from sugary or saline incrustation, agreeably fragrant; pulp soft, very sweet. The varieties known in the market are distinguished partly from their place of growth, as *Valentias* and *Smyrnas*; partly from the variety of grape from which they are prepared, as *Sultanas*, *Blooms*, and *Muscatels*; and partly from the mode of curing them, as *Raisins of the Sun*. *Muscatels* are the finest. *Sultanas* are without seeds. *Corinthian Raisins* or *Currants* are obtained from a remarkably small variety of grape called the *Black Corinth*. They were formerly produced at Corinth (whence they received their name), but are now chiefly grown in Zante, Cephalonia, Patras, &c. At Zante they are gathered in August, disposed in couches on the ground to dry, cleaned, and laid up in magazines, where they eventually adhere so firmly as to necessitate digging out. They require eight, ten, or fourteen days for drying. For exportation they are trodden in barrels. The raisins imported from Spain are *alone official*.

Composition.—The more important constituents of both grapes and raisins are *grape sugar*, $C_{12}H_{28}O_{14}$, and *acid tartrate of potash*.

Physiological Effects and Uses.—*Fresh grapes* when ripe, are wholesome, nutritious, refrigerant, and, when taken freely, diuretic and laxative. The skin and seeds are indigestible, and should be rejected. Grapes are not official. *Raisins* are somewhat more nutritive, and less refrigerant; for they abound more in sugar, and contain less acid, than the fresh grape; but, if eaten too freely, they are apt to disorder the digestive organs, and cause flatulence. They possess demulcent and emollient qualities. Both grapes and raisins are employed at the table as a dessert. They are apt to disagree with dyspeptics and children. Raisins are also used in various articles of pastry. Considered medicinally, *fresh grapes* prove valuable in febrile and inflammatory complaints; they allay thirst, and diminish febrile heat; they have been found serviceable in dysentery and in phthisical complaints. Raisins are employed in medicine only as flavouring agents.

Pharmaceutical Uses.—Raisins are contained in compound tincture of cardamoms, and tincture of senna.

[§ **Acidum Tartaricum.** *Tartaric Acid.*

$2HO,C_8H_4O_{10}$ or $\mathbf{H_2C_4H_4O_6}$.

A crystalline acid, prepared from the acid tartrate of potash.]

Natural History.—Tartaric acid is peculiar to the vegetable kingdom. In the *free* state it exists in tamarind pulp, grapes, and mulberries. It is also found native in combination with bases: thus, *acid tartrate of potash* exists in tamarind pulp and grapes. It is abundantly contained in Argol, or the crude tartar which is deposited during fermentation from the juice of the grape. The purified Argol, or acid tartrate of potash, is the principal source of this acid.

Preparation.—[§ It may be obtained by the following process :—

Take of

Acid Tartrate of Potash	45 ounces.
Distilled Water	a sufficiency.
Prepared Chalk	$12\frac{1}{2}$ ounces.
Chloride of Calcium	$13\frac{1}{2}$ ounces.
Sulphuric Acid	13 fluid ounces.

Boil the acid tartrate of potash with two gallons of the water, and add gradually the chalk, constantly stirring. When the effervescence has ceased, add the chloride of calcium dissolved in two pints of the water. When the tartrate of lime has subsided, pour off the liquid, and wash the tartrate with distilled water until it is rendered tasteless. Pour the sulphuric acid first diluted with three pints of the water on the tartrate of lime, mix thoroughly, boil for half an hour with repeated stirring, and filter through calico. Evaporate the filtrate at a gentle heat until it acquires the specific gravity of 1·21, allow it to cool, and then separate and reject the crystals of sulphate of lime which have formed. Again evaporate the clear liquor till a film forms on its surface, and allow it to cool and crystallise. Lastly, purify the crystals by solution, filtration (if necessary), and recrystallisation.]

The following is the *theory* of the process for making tartaric acid :—By the mutual action of acid tartrate of potash and prepared chalk (carbonate of lime), we obtain neutral tartrate of potash in solution, and tartrate of lime precipitated, while carbonic acid escapes.

$$2KHC_4H_4O_6 + CaCO_3 = CaC_4H_4O_6 + K_2C_4H_4O_6 + H_2O + CO_2.$$

When to the solution of neutral tartrate of potash we add chloride of calcium, double decomposition ensues ; tartrate of lime is precipitated, and chloride of potassium remains in solution.

$$K_2C_4H_4O_6 + CaCl_2 = CaC_4H_4O_6 + 2KCl.$$

The tartrate of lime obtained in the above two operations is then decomposed by sulphuric acid, which forms the almost insoluble sulphate of lime, and sets tartaric acid free.

$$2CaC_4H_4O_6 + 2H_2SO_4 = 2CaSO_4 + 2H_2C_4H_4O_6.$$

[§ *Characters and Tests.*—In colourless crystals the primary form of which is the oblique rhombic prism. It has a strongly acid taste, and is readily soluble in water and in rectified spirit. When to either solution, not too much diluted, a little acetate of potash is added, a white crystalline precipitate is formed. Seventy-five grains of crystallised tartaric acid dissolved in water require for neutralisation 1,000 grain-measures of the volumetric solution of soda. An aqueous solution of the acid is not affected by sulphuretted hydrogen, and gives no precipitate with the solution of sulphate of lime or of oxalate of ammonia. It leaves no residue, or only a mere trace, when burned with free access of air. Fifteen parts of cold water dissolve ten parts of crystallised tartaric acid: boiling water takes twice its own weight of the acid. Heated with either nitric acid or potash it yields oxalic acid. By the action of sulphuric acid on it, acetic acid is formed. When heated with sulphuric acid it is strongly blackened. A solution of tartaric acid is very sour, and causes, with solutions of caustic lime, baryta, and strontia, white precipitates, soluble in excess of acid. Hydrochlorate of ammonia dissolves the precipitate (*tartrate of lime*) produced by lime water. With acetate of lead the solution of tartaric acid also forms a white precipitate (*tartrate of lead*), soluble in excess of nitric acid.]

Therapeutics.—Tartaric acid may be used as a cheap substitute for citric acid or lemon juice, in the formation of acidulous refrigerant drinks, for febrile and inflammatory disorders. It is, however, rarely employed for this purpose. Its common medicinal use is in the preparation of effervescing compounds, with the alkaline carbonates, especially with bicarbonate of soda. The following are the relative proportions of tartaric acid and alkaline carbonates for preparing effervescing draughts:—

Twenty grains of the Crystals of Tartaric Acid are saturated by:—

Crystallised Bicarbonate of Potash . .	27 grains.
Carbonate of Ammonia	$15\frac{1}{2}$ grains.
Bicarbonate of Soda	22 grains.

The most commonly used effervescing tartrate is that made with bicarbonate of soda.

Pharmaceutical Use.—It is employed in the preparation of effervescent citro-tartrate of soda.

GUTTIFERÆ, *Jussieu.* The Gamboge Order.

GARCINIA, *Linn.*

Generic Character.—*Trees* with entire leaves. *Flowers* unisexual, polygamous or diœcious. *Sepals* 4, persistent. *Petals* 4. *Stamens* numerous, more or less united; *anthers* ovate, dehiscing longitudinally or in a circumscissile manner. *Fruit* succulent, 4–10-celled; *cells* 1-seeded.

GARCINIA MORELLA, *Desrous, var.* PEDICELLATA. The Gamboge Plant.

Specific Character.—A moderate-sized *tree.* *Leaves* obovate, elliptical, somewhat acute. *Flowers* diœcious. *Male flowers* clustered in the axils of leaves, on short single-flowered peduncles. *Sepals* yellowish-white externally; yellow within. *Petals* yellowish-white, red near the base on the inside. *Fruit* baccate, about the size of a cherry, round, reddish-brown, firm, with a sweet pulp.

Habitat.—Siam. It has been transported to Singapore, where it is now cultivated.

[§ **Cambogia.** *Gamboge.*

A gum-resin obtained from Garcinia Morella, *Desrous*, *var.* pedicellata. Imported from Siam.]

Botanical Source.—The botanical source of this gum-resin has only been determined within the last few years by Hanbury, from the examination of specimens of trees cultivated in Singapore.

Preparation.—The only account which we possess of the method of obtaining Siam gamboge is that given to König by a Roman Catholic priest residing in Cochin-China. According to this statement, when the leaves or twigs are broken, a yellow milky juice issues, which is received either on the leaves of the tree or in cocoa-nut shells, and from thence is transferred into large flat earthen vessels, where it is allowed to harden during the summer season, and is afterwards enveloped with leaves. The cylindrical or pipe variety receives its form by being run into the joints of the bamboo while it is in the liquid state.

Commerce.—It is brought to this country sometimes direct from Siam; at other times indirectly by way of Singapore, Penang, or Canton. It is rarely imported in the bamboo cylinders in which it has been prepared.

General Characters and Varieties.—Gamboge is found in commerce in two forms:—1st, *In cylindrical pieces*, termed *pipe* or *roll gamboge*; 2nd, *In cakes* or *amorphous masses.* The former is commonly the best kind, and that described in the Pharmacopœia. 1. *Pipe gamboge* consists of cylindrical pieces, solid or more or less hollow, and varying from one to three inches in diameter. Some of the pieces appear to have been formed by rolling; but many of them are striated, from the impression of the bamboo stems into the hollow of which the gamboge juice has been poured, and not unfrequently portions of the stems are still adherent. The gamboge cylinders are sometimes distinct, and covered externally with a dirty greenish-yellow dust; at others agglutinated, or even folded, so as to form masses of varying sizes and forms. Pipe gamboge occurs in all qualities—the finest and the worst specimens having this form. *Fine gamboge* is brittle and odourless: it has very little taste at first, but after some time it causes a sensation of acridity in the throat. Its fracture is conchoidal; its fractured surface is smooth, opaque, reddish-yellow, and glistening; its powder is of a bright yellow colour. It is completely dissolved by the successive action of ether and water. Mixed with a sufficient quantity of water, it forms a yellow emulsion. An emulsion made with boiling water and cooled, does not become green with the solution of iodine. *Inferior qualities* of pipe gamboge are harder, more earthy in fracture; the fractured surface is brownish- or greyish-yellow, and frequently marked with black spots, from the presence of foreign bodies which are intermixed. It is not completely dissolved by the successive action of ether and water. Solution of iodine readily detects starch in the cooled decoction, by the green colour which it gives rise to. 2. *Lump* or *cake gamboge* occurs in masses of several pounds weight. Its quality is inferior to the finest pipe kind. Internally we generally find fragments of wood, twigs, and air-cells. In most of its characters it agrees with the inferior qualities of pipe gamboge, and like these, usually contains starch.

Composition and Chemical Characters.—The principal constituent of gamboge is a *resin*, termed *gambogic acid.* It also contains *soluble gum.* The best gamboge yields from about 70 to 75 per cent. of resin, and from about 20 to 25 per cent. of soluble gum. *Gambogic Acid; Resin.*—Obtained by evaporating to dryness the ethereal tincture of the pure gum-resin. It is brittle, in thin layers of a deep orange colour, in thicker masses of a cherry-red tint. It is insoluble in water, but soluble in alcohol, and still more so in ether. It communicates an appreciable yellowness to 10,000 times its weight of spirit. It is soluble in the caustic alkalies, forming dark red solutions (*alkaline gambogiates*), which yield, with acids, a yellow precipitate (*gambogic acid*); with acetate of lead, a yellow (*gambogiate of lead*); with the salts of iron, a dark brown (*gambogiate of iron*); and with sulphate of copper, a brown precipitate (*gambogiate of copper*). In doses of five grains, gambogic acid has occasioned profuse watery discharges, without pain or other uneasiness. If the activity of gamboge depended solely on the resin, five, or five and a half grains of the resin should be equal to seven grains of gamboge; but, according to Sir R. Christison, this is not the case. Hence, either it is not the sole active ingredient, or it becomes somewhat altered in the process for procuring it; the latter supposition is the more probable. *Soluble gum* (*Arabin*?).—The gum of gamboge is soluble in cold water, like gum arabic. Gamboge emulsion becomes transparent and deep red on the addition of potash, forming *gambogiate of potash.* Digested in alcohol or ether, gamboge yields orange-red tinctures (*solutions of gambogic acid*). The detection of gamboge in pills has become, on some occasions, an important object of medico-legal research. Spurious compound extract of colocynth, and the compound pill of colocynth of the pharmacies, sometimes contain gamboge. The mode of detection, in all these cases, is simple:— Digest one portion of the suspected substance in alcohol, and another in ether. Then subject the alcoholic and ethereal tinctures to the tests above mentioned.

Physiological Effects.—Taken in *small doses*, gamboge promotes the secretions of the alimentary canal and of the kidneys, and causes more frequent and liquid stools than natural. In *larger doses* it occasions nausea, oftentimes vomiting, griping pains of the bowels, watery stools, and increased discharge of urine. When the action is very violent, there is great depression of the vascular system. In *excessive doses* it acts as an acrid poison. Sixty grains caused frightful vomiting and purging, followed by syncope and death. The deaths which have occurred from the use of enormous quantities of Morison's pills are mainly attributable to the gamboge which they contain. In these cases the symptoms were, violent vomiting and purging, abdominal pain and tenderness, cold extremities, and sinking pulse. On *post-mortem* examination, inflammation, ulceration, and mortification of the intestines, were found. Gamboge belongs to the active hydragogues and drastic purgatives. In activity it is inferior to elaterium and croton oil. In acridity it exceeds jalap, scammony, and even colocynth. It is exceedingly apt to irritate the stomach, and to occasion nausea and vomiting. This arises from its ready solubility in the gastric juices. As this action on the stomach is exceedingly objectionable, we sometimes endeavour to lessen it by giving the medicine in the form of a pill.

Therapeutics. — From the foregoing account of the effects of gamboge it is very evident that it is a remedy well adapted for acting as a stimulus to the abdominal and pelvic viscera, either to rouse them when in a torpid state, or to give them preternatural activity, and thereby to relieve some distant organ, on the principle of counter-irritation. On the other hand, the use of gamboge is highly objectionable when there is an irritable or inflammatory condition of the stomach or bowels, a tendency to abortion, or to uterine hemorrhage, and also when we do not want to promote or increase the hemorrhoidal discharge. The following are some of the cases in which we employ it :—*In constipation* where an active cathartic of small bulk is required. It is, however, not given alone, as the necessary dose would be very apt to create nausea and vomiting. It is, therefore, usually conjoined with other and milder purgatives, the operation of which it increases and quickens, while they, by diminishing its solubility in the juices of the stomach, lessen its tendency to create nausea or vomiting. The compound pill of gamboge may be referred to as a preparation in which these objects have been kept in view. *In cerebral affections*, as apoplexy, or a tendency thereto, gamboge, usually associated with other purgatives, as above stated, is a highly valuable counter-irritant purgative. By stimulating and rousing the nerves, bloodvessels, and secretory apparatus of the abdomen, it is often calculated to relieve determinations of blood to other parts. *In dropsies* gamboge has been successfully employed, on account of its hydragogue operation, where the use of drastic purgatives is indicated. It is usually given in combination with other and milder remedies of the same class, as jalap and the acid tartrate of potash. If it be desirable to act also on the kidneys, an alkaline solution of gamboge has been recommended. *As an anthelmintic.*—Gamboge has been frequently employed as a remedy for tape-worm, and not unfrequently with considerable success. Several empirical anthelmintic remedies are said to owe their efficacy to this substance. It is an important constituent of Madame Nouffer's *specific.*

Administration.—On account of its tendency to occasion vomiting and griping, gamboge is usually given in *small doses*, as from one to three or four grains, in the form of pill, and repeated every four or six hours. In this way it may be given with safety and without inconvenience. The full dose of it is from ten to fifteen grains.

Antidote.—In poisoning by gamboge our chief reliance must be placed on the palliatives already mentioned for poisoning by elaterium. I am acquainted with no well ascertained antidote, though the alkalies (carbonate of potash, according to Hahnemann) have been said to diminish the violence of the topical action of gamboge.

[§ **Pilula Cambogiæ Composita.** *Compound Pill of Gamboge.*

Take of

Gamboge, in powder . . . } of each . .	1 ounce.
Barbadoes Aloes, in powder . }	
Compound Powder of Cinnamon }	
Hard Soap, in powder	2 ounces.
Syrup	a sufficiency.

Mix the powders together, add the syrup, and beat the whole into a uniform mass.

Dose.—5 to 10 grains.]

Cathartic. Employed in obstinate constipation.

CANELLACEÆ, *Lindley*. The Canella Order.

CANELLA ALBA, *Murray*. The Canella or Wild Cinnamon.

Botanical Character.—A *tree*, growing from 10 to 50 feet high. *Leaves* alternate, shining, obovate, cuneate at the base, coriaceous and opaque when old, dotted when young. *Flowers* small, clustered, purple. *Sepals* 5. *Petals* 5; somewhat coriaceous, glaucous-blue, contorted in æstivation. *Stamens* united to form a tube; *anthers* 15, resembling furrows. *Stigmas* 3. *Fruit* baccate, 3-celled, or by abortion 1-celled, about the size of a pea, smooth, blue or black; *cells* 1- or 2-seeded.

Habitat.—West Indies.

[§ **Canellæ Albæ Cortex.** *Canella Alba Bark.*

The bark of Canella alba, *Murray*. From the West Indies.]

General Characters.—The canella alba bark of commerce is the inner bark of the stem and branches. It occurs in quills or broken pieces; these are hard, somewhat twisted, of a yellowish-white or pale orange colour, somewhat lighter on the internal surface, and have an aromatic clove-like odour, an acrid peppery taste, and a white granular fracture. It has been confounded with *Winter's bark* derived from *Drimys Winteri*, a plant of the natural order Magnoliaceæ; and hence denominated *spurious Winter's bark.* The pale colour of its inner surface is one out of several physical characters by which the two barks may be distinguished. Chemically they may be known by the action of nitrate of baryta and sulphate of iron, both of which cause precipitates in the infusion of Winter's bark, but not in that of canella alba. The Winter's bark of commerce is now, however, commonly derived from *Cinnamodendron corticosum.*

Composition. — The principal constituents are *volatile oil*, *resin*, *bitter extractive*, and *canellin* (*mannite?*)

Physiological Effects and Uses.—Canella alba bark is an aromatic stimulant and tonic. Its aromatic qualities depend on the oil and resin; its tonic properties on its bitter principle. As an aromatic it ranks between cinnamon and cloves. In this country it is employed principally as an aromatic addition to purgatives and tonics, as in *Vinum Rhei*, and is well adapted for debilitated conditions of the digestive organs. The *Pulvis Aloës cum Canella* of former Pharmacopœias was, and still is, a very favourite popular remedy, under the name of *Hiera Picra.* By the Caribs (the ancient natives of the Antilles) and the negroes of the West Indies, it is employed as a condiment. It has been considered useful in scurvy.

Administration.—*Dose* of the powder, 10 to 30 grains.

Pharmaceutical Use.—It is an ingredient in wine of rhubarb.

AURANTIACEÆ, *Corréa.* The Orange Order.

CITRUS.

Generic Character.—*Trees* or *shrubs*, with axillary spines. *Leaves* reduced to one terminal leaflet, which is jointed with the petiole;

petiole often winged. *Flowers* usually with a quinary distribution of parts. *Calyx* urceolate, 3–5-cleft. *Petals* 4 to 8. *Stamens* 20 to 60; *filaments* compressed, more or less united at the base, polyadelphous; *anthers* oblong. *Style* round; *stigma* hemispherical. *Fruit* called an *hesperidium*, 7–12-celled; *cells* many-seeded, pulpy. *Seeds* exalbuminous.

CITRUS BERGAMIA, *Risso*. The Bergamot.

Specific Character.—*Leaves* oblong, more or less elongated, acute or obtuse, lower surface somewhat paler. *Petiole* more or less winged or margined. *Flowers* usually small, white. *Fruit* pale yellow, pyriform or depressed; *rind* with concave receptacles of oil; *pulp* more or less acid.

Habitat.—Cultivated in the south of Europe.

Oleum Bergamotæ. *Oil of Bergamot.*

A volatile oil obtained from the rind of the fruit of Citrus Bergamia, *Risso.* Imported from the south of Europe.

(*Not official.*)

General Characters and Composition.—The *volatile oil* or *essence of bergamot* may be obtained either by expression or by distillation. It is pale greenish-yellow, with a remarkable odour, and a specific gravity of 0·885. Its composition is identical with that of oil of lemons, being $C_{10}H_{16}$.

Uses.—Oil of bergamot is employed as a perfume only. It is a useful odoriferous adjunct to ointments.

CITRUS LIMONUM, *D.C.* The Lemon.

Specific Character.—A *shrub* from 10 to 15 feet high, much branched; the *young branches* flexible. *Leaves* oval or oblong, serrulate (fig. 109) or somewhat dentate; *petiole* simply margined. *Flowers* white, tinged with red. *Fruit* yellow, ovoid (fig. 109), with a more or less nipple-shaped knob at the apex; *rind* with numerous convex receptacles of oil; *pulp* very acid. — *Steph. and Church.* pl. 92 (*Citrus Medica*).

Fig. 109.

Citrus Limonum.

Habitat.—A native of Asia (Himalaya, *Royle*; Persia, *Risso*). Cultivated in the south of Europe.

[§ **Limonis Cortex.** *Lemon Peel.*

The outer part of the rind of the fresh fruit of Citrus Limonum, *D.C.* Lemons are imported from southern Europe.]

Commerce.—Lemons are imported from Spain, Portugal, Italy, and the Azores. The Spanish lemons are most esteemed. The words of the Pharmacopœia *imported from southern Europe* refer to the fruit not to the rind or peel, which should be dried in this country.

General Characters.—The fresh outer yellow portion of the rind (*flavedo*) is alone official. It is pale yellow and rough. By drying its colour deepens. Its taste is aromatic and bitter, and its odour, which is owing to the volatile oil lodged in proper receptacles, strong, peculiar, and fragrant. The inner portion of the rind is white, spongy, and almost odourless and tasteless. The flavedo yields, both by distillation and expression, a volatile oil (see *Oleum Limonis*). A watery infusion of lemon peel becomes greenish-brown on the addition of perchloride of iron.

Composition.—Lemon peel has not been regularly analysed, though some of its constituents have been examined. It contains *volatile oil*, a *bitter principle*, *gallic acid*, and a neutral crystalline tasteless principle called *hesperidin.*

Physiological Effects and Uses.—Lemon peel is a grateful stomachic and aromatic. It is also employed as a flavouring agent. Candied lemon-peel is an agreeable stomachic and is employed as a dessert and in confectionery.

Pharmaceutical Uses.—Lemon peel is an ingredient in syrup of lemons, compound infusion of orange peel, and compound infusion of gentian.

[§ **Tinctura Limonis.** *Tincture of Lemon Peel.*

Take of

Fresh Lemon Peel, sliced thin . .	$2\frac{1}{2}$ ounces.
Proof Spirit	1 pint.

Macerate for seven days in a closed vessel, with occasional agitation; strain, press, and filter; then add sufficient proof spirit to make one pint.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

This tincture forms an agreeable addition to tonic and other medicines.

[§ **Oleum Limonis.** *Oil of Lemon.*

The oil expressed or distilled from fresh lemon peel. Imported chiefly from Sicily.]

Commerce.—The greater part of the oil of commerce is brought from Italy and Portugal; but some is procured from France.

Extraction, General Characters, and Composition.—This oil is usually procured by expression, as follows:—The flavedo of the lemons is removed by rasping, and is afterwards pressed in hair sacks. The oil which is thus procured is received in flasks, where it deposits some of its impurities, and is then decanted and filtered. Baumé says the rasped flavedo is pressed between glass plates. Expressed oil of lemon is somewhat turbid, and liable to undergo change by keeping, owing to the mucilaginous matter which it contains in solution. Oil of lemon may be procured also by distillation; and the oil thus procured is pure, and not disposed to undergo change by keeping, but its flavour is less pleasant and sweet. When quite pure it is colourless or pale yellow, limpid, of a fragrant odour, like that of lemons, and with a warm bitter taste. Its specific gravity at 70° F. is 0·847. It is soluble in all proportions in anhydrous alcohol, but less soluble in rectified spirit, and it boils at about 240° F. The composition of oil of lemon is $C_{10}H_{16}$—that is, it is isomeric with the oils of turpentine, savin, juniper, and copaiva. Like most other volatile oils it is composed of two isomeric oils.

Physiological Effects and Uses.—Oil of lemon has the stimulant properties of the milder volatile oils, and possesses carminative and diaphoretic properties. In full doses it is said to be apt to occasion headache and giddiness. Its principal use is for communicating an agreeable odour and flavour to other medicines. It may be taken as a carminative, in the dose of a few drops, on sugar. As a perfume it is an exceedingly useful adjunct to sulphur ointment, and to evaporating lotions. To this, as to some other volatile oils, has been ascribed the power of promoting the growth of the hair, and, in consequence, it has been added to pomatum. More recently it has been employed as a stimulant application in various external inflammations of the eye.

[§ **Limonis Succus.** *Lemon Juice.*

The freshly expressed juice of the ripe fruit of Citrus Limonum, *D.C.*]

Commerce.—Lemon juice is imported in enormous quantities for citric acid manufacturers. (See *Acidum Citricum.*)

General Characters.—A slight turbid yellowish liquid, obtained from lemons by expression and straining, and possessing a sharp acid taste, and grateful odour. Owing to the mucilage and extractive which it contains, it readily undergoes decomposition, though various methods have been proposed of preserving it.

Adulteration.—A large quantity of the so-called lemon juice, which is supplied to ships going on long voyages, is said to be manufactured in this country from tartaric, sulphuric, and other acids, and afterwards flavoured with oil of lemon.

Composition.—According to Proust, lemon juice consists of *citric acid*, 1·77; *malic acid, gum, bitter extractive*, 0·72; and *water*, 97·51. *Lime juice* contains the same ingredients, in somewhat different proportions; the quantity of citric acid in it is larger, while that of gum, &c., is less. *Citric Acid* (see *Acidum Citricum*, p. 911).

Physiological Effects and Uses.—Lemon juice furnishes a most agreeable and refreshing beverage, and proves refrigerant and antiscorbutic. It is employed for several purposes, as follows :—*In the preparation of refrigerant drinks.*—It may be either added to barley-water, or mixed with sugar and water to form *lemonade*. The latter may be extemporaneously made, by adding two lemons sliced, and two ounces of sugar, to two pints of boiling water, and digesting until cold. These acidulated drinks are exceedingly useful for allaying thirst, and as refrigerants in febrile and inflammatory complaints, and in hemorrhages. In the latter maladies *iced lemonade* should be preferred. Where there is nausea or a tendency to sickness, *effervescing lemonade* is useful. *In the formation of the effervescing draught.*—The effervescing draught, made with lemon juice (or citric acid) and bicarbonate of potash, is one of the best remedies we possess for allaying sickness and vomiting. The citrate of potash, which is formed, is a mild diaphoretic and diuretic, and often allays restlessness and watchfulness in fever. It is adapted for lithic acid deposits; but, like other remedies of the same class, is sometimes objectionable in phosphatic deposits. When our object is to determine to the skin, an effervescing draught, composed of lemon juice or citric acid and carbonate of ammonia, is to be preferred. The relative proportions of the alkaline carbonates, and of lemon juice, and citric acid, for the formation of effervescing draughts, is as follows :—

Citric Acid		Lemon Juice	Grs. 20 of the Alkali
Grs. 14	or	fl. drs. iiiss .	Bicarbonate of Potash.
Grs. 24	or	fl. drs. vj .	Carbonate of Ammonia.

Effervescing draughts are exceedingly valuable vehicles for the exhibition of other remedies. *As an Antiscorbutic.*—Lemon juice has long been regarded as an invaluable antiscorbutic; but on account of the difficulty of preserving it, crystallised citric acid is usually substituted; though certainly much less, and in Dr. Garrod's opinion, not at all efficacious. *As an Antidote.*—In poisoning by the alkalies and their carbonates, the vegetable acids are the antidotes; and the most convenient, easily procurable acidulous substances are, in general, vinegar and lemon juice. *As an Anti-narcotic.*—In poisoning by narcotic substances, as opium, lemon juice may be administered, after the poison has been removed from the stomach, to counteract the effects. *In Rheumatism.*—Lemon juice has been recommended as a remedy in acute rheumatism and gout by Dr. Owen Rees, and has been used with success by many practitioners, not only in this country, but in Italy, France, and America.

[§ **Syrupus Limonis.** *Syrup of Lemons.*

Take of

Fresh Lemon Peel	2 ounces.
Lemon Juice, strained	1 pint.
Refined Sugar	$2\frac{1}{4}$ pounds.

Heat the lemon juice to the boiling point, and, having put it into a covered vessel with the lemon peel, let them stand until they are cold, then filter and dissolve the sugar in the filtered liquid with a gentle heat. The product should weigh three pounds and a half, and should have the specific gravity 1·34.

Dose.—1 fluid drachm.]

Refrigerant and somewhat stomachic. An agreeable adjunct to diluent drinks, as barley water, in febrile and inflammatory complaints, and to gargles.

[§ **Acidum Citricum.** *Citric Acid.*

$$3HO,C_{12}H_5O_{11} + 2HO \text{ or } \mathbf{H_3C_6H_5O_7.H_2O}.$$

A crystalline acid prepared from lemon juice, or from the juice of the fruit of Citrus Limetta, *Risso*, the Lime.]

Commerce.—The juice of lemons and limes is imported in enormous quantities for citric acid manufacturers.

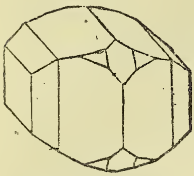
Preparation.—[§ It may be obtained by the following process :—

Take of

Lemon-juice	4 pints.
Prepared Chalk	$4\frac{1}{2}$ ounces.
Sulphuric Acid	$2\frac{1}{2}$ fluid ounces.
Distilled Water	a sufficiency.

Heat the lemon juice to its boiling point and add the chalk by degrees till there is no more effervescence. Collect the deposit on a calico filter, and wash it with hot water till the filtered liquor passes from it colourless. Mix the deposit with a pint of distilled water, and gradually add the sulphuric acid previously diluted with a pint and a half of distilled water. Boil gently for half an hour, keeping the mixture constantly stirred. Separate the acid solution by filtration, wash the insoluble matter with a little distilled water, and add the washings to the solution. Concentrate this solution to the density of 1·21, then allow it to cool, and after twenty-four hours decant the liquor from the crystals of sulphate of lime which will have formed; further concentrate the liquor until a film forms on its surface, and set it aside to cool and crystallise. Purify the crystals if necessary by recrystallisation.

Fig. 110.



Crystal of Citric Acid.

Characters and Tests.—In colourless crystals (fig. 110), of which the right rhombic prism is the primary form; very soluble in water, less soluble in rectified spirit, and insoluble in pure ether. The crystals dissolve in three-fourths of their weight of cold, and in half their weight of boiling water. The diluted aqueous solution has an agreeable acid taste. When the solution is made by dissolving thirty-four grains of the acid in one ounce of water, it resembles lemon-juice in strength and in the nature of its acid properties, and, like lemon-juice, it undergoes decomposition and becomes mouldy by keeping. The aqueous solution is not darkened by sulphuretted hydrogen, gives no precipitate when added in excess to solution of acetate of potash, or of chloride of barium, and if sparingly added to cold lime-water it does not render it turbid. The crystals leave no ash when burned with free access of air. Seventy grains of the acid dissolved in distilled water are neutralised by 1,000 grain-measures of the volumetric solution of soda.]

Composition.—Citric acid is a tribasic acid: that is, it combines with three atoms of base or metal, the latter replacing three atoms of hydrogen from a molecule of the acid.

Adulteration.—Powdered citric acid is sometimes adulterated with powdered tartaric acid. The fraud may be readily detected by dissolving the suspected acid in a small quantity of water, and adding cautiously to it a solution of carbonate of potash, taking care that the acid be in excess. If any tartaric acid be present, a white crystalline precipitate (*acid tartrate of potash*) is formed.

Physiological Effects.—Orfila ranks citric acid among the irritant poisons; but Christison and Coindet gave 60 grains of it to cats without observing that the animals suffered any inconvenience therefrom. I am not acquainted with the effects of large doses of this acid on man. Small quantities of it, dissolved in water, form an agreeable beverage, which allays thirst, diminishes preternatural heat, checks profuse sweating, and promotes the secretion of urine. Vogt considers it to act more powerfully on the skin, and less so on the alimentary canal and urinary organs, than tartaric acid. In its action on the skin it agrees with acetic acid. The continued employment of it, as well as of other acids, disturbs the functions of the digestive organs.

Therapeutics.—Citric acid is employed in medicine, as a substitute for lemon juice in the preparation of refrigerant drinks and effervescing draughts; and as an anti-scorbutic, anti-narcotic, and anti-alkaline (see *Limonis Succus*, p. 909).

Artificial Lemon Juice.—This is prepared by dissolving 680 grains of citric acid in a pint of water, and flavouring with a few drops of essence of lemon. This is less apt to undergo decomposition than the natural juice, for which the artificial juice may be substituted in the preparation of cooling beverages.

Effervescing Citrates.—Citric acid, with the alkaline carbonates, is frequently employed in the preparation of effervescing draughts. The following are the relative proportions of acid and base required to form a neutral compound. Twenty grains of Crystals of Citric Acid are saturated by about:—

Crystallised Bicarbonate of Potash . .	29 grains.
Carbonate of Ammonia	17 grains.
Bicarbonate of Soda	24 grains.

The most agreeable effervescing citrate is that prepared with bicarbonate of potash, flavoured with tincture of orange-peel and syrup. Bicarbonate of soda is rarely employed with citric acid.

Pharmaceutical Uses.—Citric acid is a constituent of wine of quinia, solution of citrate of ammonia, and solution of citrate of bismuth and ammonia; and is also used in the preparation of citrate of iron and ammonia, citrate of iron and quinia, citrate of lithia, citrate of potash, and effervescent citro-tartrate of soda. It is also contained in a free state in lemon juice, and syrup of lemon.

CITRUS AURANTIUM, *Risso.* **The Common or Sweet Orange.**

Specific Character.—*Leaves* (fig. 111) ovate-oblong, acute, sometimes slightly toothed; *petiole* more or less dilated and winged. *Flowers* white, large. *Fruit* orange-coloured, roundish or ovoid, usually depressed, rarely terminated by a small knob; *rind* with convex receptacles of oil; *pulp* sweet.—*Risso, Hist. Nat. des Orang.* pl. 3 and 4.

Habitat. — Asia; probably China. Cultivated in the south of Europe, the Azores, and the West Indies.

Products of the Sweet Orange tree.—*Orange leaves* are feebly bitter. Their watery infusion is greenish and somewhat bitter. They contain a fragrant volatile oil, which is procured by distillation and is called in the shops, *essence de petit grain.* *Orange flowers* when fresh, are white. Dried orange flowers are yellowish, and have an agreeable odour, which is less powerful than that of the fresh flowers. By distillation with water, orange flowers yield a fragrant volatile oil, called *Oil of Neroli* and *Orange-flower water.* The small green fruits which fall during the great heats of the summer, are carefully collected and dried. They as well as the unripe fruit of the next species (*Citrus bigaradia*) form the orange berries of the shops. Their size does not exceed that of a cherry; their colour is dark greyish or greenish brown; they have an aromatic odour and a bitter taste. They are used for flavouring *Curaçoa.* The smaller ones when smoothed by a lathe, constitute the *issue peas* of the pharmacies: these are preferred to ordinary peas for keeping up the discharge of an issue, on account of their pleasant odour. By distillation, these berries yield a fragrant oil (the original *essence de petit grain*). The *ripe fruit*, or the *orange*, is imported in chests and boxes; the best come from the Azores and Spain; very good ones are also brought from Portugal, Italy, and other places. The *rind* is sometimes employed as a substitute for that of the bitter orange. It yields, by distillation, a fragrant volatile oil (*essential oil of sweet orange*). *The distilled water of the flowers of the sweet orange is alone official of the several products now described.* (See *Aqua Aurantii Floris.*)

Fig. 111.

Citrus Aurantium.

Composition.—Orange flowers contain *volatile oil*, *bitter extractive*, and other substances. *Orange berries* contain *volatile oil*, *hesperidin*, *bitter astringent matter*, and *citric* and *malic acids*. *Orange peel* has not been analysed; but its composition is, doubtless, analogous to that of lemon peel. *Orange juice* consists of *citric acid*, *malic acid*, *mucilage*, *albumen*, *sugar*, *citrate of lime*, and *water*.

Physiological Effects and Uses.—Sweet orange peel is an aromatic stimulant and tonic analogous to lemon peel, and is occasionally employed as a substitute for *bitter orange peel*. *Orange juice* is a refreshing and grateful beverage, and is extensively used at the table. In febrile and inflammatory complaints it is a valuable refrigerant,—allaying thirst and diminishing preternatural heat.

Pharmaceutical Use.—The flowers are used in the preparation of orange flower water.

CITRUS BIGARADIA, *Risso.* **The Bitter or Seville Orange.**

Specific Character.—*Leaves* (fig. 112) elliptical, acute or acuminate, slightly toothed; *petiole* more or less winged. *Flowers* large, white. *Fruit* (fig. 112) orange-coloured, roundish, or slightly elongated, or depressed; *rind* with concave receptacles of oil; *pulp* acid and bitter.—*Risso, Hist. Nat. des Orang.* pl. 30.

Fig. 112.

Citrus Bigaradia.

Habitat.—Asia. Cultivated in Europe.

Products of the Bitter Orange tree.—The *leaves* of this species, when rubbed, emit a very agreeable odour. Distilled with water they yield a bitter aromatic water, known in Languedoc as *eau de naphre.* At the same operation is procured a volatile oil, called the *essence de petit grain,* of finer quality than that obtained from the leaves of the sweet orange. The *flowers* yield by distillation with water, *orange-flower water* and *oil of Neroli,* of finer quality than the corresponding preparations obtained from the flowers of the sweet orange. The *unripe fruits,* like those of the sweet orange, are called *orange berries,* and are employed for the purposes before mentioned. The *Seville orange* is round and dark, and has an uneven, rugged, very bitter rind (*bitter-orange peel*), which is used for medical purposes as well as in the preparation of *candied orange peel,* and for flavouring the liquor called *Curaçoa.* The dried outer part of the rind and the distilled water of the flowers are official. (See *Aurantii Cortex,* and *Aqua Aurantii Floris.*)

Composition.—The composition of the *leaves, flowers,* and *fruit* of the bitter orange is doubtless analogous to that of the corresponding parts of the sweet orange.

[§ **Aurantii Cortex.** *Bitter-Orange Peel.*

The dried outer part of the rind of the bitter orange, Citrus Bigaradia, *Risso.* From the ripe fruit imported from the south of Europe.

Characters.—Thin, of a dark orange colour, nearly free from the white inner part of the rind; having an aromatic bitter taste, and fragrant odour.]

Composition.—Bitter or Seville orange peel contains a *volatile oil, bitter extractive,* &c.

Physiological Effects and Uses.—Bitter orange peel is stomachic and tonic. Its principal value is as a flavouring agent.

Pharmaceutical Uses.—Bitter orange peel is a constituent of compound infusion of gentian, mixture of gentian, and compound tincture of gentian.

[§ **Infusum Aurantii.** *Infusion of Orange Peel.*

Take of

Bitter Orange Peel, cut small	$\frac{1}{2}$ ounce.
Boiling Distilled Water	10 fluid ounces.

Infuse in a covered vessel, for fifteen minutes, and strain.

Dose.—1 to 2 fluid ounces.]

An agreeable stomachic. It is an excellent vehicle for the exhibition of various other medicines, as saline purgatives, ammonia, bitter tinctures, &c.

[§ **Infusum Aurantii Compositum.** *Compound Infusion of Orange Peel.*

Take of

Bitter Orange Peel, cut small	$\frac{1}{4}$ ounce.
Fresh Lemon Peel, cut small	60 grains.
Cloves, bruised	30 grains.
Boiling Distilled Water	10 fluid ounces.

Infuse in a covered vessel, for a quarter of an hour, and strain.

Dose.—1 to 2 fluid ounces.]

An agreeable stomachic.

[§ **Tinctura Aurantii.** *Tincture of Orange Peel.*

Take of

Bitter Orange Peel, cut small and bruised	2 ounces.
Proof Spirit	1 pint.

Macerate for seven days in a closed vessel, with occasional agitation, then strain, press, and filter, and add sufficient proof spirit to make one pint.

Dose.—1 to 2 fluid drachms.]

This tincture is an agreeable stomachic, and is principally employed as a flavouring adjunct to decoctions and infusions (tonic or purgative), effervescing mixtures, &c.

Pharmaceutical Uses.—Tincture of orange peel is a constituent of aromatic mixture of iron, tincture of quinia, and the following preparation:—

[§ **Syrupus Aurantii.** *Syrup of Orange Peel.*

Take of

Tincture of Orange Peel . . .	1 fluid ounce.
Syrup	7 fluid ounces.

Mix.

Dose.—1 fluid drachm.]

Syrup of orange peel is stomachic, but its principal use is for flavouring.

Pharmaceutical Use.—It is an ingredient in confection of sulphur.

[§ **Vinum Aurantii.** *Orange Wine.*

Wine made in Britain, by the fermentation of a saccharine solution to which the fresh peel of the bitter orange has been added.

Characters and Tests.—A vinous liquid, having a golden sherry colour, and a taste and aroma derived from the bitter orange peel. It contains about 12 per cent. of alcohol, and is but slightly acid to test paper.]

Pharmaceutical Uses.—Used in the preparation of wine of citrate of iron, and wine of quinia.

[§ **Aqua Aurantii Floris.** *Orange-Flower Water.*

The distilled water of the flowers of the Bitter Orange tree, Citrus Bigaradia, *Risso* ; and of the Sweet Orange tree, Citrus Aurantium, *Risso.* Prepared mostly in France.

Characters and Tests.—Nearly colourless, fragrant. Not coloured by sulphuretted hydrogen.] That prepared from the flowers of the bitter orange possesses the most fragrant odour.

Composition.—Orange-flower water owes its odour to the presence of the following volatile oil:—*Oil of Orange Flower ; Oil of Neroli.* Procured from the flowers of both the bitter and sweet orange; but that from the former is preferred. It is obtained by submitting the flowers, with water, to distillation; and it is found floating on the water in the receiver. It has an aromatic and fragrant odour, somewhat different from that of the flower. 'It appears to me,' says Soubeiran, 'to be a product of the alteration of the natural essential oil. The latter is more soluble than the Neroli oil, and remains in solution in the water. Its presence may be demonstrated by agitating the distilled water with ether deprived of alcohol. By spontaneous evaporation the ethereal solution leaves behind an essential oil, which has absolutely the same odour as the flowers, and which dissolves in water.' Orange-flower water also contains *free acetic acid*, derived from the flowers; hence, if kept in a vessel of lead or copper, it acquires a metallic impregnation. Sulphuretted hydrogen produces, with either lead or copper, a dark-coloured precipitate.

Uses.—Orange-flower water is employed in medicine on account of its agreeable odour, and as a flavouring agent.

Dose.—1 to 2 fluid ounces.

[§ **Syrupus Aurantii Floris.** *Syrup of Orange Flower.*

Take of

Orange-Flower Water	8 fluid ounces.
Refined Sugar	3 pounds.
Distilled Water	16 fluid ounces, or a sufficiency.

Dissolve the sugar in the distilled water by means of heat; strain, and when nearly cold add the orange-flower water, with a sufficient quantity of distilled water, if necessary, to make the product four pounds and a half. The specific gravity should be 1·330.

Dose.—1 fluid drachm.]

It is used as a vehicle for the administration of other medicines, and as a flavouring agent.

ÆGLE MARMELOS, *D.C.* The Indian Bael Tree.

Botanical Character.—A large and erect *tree* with simple spines. *Leaves* usually ternate; *leaflets* oblong or broad-lanceolate, crenulated, inconspicuously dotted, the terminal one the largest. *Flowers* in small terminal and axillary panicles, large and white. *Calyx* free, 4–5-toothed. *Petals* 4–5, spreading. *Stamens* numerous; *filaments* distinct. *Ovary* 8–15-celled; *style* very short and thick; *stigma* capitate. *Fruit* large, sub-spherical, smooth, with a hard rind, 10 to 15-celled; the cells contain, besides the seeds, a large quantity of an exceedingly tenacious transparent mucus, which on drying becomes very hard, but continues transparent; when fresh it may be drawn out into threads of one or two yards in length, and so fine as to be scarcely perceptible to the naked eye, before it breaks. *Seeds* 6–10 in each cell, oblong, a little compressed, woolly, attached to the inner angle of the cell.—*Pharm. Journ.* vol. x. p. 166, plate.

Habitat.—It is a native of Malabar and Coromandel.

[§ **Belæ Fructus.** *Bael Fruit.*

The dried half-ripe fruit of Ægle Marmelos, *D.C.* From Malabar and Coromandel.]

General Characters.—Fruit roundish, about the size of a large orange or of Mogadore Colocynth, with a hard woody rind; usually imported in dried slices, or in fragments consisting of portions of the rind and adherent dried pulp and seeds. Rind about a line and a half thick, covered with a smooth pale brown or greyish epicarp, and internally, as well as the dried pulp, brownish-orange or cherry-red. The moistened pulp is mucilaginous.

Substitution.—The dried rind of the Mangosteen fruit (*Garcinia Mangostana*) has been substituted in this country for Bael Fruit. Professor Bentley, who noticed this substitution, states that mangosteen may be distinguished from bael by its greater thickness; darker colour; absence of adhering pulp and seeds; easily separable epicarp; and especially in the presence upon some of the pieces of radiating dark-coloured projecting wedge-shaped stigmas.

Composition.—No complete analysis of bael fruit has been made, but it has been ascertained to contain some astringent principle—a kind of tannin, to which its properties appear to be due.

Therapeutics and Administration.—In India, bael fruit is declared to be a valuable and efficacious remedy in dysentery and all affections of the bowels accompanied by relaxation, and also in cases of irritation of the mucous membrane of the stomach and bowels. Although it relieves diarrhœa and dysentery, it is said not to produce subsequent constipation. As tried in this country it does not, however, appear to be at all superior, if equal, to some of the other official vegetable astringents in common use. It is best administered in the form of the official liquid extract.

[§ **Extractum Belæ Liquidum.** *Liquid Extract of Bael.*

Take of

Bael Fruit	1 pound.
Distilled Water	12 pints.
Rectified Spirit	2 fluid ounces.

Macerate the bael for twelve hours in one-third of the water; pour off the clear liquor; repeat the maceration a second and third time for one hour in the remaining two-thirds of the water; press the marc; and filter the mixed liquors through flannel. Evaporate to fourteen fluid ounces; and, when cold, add the rectified spirit.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

Astringent. Employed in diarrhœa and dysentery.

BYTTNERIACEÆ, *De Cand.* The Cacao Order.

THEOBROMA CACAO, *Linn.* The Cocoa or Cacao Tree.

Botanical Character.—A small *tree. Leaves* (fig. 113), large, lanceolate-oblong, entire, stalked. *Flowers* clustered, axillary, reddish. *Sepals* 5. *Petals* 5. *Stamens* 15, connected at the base. *Style* 5-cleft. *Fruit* indehiscent, clustered, oval, large, yellow or red, with a thick fleshy rind, 5-celled, each cell containing from 6–10 seeds.

Fig. 113.

Theobroma Cacao.

Habitat.—Mexico, Demerara. Cultivated in the West Indies, Central America, Mauritius, and elsewhere.

Theobromæ Semina. *Cacao or Cocoa Seeds.* The roasted seeds of Theobroma Cacao, *Linn.*

(*Not official.*)

Preparation of Cocoa and Chocolate.—From Theobroma seeds both Cacao or Cocoa and Chocolate are prepared. Thus *Chocolate* is made by first roasting Cacao seeds, which are then divested of their husks or integuments and ground, and the powder thus left is afterwards triturated in a mortar with an equal quantity of sugar, to which some vanilla or cinnamon is added for flavouring, and a small quantity of arnatto as a colouring agent. All the finer qualities are thus prepared, but the flavouring is sometimes produced by adding sassafras nuts, cloves, or some other aromatic. *Cacao* or *Cocoa* is prepared either by grinding up the roasted seeds with their integuments between hot cylinders into a paste, which is then mixed with starch, sugar, &c., and thus *common cocoa*, *rock cocoa*, *soluble cocoa*, &c. is formed; or the roasted seeds are divested of their husks, and broken into small fragments, in which state they form *cocoa nibs*, the purest state of cocoa. The husks are also used by the poorer classes of Italy, &c.; they have been imported under the name of *miserable*.

Composition.—The principal constituents of cocoa seeds are *theobromine*, which resembles *theine*, the alkaloid contained in tea, coffee, &c., and a *concrete oil* or *fat* which constitutes about half their weight. This oil is official, (see *Oleum Theobromæ.*)

Uses.—Both cocoa and chocolate are used in the preparation of agreeable and nutritious beverages; and even the husks form a palatable and wholesome drink. These beverages are not so stimulating as tea and coffee, but they are apt to disagree with many persons on account of their oily nature. To such persons cocoa nibs should be recommended. About 100,000,000 pounds of cocoa and chocolate are annually consumed in this country and elsewhere, in the preparation of beverages.

[§ **Oleum Theobromæ.** *Oil of Theobroma.*

Synonym.—Cacao Butter.

A concrete oil obtained by expression and heat from the ground seeds of Theobroma Cacao, *Linn.*

Characters.—Of the consistency of tallow ; colour yellowish ; odour resembling that of chocolate; taste bland and agreeable; fracture clean, presenting no appearance of foreign matter. Does not become rancid from exposure to the air. Melts at a temperature of 122°.]

Pharmaceutical Uses, &c.—It enters into the composition of the suppositories of the British Pharmacopœia. In itself it possesses emollient properties.

MALVACEÆ, *R. Brown.* The Mallow Order.

GOSSYPIUM, *Linn.* Species yielding Cotton.

Generic Character.—Young *branches* and *leaves* more or less conspicuously covered with little black dots; veins below usually with one or more glands. *Calyx* cup-shaped, obtusely 5-toothed, surrounded by an involucre of 3 bracts: *bracts* united and cordate at the base, and deeply cut or toothed irregularly. *Stamens* numerous, monadelphous. *Style* simple, marked with 3 or 5 furrows towards the apex; *stigmas* usually 3, sometimes 5. *Capsules* 3–5-celled, 3–5-valved, loculicidal. *Seeds* numerous, imbedded in hairs.

Habitat.—Cultivated in warm and tropical regions.

[§ **Gossypium.** *Cotton Wool.*

The hairs of the seed of various species of Gossypium, *Linn.*, carded.]

General Characters.—The filamentous substance, called *cotton*, or incorrectly, in the Pharmacopœia, *cotton wool*, consists of tubular cells, forming the hairs which arise from the surface of the seed-coat. By drying, these hairs become flattened and twisted; and in this state, if they be immersed in water and examined by the microscope, they appear like distinct, flat, narrow ribands, with occasionally the appearance of a joint, indicating the end of a cell, and represented by a line at a right angle, or nearly so, to the side of the tube. Cotton is distinguished (under the microscope) from the fibres which constitute linen by the cells of the latter being in bundles, round, tapering at their extremities, and, overlapping each other where they come in contact, so as to present the appearance of having oblique articulations. Cotton which has undergone no preparation is denominated *raw cotton.*

Composition.—Cotton is a modification of *lignin.* In all its essential chemical properties it agrees with ordinary woody fibre. It is completely insoluble in water, alcohol, ether, oils, and vegetable acids. Strong alkaline leys dissolve it. The strong mineral acids decompose it. With nitric acid it yields oxalic acid.

Uses.—Raw cotton or cotton wool, has been employed, with apparently good effect, in the treatment of burns. It allays pain and irritation, apparently by forming, with the discharges, a substitute for the epidermis, under the protection of which the process for the formation of the new cuticle takes place, undisturbed by external irritation. The exclusion of the air seems to be a most important part of the treatment; and, of course, to effect this, many other agents (as lint) will answer in the place of cotton. The following is the method of employing cotton :—The cotton should be carded in narrow fleeces, thin enough to be translucent, and applied in successive layers, so as completely to protect the injured parts from the effects of motion and pressure. When the skin is severely scorched, a spirituous or turpentine wash may be applied previously to the application of the cotton. As complete repose of the part is necessary, the first dressing should be allowed to remain as long as possible undisturbed. Raw cotton has also been used as a topical application in erysipelas. Cotton wool, impregnated with nitre or chlorate of potash, has been employed as a moxa. The well-known superiority of linen to cotton as a dressing for wounds and ulcers, is usually ascribed to the angular shape of the cotton cells when dry, the sharp angles of which are supposed to cut and irritate the flesh; while the component fibres of linen maintain their original smoothness and rounded form.

[§ **Pyroxylin.** *Gun Cotton.*

Take of

Cotton	. . . . . .	1 ounce.
Sulphuric Acid, Nitric Acid	of each . . .	5 fluid ounces.

Mix the acids in a porcelain mortar, immerse the cotton in the mixture, and stir it for three minutes with a glass rod, until it is thoroughly wetted by the acids. Transfer the cotton to a vessel containing water, stir it well with a glass rod, decant the liquid, pour more water upon the mass, agitate again, and repeat the affusion, agitation, and decantation, until the washing ceases to give a precipitate with chloride of barium. Drain the product on filtering paper, and dry in a water-bath.

Tests.—Readily soluble in a mixture of ether and rectified spirit; leaves no residue when exploded by heat.]

Properties.—It is highly electric on friction. It is insoluble in water. It explodes at a heat of 300° F. and leaves no carbonaceous residue. If exploded on litmus paper, it reddens it; if on starch paper, moistened with iodide of potassium, the nitrous acid formed produces the blue iodised starch.

[§ **Collodium.** *Collodion.*

Take of

Pyroxylin	. . . . . .	1 ounce.
Ether	. . . . . .	36 fluid ounces.
Rectified Spirit	. . . .	12 fluid ounces.

Mix the ether and the spirit, and add the pyroxylin. Set aside for a few days, and, should there be any sediment, decant the clear solution. Keep it in a well-corked bottle.

Characters.—A colourless highly inflammable liquid with ethereal odour, which dries rapidly upon exposure to the air, and leaves a thin transparent film, insoluble in water or rectified spirit.]

Uses.—Collodion is applied to many uses in medicine, surgery, and pharmacy. In chapped hands, chapped nipples, and fissures of the anus, it has been employed with great success as an adhesive, and for the protection of the affected parts. In chapped nipples, while it relieves the female it is not injurious to the infant. It has been used in various cutaneous diseases attended with excoriation; in ulcers; in erysipelas; in superficial burns and wounds; and as a stopping, applied on cotton, to carious teeth. Among its pharmaceutical uses may be mentioned the property of investing pills with a layer of cotton. Aloetic, colocynth, and other pills, may be coated, by placing them on the point of a needle, and dipping them into the collodion twice, allowing the first coat to dry before the second is applied.

[§ **Collodium Flexile.** *Flexible Collodion.*

Take of

Collodion	6 fluid ounces.
Canada Balsam	120 grains.
Castor Oil	1 fluid drachm.

Mix, and keep in a well-corked bottle.]

ALTHÆA OFFICINALIS, *Linn.* Common Marsh Mallow.

Botanical Character. — *Root* perennial. *Stem* 2–3 feet high. *Leaves* peculiarly soft and downy on both surfaces, with a fine starry pubescence, cordate or ovate, toothed, undivided or somewhat 3-lobed. *Peduncles* axillary, many-flowered, much shorter than the leaves. *Flowers* 3 or 4 together, on axillary stalks, large, pale rose-coloured. *Calyx* surrounded by a 6–9-cleft involucre. *Carpels* numerous, capsular, closely and circularly arranged round the axis.

Habitat.—Indigenous. In marshes, especially near the sea.

Althææ Radix. *Marsh Mallow Root.*

The dried root of Althæa officinalis, *Linn.*

(*Not official.*)

General Characters.—The root is long, cylindrical, branched, about the thickness of the middle finger, plump, mucilaginous, white internally, and covered with a yellowish epidermis. That which is imported from France has been deprived of its epidermis, and is white. Its odour is feeble; its taste sweet and mucilaginous. Iodine colours it dark blue. Perchloride of iron forms with the concentrated decoction a brown semi-transparent gelatinous mass.

Composition.—The principal constituents of marsh mallow root are, *uncrystallisable sugar*, *althein*, *mucilage*, and *starch.*

Physiological Effects and Uses.—Emollient and demulcent. Employed in the form of decoction, in irritation of the alimentary canal, and of the pulmonary and urinary organs. In tenesmus, the decoction is used in the form of an enema. In external inflammations, emollient fomentations and poultices are sometimes employed. It is but little used in this country, but on the Continent it is a favourite demulcent. The *pastilles* and *pâte de guimauve* are there largely used as pectorals. The powder of marsh mallow root is employed in France to envelope pills.

LINACEÆ, *Lindley.* THE FLAX ORDER.

LINUM USITATISSIMUM, *Linn.* Common Flax.

Botanical Character.—*Annual* plant (fig. 114). *Stem* erect, slender, simple, smooth, one to two feet high. *Leaves* alternate, simple, lanceolate or linear, sessile, smooth. *Flowers* corymbose-panicled, large, purplish-blue. *Sepals* 5, ovate, acute, with membranous margins. *Petals* 5, somewhat crenated, much larger than the sepals, caducous. *Stamens* 5. *Styles* 5. *Capsule* roundish, containing ten seeds.—*Woodv. Med. Bot.* pl. 3.

Fig. 114.

Linum usitatissimum.

Habitat.—Not unfrequent in corn fields, &c. in this country, escaped from cultivation. Extensively cultivated in this, as well as in other European countries.

Products of the Flax Plant.—Besides the seeds, the substance termed *flax* is prepared from the fibrous portions of the bark. The short fibres which are removed in the process constitute *tow*, which is employed both in pharmacy and surgery, and for various other purposes. Of flax is made *linen*, which, when scraped, constitutes *lint*, an important agent to the surgeon.

[§ **Lini Semina.** *Linseed.*

The seeds of Linum usitatissimum, *Linn.* Cultivated in Britain.]

General Characters.—The seed of the flax plant, commonly termed *linseed* or *lintseed*, is small (about a line long), oval, flattened on the sides with acute edges, pointed at one extremity, smooth, shining, brown externally, yellowish-white internally, odourless, and with an oily mucilaginous taste.

Adulterations.—Linseed is extensively adulterated, and hence should be carefully examined to see if it agrees with the above description.

Composition.—The nucleus or kernel contains a fixed oil, and the seed-coats mucilage, &c. *Fixed Oil* (see *Oleum Lini*). *Mucilage of Linseed.* — This is extracted from the seed-coats by hot water. When the solution is mixed with alcohol, white mucilaginous flocks are precipitated. Subacetate of lead forms a precipitate in it. Neither infusion of galls nor chlorine has any effect on it. It is not coloured blue by iodine. It reddens litmus (owing to the free acetic acid). It consists of two parts: one soluble, the other insoluble in water. The insoluble part contains nitrogen.

Physiological Effects and Uses.—Linseed is emollient and demulcent. It is employed to allay irritation in the form of *infusion*.

[§ **Infusum Lini.** *Infusion of Linseed.*

Take of

Linseed	160 grains.
Fresh Liquorice Root, sliced . .	60 grains.
Boiling Distilled Water . . .	10 fluid ounces.

Infuse in a covered vessel, for four hours, and strain.]

Employed as an emollient and demulcent in irritation and inflammation of the pulmonary and urinary organs, and of the mucous membranes generally; as gonorrhœa, dysentery, alvine irritation, and pulmonary affections. It is rendered more palatable by the addition of sliced lemon and sugar-candy.

Dose.—1 to 4 fluid ounces, or *ad libitum.*

[§ **Lini Farina.** *Linseed Meal.*

The cake of linseed from which the oil has been pressed, reduced to powder.]

General Characters.—The *cake* left after the expression of the oil, is usually denominated *oil cake*; it forms, when ground to a fine powder, *linseed meal.* The best oil cake for the preparation of linseed meal is the English, fresh made. Foreign cake is of inferior quality. The colour of linseed meal is greyish-brown. It abounds in mucilage.

Physiological Effects and Uses.—Emollient, applied externally in the form of a *poultice* to inflamed and suppurating surfaces.

[§ **Cataplasma Lini.** *Linseed Poultice.*

Take of

Linseed Meal	4 ounces.
Olive Oil	$\frac{1}{2}$ fluid ounce.
Boiling Water	10 fluid ounces.

Mix the linseed meal gradually with the water, then add the oil, with constant stirring.]

The linseed poultice was ordered, in the last London Pharmacopœia, to be prepared with *powdered linseed*, and hence it contained the oil of the seeds, but the *linseed meal* now ordered is described as 'the cake of linseed *from which the oil has been pressed*, reduced to powder,' and the poultice is directed to be prepared from this with the addition of *olive oil*. The supposed advantage of the present formula is, that crushed linseed soon becomes rancid, and when applied in this state is apt to irritate the skin; and hence, as the seeds cannot be readily ground when wanted, the above powdered meal, which keeps well, is directed to be used, and the oil added at the time the poultice is prepared.

Pharmaceutical Uses.—Linseed meal also enters as an ingredient into several other poultices, in all of which it is directed to be used without the addition of any oil.

[§ **Oleum Lini.** *Linseed Oil.*

The oil expressed without heat from linseed.]

Preparation, General Characters, and Composition.—To prepare this oil, the seeds are first bruised or crushed, then ground, and afterwards subjected to pressure in the hydraulic or screw press. *Cold drawn linseed oil* is paler coloured, less odorous, and has less taste, than linseed oil prepared by the aid of a steam heat of about 200° F.; but, according to Mr. Brande, it 'soon becomes rancid and more disagreeable than that expressed at a higher temperature.' The seeds yield by cold expression 18 or 20 per cent. of oil; but by the aid of heat from 22 to 27 per cent. Linseed oil is usually amber-coloured; but it may be rendered quite colourless; it has a peculiar odour and taste; and is soluble in alcohol, but more readily so in ether. It is a viscid oil, and when exposed to the air it dries into a hard transparent varnish. This change is greatly accelerated by boiling the oil, either alone, or with oxide of lead, &c. Its proximate constituents are *oleic acid*, *margaric acid*, and *glycerine*.

Physiological Effects and Uses.—Emollient and laxative. It is rarely employed internally, but it is a valuable external application to burns or scalds, either alone, or mixed with an equal volume of solution of lime.

POLYGALACEÆ, *D.C.* THE MILKWORT ORDER.

POLYGALA SENEGA, *Linn.* The Senega Plant.

Botanical Character.—*Root* perennial, branching. *Stems* several, annual, somewhat erect, smooth, simple, round, leafy, 9–12 inches high. *Leaves* alternate, sessile or on very short petioles, paler beneath, smooth, ovate-lanceolate, the upper ones acuminate. *Flowers* in loose terminal spikes, white, often tinged with purple. *Sepals* 5, persistent, the two inner ones wing-like; *wings* orbiculate, white, with green veins. *Petals* 3, small, with a beardless keel. *Stamens* 8, united in two equal bundles. *Capsule* elliptical, emarginate, small, with 2 blackish seeds.—*Steph. and Church.* pl. 103.

Habitat.—United States of America; especially in the Southern and Western States.

[§ Senegæ Radix. *Senega Root.*

The dried root of Polygala Senega, *Linn.* From North America.]

General Characters.—*Senega root*, sometimes called *senega-snake-root*, varies in size from the thickness of a writing-quill to that of the little finger; it is twisted, branched, and terminated above by an irregular tuberosity, which exhibits traces of numerous stems; a projecting line or keel-shaped process extends the whole length of the concave side of the root. The cortical portion is corrugated, transversely cracked, thick, and of a greyish-yellow or yellowish-brown colour. The central portion (*meditullium*) is woody and white. The taste of the root is at first sweetish and mucilaginous, afterwards acrid and pungent, and exciting cough and a flow of saliva; its odour is peculiar and nauseous. The taste and odour reside entirely in the cortical portion, the meditullium being without any sensible properties.

Adulterations.—American ginseng root, derived from *Panax quinquefolium*, is sometimes found mixed with senega root, but is readily known by its commonly greater size, its more or less fusiform shape, and by the absence of the projecting line of senega. The roots of *Gillenia trifoliata and other species of Gillenia* have also been found mixed with those of senega. They are readily distinguished by the absence from them of any projecting line.

Composition.—Senega is said to owe its active properties to a peculiar principle, called *polygalic acid* or *senegin.* It also contains a *peculiar volatile fatty acid*, *tannic acid pectin*, &c. *Polygalic acid* is only found in the cortical part of the root. When pure it is a white odourless powder, which is at first tasteless, but afterwards communicates an acrid feeling to the mouth, and a sense of constriction to the fauces. It irritates the nostrils, and excites sneezing. It is volatile, and, when decomposed by heat in a glass tube, evolves no ammonia, and hence contains no nitrogen. It is soluble in water and in alcohol, especially when aided by heat; but it is insoluble in ether, acetic acid, and the oils.

Physiological Effects.—Senega root possesses acrid and stimulant properties. In small doses it is diaphoretic, diuretic, and expectorant; in larger doses, emetic and purgative. It appears to excite moderately the vascular system, to promote the secretions (at least those of the kidneys, skin, uterus, and bronchial membrane), and to exert a specific influence over the nervous system. It has been principally valued for its expectorant effects. In its operation on the nervous system it has considerable resemblance to Arnica; but its influence over the secreting organs is much greater. Its active constituent—*polygalic acid*, when given to dogs in doses of six or eight grains, causes vomiting, embarrassed respiration, and death in three hours. Two grains thrown into the jugular vein produced vomiting, and, in two hours and a half, death.

Therapeutics.—In this country senega root is comparatively but little employed. It is, however, an exceedingly valuable remedy in the latter stages of *bronchial* or *pulmonary inflammation*, when this disease occurs in aged, debilitated, or torpid constitutions, and when the use of depletives is no longer admissible. I usually administer it in combination with ammonia, which appears to me to promote its beneficial operation. Frequency of pulse, and a febrile condition of the system, are by no means to be regarded as impediments to the use of this medicine. In *chronic catarrh* and *humoral asthma* it has been used. It has been also employed in *hooping cough* and *croup*; as an emetic, purgative, and diaphoretic, in *rheumatism*; and as a diuretic, in *dropsy*. It was introduced into practice as a remedy against the bite of venomous animals—as the rattlesnake; but it is quite useless in such cases.

Administration.—The dose of the *powder* is from 10 to 30 grains. But the *infusion* or *tincture* is a better form of administration.

[§ **Infusum Senegæ.** *Infusion of Senega.*

Take of

Senega Root, bruised . . . $\frac{1}{2}$ ounce.
Boiling Distilled Water . . . 10 fluid ounces

Infuse in a covered vessel, for one hour, and strain.

Dose.—1 to 2 fluid ounces.]

Stimulant, expectorant, and diuretic. Ammonia is often a valuable addition to it.

[§ **Tinctura Senegæ.** *Tincture of Senega.*

Take of

Senega Root, in coarse powder . .	$2\frac{1}{2}$ ounces.
Proof Spirit	1 pint.

Macerate the senega for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

KRAMERIA TRIANDRA, *Ruiz and Pavon.* The Peruvian Rhatany.

Botanical Character.—*Suffruticose. Root* long, branching. *Stems* many, branching, procumbent. *Leaves* alternate, sessile, simple, entire, oblong-ovate, somewhat acute, silky on both surfaces. *Flowers* solitary, terminal, lake-coloured. *Pedicels* bibracteate, somewhat longer than the leaf. *Calyx* of 4 sepals, silky externally, deciduous, spreading. *Petals* 5, unequal. *Stamens* 3. *Fruit* globular, drupaceous, beset with stiff reddish hairs, 1-celled, 1-seeded.—*Steph. and Church.* pl. 72.

Habitat.—Peru and Bolivia, half way up the western slopes of the Cordilleras.

[§ **Krameriæ Radix.** *Rhatany Root.*

The dried root of Krameria triandra, *Ruiz and Pavon.* Imported from Peru.]

General Characters.—Rhatany root occurs in cylindrical, long, simple or branched pieces, which vary in thickness from that of a writing-quill to two inches or more. The pieces are sometimes united above to a short thicker portion. They consist of a slightly fibrous, brittle, easily separable, reddish-brown, rough bark, which is powdered with difficulty, and has an intensely astringent and slightly bitter taste; and of a very hard woody portion, of a yellowish or pale red colour, and almost tasteless. As by far the largest quantity of astringent matter resides in the bark, the smaller pieces (which have a larger proportion of bark) are to be preferred. Rhatany has no odour. When chewed it tinges the saliva red.

Varieties.—Besides the above official rhatany, which is commonly known in commerce as *Peruvian* or *Payta rhatany*, there is another variety, which is imported from New Granada, and known as *Savanilla* or *New Granada rhatany*. Hanbury has traced its botanical source to *Krameria Ixina*, Linn., a native of the northern parts of South America and the Antilles. *Savanilla rhatany* bears a considerable resemblance to Peruvian rhatany, but it may be distinguished by its dark violet colour, by the firmer adherence of its bark to the wood, by the even and less fibrous fracture of the bark, by the greater facility with which that bark can be reduced to powder, and by its more astringent taste. It is equal, if not superior, to Peruvian rhatany in medicinal value. A third variety of Rhatany, the source of which is unknown, but which is exported from Para, and hence termed *Para Rhatany*, is now also found in commerce. Its colour varies between dark grey and brown, and is very distinct from that of *Payta*, and *Savanilla rhatany*. Para rhatany is also remarkable for its elasticity.

Composition.—Rhatany root contains a peculiar acid, called *krameric acid*, about 40 per cent. of *tannic acid*, &c. *Tannic Acid.*—To this, as well as in part to a minute portion of gallic acid, rhatany owes its astringent qualities. It is this acid which causes an infusion of rhatany to form, with a solution of gelatine, a precipitate, and with perchloride of iron a brownish-grey precipitate. *Krameric Acid.*—Peschier ascribes the stypticity of rhatany to this acid, the properties of which are at present imperfectly known.

Physiological Effects.—A powerful astringent, and, like other agents of this class, tonic also.

Therapeutics.—Rhatany root is adapted to all those cases requiring the employment of astringents: such as *profuse mucous discharges* (as humid catarrh, old diarrhœas, fluor albus, &c.) *passive hemorrhages*, and *relaxation* and *debility of the solids*. It is sometimes used as a *tooth powder* (as with equal parts of orris rhizome and charcoal). Dentists sometimes employ tincture of rhatany diluted with water *as an astringent mouth wash.*

Administration.—The *powder* may be given in doses of from 10 to 30 grains. The *extract*, *infusion*, or *tincture*, is more commonly employed.

Pharmaceutical Use.— Rhatany is an ingredient in compound powder of catechu.

[§ **Extractum Krameriæ.** *Extract of Rhatany.*

Take of

Rhatany Root, in coarse powder . .	1 pound.
Distilled Water	a sufficiency.

Macerate the rhatany in a pint and a half of the water for twenty-four hours; then pack in a percolator, and add more distilled water, until twelve pints have been collected, or the rhatany is exhausted. Evaporate the liquor by a water-bath to dryness.

Dose.—5 to 20 grains.]

Astringent.

[§ **Infusum Krameriæ.** *Infusion of Rhatany.*

Take of

Rhatany Root, bruised . . .	$\frac{1}{2}$ ounce.
Boiling Distilled Water . . .	10 fluid ounces.

Infuse in a covered vessel, for one hour, and strain.

Dose.—1 to 2 fluid ounces.]

Astringent and tonic.

[§ **Tinctura Krameriæ.** *Tincture of Rhatany.*

Take of

Rhatany Root, in coarse powder . .	$2\frac{1}{2}$ ounces.
Proof Spirit	1 pint.

Macerate the rhatany root for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

Used as an adjunct to cretaceous mixtures, or with tonics. It may be employed diluted with water as a gargle.

VIOLACEÆ, *Lindley.* The Violet Order.

VIOLA ODORATA, *Linn.* The Sweet Violet.

Botanical Character.—*Perennial. Runners* flagelliform. *Leaves* rounded-cordate. *Flowers* fragrant, deep purple, often white, occasionally lilac. *Bracts* inserted above the middle of the scape. *Sepals* 5, unequal, ovate, obtuse, prolonged into appendages at the base. *Corolla* unequal, 2-lipped, of 5 petals, the lower calcarate; *spur* very blunt. *Stigma* naked, uncinate. *Capsule* turgid, hairy, many-seeded, 3-valved. *Seeds* pale, turbinate.

Habitat.—Indigenous. Flowers in March and April. Cultivated on account of the odour and colour of its flowers.

Violæ Odoratæ Flores. *Violets.*

The fresh flowers of Viola odorata, *Linn.*

(*Not official.*)

General Characters.—Flowers deep purple, white, or lilac, and delightfully fragrant. Violets should be gathered immediately they are expanded.

Composition.—The chief constituents of the flowers are :—*odorous principle*, *blue colouring matter*, and *sugar*. Boullay obtained from the *root*, *leaves*, *flowers*, and *seeds*, an acrid principle, which he termed *violin*.

Physiological Effects.—Taken internally, violets act as a laxative. The seeds possess similar properties. The *root*, in doses of from 30 to 60 grains, proves emetic and purgative.

Administration and Uses.—Violets are best administered in the form of a syrup. The root has been recommended as a substitute for ipecacuanha.

The syrup may be prepared as follows :—

Take of

Fresh Violets	1 pound.
Boiling Water	$2\frac{1}{2}$ pints.
Refined Sugar	$7\frac{1}{2}$ pounds.

Infuse the flowers for twenty-four hours in the water in a covered tin or pewter vessel, strain without squeezing, and dissolve the sugar in the filtered liquor.

Genuine syrup of violets is readily distinguished from most counterfeits by its being reddened by an acid, and made green by an alkali : hence it is sometimes employed as a test. As a medicine it is used as a mild laxative for new-born infants. Thus, a mixture of equal parts of oil of almonds and syrup of violets is often administered, in the dose of one or two tea spoonfuls, for that purpose.

CRUCIFERÆ, *Jussieu.* THE CRUCIFEROUS ORDER.

COCHLEARIA ARMORACIA, *Linn.* **Horseradish.**

Botanical Character.—*Root* (fig. 115, *b*) perennial, long, cylindrical, white, or yellowish, and very pungent ; from this root, erect annual stems 2 to 3 feet high arise, bearing sessile *leaves* (fig. 115, *a*), which are lanceolate, and toothed or incised. *Radical leaves* much veined, oblong, crenate, dark green. *Inflorescence* (fig. 115, *a*) racemose, ebracteated. *Calyx* equal, spreading. *Petals* white, entire. *Stamens* 6, tetradynamous, not toothed. *Silicules* oval.—*Woodv. Med. Bot.* pl. 150.

Habitat.—On waste ground in this country, but not indigenous. Extensively cultivated in all parts of Europe and North America.

Fig. 115.

Cochlearia Armoracia.

a. Flowering branch. *b. Root.*

[§ **Armoraciæ Radix.** *Horseradish Root.*

The fresh root of Cochlearia Armoracia, *Linn.* Cultivated in Britain.]

General Characters.—Horseradish root (fig. 115, *b*) is long, cylindrical, white, or with a tinge of yellow externally, whitish within. It has a very pungent, and sweetish or sometimes bitterish taste; and when bruised or scraped, its odour is highly pungent, frequently causing sneezing and a flow of tears. (For the Distinctive Characters of this root and that of Aconite, see *Aconiti radix.*)

Composition.—Horseradish root contains *myrosin*, *myronic acid* (see *composition of seeds of Sinapis nigra*, p. 935), in combination, *water*, &c. It owes its properties essentially to the formation of an acrid volatile oil, produced by the action of myrosin on the myronic acid in the presence of water. If the root be dried with care, these principles can be retained. *Volatile Oil* ($\mathbf{C_4H_5NS}$).—Obtained by distillation of the fresh root broken to a pulp without additional water. It is of a pale yellow colour, heavier than water, and very volatile. Its odour is exceedingly powerful, and like that of horseradish. One drop is sufficient to infect a whole room. Its taste is at first sweetish, then burning and acrid. It is slightly soluble in water, easily so in alcohol. The watery solution yields with acetate of lead a brown precipitate, with nitrate of silver a black one. It is identical with volatile oil of mustard. (See *Oleum Sinapis.*)

Physiological Effects.—Horseradish root is a well-known acrid stimulant, capable of producing vesication when applied to the skin, and of causing vomiting, when taken in the form of infusion into the stomach. Its odorous emanations readily excite a copious flow of tears. On the general system it operates as a stimulant, and promotes the secretion of urine and perspiration.

Therapeutics.—It is not much employed as a medicine. Chewed, it serves as an excellent masticatory. Taken in this way, it may be serviceable in some forms of hoarseness. An infusion of it may be taken to excite vomiting, or to promote the operation of other emetics, as in poisoning by narcotic substances. As a general stimulant, diaphoretic, and diuretic, it has been used in palsy, chronic rheumatism, and dropsy. It promotes digestion when used as a condiment.

[§ **Spiritus Armoraciæ Compositus.** *Compound Spirit of Horseradish.*

Take of

Horseradish Root, scraped Bitter-Orange Peel, cut small and bruised	of each	20 ounces.
Nutmeg, bruised		$\frac{1}{2}$ ounce.
Proof Spirit		1 gallon.
Water		2 pints.

Mix and distil a gallon with a moderate heat.

Dose.—1 to 2 fluid drachms.]

It is of course understood that *fresh* horseradish root will be employed in this preparation. As the root varies much in its pungent odour and taste at different seasons of the year, being much weaker in the summer months than in the early spring or late autumn, it would have been advisable to have directed the Compound Spirit of Horseradish to be prepared at the latter seasons.

Usually employed as a stimulating adjunct to other medicines, especially to diuretic infusions.

SINAPIS, *Linn.*

Generic Character.—*Calyx* spreading in the flower. *Stamens* 6, tetradynamous. *Style* short, acute. *Silique* somewhat terete or angular; *valves* veined. *Seeds* in one row, somewhat globose.

SINAPIS NIGRA, *Linn.* Black Mustard.

Specific Character.—*Annual.* *Stem* 3–4 feet high. *Lower leaves* lyrate, large, rough; *upper ones*, lanceolate, stalked, entire. *Flowers* yellow, ebracteated. *Siliques* smooth, even, pressed close to the floral axis, quadrangular; *beak* short, sterile, subulate (fig. 116, *b*). —*Eng. Bot.* pl. 969.

Habitat. — Indigenous; hedges and waste places. Cultivated in fields, especially in Durham and Yorkshire.

General Characters of the Seeds.—Black mustard seeds are small and roundish. Externally they are beautifully veined, and of a reddish or blackish-brown colour; internally they are yellow. They are inodorous when entire, but when rubbed down with water they exhale a strong pungent odour. They have an acrid, bitter, oleaginous taste.

Fig. 116.

a. Sinapis alba.
b. Sinapis nigra.

Composition. — Black mustard seeds contain a *fixed oil*, *myronate of potash*, *myrosin*, a substance called, by Simon, *sinapisin*, &c. *Myronate of Potash.*—This is a neutral salt in colourless crystals, having a cooling bitter taste. *Myrosin; Emulsin of Black Mustard.*—This substance yields, with the myronic acid of the myronate of potash, and water, the volatile oil of mustard. It has considerable resemblance to vegetable albumen and emulsin; but as it cannot be replaced by either of these substances, in the development of the volatile oil, it must be regarded as a compound *sui generis*. It is soluble in water; but is coagulated by heat, alcohol, and acids, and in this state it loses the power of acting on the myronates, and of yielding the volatile oil. *Sinapisin.*—This term has been given, by Simon, to a substance which he procured from *black* mustard seeds, and which he states possesses the following properties:—It presents itself in the form of white, brilliant, micaceous, volatile crystals, which are soluble in alcohol, ether, and the oils, but are insoluble in acids and alkalies. Simon says sinapisin contains no sulphur. *Volatile Oil of Mustard*, $\mathbf{C_4H_5NS}$. (See *Oleum Sinapis.*) *Fixed Oil of Mustard.*—Usually procured by expression from the dressings or siftings left in the manufacture of mustard. It constitutes about 28 per cent. of the seeds. Its colour is reddish or brownish yellow. It has a faint odour of mustard, and a mild oily taste. It does not readily become rancid. It has been used as a purgative and anthelmintic.

[§ **Oleum Sinapis.** *Oil of Mustard.*

The oil distilled with water from the seeds of Black Mustard. Sinapis nigra, *Linn.*, after the expression of the fixed oil.]

Formation and General Characters.—This does not pre-exist in the seeds; but is formed when water at about 120° is added to the powdered seeds, by the mutual action of the contained myrosin and myronate of potash, just as the volatile oil of bitter almonds is generated by the mutual action of emulsin, amygdalin, and water. If the temperature be at 175°, or suddenly raised to 212°, no oil is formed. Alcohol extracts from the seeds no volatile oil; but, by coagulating the myrosin, renders the seeds incapable of developing the oil by the subsequent action of water. Sulphuric acid and the other mineral acids, as well as carbonate of potash, check the formation of the oil. Volatile oil of mustard is colourless or pale yellow; it has a most penetrating odour, and a most acrid and burning taste. Its specific gravity at 68° F. is 1·015. It is only slightly soluble in water, but readily so in alcohol and ether. Applied to the skin it produces almost instant vesication.

[§ **Linimentum Sinapis Compositum.** *Compound Liniment of Mustard.*

Take of

Oil of Mustard	1 fluid drachm.
Ethereal Extract of Mezereon . .	40 grains.
Camphor	120 grains.
Castor Oil	5 fluid drachms.
Rectified Spirit	4 fluid ounces.

Dissolve the extract of mezereon and camphor in the spirit and add the oil of mustard and castor oil.]

This liniment applied to the skin on impermeable piline or on a piece of lint covered with oiled silk, acts as a powerful rubefacient. Simply rubbed on the skin its action is much milder. It is an excellent application for *chilblains*, for *chronic rheumatism*, *pains in the chest or belly*, *chronic sprains*, *scrofulous glands*, &c. It deteriorates by keeping, through the escape of the volatile oil.

SINAPIS ALBA, *Linn.* White Mustard.

Specific Character.—Annual. Stem 1–2 feet high. *Leaves* lyrato-pinnatifid, irregularly lobed, and, as well as the *stem*, nearly smooth. *Flowers* ebracteated, large, yellow. *Siliques* hispid, spreading (fig. 116, *a*), cylindrical, knotty, shorter than the sword-shaped beak.—*Eng. Bot.* pl. 1,677.

Habitat.—Indigenous: in waste places. Cultivated in both fields and gardens.

General Characters of the Seeds.—White mustard seeds are much larger than those of black mustard. In form they are roundish-elliptical and are composed of a yellow nucleus, enveloped in thin semi-transparent yellow coats. They are inodorous when entire, and nearly so even when rubbed up with water. They have a similar, but less pungent taste than black mustard seeds.

Composition.—White mustard seeds contain *a similar fixed oil* to black mustard seeds; an acrid, thick, reddish *oily principle*, soluble in ether and alcohol, and which gives the sharp taste to the seeds; also *myrosin*; but they *do not* appear to contain *myronate of potash*; hence they do not yield, when mixed with water, any volatile oil of the nature of that developed in black mustard seeds under similar circumstances. The peculiarity of white mustard seeds is that they contain a principle called *hydrosulpho-cyanate of sinapin*; hence while perchloride of iron strikes a deep red colour in an infusion of white mustard seeds, it merely communicates an orange tint to the infusion of black mustard seeds. They also contain a non-crystallisable yellowish white substance called *erucin*, insoluble in water, but soluble in ether.

[§ **Sinapis.** *Mustard.*

The seeds of Sinapis nigra, *Linn.*, and Sinapis alba, *Linn.*, reduced to powder, mixed.]

Manufacture.—The following method of preparing *flour of mustard* was furnished me by a manufacturer:—The seeds of both black and white mustard are first crushed between rollers, and afterwards pounded in mortars. The pounded seeds are then sifted. The residue in the sieve is called *dressings* or *siftings*: what passes through is *impure flour of mustard.* The latter by a second sifting yields *pure flour of mustard*, and a second quantity of dressings. By pressure the dressings or siftings yield a fixed oil (*fixed oil of mustard*). The whole seeds are never pressed to obtain the oil.

General Characters.—[§ Greenish-yellow, of an acrid bitterish oily pungent taste, scentless when dry, but exhaling when moist a pungent penetrating peculiar odour, very irritating to the nostrils and eyes. A decoction cooled is not made blue by tincture of iodine.]

Adulteration.—The *flour of mustard* of commerce is commonly adulterated with flour or starch, coloured by turmeric, and rendered hot by capsicum. The presence of flour and starch may be readily detected by making a decoction of the suspected specimen, which if adulterated will, when cool, become blue by the addition of tincture of iodine.

Physiological Effects.—Mustard holds an intermediate rank between horseradish and pepper. Its topical action is that of a powerful acrid, and depends on the volatile oil and acrid principle developed by the action of water. The irritant operation, on the eyes, of the vapour arising from a mixture of hot water and flour of mustard, is familiarly known. Mustard poultices cause redness and burning pain, which if the application be continued, becomes almost insupportable. A prolonged application causes vesication, with even ulceration and gangrene. Compared with those of cantharides, the topical effects of mustard on the skin sooner subside when the application is discontinued. When swallowed, mustard evinces the same stimulant operation on the stomach and bowels. Taken *in moderate quantities*, with the food, it promotes the appetite and assists the assimilation of substances which are difficult of digestion. *In somewhat larger doses* (as one or two tea spoonfuls), it rouses the gastric susceptibility, and operates as an emetic. *In excessive quantities*, it gives rise to vomiting, purging, and gastro-enteritis. The effects of mustard on the general system are those of a stimulant. It quickens the pulse, and promotes the secretions (especially the urine), and the exhalations.

Therapeutics.—As a *medicinal* agent, mustard is employed for several purposes. As an *emetic* it is useful where we want to rouse the gastric sensibility, as in narcotic poisoning, malignant cholera, and some forms of paralysis. As a *stimulant* to the digestive organs it is applicable in atonic or torpid conditions of these parts, with dyspepsia, loss of appetite, and hepatic torpor. As a *diuretic* it has been employed with some benefit in dropsy. But the principal use of mustard is as a *rubefacient* (see *Cataplasma Sinapis*). Flour of mustard, or bruised mustard seeds, is sometimes added to pediluvia. (See also *Oleum Sinapis.*)

Administration.—As an emetic, the dose is from a tea spoonful to a table spoonful in a tumblerful of water. As a *diuretic* in dropsies, and for some other purposes, *mustard whey* is a convenient form of exhibition. It is prepared by boiling half an ounce of the bruised seeds or powder in a pint of milk, and straining. Half this quantity may be taken in the course of the day.

[§ **Cataplasma Sinapis.** *Mustard Poultice.*

Take of

Mustard, in powder	$2\frac{1}{2}$ ounces.
Linseed Meal	$2\frac{1}{2}$ ounces.
Boiling Water	10 fluid ounces.

Mix the linseed meal gradually with the water, and add the mustard, with constant stirring.]

The mustard poultice is a powerful local irritant. It readily excites inflammation, and, when allowed to remain applied sufficiently long, causes vesication. It proves, in many cases, a most painful application. In various affections of the brain (as in the stupor and delirium of low fever, in apoplexy, and in poisoning by opium), it is a most valuable application to the feet and ankles. In pulmonary and cardiac diseases it is occasionally applied to the chest with excellent effects. Of course, in all these cases, it operates on the principle of a blister, over which its speedy effect gives it a great advantage. It is applied spread on linen or calico. Great caution is necessary in its application to persons who are insensible to pain; for if it be continued too long, it may occasion ulceration and sloughing, though no pain be manifested. Hence its effects should be examined at short intervals. In one case death nearly resulted from the neglect of this caution.

Mustard leaves are said to consist of mustard moistened, spread on paper, and dried.

PAPAVERACEÆ, *Jussieu*. The Poppy Order.

PAPAVER, *Linn.* Poppy.

Generic Character.—*Herbs*, usually with a milky juice. *Peduncles* inflexed at the apex before flowering. *Sepals* 2, or rarely 3, deciduous. *Petals* 4, crumpled in æstivation. *Stamens* numerous. *Style* 0; *stigmas* 4–20, radiating upon the top of the ovary. *Capsule* 1-celled, composed of from 4–20 carpels united together, dehiscing by pores under the stigmas, or indehiscent; *placentas* numerous, projecting internally and forming more or less complete dissepiments.

PAPAVER RHŒAS, *Linn.* Common Red or Corn Poppy.

Specific Character.—*Annual. Stem* many-flowered, with spreading stiff hairs. *Leaves* pinnatipartite, with oblong inciso-dentate acute partitions. *Peduncles* usually with spreading, or rarely adpressed hairs. *Flowers* large. *Sepals* hairy. *Petals* deep scarlet, often nearly black at the base. *Filaments* subulate. *Capsule* roundish-obovate, smooth, the margin of the stigma with incumbent lobes. —*Woodv.* pl. 186.

Habitat.—Indigenous, and throughout Europe. Very common in fields, and on roadsides.

[§ **Rhœados Petala.** *Red-Poppy Petals.*

The fresh petals of Papaver Rhœas, *Linn.* From indigenous plants.]

General Characters. — When fresh, red-poppy petals are of a scarlet colour, and have a heavy poppy odour; when dry, they are scentless, and more dingy red. The fresh petals are alone official.

Composition.—Red-poppy petals contain about 40 per cent. of a red colouring matter, for which they are principally employed in medicine. According to Chevalier they also contain a trace of morphia. *Red colouring matter.*—This is deliquescent in the air, soluble in alcohol and in water, but insoluble in ether. Acids diminish the intensity of its colour; while alkalies blacken it. By the last character it is distinguished from the colouring matter of the red cabbage, &c., which becomes green by alkalies. Perchloride of iron gives it a dark violet or brown tinge. According to Leo Meier the colouring principles of the petals are two acids, which he has termed *rhœadic* and *papaveric.*

Use.—The red poppy is valued as a colouring ingredient only.

[§ **Syrupus Rhœados.** *Syrup of Red Poppy.*

Take of

Fresh Red Poppy Petals . .	13 ounces.
Refined Sugar	$2\frac{1}{4}$ pounds.
Distilled Water	1 pint, or a sufficiency.
Rectified Spirit	$2\frac{1}{2}$ fluid ounces.

Add the petals gradually to the water heated in a water-bath, frequently stirring, and afterwards, the vessel being removed, infuse for twelve hours. Then press out the liquor, strain, add the sugar and dissolve by means of heat. When nearly cold, add the spirit, and as much distilled water as may be necessary to make up for loss in the process, so that the product shall weigh three pounds ten ounces. It should have the specific gravity 1·330.

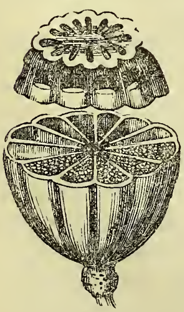
Dose.—1 fluid drachm.]

Employed only as a colouring agent. It readily ferments and spoils.

PAPAVER SOMNIFERUM, *Linn.* **The White or Opium Poppy.**

Specific Character.—An annual *herb.* *Stem* 2–4 feet high, erect, round, glaucous green, smooth or with a few hairs towards its upper extremity. *Leaves* oblong, large, amplexicaul, smooth, glaucous green, margins wavy, incised and toothed; *teeth* sometimes tipped with a rigid hair. *Peduncles* with a few stiff spreading hairs. *Flowers* large. *Calyx* smooth; *sepals* concave. *Filaments* dilated upwards. *Capsule* (fig. 117) globose or ovate-globose, large, smooth, and with as many parietal placentas projecting into its cavity as there are stigmas. *Seeds* numerous, reniform.—*Woodv.* pl. 185.

Fig. 117.



Capsule of the Opium Poppy, var. nigrum.

Varieties.—There are several varieties of this species, two of which are well-marked as follows:—

a. nigrum.—*Capsule* globose, opening by pores under the stigma (fig. 117). *Seeds* brownish-black. *Flowers* usually violet or red, of different tints, though sometimes white.

β. album.—*Capsule* ovate-globose; indehiscent, the pores under the stigma being either obliterated or absent. *Seeds* and *petals* white.

Habitat.—Asia and Egypt. Grows apparently wild in some parts of Europe, and in England, but has doubtless escaped from gardens. Cultivated in Asia Minor, Egypt, Persia, and India, on account of the opium obtained from it. According to Dr. Royle, var. *album* is cultivated in the plains of India; and var. *nigrum* in the Himalayas. In Europe, the opium poppy is principally cultivated for its capsules, or for the oil obtained from the seeds which are commonly known as *maw seeds*; but also to some extent, for the purpose of obtaining opium. Homer speaks of this poppy growing in gardens, so that it appears to have been cultivated at an early period.

[§ **Papaveris Capsulæ.** *Poppy Capsules.*

The nearly ripe dried capsules of the white poppy, Papaver somniferum, *Linn.* Cultivated in Britain.]

The London market is principally supplied with poppy capsules, which are commonly termed poppy heads, from the neighbourhood of Mitcham; but also to some extent, from Banbury, Market Deeping, Hitchin, &c.

General Characters.—Poppy capsules are most active as medicinal agents when gathered before they are quite ripe, as directed in the Pharmacopœia. They are globular or ovate-globular in form, and crowned by a star-like stigma. They vary in size, from that of a hen's egg to that of the fist. Their texture is papyraceous; they are yellowish or yellowish-brown in colour, and, if they have been collected before they were quite ripe, have an opiate bitterish taste. When fresh, they have a slightly opiate odour, which they lose by drying. The seeds, called *maw seeds*, have an oily, sweetish taste, and are altogether destitute of narcotic properties.

Composition.—Poppy capsules contain a small quantity of the principles found in opium, which they yield to boiling water. The presence of some of the principles is readily indicated as follows:— A decoction of poppy capsules is rendered, by the perchloride of iron, brownish-red (*meconate of iron*). Nitric acid makes the decoction transparent, and communicates a slightly orange-red tinge, indicative of the presence of morphia.

Physiological Effects.—Their effects are similar to, but much weaker and less to be depended upon than, opium.

[§ **Decoctum Papaveris.** *Decoction of Poppies.*

Take of

Poppy Capsules, bruised	2 ounces.
Distilled Water	$1\frac{1}{2}$ pint.

Boil for ten minutes in a covered vessel, then strain, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint.]

In this preparation the seeds are directed to be used with the pericarps, as they contribute by their oily properties to the emollient quality of the decoction, but in the other official preparations of poppy capsules, the seeds are ordered to be removed.

Anodyne and slightly emollient. This preparation forms a common fomentation, which is applied to bruised, inflamed, excoriated, tender, or swollen parts; to the eye in ophthalmia, to the abdomen in enteritis and peritonitis, to tender ulcers, &c. In cancer and other painful affections of the uterus, it is thrown into the vagina as a soothing remedy.

[§ **Extractum Papaveris.** *Extract of Poppies.*

Take of

Poppy Capsules, dried, freed from the seeds and coarsely powdered	1 pound.
Rectified Spirit	2 ounces.
Boiling Distilled Water	a sufficiency.

Mix the poppy capsules with two pints of the water, and infuse for twenty-four hours, stirring them frequently; then pack them in a percolator, and adding more of the water allow the liquor slowly to pass until about a gallon has been collected, or the poppies are exhausted. Evaporate the liquor by a water-bath until it is reduced to a pint, and, when cold, add the spirit. Let the mixture stand for twenty-four hours, then separate the clear liquor by filtration, and evaporate this by a water-bath until the extract has acquired a suitable consistence for forming pills.

Dose.—2 to 5 grains.]

Anodyne and soporific. It appears to me to produce effects similar to those of opium, for which it is frequently substituted, on the supposition that, while it allays pain and promotes sleep, it is less liable to occasion nausea, constipation, headache, or delirium. If it be prepared from a decoction, instead of an infusion of poppy heads as directed in the Pharmacopœia, it will contain a considerable quantity of inert mucilaginous matter.

[§ **Syrupus Papaveris.** *Syrup of Poppies.*

Take of

Poppy Capsules, dried, freed from the seeds and coarsely powdered	36 ounces.
Rectified Spirit	16 fluid ounces.
Refined Sugar	4 pounds.
Boiling Distilled Water	a sufficiency.

Mix the poppy capsules with four pints of the water, and infuse for twenty-four hours, stirring them frequently; then pack them in a percolator, and adding more of the water allow the liquor slowly to pass until about two gallons have been collected or the poppies are exhausted. Evaporate the liquor by a water-bath until it is reduced to three pints. When quite cold, add the spirit, let the mixture stand for twelve hours, and filter. Distil off the spirit, evaporate the remaining liquor to two pints, and then add the sugar. The product should weigh six pounds and a half, and should have the specific gravity 1·320.]

Syrup of poppies, especially if too thin, is very liable to ferment, and then contains spirit or acetic acid, or both, and is of course ill-adapted for medicinal use. To check these changes, it should be carefully made with spirit, according to the directions of the Pharmacopœia, taking care that it has the proper consistency, and is kept in a cool place. Occasionally a mixture of treacle and laudanum, or of syrup and extract of poppies, has been substituted for it; but this fraud is highly dangerous, and has on several occasions proved fatal to children. Syrup of poppies is narcotic, sedative, and anodyne, and is commonly, though not wisely, employed as the infant's opiate. It mitigates pain, allays spasm and troublesome cough, and promotes sleep. Even in the adult it is sometimes used for these purposes. It forms a useful adjunct to pectoral tinctures. Over ordinary opiates it has the positive advantage of a less disagreeable taste, and the supposed one of being less likely to create nausea and headache. Even when properly prepared, its administration to infants requires the greatest caution, on account of their known susceptibility to the influence of opiates, and the varying strength of the preparation.

Dose.—For an infant of three or four months old, from 10 to 15 minims; for adults, from 1 to 4 fluid drachms.

[§ **Opium.** *Opium.*

The juice, inspissated by spontaneous evaporation, obtained by incision from the unripe capsules of the poppy, Papaver somniferum, *Linn.*, grown in Asia Minor.]

History.—It is uncertain at what period *opium* was first known or introduced into medicine. Hippocrates recommends the μηκώνιον or *poppy juice*, in a disease of the uterus; and Dioscorides, on the authority of Erasistratus, tells us that Diagoras (who was contemporary, it is supposed, with Hippocrates) condemned the use of opium. These are, I believe, the most ancient Greek authorities who speak of this substance; and it is impossible, I think, to arrive at any accurate conclusion from their remarks, whether opium had or had not been known long before their time, though Alston infers from the little use made of it by Hippocrates, as well as from Diagoras condemning its use in diseases of the eyes, that its virtues were not known long before him. Dioscorides and Pliny mention that the expressed juice of the heads and leaves is termed *Meconium*, and that it is much weaker than opium. Theodore Zwinger, Sprengel, and others, have supposed that the *nepenthes* (νηπενθές) of Homer was opium. It would appear that opium was not much employed until the time of the Arabs, except in the form of the confections known as Theriaca, Mithridatica, &c. The word *opium* is derived from ὀπός, *the juice*.

Extraction, Collection, and Preparation.—The mode of extracting opium is to a certain extent similar in all countries, and consists in making incisions into the half ripe capsules, and collecting the exuded juice when concreted into tears. After collection, the masses of tears are either worked up into a homogeneous mass in a mortar or otherwise, as in Egypt and India; or the separate portions are merely put together, as in Asia Minor and Persia. In the latter case, opium, when examined by means of a magnifying lens, is seen to be composed of agglutinated tears, and may be termed *granular opium*; in the former the opium appears perfectly homogeneous, and may be called *homogeneous opium*.

A full account of the cultivation, mode of obtaining, and preparation of opium in India has been published by Dr. Eatwell, and will found in the eleventh and twelfth volumes of the first series of the *Pharmaceutical Journal*. As the opium obtained in Asia Minor is, however, alone official, we subjoin the mode of collection, preparation, &c. which is adopted there, and which has been described by Messrs. Maltass and Wilkin in the fourteenth volume of the first series of the *Pharmaceutical Journal*. It is as follows:—About the end of May the plants arrive at maturity, and the flowers expand. A few days after the petals have fallen, the capsule is ready for incision. This operation is performed in the afternoon of the day, and in the following manner:—a transverse incision is made with a knife in the lower part of the capsule, the incision being carried round until it arrives nearly at the part where it commenced; sometimes it is continued spirally to half way beyond its starting point. The greatest nicety is required to avoid cutting too deep, and penetrating the interior coating of the capsule, as this would cause the exuding milky juice to flow into the inside. The following morning those engaged in collecting the opium lay a large poppy leaf on the palm of the left hand, and, having a knife in the right hand, they scrape the opium which has exuded from the incision in each capsule, and then transfer it from the knife to the leaf, until a mass of sufficient size has been formed, when a second poppy leaf is placed over the top of the mass. If the dew has been heavy during the night the yield is greater, but the opium is dark in colour; if, on the contrary, there has been no dew, the yield is less, but the opium is of a lighter colour. A high wind is prejudicial, as the dust raised from the pulverised soil adheres to the exudation, and cannot be separated. The poppy capsules are cut but once, but as each plant will from one stem produce several branches, and each branch produce a flower, it is usual to pass over the field a second or a third time, to cut such capsules as were not ready at the first cutting. After the opium is collected it is dried in the shade.

General Characters. — [§ Irregular lumps, weighing from four ounces to two pounds; enveloped in the remains of poppy leaves, and generally covered with the chaffy fruits of a species of rumex; when fresh, plastic, tearing with an irregular slightly moist chestnut-brown surface, shining when rubbed smooth with the finger, having a most peculiar odour and nauseous bitter taste.

Test.—Take of opium one hundred grains, slaked lime one hundred grains, distilled water four ounces. Break down the opium, and steep it in an ounce of the water for twenty-four hours, stirring the mixture frequently. Transfer it to a displacement apparatus, and pour on the remainder of the water in successive portions, so as to exhaust the opium by percolation. To the infusion thus obtained, placed in a flask, add the lime, boil for ten minutes, place the undissolved matter on a filter, and wash it with an ounce of boiling water. Acidulate the filtered fluid slightly with diluted hydrochloric acid, evaporate it to the bulk of half an ounce, and let it cool. Neutralise cautiously with solution of ammonia, carefully avoiding an excess; remove by filtration the brown matter which separates, wash it with an ounce of hot water, mix the washings with the filtrate, concentrate the whole to the bulk of half an ounce, and add now solution of ammonia in slight excess. After twenty-four hours collect the precipitated morphia on a weighed filter, wash it with cold water, and dry it at 212°. It ought to weigh at least from six to eight grains.]

Varieties.—Several varieties of opium have been described by pharmacologists, as Smyrna, Constantinople, Egyptian, Persian or Trebizond, Indian, English, French, German, &c. Of these, only the Smyrna, Constantinople, Egyptian, and Persian kinds are ordinarily found in commerce; and as only the first two are collected in Asia Minor, they are alone official, and should be therefore exclusively used in the preparations ordered in the Pharmacopœia. Although Smyrna and Constantinople opiums are commonly regarded by European pharmacologists as distinct varieties, according to Mr. Maltass, there is no real difference between them, both being the produce of the same districts, from which they are forwarded to either Smyrna or Constantinople for sale, according to circumstances. The Smyrna variety is that most commonly imported into this country. Our space will only allow us to describe the four commercial kinds of opium.

1. *Smyrna Opium.*—This is the *Turkey* or *Levant opium* of commerce. It occurs in irregular rounded or flattened masses, of various sizes, although rarely exceeding two pounds in weight, enveloped in poppy leaves, and usually surrounded with the reddish fruits of some species of *Rumex.* After the opium has been much handled the rumex fruits become more or less divested of their pericarps, and the seeds are then found, to a corresponding degree, upon the surface, instead of the fruits. Some of the flat cakes are without these fruits, and somewhat resemble Constantinople opium. When first imported, the masses, which are made up of agglutinated tears (*granular opium*), are soft, and of a reddish-brown colour internally; but, by keeping, they become harder and blackish. Smyrna opium has a waxy lustre; its odour is strong and unpleasant; its taste bitter, acrid, nauseous, and persistent. Notwithstanding occasional adulterations (see *Adulterations and Impurities*, p. 947), Smyrna opium is the best commercial kind. It yields commonly more *morphia* and *meconic acid* than either Constantinople, Egyptian, or Persian opium. The quantity of *morphia* which can be obtained from it is, perhaps on the average, about 8 per cent. Merck examined five kinds of Smyrna opium: from the worst he procured 3 to 4 per cent. of morphia; from the best 13 to 13·5 per cent.

2. *Constantinople Opium.*—There are two sorts of this variety of opium: one in large irregular cakes, which are flattened like Smyrna opium, and of very good quality; and the other in small, flattened, regular cakes, of a lenticular form, from two to two and a half inches in diameter, and covered with a poppy leaf, the midrib of which divides the cake into two parts. Constantinople opium has an odour similar to the preceding kind, but more feeble; it blackens and dries in the air. It is more mucilaginous than the Smyrna variety; and the cakes are never covered with rumex fruits. Constantinople opium is, as a rule, inferior to Smyrna. But it is of very unequal quality, some specimens only yielding 3 or 4 per cent. of morphia, while in others 14 or 15 per cent. have been found. It is probable that opium of unequal qualities, and produced in several parts of the Turkish empire, is carried to the capital, and, being exported thence, bears the name of Constantinople opium.

3. *Egyptian Opium.*—Though not official, this is sometimes of good quality. It occurs in round flattened cakes of about three inches in diameter, covered externally with the vestiges of a leaf, which

Professor Bentley believes to be that of the Oriental Plane (*Platanus orientalis*). It is usually very dry. It is distinguished from the two preceding varieties by its reddish colour, which is analogous to that of socotrine or hepatic aloes. Some very inferior qualities are sometimes offered for sale, which appear to the sight and touch to be largely adulterated. By keeping, it does not blacken like the other kinds; its odour is less strong, and somewhat musty. Sometimes it becomes damp by keeping. Egyptian opium is, for the most part, inferior to either of the preceding kinds; but its quality is by no means uniform, some specimens yielding only 5 per cent. of morphia, while others have of late years yielded chemists in this country as much as 8 per cent. Merck procured from 6 to 7 per cent. of morphia, with much meconic acid. Some experimenters have found much narcotine in this opium.

4. *Persian* or *Trebizond Opium.*—Some years since a quantity of opium was imported into this country from Trebizond in the form of cylindrical sticks, which, by pressure, have become somewhat angular. Their length is about six inches; their diameter about half an inch, a little more or less. Each one is enveloped in a smooth shiny paper, and tied with cotton; its colour is similar to that of socotrine aloes. It has the opiate odour stronger than that of the Egyptian kind, but less than Smyrna opium, and mixed somewhat with a musty smell; its taste is intensely bitter. It is commonly termed in commerce Persian opium, but the specimens I received came from Trebizond. It is a very inferior kind of opium. Of late years, however, opium of good quality has been occasionally imported from Persia. It occurred in the form of roundish irregular lumps.

Adulterations and Impurities.—Opium is brought into the market of very unequal degrees of purity, chiefly in consequence of its having been subjected to adulteration; and partly, perhaps, from the employment of different methods of preparation. Moreover, its consistence is by no means uniform; that of some kinds being quite soft, and of others hard; the Smyrna opium being generally much softer than the Constantinople. As this difference depends on the presence of unequal quantities of water, an obvious variation of strength is the consequence. Moreover, the quantity of morphia in good opium of different or even of the same localities, is, as we have seen, by no means constant. Furthermore, opium, from which the morphia has been extracted, has been fraudulently introduced into commerce. *The Water* in opium will be readily judged of by the consistence, but still better by observing the loss on drying a given weight of the opium at 212°; and a physical examination of opium will frequently detect impurities (as leaves, bullets, stones, fruits,

&c.). If a decoction of the suspected opium be made and strained, various foreign matters are left on the sieve. In this way I obtained 600 grains of small stones and gravel from 10 ounces of opium. A decoction of opium when cold should not give a blue precipitate (*iodide of starch*) on the addition of tincture of iodine: if it do, the presence of starch or flour is obvious. (See also *Test*, p. 945.)

Composition.—The following substances may be regarded as the principal constituents of opium:—Morphia, codeia, narcotia, thebaia, narcein, meconin, meconic acid, extractive, and volatile odorous principle.

1. *Morphia.*—(See p. 977.)

2. *Codeia* (*Codein*).—So called from κώδεια, *a poppy head* ($C_{18}H_{21}NO_3$). This is a white crystalline solid, soluble in cold, and still more so in boiling water; soluble in alcohol and ether; insoluble in a cold weak solution of potash. If more codeia be added to boiling water than this liquid can dissolve, the excess melts and forms an oily layer at the bottom of the vessel; and, by cooling, a crystalline mass is obtained. It reacts as an alkali on test papers, and unites with acids to form crystalline salts. From morphia, codeia is distinguished by its not becoming blue on the addition of a persalt of iron. It is also said not to redden nitric acid like morphia (Turner). All the specimens of codeia which I have met with become orange-yellow on the addition of nitric acid. Moreover, ammonia does not precipitate it from its very diluted solution in hydrochloric acid, on account of its solubility in water; and this affords a means of separating morphia from codeia. The separation may be more easily effected by ether, which readily dissolves codeia, or by alkalies (potash or soda), which dissolve morphia, but leave codeia. From meconin it is distinguished by its aqueous solution possessing marked alkaline properties, as manifested by its action on test papers. Tincture of galls produces a copious precipitate (*tannate of codeia*) in solutions of codeia.

3. *Narcotia* (*Narcotine*).—So called from ναρκωτικός, *narcotic* ($C_{22}H_{23}NO_7$). The greater part of the narcotia of opium is in a free state, as it is removable by ether without the aid of either acids or alkalies. It is a white inodorous substance, crystallising in prisms, which are fluted or striated; distinguished from morphia by being insipid, very soluble in ether, insoluble in alkalies, by its not becoming blue on the addition of perchloride of iron, by its not decomposing iodic acid, and, when quite pure, by its not yielding a brown colour when treated by chlorine and ammonia. Heated on paper over a candle, it gives a greasy-looking stain to the paper. Nitric acid dissolves it, and acquires an orange tint. It does not affect vegetable colours, and by this character is readily distinguished from both morphia and codeia. It is insoluble in cold water,

but dissolves in 400 parts of boiling water, in 100 parts of cold alcohol, or in 24 parts of boiling alcohol. The volatile oils, also, dissolve it; it is soluble in ether. It combines with acids, and forms salts. The *salts of narcotia* have been but little examined. They are more bitter than those of morphia, redden litmus, and are precipitated from their solutions by infusions of galls and by the alkalies. The *hydrochlorate* is crystallisable. Both this and the *sulphate* are very soluble in water. Narcotia is extracted from the residue of the opium which has been subjected to the action of cold water. This is treated with water acidulated with either acetic or hydrochloric acid, and to the filtered solution ammonia is added. The precipitate treated with boiling alcohol yields narcotia, which is deposited as the liquor cools. It may be separated from morphia by ether, which dissolves the narcotia but leaves the morphia, or by a solution of potash, which dissolves the morphia but leaves the narcotia, or by the cautious addition of weak acetic acid, which dissolves the morphia, and, unless the acid be greatly in excess, does not dissolve the narcotia. Narcotia possesses but little activity. Dr. Roots gave gradually increased doses of it, up to twenty grains without the least injury. The bitterness of its sulphuric solution led him to employ it in intermittents, as a substitute for sulphate of quinia. Attention has been also drawn to it in India, by Dr. O'Shaughnessy, as an Indian indigenous substitute for quinia; and nearly 200 cases of intermittent and remittent fevers, treated by it with success, have been published.

4. *Thebaia* (*Paramorphia*).—So called from *Thebes*, an ancient city of Egypt ($C_{19}H_{21}NO_3$). It is a white, crystalline, fusible solid, having an acrid, styptic taste, very soluble in alcohol and ether, but hardly at all soluble in water. It possesses alkaline properties, and dissolves in weak acids. From these solutions it is precipitated by alkalies. An excess of alkali cannot dissolve it, unless, indeed, the alkaline solution be very concentrated. It fuses at 302°, but does not volatilise at any temperature. It is distinguished from morphia by not becoming blue on the addition of the perchloride of iron, and by not forming crystallisable salts with acids. From codeia it differs in not crystallising in large crystals, and in not forming crystallisable salts. With meconin and narcein it has no analogy, and it is distinguished from them by the want of the peculiar properties which characterise those bodies. It resembles narcotia more than any other substance, but is distinguished by the crystals being shorter or granular, and wanting the pearly brilliancy possessed by those of narcotia; by its acrid taste; by its fusibility at 302°; by its greater solubility in alcohol; and by nitric acid, when dropped on it, converting it into a substance like a soft resin before dissolving it. Pelletier considered it to be isomeric with morphia—

hence he called it *paramorphia.* Magendie states that one grain injected into the jugular vein, or placed in the pleura, acts like brucia or strychnia, and causes tetanus, and death in a few minutes.

5. *Narcein.*—So called from νάρκη, *stupor* ($C_{23}H_{29}NO_9$). It is a white inodorous solid, crystallised in long, fine, silky needles, radiating in tufts from a centre, with a slightly bitter, and even somewhat metallic taste. It dissolves in 230 parts of boiling water, or 375 parts of water at 60°. It fuses at about 198°, and at a higher temperature is decomposed. Narcein has several very striking properties by which it is distinguished from other substances. The sulphuric, nitric, and hydrochloric acids, so diluted with water that they cannot alter the elementary composition of narcein, give to this substance a fine light-blue colour, immediately on coming in contact with it. This alteration of colour does not appear to depend on any change in the elementary composition of narcein, since, by saturating the acids with ammonia, it is precipitated unchanged. When much water is added, the blue colour disappears. Another peculiar trait of narcein is, that it forms a bluish compound (*iodide of narcein*) with iodine: heat and alkalies destroy the colour. These characters are sufficient to distinguish narcein from all other known substances. In addition, I may add that it does not form a blue colour with the perchloride of iron, as morphia does. Narcein was at first supposed to be an alkaloid; but as it does not affect vegetable colours, nor combine with nor saturate acids, it is now regarded as a neutral principle. Two grains have been several times thrown into the jugular vein of a dog, without producing any appreciable effect. It is presumed, therefore, to be iuert.

6. *Meconin.*—So called from μήκων, *a poppy* ($C_{10}H_{10}O_4$). It was discovered by Pelletier, and its properties were examined by Couerbe. It is a white crystalline odourless solid. Its taste, which is at first scarcely perceptible, is afterwards sensibly acrid. The crystals are six-sided prisms, with dihedral summits. It fuses at 194°, and becomes a colourless limpid fluid. At a higher temperature it may be distilled. It dissolves in 265 parts of cold water, or in 18 parts of boiling water. It is soluble in alcohol and in ether. It is distinguished from morphia and codeia by not possessing alkaline properties. From morphia it is further distinguished by its great fusibility, its greater solubility in water, and in not becoming blue on the addition of perchloride of iron. Cold sulphuric acid dissolves meconin, the solution being limpid and colourless. Meconin is remarkable for not containing nitrogen. A grain dissolved in water, and injected into the jugular vein of a dog, produced no remarkable effect. Further experiments, however, are required before we can positively declare it to be an inert substance.

7. *Meconic Acid* ($C_7H_4O_7.3H_2O$).—This is usually procured from meconate of lime by acting on it, in hot water, with hydrochloric acid. The meconic acid crystallises on cooling. It is a tribasic acid. When pure it is in the form of white, transparent, micaceous scales, which are soluble in four times their weight of boiling water. But at this temperature water decomposes it; carbonic acid is evolved, and a solution of *comenic acid* is obtained. Cold water dissolves a smaller quantity of meconic acid. Alcohol is also a solvent for meconic acid. *It reddens the neutral persalts of iron*, forming the *meconate of the peroxide of iron.* Alkalies, protochloride of tin, and nitric acid, assisted by heat, destroy this red colour. A solution of corrosive sublimate, which destroys the red colour of sulphocyanide of iron, does not decolorise a red solution of meconate of iron. It forms with a weak solution of *ammonio-sulphate of copper*, a green precipitate (*meconate of copper*). It yields white precipitates (*meconates*), which are soluble in nitric acid, with *acetate of lead*, *nitrate of silver*, and *chloride of barium.* The alkaline acetates which, like meconic acid, redden the persalts of iron, and might, therefore, be confounded with it, do not occasion precipitates with the salts of lead and of barium. Besides, the meconate of lead is insoluble in acetic acid; and if a solution of an alkaline acetate be first boiled with a few drops of diluted sulphuric acid, it is not reddened by a persalt of iron. It is not reddened by *chloride of gold*, which reddens hydrosulphocyanic acid and the sulphocyanides. Meconic acid is believed to be an inert substance. Sertürner swallowed five grains of it without observing any effect. Sömmering gave ten grains to a dog; Feneglio and Blengini gave eight grains to dogs, cows, and frogs, and four grains to various men: in all cases no effects were observed. Combined with bases, it doubtless modifies their action. Meconate of soda, however, is not active, as Sertürner asserted. It is supposed that the effect of the morphia in opium is modified by its combination with meconic acid.

8. *Extractive.*—The substance usually denominated the extractive of opium is probably a heterogeneous body. It is brown and acid, and has been supposed to be one of the active principles of opium. The reasons for this opinion are the following:—In the *first* place, it has been asserted that after the morphia has been separated from an infusion of opium by magnesia, the filtered liquor gives, by evaporation, an extract which produces the same kind of narcotic effect that opium does. *Secondly*, the effects of the known active principles of opium are not sufficiently powerful to authorise us to refer the whole of the active properties of opium to them.

9. *Volatile Odorous Principle* (*Volatile Oil?*).—The distilled water of opium has the peculiar odour of this drug, and by keeping

deposits a ropy substance. Hitherto, however, all attempts to isolate the volatile odorous principle of opium have failed, and its nature, therefore, is as yet unknown. Nysten swallowed two ounces of the distilled water without any sensible effect; and Orfila injected a like quantity of it into the jugular vein of a dog without apparently causing any inconvenience to the animal. The volatile principle cannot, therefore, possess much activity; but Nysten concludes 'that the distilled water of opium, strongly saturated with the aromatic principle, is capable of producing drunkenness and sleep, when taken in a strong dose.'

Chemical Characteristics.—Litmus paper is reddened by a watery infusion of opium (or tincture of opium diluted with water), owing to a free acid (*meconic*). Perchloride of iron gives it a deep red colour (*meconate of iron*). Acetate and subacetate of lead occasion a copious grey precipitate (*meconate and sulphate of lead with colouring matter*), which, treated by sulphuric acid or sulphuretted hydrogen, yields free meconic acid. Chloride of barium also causes a precipitate (*meconate and sulphate of baryta*). Ammonia renders the infusion turbid (*precipitated morphia and narcotia*). Tincture of galls causes a precipitate (*tannates of morphia and codeia*). Nitric acid communicates to the infusion a red colour (*oxidised? morphia*). Chloride of gold causes a deep fawn-coloured precipitate.

Physiological Effects.—I propose to examine the effects of opium under three heads or subdivisions:—*first*, the effects of one or a few doses employed medicinally; *secondly*, the effects of the habitual employment of opium; and *thirdly*, its effects on the different systems of organs.

1. *Effects of one or a few doses.*—We may consider these under three degrees of operation. *First degree of operation.*—In *small doses*, as from a quarter of a grain to one grain, opium generally acts as a stimulant, though in this respect the symptoms are not uniform. Usually the vascular system is somewhat excited, and a sensation of fulness is experienced about the head. The excitement in the cerebral vascular system is accompanied by alterations in the condition of the nervous functions. The mind is usually exhilarated; the ideas flow more quickly; a pleasurable or comfortable condition of the whole system is experienced, difficult to describe; there is a capability of greater exertion than usual. These symptoms are followed by a diminution of muscular power, and of susceptibility to the impression of external objects; a desire of repose is experienced, with a tendency to sleep. While these effects are taking place, the mouth and throat become dry, and hunger is diminished, though the thirst is increased; and slight constipation usually follows. Such are the ordinary effects of a small dose of opium on persons unaccustomed to its use. By repetition, however, its influence

becomes considerably diminished. *Second degree of operation.*—Given in a *full medicinal* dose (as from two to five grains), the stage of excitement is soon followed by that of depression. The pulse, which at first is increased in fulness and frequency, is afterwards reduced below the natural standard. The skin becomes hot; the mouth and throat dry; the appetite diminished; the thirst increased; and frequently nausea, or even vomiting, is induced. The symptoms of excitement soon pass away, and a state of torpor succeeds: the individual seems indisposed to exertion; the muscular system appears enfeebled; the force of external impressions on the organs of the senses is diminished; and the ideas become confused. This state is followed by an almost irresistible desire to sleep, which is frequently attended by dreams—sometimes of a pleasing, at others of a frightful nature. These effects are usually succeeded by constipation (which may continue for several days), by nausea, furred tongue, headache, and listlessness. *Third degree of operation: Poisonous effects of opium.*—Sir R. Christison has so briefly summed up the effects of a poisonous dose of opium, that I cannot do better than quote his statement:—'The symptoms of poisoning with opium, when it is administered at once in a dangerous dose, begin with giddiness and stupor, generally without any previous stimulus. The stupor rapidly increasing, the person becomes motionless and insensible to external impressions; he breathes very slowly, generally lies quite still, with his eyes shut and the pupils contracted; and the whole expression of the countenance is that of deep and perfect repose. As the poisoning advances, the features become ghastly, the pulse feeble and imperceptible, the muscles exceedingly relaxed, and, unless assistance is speedily procured, death ensues. If the person recover, the sopor is succeeded by prolonged sleep, which commonly ends in twenty-four or thirty-six hours, and is followed by nausea, vomiting, giddiness, and loathing of food.' There is also a smell of opium in the breath, although this may be concealed in some instances by other odours.

2. *Habitual use of Opium.*—Numerous instances of the enormous quantities of opium which, by habit, may be taken with impunity, have been published. Dr. Chapman tells us that he knew a wine-glassful of laudanum to be given several times in the twenty-four hours. 'But what is still more extraordinary,' says this author, 'in a case of cancer of the uterus, which was under the care of two highly respectable physicians (Drs. Monges and La Roche) of Philadelphia, the quantity of laudanum was gradually increased to three pints, besides a considerable quantity of solid opium in the same period. Some doubt has been entertained as to the alleged injurious effects of opium-eating on the health, and its tendency to shorten life; and it must be confessed that in several known cases

which have occurred in this country no ill effects have been observable. Sir R. Christison has given abstracts of eleven cases, the general result of whose histories 'would rather tend to throw doubt over the popular opinion.' In those cases of disease (usually cancerous) in which enormous doses of opium are taken to alleviate pain, I have usually observed constipation produced; but Sir R. Christison says, 'constipation is by no means a general effect of the continued use of opium. In some of the cases mentioned above, no laxatives have been required; in others, a gentle laxative once a week is sufficient.'

3. *Action of Opium on the different organs.*—In discussing this subject, it will be convenient to consider the organs arranged in groups or systems devoted to some common functions.

a. On the Cerebro-spinal System.—Taken in small or moderate doses, opium first produces excitement of the vascular system of the brain, accompanied with corresponding excitement in the cerebro-spinal functions. This state, however, is succeeded by that of depression. In large or poisonous doses the leading symptom is sopor; that is, a state analogous to profound sleep, from which the patient *can* be roused, though with difficulty. In the latter stage of poisoning this symptom is succeeded by coma—that is, profound sleep, from which the patient *cannot* be roused. Sopor is usually accompanied either with actual paralysis of the muscular fibres, or with a diminished power almost amounting to it; both of which states doubtless arise from the same condition of the cerebro-spinal system which produces sopor or coma. This state is commonly supposed to be sanguineous (venous) congestion. The pupil is usually contracted, a circumstance deserving of especial notice. In some cases there is delirium in the place of sopor or coma, and convulsions instead of paralysis. Another effect of opium is diminished sensibility. Thus the whole body becomes less susceptible of painful impressions; in dangerous and fatal cases, the eyes are insensible to light, and the ears to sound. From these effects of opium on the cerebro-spinal system the following inferences may be drawn:—1. That it is an objectionable agent in apoplexy, phrenitis, and paralysis. 2. That under proper regulations it is a remedy which may be used to stimulate the cerebro-vascular system, to promote sleep, to diminish inordinate muscular contraction, and to lessen the sensibility of the body, and thereby to alleviate pain.

b. On the Digestive System.—The usual effects of opium on the organs of digestion are the following:—It reduces the amount of secretion and exhalation from the whole canal; and thus causes dryness of the mouth and throat, and diminishes the liquidity of the stools: it excites thirst, lessens hunger, checks the digestive process, and in some cases causes vomiting. In a case of poisoning by opium, in which a female remained eighteen hours in a state of insensibility, farinaceous food was found still unchanged in the stomach. The Tartar couriers, who travel immense distances in a short period of time, take opium only during the journey, to support them. It lessens the sensibility and contractility of the digestive organs: hence the difficulty, in severe cases of poisoning, of producing vomiting. The constipation which follows the use of opium depends partly on the same cause, and in part also on the lessened excretion of bile, and diminished secretion from the gastro-intestinal mucous membrane. From these effects of opium on the digestive organs, we may draw the following inferences:—1. That in reduced secretion from the gastro-intestinal membrane, in extreme thirst, in loss of appetite and weak digestion, in obstinate costiveness, and in diminished excretion of bile, opium is an objectionable remedy. 2. That under proper regulations opium is an admissible remedy for the following purposes:—To lessen excessive hunger; to allay pain, when unaccompanied by inflammation; to diminish the sensibility of the digestive organs, in cases of acrid poisoning, and in the passage of biliary calculi; to produce relaxation of the muscular fibres of the alimentary canal in colic and diarrhœa, and of the gall ducts in the passage of calculi; and to diminish excessive secretion from the intestinal canal, in diarrhœa. By continued use (as by opium-eaters), this drug frequently ceases to cause dryness of the mouth, to pall the appetite, or to confine the bowels.

c. On the Vascular System.—Opium certainly influences the movements of the heart and arteries; but the effect is by no means uniform, since in some cases we see the pulse increased, in others diminished in frequency; and a like variation is noticed in its fulness. Moreover, these variations occur in the same case at different stages. From Dr. Crumpe's experiments, it appears that, after the use of a moderate dose of opium, the frequency of the pulse is first increased, then decreased. The diameter of the artery, and the force and regularity with which the pulsations are effected, are properties of the pulse, readily, but by no means uniformly, affected by opium. To a certain extent we perceive a relation between the condition of the pulse and that of the cerebro-spinal functions. Thus, when convulsions occur, we usually have a hurried pulse, whereas when sopor or coma supervenes, the pulse becomes weaker or slower, or both, than natural. But these conditions are by no means uniform. A frequent pulse, with a feverish condition of the body, are common consequences of the use of small or moderate doses of opium; and in poisoning by this drug, a quick pulse, even though no convulsive movements are observed, is by no means rare. A poisonous dose of opium usually enfeebles the pulse, sometimes makes it fuller, often renders it irregular, and towards death always renders it feeble, and often imperceptible. The accumulation of blood observed in the large venous trunks and cavities of the right side of the heart is supposed to arise from the obstruction experienced to its passage through the pulmonary vessels. In attempting to lay down indications and contra-indications for the use of opium as a remedy for morbid conditions of the circulation, two difficulties present themselves:—*first*, the same condition of the vascular system may be induced by various and even opposite causes, for some of which opium may be an appropriate remedy, while for others it may prove an injurious agent; *secondly*, the effects of opium on the circulation are not uniform, and hence not to be relied on. The following conclusions, therefore, are submitted with considerable hesitation as to the universality of their application:—1. That in increased activity of the vascular system with considerable power, or with diminished secretions and exhalations, and in morbid conditions of the vascular system with a tendency to sopor or coma, opium is an objectionable remedy. 2. That in vascular excitement with great diminution of power, as after hemorrhage, and in various morbid conditions of the pulse attended with acute pain, spasm, or profuse secretion and exhalation, but without visceral inflammation, opium often proves a serviceable agent.

d. On the Respiratory System.—In studying the effects of opium on the respiration, we must remember that the mechanical part of this function is effected by muscular agency; and as the contractility of the muscular fibre is powerfully influenced by opium, so the respiratory movements are also necessarily modified. Occasionally the primary effect is a slight increase in their frequency; but the secondary effect is almost always of an opposite kind, the respiration being slower than usual; and when coma is present, the breathing is usually gentle, so as scarcely to be perceived; but in some cases it is stertorous. In fact, a paralytic condition of the respiratory muscles takes place, in consequence of which inspiration becomes gradually more and more difficult, until eventually asphyxia is induced, which is usually the immediate cause of death. Another effect ascribed to opium is, that it checks the arterialisation of the blood, by diminishing the supply of nervous agency, without which the decarbonisation or oxygenisation of this fluid cannot take place. It is difficult, however, to distinguish the consequences of this effect from those of asphyxia produced by paralysis of the respiratory muscles. The third point of view under which we have to examine the influence of opium on the respiratory system is, its effect on the membrane lining the trachea and bronchial tubes and cells. In the first place, it diminishes the sensibility of this, in common with other parts of the body; and, secondly, it checks exhalation and mucous secretion. A knowledge of these effects of opium on the organs of respiration leads to the following conclusions:—1. That this agent is contra-indicated in difficulty of breathing arising from a deficient supply of nervous energy, as in apoplectic cases; that it is improper where the venous is imperfectly converted into arterial blood; and, lastly, that it is improper in the first stage of catarrh and peripneumony, both from its checking secretion, and from its influence over the process of arterialisation. 2. That in cases of poisoning by opium, artificial respiration is indicated to prevent asphyxia. 3. That opium may, under proper regulations, be useful to diminish the sensibility of the bronchi, in the second stage of catarrh, and thereby to allay cough by lessening the influence of the cold air; and lastly, to counteract excessive bronchial secretion.

e. On the Urinary System.—Authors are not agreed as to the effect of opium on the kidneys; some asserting that it increases, others that it diminishes, the quantity of urine secreted. It cannot be doubted, that in most cases a moderate quantity of opium diminishes the excretion, while at the same time it makes this fluid turbid and thick. This does not, however, prove that the kidneys are the parts affected. In some morbid conditions of system opium certainly checks the urinary secretion. This is decidedly the case in diabetes. The ureters and bladder have their sensibility and contractility diminished by opium. With respect to the effect on the first of these parts the statement seems proved by the well-known beneficial influence of opium in cases where calculi are descending along these tubes. The acute pain is frequently relieved, and the ureters relaxed, so that large calculi are sometimes allowed to descend from the kidneys along them. In some cases of poisoning by this substance the bladder has been found to be unable to contract on its contents. In some other instances the sphincter of the bladder has been paralysed, and in consequence the urine was voided involuntarily. The effect of morphia on the bladder is more marked than that of opium. These remarks on the effects of opium on the urinary organs lead to the following conclusions:—1. That in diminished sensibility or contractility, or both, of the ureters or bladder, the use of opium is objectionable. 2. That, under proper regulations, opium may be a valuable remedy to dull the sensibility of the pelvis of the kidney, in cases of renal calculi; to allay pain and produce relaxation of the ureters when calculi are passing along these tubes; and, lastly, to diminish irritation of the bladder, whether produced by cantharides or other causes.

f. On the Sexual System.—We have little positive information as to the effects of opium on the reproductive organs of women. It is said that the catamenia, lochia, and secretion of milk, are unaffected by it. Under its use the milk acquires a narcotic property.

Furthermore, at times it has appeared to have an injurious effect on the fœtus *in utero*. Opium appears to act on the uterus as on most other contractile parts of the body; that is, it diminishes the contractility and sensibility of this viscus. From these observations it follows:—1. That wet nurses and pregnant women must employ opium with great caution, as its use by them may endanger the life of the child. 2. That opium may be employed to allay pain, spasm, and morbid irritation of the sexual organs; and that its use in the female is not likely to be attended with retention of the uterine or mammary secretions.

g. On the Cutaneous System.—Considered as an organ of sense, the cutaneous system is affected by opium in an analagous way to the other organs of sense; that is, its sensibility is diminished. But the skin has another function—that of excretion, which does not appear to be at all diminished, nay, to be increased, by the use of opium; one of the usual effects of this medicine being perspiration, which is in some cases attended with a pricking or itching of the skin, and occasionally with an eruption. In fact, taken medicinally, opium is a powerful sudorific, and often proves so even when acting as a poison. From these remarks it follows:—1. That opium is not likely to relieve loss of feeling or excessive perspiration; but may, on the other hand, under some conditions of the system, prove injurious. 2. That opium is adapted to the relief of pain or excessive sensibility of the skin, and for provoking perspiration; but the propriety of its use for these purposes must be determined by reference to the condition of the system generally. Experience proves that when the skin is very hot, and especially if it be also dry, opium is seldom beneficial, but often hurtful.

h. Topical Effects.—The local effects of opium are, compared with its general effects, very slight, except when hypodermically and endermically employed. Applied to the eye, the internal membrane of the nose, urethra, cutis vera, wounds or ulcers, it first causes pain, a sense of heat, and inflammation; but these effects subside, and are followed by a weakened or a paralytic condition of the sensitive and motor nerves. Several physiologists have proved that opium causes a local paralysis of the nerves; and Müller has shown that the narcotic action is not propagated from the trunk of a nerve to its branches. Scarcely any obvious effect results from the application of opium to the ordinary integument, on account of the barrier presented by the cuticle. Employed hypodermically or endermically, however, the effects of opium and its active constituents are at least as powerful and as rapidly produced as when introduced into the stomach.

Post-mortem Appearances.—The most important appearances are those observed in the nervous system; such as turgescence of vessels, effusion of water or of coagulable lymph, and occasionally, though rarely, extravasation of blood. Whenever redness of the digestive canal is observed, I believe it is referable to the use of some irritants (such as alcohol, ammonia, or emetics) taken either with, or after the use of, opium.

Modus Operandi of Opium.—Under this head I propose to examine several points not hitherto noticed, which involve the theory of the operation of opium on the system. 1. *The Odorous and Active Principles of Opium are absorbed.*—This assertion is proved by the following facts :—*a.* The odour of opium is sometimes recognisable in the secretions and exhalations : thus it is well known that the opiate odour is frequently detected in the breath of persons poisoned by this drug; and Barbier states, it may be also noticed in the urine and sweat. *b.* The secretions, in some cases, appear to possess narcotic properties. Barbier mentions the case of an infant that was thrown into a state of narcotism of several hours' duration, in consequence of having been suckled by a nurse who had previously swallowed a dose of laudanum to relieve cramp of the stomach. 2. *The Constitutional Effects of Opium depend in great part, if not wholly, on the absorption of its active principles.*—The facts on which this assumption rests are :—*α.* The active principles of opium are absorbed. *β.* The constitutional effects of it are found to be proportionate to the absorbing powers of the part. *γ.* The effect of opium, when thrown into the jugular vein, is similar to, though more powerful than, that produced by its application to other parts of the body. *δ.* The narcotic action does not react from a particular point of a nerve on the brain. 3. *The Essential and Primary Operation of Opium is on the Nervous System (the Brain and Spinal Cord chiefly).*—This is proved by reference to the already-described effects of opium. An examination of them shows that—*α.* The most important effects of opium are direct and obvious lesions of the nervous functions. *β.* The other effects of opium appear, for the most part, to be secondary, —that is, they arise out of the nervous lesions just referred to. 4. *Opium acts on the Nervous System as an Alterative.*—There are but three kinds of changes, compatible with life, which medicines can effect in the vital actions of an organ,—viz., an increase, a diminution, or an alteration of activity. A change in the intensity or energy merely of the vital actions of the nervous system, would not give a satisfactory explanation of the effects of opium. We are obliged, therefore, to assume that opium changes the quality of the actions. That is what is meant by the term *alterative.* The inquiry into the nature and kind of influence exercised by opium over the system, presents an extensive field for speculation and hypothesis. Dr. Cullen considered opium to be a sedative, and referred its effects to its power of 'diminishing the mobility, and in a certain manner suspending the motion of the nervous fluid.' Several later writers, Barbier for example, also call opium a sedative. Brown declared it to be a stimulant, and his opinion has been adopted by Crumpe, Murray, and Dr. A. T. Thomson, in this country, and of course by the continental Brunonians, as well as by the partisans of the Italian theory of contra-stimulus. Fontana ascribed the operation of opium to changes which it induces in the blood. Mayer declared opium to be both stimulant and sedative,—viz., stimulant to the nerves and vascular system, but sedative to the muscles and digestive organs. Lastly, Orfila asserts that 'opium, employed in strong doses, ought not to be ranked among the narcotics or the stimulants; it exerts a peculiar mode of action which cannot be designated by any of the terms at this moment employed in the Materia Medica.' These examples selected out of many opinions, will be sufficient to prove how little is really known of the real action of opium; and I believe we shall save ourselves much time and useless speculation by at once confessing our ignorance on this point. 5. *The operation of Opium, compared with that of other cerebro-spinants or narcotics, is distinguished by both positive and negative characteristics.*—The symptoms constituting the *positive* characters, are relaxation or paralysis of the contractile tissues, a tendency to sleep or stupor, a contracted pupil, and constipation. The symptoms whose absence furnishes the *negative* characters, are tetanic convulsions, delirium or inebriation, dilated pupil, syncope, gastro-intestinal irritation, and topical numbness. These are the general characteristics of the opiate medication. To some of them occasional, or perhaps frequent, exceptions exist. I have already pointed out the distinguishing effects of hyoscyamus, belladonna, stramonium, and conium. The topical numbness caused by aconite distinguishes its operation from that of opium. Moreover, in three cases of poisoning by this substance, which came under my notice, there was no stupor. Tobacco and foxglove enfeeble the vascular system, causing syncope; and they also produce gastro-intestinal irritation. Furthermore, they have not that tendency to induce sleep which we observe after the use of opium. The speedy operation, short period of influence, and usually, the presence of convulsions, distinguish the operation of hydrocyanic acid. Indian hemp induces a cataleptic state. Vinous liquids cause their well-known peculiar inebriation. Their effects in small doses agree to a certain extent with those of small doses of opium; but they are not equally available as antispasmodics.

Therapeutics.—Opium is undoubtedly the most important and valuable remedy of the whole Materia Medica. For other medicines we have one or more substitutes; but for opium, none,—at least, in the large majority of cases in which its peculiar and beneficial influence is required. Its good effects are not, as is the case with some valuable medicines, remote and contingent, but they are immediate, direct, and obvious; and its operation is not attended with pain or discomfort. Furthermore, it is applied, and with the greatest success, to the relief of maladies of every day's occurrence, some of which are attended with the most acute human suffering. These circumstances, with others not necessary here to enumerate, conspire to give to opium an interest not possessed by any other article of the Materia Medica. We employ it to fulfil various indications, some of which have been already noticed. Thus we exhibit it under certain regulations, to mitigate pain, to allay spasm, to promote sleep, to relieve nervous restlessness, to produce perspiration, and to check profuse mucous discharges from the bronchial tubes and gastro-intestinal canal. But experience has proved its value in relieving some diseases in which not one of these indications can be at all times distinctly traced.

1. *In Fevers.*—The consideration of the use of opium in fever presents peculiar difficulties. Though certain symptoms which occur in the course of this disease are, under some circumstances, most advantageously treated by opium, yet, with one or more of these symptoms present, opium may, notwithstanding, be a very inappropriate remedy. The propriety or impropriety of its use, in such cases, must be determined by other circumstances, which, however, are exceedingly difficult to define and characterise. It should always be employed with great caution, giving it in small doses, and carefully watching its effects. The symptoms for which it has been resorted to are, *watchfulness*, *great restlessness*, *delirium*, *tremor*, and *diarrhœa*. When watchfulness and great restlessness are disproportionate, from first to last, to the disorder of the vascular system or of the constitution at large; or when these symptoms continue after excitement of the vascular system has been subdued by appropriate depletives, opium frequently proves a highly valuable remedy: nay, the safety of the patient often arises from its judicious employment. The same remarks also apply to the employment of opium for the relief of delirium; but it may be added, that in patients who have been addicted to the use of spirituous liquors, the efficacy of opium in allaying delirium is greatest. Yet I have seen opium fail to relieve the delirium of fever, even when given apparently under favourable circumstances; and I have known opium restore the consciousness of a delirious patient, and yet the case has terminated fatally. If the skin be damp and the tongue moist, it rarely, I think, proves injurious. The absence, however, of these favourable conditions by no means precludes the employment of opium; but its efficacy is more doubtful. Sir Henry Holland suggests that the condition of the pupil may serve as a guide in some doubtful cases;—where it is contracted, opium being contra-indicated. When

sopor or coma supervenes in fever, the use of opium generally proves injurious.

2. *In Inflammatory Diseases.*—Opium has long been regarded as an objectionable remedy in inflammation ; but it is one we frequently resort to, either for the purpose of palliating particular symptoms, or even as a powerful auxiliary antiphlogistic remedy. The objects for which opium is usually exhibited in inflammatory diseases are to mitigate excessive pain, to allay spasm, to relieve great restlessness, to check excessive secretion, and to act as an antiphlogistic. In employing it as an anodyne, we are to bear in mind that it is applicable to those cases only in which the pain is disproportionate to the local vascular excitement; and even then it must be employed with considerable caution ; for to 'stupify the sensibility to pain, or to suspend any particular disorder of function, unless we can simultaneously lessen or remove the causes which create it, is often but to interpose a veil between our judgment and the impending danger.' As an antiphlogistic, it is best given in conjunction with calomel. This practice, however, does not prove equally successful in all forms of inflammation. It is best adapted for the disease when it affects membranous parts ; and is much less beneficial in inflammation of the parenchymatous structure of organs. In *gastritis* and *enteritis* the use of opium has been strongly recommended. After bleeding the patient to syncope, a full opiate is to be administered ; and if the stomach reject it, we may give it by injection. It acts on the skin, induces quiet and refreshing sleep, and prevents what is called the hemorrhagic reaction. If the urgent symptoms return when the patient awakes, the same mode of treatment is to be followed, but combining calomel with the opium. In *peritonitis*, the same plan of treatment is to be adopted; but warm moist applications are on no account to be omitted. Of the great value of opiates in *puerperal fever* abundant evidence has been adduced by Dr. Ferguson. In *cystitis*, opium, preceded and accompanied by blood-letting and the warm bath, is a valuable remedy; it relieves the scalding pain, by diminishing the sensibility of this viscus to the presence of the urine, and also counteracts the spasmodic contractions. In *inflammation of the walls of the pelvis of the kidney, and also of the ureters*, especially when brought on by the presence of a calculus, opium is a most valuable remedy: it diminishes the sensibility of these parts, and prevents spasm; furthermore, it relaxes the ureters, and thereby facilitates the passage of the calculus. In *inflammation of the gall ducts*, produced by calculus, opium is likewise serviceable; but, as in the last-mentioned case, blood-letting and the warm bath should be employed simultaneously with it. In *inflammation of the mucous membranes*, attended with increased secretion, opium is a most valuable remedy. Thus in *pulmonary*

catarrh, when the first stage of the disease has passed by, and the mucous secretion is fully established, opium is frequently very beneficial: it diminishes the sensibility of the bronchial membrane to cold air, and thereby prevents cough. In severe forms of the disease, blood-letting ought to be premised. In *diarrhœa*, opium, in mild cases, is often sufficient of itself to cure the disease; it diminishes the increased muscular contractions and increased sensibility, thereby relieving pain, and at the same time checks excessive secretion. Aromatics and chalk are advantageously combined with it. *Mild* or *English cholera*, the disease which has been so long known in this country, and which consists in irritation or inflammation of the mucous lining of the stomach, is generally most successfully treated by the use of opium: two or three doses will in slight cases be sufficient to effect a cure. In *dysentery*, opium has been found very serviceable: it is best given in combination with either ipecacuanha or calomel. I have already stated that in *inflammation of the parenchymatous tissues of organs* the use of opium is less frequently beneficial, and often injurious. Thus in *inflammation of the cerebral substance* it is highly objectionable, since it increases the determination of blood to the head, and disposes to coma. In *pneumonia* it is for the most part injurious; partly by its increasing the febrile symptoms, partly by its diminishing the bronchial secretion, and probably also, by retarding the arterialisation of the blood, and thereby increasing the general disorder of the system. It must be admitted, however, that there are circumstances under which its use in this disease is justifiable. Thus, in acute pneumonia, when blood-letting has been carried as far as the safety of the patient will admit, but without the subsidence of the disease, I have seen the repeated use of opium and calomel of essential service. Again, in the advanced stages of pneumonic inflammation, when the difficulty of breathing has abated, opium is sometimes beneficially employed to allay painful cough, and produce sleep. In *inflammation of the substance of the liver*, opium is seldom beneficial: it checks the excretion, if not the secretion, of bile, and increases costiveness. In *rheumatism*, opium frequently evinces its happiest effects. In acute forms of the disease it is given in combination with calomel,—blood-letting being usually premised. From half a grain to two grains of opium should be given at a dose. In some cases Dover's powder will be found the best form of exhibition. This plan of treatment is well adapted for the diffuse or fibrous form of acute rheumatism; but it does not prove equally successful in the synovial forms of the disease. It is also valuable in chronic rheumatism.

3. *In diseases of the Brain and Spinal Cord.*—In some cerebro-spinal diseases great benefit arises from the use of opium: while in

other cases injury only can result from its employment. The latter effect is to be expected in inflammation of the brain, and in apoplectic cases. In other words, in those cerebral maladies obviously connected with, or dependent on, an excited condition of the vascular system of the brain, opium acts injuriously. But there are many disordered conditions of the cerebro-spinal functions, the intensity of which bears no proportion to that of the derangement of the vascular system of the brain; and there are other deviations from the healthy functions in which no change in the cerebral circulation can be detected. In these cases opium or morphia frequently evinces its best effects. In *insanity* its value has been properly insisted on by Dr. Seymour. He, as well as Messrs. Beverley and Phillips, employed the acetate of morphia. Its good effects were manifested rather in the low, desponding, or melancholic forms of the disease, than in the excited conditions; though I have seen great relief obtained in the latter form of the disease by full doses. In *delirium tremens* the efficacy of opium is almost universally admitted. Its effects, however, require to be carefully watched: for large doses of it, frequently repeated, sometimes hasten coma and other bad symptoms. If there be much fever, or evident marks of determination of blood to the head, it should be used with great caution, and ought to be preceded by loss of blood, cold applications to the head, and other antiphlogistic measures. Though opium is to be looked on as a chief remedy in this disease, yet it is not to be regarded as a specific. I have before noticed the use of opium in alleviating some of the *cerebral symptoms which occur during fever.* In *spasmodic and convulsive diseases* opium is a most important remedy. In *local spasms produced by topical irritants*, it is a most valuable agent, as I have already stated; for example, *in spasm of the gall ducts* or *of the ureters*, brought on by the presence of calculi; in *colic*, and in *painful spasmodic contractions of the bladder*, *rectum*, or *uterus*. In *spasmodic stricture* opium is sometimes useful. In genuine *spasmodic asthma*, which probably depends on a spasmodic condition of the muscular fibres investing the bronchial tubes, a full dose of opium generally gives temporary relief; but the recurrence of the paroxysms is seldom influenced by opium. There are several reasons for believing that one effect of narcotics in dyspnœa is to diminish the necessity for respiration. In the *convulsive diseases* (*chorea*, *epilepsy*, and *tetanus*), opium has been used, but with variable success: in fact, the conditions of system under which these affections occur, may be, at different times, of an opposite nature, so that a remedy which is proper in one case is often improper in another. In *tetanus*, opium was at one time a favourite remedy, and is undoubtedly at times a remedy of considerable value. But it is remarkable that the susceptibility of the system to its influence is greatly diminished during tetanus. In 128 cases noticed by Mr. Curling, opium in various forms, and in conjunction with other remedies, was employed in 84 cases; and of these, 45 recovered. Notwithstanding, however, the confidence of the profession in its efficacy is greatly diminished. Lastly, opium occasionally proves serviceable in several forms of *headache*, especially after loss of blood. I have seen it give great relief in some cases of what are commonly termed nervous headaches; while in others, with apparently the same indications, it has proved injurious. Endermically applied, it has been found to allay severe headache.

4. *In diseases of the chest.*—In some affections of the heart and of the organs of respiration opium is beneficial. I have already alluded to its employment in *catarrh*, *pneumonia*, and *spasmodic asthma*. In the first of these maladies caution is often requisite in its use. 'In an aged person, for example, suffering under *chronic bronchitis* or *catarrhal influenza*—and gasping, it may be, under the difficulties of cough and expectoration—an opiate, by suspending these very struggles, may become the cause of danger and death. The effort here is needed for the recovery of free respiration; and if suppressed too long, mucus accumulates in the bronchial cells, its extrication thence becomes impossible, and breathing ceases altogether.'

5. *In maladies of the digestive organs.*—I have already referred to the use of opium in *gastritis*, *enteritis*, *peritonitis*, *diarrhœa*, *dysentery*, *colic*, *the passage of gall-stones*, and *in hepatitis*. With respect to the use of opium *in hepatic affections*, I am disposed to think with Sir Henry Holland, that, with the exception of the painful passage of a gall-stone through the ducts, there is scarcely a complaint of the liver and its appendages 'where opium may not be said to be hurtful, though occasionally and indirectly useful when combined with other means.' *In poisoning by acrid substances* opium is used with advantage to lessen the susceptibility of the alimentary canal, and thereby to diminish the violence of the operation of these local irritants. Cantharides, all the drastic purgatives, when taken in excessive doses (as elaterium, colocynth, gamboge, scammony, and croton oil), may be mentioned as examples of the substances alluded to. Besides the above-mentioned beneficial operation, opium allays the spasmodic contractions of the bowels, relieves pain, and checks inordinate secretion and exhalation. *In poisoning by corrosives* (the strong mineral acids and alkalies, for example), opium diminishes the sensibility of the alimentary canal: it cannot, of course, alter the chemical influence of the poisons, but it may prove useful by allaying the consequences of inflammation. In poisoning by the preparations of arsenic, lead, and copper, opium is sometimes found useful. It has been used in poisoning by strychnia. It has had, to

a certain extent, the effect of masking the symptoms, but not of preventing the fatal action of the poison.

6. *In maladies of the urino-genital apparatus* opium is a most valuable remedy. It mitigates pain, allays spasmodic action, checks copious mucous secretion, and diminishes irritation. Its use for one or more of these purposes in *nephritis*, *cystitis*, *the passage of urinary calculi*, and *spasmodic stricture*, has been already pointed out. *In irritable bladder* it is an invaluable remedy, especially in conjunction with solution of potash. *In irritation* and *various painful affections of the uterus*, and in *chordee*, the value of opium is well known. In the treatment of the *phosphatic diathesis* it is the only remedy that can be employed, according to Dr. Prout, to diminish the unnatural irritability of the system. Of all remedies for that hitherto intractable malady, *diabetes*, opium has been found to give the greatest relief. Under its use the specific gravity, saccharine quality, and quantity of urine, have been diminished. Dr. Prout has also found it serviceable when there is an *excess of urea in the urine.*

7. *As an anodyne.*—To relieve pain by dulling the sensibility of the body, opium is, of all substances, the most useful, and the most to be relied on for internal exhibition. We sometimes use it to alleviate the pain of inflammation, as already mentioned; to diminish spasm and the sensibility of the parts in calculi of the gall ducts, in the ureters, and even when in the urinary bladder; to relieve pain in the various forms of scirrhus and carcinoma, in which diseases opium is our sheet-anchor; to allay the pain arising from the presence of foreign bodies in wounds; to prevent or relieve after-pains; to diminish the pain of menstruation; and, lastly as an anodyne in neuralgia. As a *benumber* or *topical anodyne* it is greatly inferior to aconite. Hence in neuralgia the latter is much more successful than opium.

8. *In hemorrhages.*— Opium is at times serviceable to obviate certain *ill effects of hemorrhages*; as when there is great irritability attended with a small and frequent pulse, and also to relieve that painful throbbing about the head so often observed after large evacuations of blood. In, or immediately after, *uterine hemorrhage*, the use of opium has been objected to, on the ground that it might prevent the contraction of the womb; but where the employment of opium is otherwise indicated, this theoretical objection deserves no weight. In *bronchial hemorrhage* it is at times a valuable remedy, and may be associated with acetate of lead (notwithstanding the chemical objections to the mixture) with good effect.

9. *In mortification.*—When mortification is attended with excessive pain, opium is resorted to. In that kind of mortification called *gangræna senilis*, Mr. Pott strongly recommended opium, in con-

junction with a stimulating plan of treatment, and experience has fully proved its great efficacy.

10. *In venereal diseases.*—Opium is frequently employed in venereal diseases to prevent the action of mercurials on the bowels during salivation; also to allay the pain of certain venereal sores and venereal diseases of the bones. Although opium possesses no specific anti-venereal powers, it has appeared to me on several occasions to promote the healing of venereal sores.

11. In various forms of *ulcers* and in *granulating wounds*, the efficacy of opium has been satisfactorily established by Mr. Skey. Its use is prejudicial in ulcers attended with inflammation, in the florid or sanguineous temperament, and in childhood. But in the chronic or callous ulcer, in the so-called varicose ulcer, in recent ulcers from wounds, in which granulation proceeds slowly, or in other cases, the efficacy of opium, administered in small doses (as ten minims of laudanum three times daily), is most manifest, especially in elderly persons, and in those whose constitutions have been debilitated by disease, labour, spirituous liquors, &c. It appears to promote the most genial warmth, to give energy to the extreme arteries, and thereby to maintain an equal balance of the circulation throughout every part of the body, and to animate the dormant energies of healthy action. It is by means of these properties that, as Mr. Skey has pointed out to me, it restores the circulation and warmth in fingers that are liable to become cold and bloodless.

12. *In poisoning by belladonna or stramonium.*—Dr. C. C. Lee, of the Pennsylvanian Hospital, has published in the American *Journal of Medical Science* some interesting cases, showing that opium on the one hand, and belladonna and stramonium on the other, are mutually antagonistic, counteracting their respective poisonous effects. One of these is the case of a child, six years old, who took by mistake a fluid drachm of concentrated juice of belladonna. The face became rapidly scarlet, deepening to violet, and the pupils dilated to the utmost. No stomach-pump being at hand, 20 minims of laudanum were given by the rectum, and the same quantity by the mouth, the latter being repeated every half hour till 120 minims were taken. After the third dose the pupils began to contract, the purple complexion faded, and in three hours the child was well and playing about the room.

13. The *external application* of opium is comparatively but little resorted to, and for two reasons: in the first place, its topical effects are slight; and, secondly, its specific effects on the brain and general system are not readily produced through the skin. Aconite and belladonna greatly exceed opium in their topical effects. The following are some of the local uses of opium:—In *ophthalmia*, the wine of opium is dropped into the eye when there is much pain and

lachrymation (see *Vinum Opii*). Opiate *frictions* have been employed as topical anodynes, and to affect the general system. Thus in *chronic rheumatism and sprains*, the opium liniment proves a useful application. In *maniacal delirium*, as well as some other cerebral disorders, Mr. Ward employed, with apparently beneficial effects, opiate frictions; for example, half an ounce of opium, mixed with 4 grains of camphor, 80 grains of lard, and 1 fluid drachm of olive oil. In *neuralgic affections*, an opiate ointment, or finely powdered hydrochlorate of morphia, applied to a blistered surface, occasionally gives relief. In *gastrodynia*, it may be applied in the same way to the epigastrium. In *gonorrhœa and gleet*, opium injections have been used. In *spasmodic stricture*, *diseases of the prostate gland*, and in *gonorrhœa to prevent chordee*, an opiate suppository is a useful form of employing opium, especially where it is apt to disagree with the stomach. In *nervous and spasmodic affections* (as some forms of asthma), the endermic application of opium or morphia, applied along the course of the spine, is often singularly beneficial, when all methods of depletion and counter-irritation have proved utterly unavailing (Holland). In *toothache*, opium is applied to the hollow of a carious tooth. Dr. Bow speaks in the highest terms of the efficacy of the external application of opium *in inflammatory diseases*, especially *bronchitis* and *croup*. Warm opium fomentations, *freely* applied to the spine and abdomen, greatly relieved the *cramps of cholera.*

Of late years opium, and more especially the salts of morphia (see *Morphia and its Salts*, p. 979), have been extensively employed, both hypodermically and endermically, and then the effect produced is quite equal, at least, and as rapidly produced as when given by the mouth. In this way the effects of opium in the diseases mentioned originally by Dr. Pereira are far more manifest.

Administration.—Opium is given, *in substance*, in the form of pill, powder, or lozenge. The dose is subject to great variation, depending on the age and habits of the patient, the nature of the disease, and the particular object for which we wish to employ it. In a general way, we consider from a quarter of a grain to half a grain a *small dose* for an adult. We give it to this extent in persons unaccustomed to its use, when we require its stimulant effects, and in mild catarrhs and diarrhœas. From half a grain to two grains we term a *medium dose*, and employ it in this quantity as an ordinary anodyne and soporific. From two to five grains we denominate a *full* or *large dose*, and give it to relieve excessive pain, violent spasm, in some inflammatory diseases after blood-letting, in tetanus, &c. These are by no means to be regarded as the limits of the use of opium. *Opium pills* may be prepared either with crude or powdered opium. The latter has the advantage of a more speedy operation, in consequence of its more ready solution in the gastric secretions. Employed as a *suppository*, opium is used in larger doses than when given by the stomach. Five grains, made into a cylindrical mass with soap, may be introduced into the rectum, to allay irritation in the urino-genital organs; although in some cases such a dose has produced injurious effects. Externally, opium may be applied endermically, or by friction in a liniment, or added to plasters, lotions, poultices, &c.

Antidotes.—In a case of poisoning by opium, the first indication is to remove the poison from the stomach; the second is to neutralise any of it which may be retained in the system; and the third is to obviate its injurious effects. 1. *Use of Evacuants.*—Until other and more powerful evacuant means can be obtained, we should have recourse to tickling the throat with the fingers, or with a feather dipped in oil. As domestic emetics, mustard or salt may be exhibited. A dessert spoonful of flour of mustard, or a table spoonful of salt, may be taken, stirred up in a tumblerful of water. The stomach-pump is, however, the best means of evacuating the contents of the stomach, and when it can be procured, should always be used. The emetics usually resorted to are the sulphates of zinc and copper: the first is preferred. It should be given in doses of from twenty to forty grains. The dose of sulphate of copper is less—from five grains to fifteen. Ipecacuanha or tartarated antimony may be resorted to when the other means are not at hand. Enemas containing fifteen or twenty grains of tartarated antimony may be administered; or, in extreme cases, a solution of one or two grains of this salt may be injected into the veins, taking care to prevent the introduction of air. 2. *Use of Chemical and Physiological Antidotes.*—There are no known agents which completely destroy the activity of opium by their chemical properties, and which can be resorted to in these cases. Infusion of galls, however, is regarded as the best, though an imperfect antidote. The preparations of belladonna and stramonium might be tried as physiological antidotes, but they must be very cautiously administered (see *below*). 3. *Use of Therapeutic Means to obviate the Effects.*—The following are the principal means which have been found efficacious:—*Rousing the patient*, by exercising him up and down the room between two men. It may sometimes be necessary to continue this for several hours. *Cold affusion.*—Cold water dashed over the head and chest is an exceedingly valuable agent. It often assists the operation of emetics. *Irritants.*—The application of irritants to the body is also sometimes a useful practice; thus blisters and mustard poultices to the feet. *Stimulants.*—Ammonia, camphor, musk, strong coffee, and other stimulants, are sometimes used with advantage. *Vegetable acids.*—Orfila has found the vegetable acids to be the best anti-narcotics. For this purpose, drinks of vinegar and water, lemon juice, or the acid tartrate of potash and water, should be given every ten minutes. These agents, however, should not be resorted to till the poison has been evacuated from the stomach. In one of Dr. Lee's cases (see *Therapeutics*, p. 967) laudanum had been given to a child two years old, apparently for the purpose of destroying life. The child was in a state of profound coma, the pupils strongly contracted, and the pulse beating feebly, 40 in the minute. *No means were used to remove the poison from the stomach*, but fifteen minims of tincture of belladonna were administered every twenty minutes. Four doses were sufficient, not only to remove the symptoms of opium poisoning, and to raise the pulse to 86, but to dilate the pupil widely, and to produce the excitement peculiar to belladonna. In an hour the new symptoms had subsided, and the child was apparently well. *Artificial respiration.*—As a last resource this is on no account to be omitted. Death has on several occasions been apparently averted by it. *Electricity* and *electro-magnetism* have also been successfully employed of late years in several cases of poisoning by opium. These agents have been found effectual in keeping roused, children that are labouring under the effects of narcotic poison.

Pharmaceutical Uses.—Opium is an ingredient of aromatic powder of chalk and opium, compound powder of kino, compound powder of ipecacuanha, compound tincture of camphor, ointment of galls and opium, pill of ipecacuanha with squill, and pill of lead and opium; and is employed in the preparation of hydrochlorate of morphia.

[§ **Confectio Opii.** *Confection of Opium.*

Take of

Compound Powder of Opium . . .	192 grains.
Syrup	1 fluid ounce.

Mix.

Dose.—5 to 20 grains.]

Aromatic and narcotic. Employed in flatulent colic and diarrhœa; in the latter complaint usually as an adjunct to the chalk mixture.

[§ **Emplastrum Opii.** *Opium Plaster.*

Take of

Opium, in fine powder	1 ounce.
Resin Plaster	9 ounces.

Melt the resin plaster by means of a water-bath; then add the opium by degrees, and mix thoroughly.]

Employed as a tonic anodyne in rheumatism, lumbago, and neuralgia. Its powers are very slight, or even equivocal.

[§ **Enema Opii.** *Enema of Opium.*

Take of

Tincture of Opium	$\frac{1}{2}$ fluid drachm.
Mucilage of Starch	2 fluid ounces.

Mix.]

In the passage of renal and biliary calculi, in nephritis, irritation or inflammation of the bladder, uterus, or prostate gland, in dysentery, and painful affections of the large intestine, the opium enema is most valuable.

[§ **Extractum Opii.** *Extract of Opium.*

Take of

Opium, in thin slices	1 pound.
Distilled Water	6 pints.

Macerate the opium in two pints of the water for twenty-four hours, and express the liquor. Reduce the residue of the opium to a uniform pulp, macerate it again in two pints of the water for twenty-four hours, and express. Repeat the operation a third time. Mix the liquors, strain through flannel, and evaporate by a water-bath until the extract has acquired a suitable consistence for forming pills.

Dose.—$\frac{1}{2}$ grain to 2 grains.]

When opium is digested in water, this fluid takes up the *odorous principle*, the *salts of morphia and codeia*, the *narcotia*, the *gum*, the *extractive*, and some of the *resin* and *oil*. A portion of morphia is frequently found in the dregs. By concentration, the odorous principle is dissipated, and the resin and the oil, combined with, and in part saturating, the narcotine, are separated. The removal of these inert principles, as well as the impurities of opium and the consequent concentration of the active constituents of this substance, must, of course, render the extract a more powerful preparation than ordinary opium. Good opium yields from 50 to 60 per cent. of extract. It is usually believed to operate with less disturbance to the general system than the ordinary preparations of opium. It is employed as an anodyne, sedative, and soporific, in cases where crude opium or its tincture disagrees.

Pharmaceutical Uses.—It is employed in the preparation of liquid extract of opium, opium lozenges, and wine of opium.

[§ **Extractum Opii Liquidum.** *Liquid Extract of Opium.*

Take of

Extract of Opium	1 ounce.
Distilled Water	16 fluid ounces.
Rectified Spirit	4 fluid ounces.

Macerate the extract of opium in the water for an hour, stirring frequently; then add the spirit, and filter. The product should measure one pint.

It contains 22 grains of extract of opium, nearly, in 1 fluid ounce.

Dose.—10 to 40 minims.]

This preparation is apparently intended to be of the same strength as tincture of opium, 22 minims containing 1 grain of extract. Warington found that 10 parts of good fresh Smyrna opium yielded 8 parts of dried opium and 5 of extract. Hence 1 grain of extract is equal to 1·6 grain of dried opium, and 1 grain of dried opium is contained in 14 minims of the liquid extract, so that the difference in strength is extremely slight. It represents *Battley's Sedative Solution of Opium*, which that gentleman assured the author was prepared from opium solely by cold water and heat, and preserved by the subsequent addition of spirit. According to Mr. Wilkinson, two fluid drachms of Battley's solution yielded 5·4 grains of dry extract, which correspond to 8·55 grains of powdered opium, and 13 minims were equivalent to 1 grain of powdered opium. It was, therefore, *a little* stronger than the liquid extract.

[§ **Linimentum Opii.** *Liniment of Opium.*

Take of

Tincture of Opium Liniment of Soap	} of each . .	2 fluid ounces.

Mix.]

Employed as an anodyne in rheumatism, neuralgic pains, sprains, &c.

[§ **Pilula Saponis Composita.** *Compound Pill of Soap.*

Synonym.—Pilula Opii,—1864.

Take of

Opium, in powder	½ ounce.
Hard Soap, in powder	2 ounces.
Distilled Water	a sufficiency.

Mix the opium and soap and beat into a mass with the water.]

Employed as an anodyne and soporific. Six grains contain about one grain of opium. The soap enables the pills to dissolve readily in the juices of the stomach.

Dose.—From 3 to 5 grains. From 5 grains to 20 grains are sometimes used as a suppository; but its use in this way requires caution, more especially when administered to those unaccustomed to the drug.

[§ **Pulvis Opii Compositus.** *Compound Powder of Opium.*

Take of

Opium, in powder	$1\frac{1}{2}$ ounce.
Black Pepper, in powder	2 ounces.
Ginger, in powder	5 ounces.
Caraway Fruit, in powder	6 ounces.
Tragacanth, in powder	$\frac{1}{2}$ ounce.

Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle.

This powder nearly represents the dry ingredients of Confectio Opii, *Lond.*

Dose.—2 to 5 grains.]

Its effects and uses are similar to those of confection of opium.

Pharmaceutical Use.—It is used in the preparation of confection of opium.

[§ **Tinctura Opii.** *Tincture of Opium.*

Take of

Opium, in coarse powder	$1\frac{1}{2}$ ounce.
Proof Spirit	1 pint.

Macerate for seven days in a closed vessel, with occasional agitation, then strain, press, filter, and add sufficient proof spirit to make one pint.

It contains the soluble matter of 33 grains of opium, nearly, in 1 fluid ounce.

Dose.—5 to 40 minims.]

Tincture of opium (*laudanum*) is of a deep brownish-red colour, with the peculiar odour and taste of opium. Its specific gravity is 0·942. It is nearly one-eighth weaker than the London tincture, in consequence of the use of the avoirdupois ounce, and the addition of proof spirit to make up the pint. Proof spirit dissolves the same constituents as water, but it takes up a large proportion of narcotia, resin, and oil. I have repeatedly prepared morphia from the insoluble residue left behind in the preparation of the tincture. Dr. Garrod, however, did not find any morphia in the insoluble residue, but it yielded abundance of narcotine and meconic acid. When the residue was given internally, in doses of from 1 to 30 grains, it was found to be quite inert. He therefore believes that the *Tinctura Opii* contains the active matter of the whole of the drug used in its formation. One grain of dry opium is contained in about $14\frac{1}{2}$ minims of tincture of opium. Tincture of opium is a powerful and valuable anodyne and soporific. Its employment is to be preferred to that of solid opium where a more immediate effect is required.

Moreover, in administering opiates to children, the facility of adjusting small doses of it presents a great advantage over solid opium. The dose of it, like that of solid opium, must vary according to several circumstances. For an adult it varies from 10 to 40 minims, or more. To children it must be given with the greatest caution. In infants exhausted by illness and of a delicate constitution one minim has been known to cause death.

Pharmaceutical Uses.—It is used in the preparation of enema of opium, and liniment of opium.

[§ **Tinctura Opii Ammoniata.** *Ammoniated Tincture of Opium.*

Take of

Opium, in coarse powder . . .	100 grains.
Saffron, cut small } of each . . .	180 grains.
Benzoic Acid }	
Oil of Anise	1 fluid drachm.
Strong Solution of Ammonia . .	4 fluid ounces.
Rectified Spirit	16 fluid ounces.

Macerate for seven days in a well-closed vessel, with occasional agitation, then strain, press, filter, and add sufficient rectified spirit to make one pint.

Dose.—$\frac{1}{2}$ to 1 fluid drachm.]

This was formerly known as *Scotch Paregoric.* It is employed as a powerful diffusible stimulant and antispasmodic in hooping-cough and other spasmodic affections.

[§ **Trochisci Opii.** *Opium Lozenges.*

Take of

Extract of Opium	72 grains.
Tincture of Tolu	$\frac{1}{2}$ fluid ounce.
Refined Sugar, in powder . .	16 ounces.
Gum Acacia, in powder . . .	2 ounces.
Extract of Liquorice . . .	6 ounces.
Distilled Water	a sufficiency.

Add the extract of opium, first softened by means of a little water, and the tincture of tolu, to the extract of liquorice heated in a water-bath. When the mixture is reduced to a proper consistence remove it to a slab, add the sugar and gum, previously rubbed together, and mix thoroughly. Divide the mass into 720 lozenges, and dry these in a hot-air chamber with a moderate heat.

Each lozenge contains one-tenth of a grain of extract of opium.

Dose.—1 to 6 lozenges.]

Opium lozenges are used to allay troublesome cough.

[§ **Vinum Opii.** *Wine of Opium.*

Take of

Extract of Opium		1 ounce.
Cinnamon Bark, bruised	of each . .	75 grains.
Cloves, bruised . .		
Sherry		1 pint.

Macerate for seven days in a closed vessel, with occasional agitation, and filter.

It contains 22 grains of extract of opium, nearly, in 1 fluid ounce.

Dose.—10 to 40 minims.

This is about $\frac{1}{4}$ stronger than Vinum Opii of the *Brit. Pharm.* 1864, and also of the *Edin.* and *Dubl. Pharm.* It is about $\frac{1}{5}$ weaker than Vinum Opii, *Lond.*, and corresponds in strength with Extractum Opii Liquidum.]

If sherry were as good a solvent as proof spirit, the wine would be of nearly the same strength as the tincture, for one grain of dried opium is contained in about 14 minims of the wine. Its effects are similar to those of the tincture, but its taste and smell are more agreeable.

Dropped into the eye in ophthalmia, it soon relieves pain, lachrymation, and intolerance of light.

The following table shows the strength of each preparation of opium intended for internal administration.

Quantity.	Preparation of Opium.	Equivalent to of dried Opium
40 grains.	Confectio Opii	1 grain.
2 fluid ounces.	Enema Opii	,,
About $\frac{6}{10}$ of a grain.	Extractum Opii	,,
About 14 minims.	Extractum Opii liquidum	,,
8 grains.	Pilula Plumbi cum Opio	,,
6 grains.	Pilula Saponis composita	,,
40 grains.	Pulvis Cretæ aromaticus cum Opio	,,
10 grains.	Pulvis Ipecacuanhæ compositus	,,
20 grains.	Pulvis Kino compositus	,,
$\frac{1}{2}$ fluid ounce.	Tinctura Camphoræ composita	,,
$14\frac{1}{2}$ minims.	Tinctura Opii	,,
About 73 minims.	Tinctura Opii ammoniata	,,
10 lozenges.	Trochisci Opii	,,
About 14 minims.	Vinum Opii	,,

[§ **Morphiæ Hydrochloras.** *Hydrochlorate of Morphia.*

Synonym.—Morphiæ Murias, *Edin.*, *Dubl.*

$C_{34}H_{19}NO_6,HCl + 6HO$ or $\mathbf{C_{17}H_{19}NO_3.HCl.3H_2O}$.

It may be obtained by the following process :—

Take of

Opium, sliced	1 pound.
Chloride of Calcium	$\frac{3}{4}$ ounce.
Purified Animal Charcoal . . .	$\frac{1}{4}$ ounce.
Diluted Hydrochloric Acid . .	2 fluid ounces, or a sufficiency.
Solution of Ammonia, Distilled Water, of each . .	a sufficiency.

Macerate the opium for twenty-four hours with two pints of the water, and decant. Macerate the residue for twelve hours with two pints of the water, decant, and repeat the process with the same quantity of the water, subjecting the insoluble residue to strong pressure. Unite the liquors, evaporate in a water-bath to the bulk of one pint, and strain through calico. Pour in now the chloride of calcium previously dissolved in four fluid ounces of distilled water, and evaporate until the solution is so far concentrated that upon cooling it becomes solid. Envelope the mass in a double fold of strong calico, and subject it to powerful pressure, preserving the dark fluid which exudes. Triturate the squeezed cake with about half a pint of boiling distilled water, and, the whole being thrown upon a paper filter, wash the residue well with boiling distilled water. The filtered fluids having been evaporated as before, cooled, and solidified, again subject the mass to pressure; and, if it be still much coloured, repeat this process a third time, the expressed liquids being always preserved. Dissolve the pressed cake in six fluid ounces of boiling distilled water; add the animal charcoal, and digest for twenty minutes; filter, wash the filter and charcoal with boiling distilled water, and to the solution thus obtained add the solution of ammonia in slight excess. Let the pure crystalline morphia which separates as the liquid cools, be collected on a paper filter, and washed with cold distilled water until the washings cease to give a precipitate with solution of nitrate of silver acidulated by nitric acid.

From the dark liquids expressed in the above process an additional product may be obtained by diluting them with distilled water, precipitating with solution of potash added in considerable excess, filtering, and supersaturating the filtrate with hydrochloric acid. This acid liquid digested with a little animal charcoal, and again filtered, gives upon the addition of ammonia a small quantity of pure morphia.

Diffuse the pure morphia, obtained as above, through two fluid ounces of boiling distilled water placed in a porcelain capsule kept hot, and add, constantly stirring, the diluted hydrochloric acid, proceeding with caution, so that the morphia may be entirely dissolved, and a neutral solution obtained. Set aside to cool and crystallise. Drain the crystals, and dry them on filtering paper. By further evaporating the mother liquor, and again cooling, additional crystals are obtained.]

Water extracts from opium the *meconate and sulphate of morphia and codeia*; a part of the *narcotia*, of the *meconin*, of the *narcein*, and of the *thebaia*; the *brown acid extractive*; and a part of the *resin*, and of the *fat oil*. When chloride of calcium is added to infusion of opium, meconate with a little sulphate of lime, and some resinous colouring matter, are precipitated, while the hydrochlorates of morphia and of codeia are left in solution. A watery solution of the impure crystals obtained by evaporation is then decomposed by ammonia, by which the morphia is precipitated, while codeia and hydrochlorate of ammonia are left in solution. The morphia is dissolved in hydrochloric acid, and the solution of the hydrochlorate decolorised by charcoal.

[§ *Characters and Tests.*—In white flexible acicular prisms of a silky lustre, not changed by exposure to the air, and soluble in water and spirit. The aqueous solution gives a white curdy precipitate with nitrate of silver, and a white one with potash, which is redissolved when an excess of the alkali is added. Moistened with strong nitric acid it becomes orange-red, and, with solution of perchloride of iron, greenish-blue. Entirely destructible by heat, leaving no residue. Twenty grains of the salt dissolved in half an ounce of warm water, with ammonia added in the slightest possible excess, give on cooling a crystalline precipitate which, when washed with a little cold water, and dried by exposure to the air, weighs 15·18 grains.]

Morphia. *Morphia.*

An alkaloid obtained from opium.

(*Not official.*)

Characters and Tests.—Pure morphia ($C_{17}H_{19}NO_3$) presents itself under the form of transparent crystals, whose primary form is the right rhombic prism. On turmeric paper, as well as on reddened litmus paper, morphia has an alkaline reaction. Notwithstanding that it is insoluble, or nearly so, in cold water, it has a distinctly bitter taste. Boiling water dissolves a little more than one-hundredth part of morphia. It dissolves in 40 parts of cold anhydrous alcohol, and 30 parts of boiling alcohol; but it is insoluble, or nearly so, in ether. It is soluble in the oils (fixed and volatile), in solutions of potash and soda, and also, but in much smaller quantity, in solution of ammonia; lastly, it readily dissolves in sulphuric, hydrochloric, and acetic acids. When heated, the crystals lose their transparency and water of crystallisation; a strong heat causes them to enter into fusion, in which state they form a yellow liquid similar to melted sulphur, and which becomes white and crystalline on cooling. Heated in the open air, it burns like resin, and leaves a carbonaceous residuum. Moistened with strong nitric acid, morphia becomes red, and with solution of perchloride of iron blue.

Physiological Effects of Morphia and its Salts.—The precise relation which the effects of morphia and its salts bear to those of opium, is a point on which the profession is by no means agreed. Some writers declare that, after having carefully compared the effects of the morphia salts with those of opium, they can discover no difference between them; but my own limited observation of the effects of these salts induces me to agree with those who admit the similarity, but not the identity, of the effects of these substances. The effects of morphia are in several respects different from those of opium, but they appear to want uniformity; that is, the same results have not been arrived at by different experimenters. This may, in some cases at least, be ascribed to the employment of morphia contaminated with some other principles of opium. From the investigations of Claude Bernard, Dr. John Harley, and others, it would appear that the alkaloids of opium possess generally a double action: 1st, hypnotic; 2nd, convulsant. The hypnotic tendency is the stronger in morphia. *In small doses*, as from a quarter of a grain to one grain, acetate of morphia causes a feeling of distension or fulness about the head, some disturbance of vision, oftentimes headache, giddiness, and somnolency, or actual sleep, which, however, differs from ordinary sleep, and is often more or less disturbed. The pupils are usually contracted. But in some instances dilatation has been observed, in others the pupil was natural, and in others one pupil has been found contracted and the other dilated. The pulse is generally slow and small, though sometimes it is more frequent, and occasionally is soft and full. Itching of the skin is frequently noticed, and even a cutaneous eruption is by no means uncommon. Grain doses readily excite gastric uneasiness, nausea, and vomiting. One remarkable symptom often caused by acetate of morphia, especially in men, is a difficulty in voiding the urine, and which appears to depend on a weakened or paralytic condition of the bladder. When these effects subside, loss of appetite, muscular feebleness, and constipation, are left behind. When the dose is increased, the effects become somewhat alarming. Great cerebral excitement is produced, vision is disordered and obscured, there is singing in the ears, and the patient, when lying horizontally, experiences sudden convulsive movements, like those produced by an electric shock. When a fatal dose has been swallowed, the stomach sometimes manifests irritation, but this is soon followed by great disorder of the cerebro-spinal system, which ultimately assumes an apoplectic character. The sight becomes dim, excessive weakness is experienced, gradually all consciousness is lost, and coma supervenes, attended usually with contracted, though sometimes with dilated pupils, coldness of the surface, frequent and small pulse, hurried stertorous respiration and occasionally with convulsions. Before insensibility comes on, as well as when it is subsiding, there is itching of the skin. Difficulty in passing the water is also experienced, in consequence of the paralysed state of the bladder. Not unfrequently lividity of the skin is observed. In comparing the morphia salts with opium, we observe that they are less stimulant, and less disposed to cause sweating, constipation, headache, and dryness of the tongue. The feelings which they excite are less agreeable, and hence they are not adapted to be substituted for opium by the eaters of this drug. They more readily affect the bladder than opium. These effects, though mentioned as those of acetate of morphia, are equally produced by the hydrochlorate. The effects of morphia and its salts appear to be identical in their nature; but the soluble salts, as the hydrochlorate, are more constant and certain in their operation than uncombined morphia, in consequence probably of the difficult solubility of the latter.

Therapeutics.—We employ morphia or its salts in preference to opium when our object is to make applications *endermically*, i.e. to the denuded dermis; or, *hypodermically*, i.e. by injecting a solution under the skin. They are employed in this way *externally* for the purpose of alleviating violent neuralgic pains, and to relieve tetanus and the effects of strychnia. To relieve neuralgia it is not necessary to inject in the seat of the pain. Gastrodynia and obstinate vomiting are sometimes relieved by the endermic application of morphia to the epigastrium; and violent headache by the application of this remedy to the temples. Occasionally this mode of administration is adopted, when we wish to bring the general system under the calming and sedative influence of morphia, and where from some cause its exhibition by the mouth is objectionable. Some cases of maniacal delirium may be treated with advantage this way. The acetate of morphia appears to be best adapted for hypodermic use. The morphia salts are given *internally* in cases where we wish to obtain the anodyne, soothing, sedative, soporific, and antispasmodic qualities of opium, and where this drug is objectionable on account of its tendency to excite certain injurious effects already referred to. In all cases where both opium and the morphia salts are equally admissible, I prefer the former, its effects being better known and regulated: moreover, opium is to be preferred as a stimulant and sudorific, and for suppressing excessive mucous discharges.

Administration.—Hydrochlorate of morphia is given internally in substance or solution, in doses of from one-eighth to one half of a grain, or even beyond this. I have given in insanity two grains at a dose. For endermic use it should be finely powdered, and applied to the extent of a grain or a grain and a half at a time. Acetate of morphia may be administered in a similar manner and in similar doses to that of hydrochlorate of morphia.

[§ **Liquor Morphiæ Hydrochloratis.** *Solution of Hydrochlorate of Morphia.*

Take of

Hydrochlorate of Morphia . . .	4 grains.
Diluted Hydrochloric Acid . . .	8 minims.
Rectified Spirit	2 fluid drachms.
Distilled Water	6 fluid drachms.

Mix the hydrochloric acid, the spirit, and the water, and dissolve the hydrochlorate of morphia in the mixture.

Dose.—10 to 60 minims.

This solution contains half as much morphia as Liquor Morphiæ Hydrochloratis, *Lond.*]

One fluid drachm of this solution contains half a grain of hydrochlorate of morphia.

[§ **Suppositoria Morphiæ.** *Morphia Suppositories.*

Take of

Hydrochlorate of Morphia . . .	6 grains.
Benzoated Lard	64 grains.
White Wax	20 grains.
Oil of Theobroma	90 grains.

Melt the wax and oil of theobroma with a gentle heat, then add the hydrochlorate of morphia and benzoated lard previously rubbed together in a mortar, and mix all the ingredients thoroughly. Pour the mixture while it is fluid into suitable moulds of the capacity of fifteen grains; or the fluid mixture may be allowed to cool, and then be divided into twelve equal parts, each of which shall be made into a conical or other convenient form for a suppository, which will contain half a grain of hydrochlorate of morphia.]

Employed in painful affections of the lower bowel, uterus, or bladder; also in dysentery, after operation for stone, and in difficult parturition.

[§ Trochisci Morphiæ. *Morphia Lozenges.*

Take of

Hydrochlorate of Morphia . . .	20 grains.
Tincture of Tolu	$\frac{1}{2}$ fluid ounce.
Refined Sugar, in powder . . .	24 ounces.
Gum Acacia, in powder . . .	1 ounce.
Mucilage of Gum Acacia . . .	a sufficiency.
Distilled Water	$\frac{1}{2}$ fluid ounce.

Dissolve the hydrochlorate of morphia in the water; add this solution to the tincture of tolu, previously mixed with two fluid ounces of the mucilage; then add the gum and sugar, previously mixed, and more mucilage if necessary to form a proper mass. Divide into 720 lozenges, and dry these in a hot-air chamber with a moderate heat.

Each lozenge contains one thirty-sixth of a grain of hydrochlorate of morphia.

Dose.—1 to 6 lozenges.]

An agreeable mode of giving morphia, especially in coughs.

[§ Trochisci Morphiæ et Ipecacuanhæ. *Morphia and Ipecacuanha Lozenges.*

Take of

Hydrochlorate of Morphia . . .	20 grains.
Ipecacuanha, in fine powder . . .	60 grains.
Tincture of Tolu	$\frac{1}{2}$ fluid ounce.
Refined Sugar, in powder . . .	24 ounces.
Gum Acacia, in powder . . .	1 ounce.
Mucilage of Gum Acacia . . .	a sufficiency.
Distilled Water	$\frac{1}{2}$ fluid ounce.

Dissolve the hydrochlorate of morphia in the water; add this solution to the tincture of tolu, previously mixed with two fluid ounces of the mucilage; then add the ipecacuanha, gum, and sugar, previously mixed, and more mucilage if necessary to form a proper mass. Divide into 720 lozenges, and dry these in a hot-air chamber with a moderate heat.

Each lozenge contains one thirty-sixth of a grain of hydrochlorate of morphia, and one-twelfth of a grain of ipecacuanha.

Dose.—1 to 6 lozenges.]

Very useful to allay tickling cough.

[§ **Morphiæ Acetas.** *Acetate of Morphia.*

$C_{34}H_{19}NO_6,C_4H_3O_3+HO$ or $\mathbf{C_{17}H_{19}NO_3.C_2H_4O_2}$.

Take of

Hydrochlorate of Morphia	. . .	2 ounces.
Solution of Ammonia, Acetic Acid, Distilled Water	of each . . .	a sufficiency.

Dissolve the hydrochlorate of morphia in one pint of distilled water, and add solution of ammonia until the morphia is precipitated and the liquid rendered slightly alkaline. Collect the precipitate on a filter, wash it with distilled water, then having transferred it to a porcelain dish, add four ounces of distilled water and a sufficient quantity of acetic acid to neutralise and dissolve it. Evaporate the solution by the heat of a water-bath until it concretes on cooling. Lastly, dry the salt with a gentle heat, and reduce it to powder.

Characters and Tests.—A white powder, soluble in water and in spirit. From its solution potash throws down a precipitate which is dissolved by excess of the alkali. It is affected by nitric acid and perchloride of iron in the same way as hydrochlorate of morphia is. When sulphuric acid is added to the salt, acetous vapours are evolved.

Dose.—$\frac{1}{8}$ to $\frac{1}{2}$ grain.]

Physiological Effects and Therapeutics.—(See *Morphia and its Salts*, p. 978.)

[§ **Liquor Morphiæ Acetatis.** *Solution of Acetate of Morphia.*

Take of

Acetate of Morphia	. . . .	4 grains.
Diluted Acetic Acid	. . . .	8 minims.
Rectified Spirit	. . . .	2 fluid drachms.
Distilled Water	. . . .	6 fluid drachms.

Mix the acid, the spirit, and the water, and dissolve the acetate of morphia in the mixture.

Dose.—10 to 60 minims.

This solution contains half as much morphia as the Liquor Morphiæ Acetatis, *Lond.*]

Solution of Acetate of Morphia for Subcutaneous Injection.

A neutral aqueous solution of acetate of morphia, containing one grain of the acetate in six minims of solution, is used for this purpose. It should be made with recently prepared acetate, and not kept long when made.

Apomorphia.

Messrs. Matthiessen and Wright produced this alkaloid by heating morphia under pressure with excess of hydrochloric acid. The morphia loses a molecule of water; $C_{17}H_{19}NO_3 - H_2O = C_{17}H_{17}NO_2$. Apomorphia acts as a prompt and active emetic. Introduced subcutaneously in doses of about $\frac{1}{10}$th of a grain, it causes vomiting in ten minutes.

MENISPERMACEÆ, *D.C.* The Calumba Order.

JATEORHIZA CALUMBA, *Miers.* The Calumba Plant.

Botanical Character.—*Root* perennial, of several fasciculated, fusiform, fleshy tubercules, which are brown externally, and deep yellow internally, odourless, and very bitter. *Stems* annual, herbaceous, twining, beset at the lower part with long glandular hairs. *Leaves* alternate, 5–7-lobed, nearly orbicular, cordate at the base, wavy on the margins, with long hairy petioles. *Racemes* axillary, solitary; in the male plants compound. *Flowers* small, green, diœcious. *Calyx* of 6 sepals. *Petals* 6. *Stamens* 6, opposite to the petals. *Fruit* drupaceous or berried, about the size of a hazel nut, densely clothed with long spreading hairs.—*Steph. and Church.* pl. 160 (*Cocculus palmatus*).

Habitat.—Thick forests between Ibo and the Zambesi, Eastern Africa.

[§ Calumbæ Radix. *Calumba Root.*

The root cut transversely, and dried, of Jateorhiza Calumba, *Miers*, and J. Miersii, *Oliv.* From the forests of Eastern Africa between Ibo and the Zambesi.]

Botanical Source.—The source of calumba root, as now given in the Pharmacopœia, is in accordance with the investigations of Miers, which prove that the official calumba is not derived, as stated in the British Pharmacopœia of 1864, from *Cocculus palmatus*, D.C., but essentially, if not entirely, from the *Cocculus palmatus*, Wallich; the *Menispermum Calumba*, Roxb.; and the *Jateorhiza Calumba*, Miers. Whether any of this drug is derived, as stated in the Pharmacopœia, from J. Miersii, *Oliv.*, or wholly from J. Calumba, *Miers*, is unknown.

Preparation of the Roots.—The natives never cultivate the plant, the spontaneous produce being sufficient. The roots are dug up in March (the hot season), the tubercules from the main root are then separated and cut into transverse slices, and dried in the shade. Calumba root is deemed fit for commerce when, on exposure to the sun, it breaks short; and of bad quality when it is soft or black.

Commerce.—Calumba root is exported by the Portuguese from their territories in the south-east of Africa. It is sent direct to India, and from thence forwarded to Europe. The root was at first supposed to come from Colombo, the capital of Ceylon, and from which it was said to derive its name; but its English name is derived from the Portuguese word Kalumbo, the *o* in which is mute.

General Characters.—Calumba root is usually met with in flat circular or somewhat oval pieces of from half an inch to three inches, or sometimes more, in diameter; and from one to three or four lines, or, in some cases, nearly an inch thick. It occurs also in cylindrical pieces from one to two inches long. The epidermis is of a yellowish-grey or brownish colour, and smooth or irregularly rugous. The transverse surfaces are of a greyish-yellow colour, depressed in the middle from shrinking in the drying process, and marked with concentric circles and radiating lines. The outer or cortical portion varies in thickness, but is usually about two or three lines. It is separated from the ligneous portion by a dark-coloured line, not exceeding a hair in thickness. The internal portion is light, and spongy in texture. The odour of calumba root is faint, but somewhat aromatic: the taste very bitter, more especially that of the cortical portion. On account of the starch which it contains, it is readily attacked by insects, and hence may be often seen perforated with small holes. The root is brittle, and therefore easily reduced to powder. A decoction when cold is blackened by solution of iodine.

Adulterations and Substitutions.—Although at the present time calumba root is of very varying quality, it is, according to our experience, scarcely ever adulterated in this country. Some years since, however, the transverse slices of the stems of *Coscinium fenestratum* were offered in the drug market as calumba root. Hanbury has fully described this so-called *Calumba root.* The slices are readily distinguished from those of true calumba root by their greater smoothness and hardness, different structure, from not being contracted in the centre, and the comparatively little starch which they contain. These slices are even now sometimes offered in the market as the produce of the stems of the true calumba plant, but their botanical source, as noticed above, is different, although also from a Menispermaceous plant, and their geographical source is Ceylon, not Eastern Africa. Calumba root is also said to have been adulterated with the sliced root of White Bryony (*Bryonia dioica*), but the structure of the two roots is so different that no one ought to be deceived. A simple test would be to touch the false root with tincture of iodine, when scarcely any discoloration will take place. The root of *Frasera Walteri*, called *American* or *false calumba*, has also been occasionally substituted for calumba root on the Continent. Such a fraud would not be practicable in England, at least to any extent, as the appearance of the root is quite dissimilar from that of the genuine calumba. It is distinguished chemically from the latter by two characters: 1st, it undergoes no change of colour when touched with tincture of iodine, showing that it contains no starch; 2ndly, its infusion becomes blackish-green on the addition of persulphate of iron, indicating the presence of tannic acid.

Composition and Chemical Characteristics.—If the root be moistened with water, and then touched with tincture of iodine, it becomes black, indicating the presence of starch. Sulphate of iron, tartarated antimony, and gelatine, produce no obvious change in an infusion of calumba, showing the absence of tannic and gallic acids. Litmus detects no free acid. Infusion of galls causes in the infusion of calumba a precipitate. The principal constituents of calumba are *calumbin*, the alkaloid *berberia* combined with *calumbic acid*, and *starch*. The latter constitutes almost one-third by weight of the root. *Calumbin.*—A crystallisable, odourless, very bitter, neutral substance, extracted from calumba root by Wittstock. Its crystals are rhombic prisms. It is fusible; very slightly soluble in water, alcohol, ether, and volatile oils. Boiling rectified spirit dissolves about $\frac{1}{40}$th of its weight. It dissolves in acids and alkalies; its best solvent being acetic acid. It is unaffected by metallic solutions, and by infusion of galls. Sulphuric acid dissolves it, assuming first a yellow, then a red colour. *Berberia* ($C_{20}H_{17}NO_4$). This alkaloidal base, which was discovered by Buchner and Herberger in the common barberry (*Berberis vulgaris*), has been found in calumba root, combined with calumbic acid, by Bödecker. Berberia is in fine stellated prisms of a yellow colour, is without smell, has a strong bitter taste, and manifests no reaction on test paper. When heated to 212° it acquires a red colour, but becomes again yellow on cooling. At a much higher temperature it is decomposed, and gives off yellow vapours. It is very soluble in alcohol, but is precipitated from its alcoholic solution by water. The alcoholic solution is green by reflected light. At 60° it is soluble in 100 parts of water, forming a clear yellow solution. It is destroyed by concentrated sulphuric or nitric acid. It forms saline combinations, more or less soluble, with the mineral acids. Calumba root owes its yellow colour to salts of berberia. *Calumbic Acid.*—As described by Bödecker, is in the form of an amorphous powder of a pale straw-yellow colour, it reddens moistened litmus paper, is nearly insoluble in water, slightly soluble in ether, but readily dissolved by alcohol and acetic acid.

Physiological Effects.—Calumba root is an excellent tonic, promoting the appetite, assisting the digestive process, and improving the quality of the secretions from the gastro-intestinal mucous membrane. In consequence of the quantity of starch which it contains, it is sometimes termed a *mucilaginous* or *demulcent tonic.* It agrees with Iceland moss in this circumstance. But from this as well as from quassia, it is distinguished by its aromatic properties. In some respects (i.e. in its tonic and aromatic qualities) it approximates to rhubarb, but it is devoid of the purgative and astringent properties of the latter. Its want of astringency distinguishes it from the astringent tonics (as cinchona). It does not appear either to constipate or relax the bowels.

Therapeutics.—Calumba root is one of our most useful stomachics and tonics. Its great value consists in its not being apt, like other and more powerful tonics, to create nausea, sickness, febrile disorder, or headache, so that it is tolerated when other remedies of this class would be immediately rejected. Indeed, on many occasions it evinces a positive power of checking vomiting. The following are the principal uses to which it has been applied: *In a languid state of the stomach, with general debility*, attended with want of appetite, indigestion, nausea, and flatulence, experience has fully established the value of calumba root. It is of all tonics the least likely to disagree with the stomach. In the stage of convalescence after an attack of fever, the infusion of calumba is an excellent preparative for the more powerful tonics (infusion of cinchona and sulphate of quinia). In those forms of dyspepsia attended with great acidity of stomach, it may be given with advantage in combination with bicarbonate of potash. *To allay vomiting*, when not dependent on inflammatory conditions of the stomach, calumba root is often highly serviceable; as in bilious vomiting, in the sickness which so frequently attends pregnancy, and dentition. Even vomiting arising from renal calculi or diseased kidney has been somewhat palliated by it. I have seen the most satisfactory results from the combined use of the infusion of calumba and effervescing draughts (composed of citric acid and bicarbonate of potash) in those occasional attacks of vomiting especially observed in delicate females, and which are commonly termed bilious attacks. *In diarrhœa and dysentery*, where tonics are admissible, as in the later periods of these diseases, when the inflammatory symptoms have subsided, and in habitual diarrhœa, calumba root often proves serviceable.

Administration.—Calumba root is administered in the form of *powder*, *extract*, *infusion*, or *tincture.* The dose of the *powder* is from 10 to 30 grains. The infusion is the most eligible form of exhibition.

Pharmaceutical Use. — Calumba root is a constituent of the aromatic mixture of iron.

[§ **Extractum Calumbæ.** *Extract of Calumba.*

Take of

Calumba Root, cut small	1 pound.
Distilled Water	4 pints.

Macerate the calumba with two pints of the water for twelve hours, strain and press. Macerate again with the same quantity of water, strain and press as before. Mix and filter the liquors, and evaporate them by the heat of a water-bath until the extract is of a suitable consistence for forming pills.

Dose.—2 to 10 grains.]

[§ **Infusum Calumbæ.** *Infusion of Calumba.*

Take of

Calumba Root, cut small . . .	$\frac{1}{2}$ ounce.
Cold Distilled Water	10 fluid ounces.

Macerate in a covered vessel, for one hour, and strain.

Dose.—1 to 2 fluid ounces.]

It may be conjoined with alkalies or chalybeates, without injury or obvious change, as it contains neither tannic nor gallic acid.

[§ **Tinctura Calumbæ.** *Tincture of Calumba.*

Take of

Calumba Root, cut small . . .	$2\frac{1}{2}$ ounces.
Proof Spirit	1 pint.

Macerate the calumba for forty-eight hours, in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof spirit to make one pint.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

An excellent adjunct to bitter infusions and effervescent medicines, when given to check vomiting.

ANAMIRTA COCCULUS, *Wight and Arnott.* The Cocculus Indicus Plant.

Botanical Character.—A strong climbing *shrub.* *Bark* corky, deeply cracked, ash-coloured. *Leaves* stalked, large, cordate-ovate, coriaceous. *Flowers* panicled, diœcious. *Calyx* of 6 sepals arranged in a double series, with 2 close-pressed bractlets. *Corolla* none. *Males*:—*Stamens* united into a central column dilated at the apex; *anthers* numerous, covering the whole globose apex of the column. *Drupes* 1 to 3, 1-celled, 1-seeded. *Seed* deeply excavated at the hilum so as to become somewhat semilunar in outline; *albumen* fleshy; *cotyledons* very thin, diverging.—*Wallich, Asiat. Res.* (*Menispermum Cocculus*) vol. xiii. pl. 15 and 16.

Habitat.—Malabar, and Eastern Islands, &c. of India.

Cocculus. *Cocculus Indicus.*

The dried fruit of Anamirta Cocculus; produced in Malabar and the Eastern Archipelago.

(*Not official.*)

Commerce.—Cocculus indicus is obtained from Bombay, Madras, and Ceylon. Formerly it was imported into Europe entirely from the Levant, whence it obtained the name of Levant Shell, by which it was formerly exclusively known. In 1866 no less than 50,000 pounds were imported into England.

General Characters.—As met with in commerce, *Cocculus indicus* is somewhat kidney-shaped or reniform-ovate, and about the size of a very large pea, or small hazel nut. It consists externally of a thin blackish-brown wrinkled skin, which envelopes a thin, bivalved, white, ligneous shell. In the middle of this shell internally, arises the placenta, which is contracted at its base, but enlarged and divided into two superiorly. Upon this placenta is placed an oleaginous, yellowish, very bitter seed, of a reniform or somewhat semilunar outline. This seed never wholly fills the cavity of the shell—at least in the Cocculus indicus of commerce; for by keeping it gradually becomes atrophied, and in old samples it is not uncommon to find the shell almost empty. A test of the goodness of cocculus indicus is, that the seed should fill at least two-thirds of the shell. This character will also at once distinguish cocculus indicus berries from bay berries, which have sometimes been confounded with them. Bay berries are also larger, more oval in shape, and the seed not only fills the cavity of the fruit, but it is also oval in shape and not attached to the pericarp.

Composition.—The seed (the only part used) owes its activity to the presence of a neutral principle termed *picrotoxin*. *Picrotoxin* ($C_5H_6O_2$), is a white, intensely bitter substance, usually crystallising in needles, but sometimes in silky, flexible filaments, transparent plates, or granular crystals. It is soluble in 150 parts of water at 57° F., in 25 parts of boiling water, in a third of its weight of alcohol, and in less than half its weight of ether. It is insoluble in the fixed and volatile oils, but is soluble in acetic acid, and in alkaline solutions. It does not combine with acids to form salts. The pericarp contains two alkaloids, *menispermia* and *paramenispermia*. *Menispermia* ($C_9H_{12}NO$). Menispermia is a white, crystalline, fusible compound, insoluble in water, soluble in alcohol and ether. It forms salts with the acids, the sulphate being crystallisable. *Paramenispermia* has the same composition as menispermia, but it differs from it, by not neutralising acids or forming definite salts.

Physiological Effects.—Its effects have not been accurately ascertained. It is frequently added to malt liquors, for the purpose of increasing their intoxicating powers; but from some accounts which I have received from an excise officer, who has been repeatedly subjected to the influence of beer thus adulterated, its action appeared to be rather on the voluntary muscles than on the intellectual powers. The operation of picrotoxin is analogous to, though stronger than, that of cocculus indicus. A case has been reported in America, where death was produced in a child of six years old, with previous tetanic spasms, and with contracted pupil, by applying a strong tincture of the fruit to the scalp. Other cases have been published, in which its external application has produced injurious effects.

Therapeutics and Uses.—Cocculus indicus is rarely employed in medicine. It is, however, sometimes used as an external application in the form of powder or ointment, to destroy pediculi; and has also been employed in some obstinate skin diseases, as porrigo; but its use requires caution, especially where the skin is not entire, on account of the danger of absorption. The greater part is consumed for illegal purposes,—principally for adulterating beer and ale, though this practice is prohibited by the Legislature, under a penalty of 200*l*. upon the brewer, and 500*l*. upon the seller of the drug.

Antidote.—In poisoning by cocculus indicus, or picrotoxin, remove the poison from the stomach as quickly as possible. No chemical antidote is known, though acetic acid has appeared to give relief. The symptoms must be combated on general principles, no peculiarities in the treatment being known. As a last resource, try artificial respiration.

Administration.—It is only used as an external application. It was official in the British Pharmacopœia of 1864, and the following preparation ordered.

Unguentum Cocculi. *Ointment of Cocculus.*

Take of

The Seeds of Cocculus Indicus . .	80 grains.
Prepared Lard	1 ounce.

Beat the seeds well in a mortar, and rub them with the prepared lard.

Used to destroy pediculi, and occasionally in porrigo.

CISSAMPELOS PAREIRA, *Linn.* Pareira Brava or Velvet Leaf.

Botanical Character.—A climbing *shrub.* *Root* woody, branching. *Stem* round, smooth or downy. *Leaves* roundish, peltate, subcordate, aristate, smooth above when full grown, covered underneath with silky pubescence. *Flowers* small, diœcious. *Males:—Sepals* 4. *Petals* 4, united into a cup-shaped corolla. *Stamens* monadelphous, bearing two 2-celled anthers opening horizontally at the top. *Females:—Calyx* of 1-lateral sepal. *Corolla* of 1-petal in front of the sepal. *Ovary* solitary; *stigmas* 3. *Drupe* roundish or somewhat reniform, scarlet, hispid, compressed and wrinkled round its margin. *Seed* solitary, uncinate.—*Woodv.* pl. 82, p. 227.

Habitat.—West India Islands, and Spanish Main.

[§ Pareiræ Radix. *Pareira Root.*

The dried root of Cissampelos Pareira, *Linn.* Brazil.]

Botanical Source.—Although the ordinary commercial pareira root is stated in the Pharmacopœia, in accordance with the generally received opinion, to be derived from Cissampelos Pareira, *Linn.*, it is clear from Hanbury's researches that this is not the case, but that it is obtained from some other Menispermaceous plant of Brazil. A sample of the drug derived from *C. Pareira* in Mr. Hanbury's possession is in the form of long cylindrical stems, some of them terminating in roots, and others emitting roots here and there. In diameter these stems are about half an inch, but varying from a quarter of an inch to an inch or more; and when cut transversely, they exhibit large medullary rays, but the large concentric zones so marked in the pareira root of commerce, are absent. The wood has a pale greyish-brown colour, its bark is dark greyish-brown; its taste is bitter, but without any aromatic or sweetish character.

General Characters and Commerce.—Pareira root, commonly known as *pareira brava*, occurs in more or less cylindrical, flattened, or bluntly angular pieces. These pieces are entire or split longitudinally, half an inch to four inches in diameter, and four inches to four feet in length. Externally they are covered with a dark brown epidermis, which is furrowed longitudinally, and wrinkled transversely. The surface of the transverse section of the root presents a number of concentric circles, traversed by numerous radiating lines;

between these lines are wedge-shaped bundles of woody fibres and vessels; the latter are large, and being cut transversely, constitute the numerous holes or apertures presented by the surface of the section. The concentric circles occasionally assume a very eccentric appearance, and frequently form only portions of circles, the organic centre being at, or near, the circumference. The number of concentric circles varies with the age of the root. The fracture of the root is coarsely fibrous. It has no odour. Its taste is at first sweetish and aromatic, afterwards bitter and unpleasant. It is exported to Europe from Rio Janeiro.

Adulterations and Substitutions.—Portions of the stem of this, or of allied species, are frequently found mixed with pareira root, or substituted for it. These may be known by their smoother appearance, frequent presence of lichens, evident pith, absence of irregular rootlets or branches, and less bitter taste. Generally also, the pieces of stem have a more uniform internal structure, and their texture is less compact. The stem is less efficacious than the root. (See also *Botanical Source.*)

Composition.—It contains *resin*, *starch*, and a bitter principle termed *cissampelia* or *pelosia*. *Cissampelia* or *Pelosia* ($C_{18}H_{21}NO_3$).—This alkaloid has been examined by Bödecker. It forms about 4 or 5 per cent. of the dried root. It is an uncrystallisable alkaloid, insoluble in water, hot or cold, but soluble in alcohol and ether. It melts when heated, burns with a smoky flame, and leaves a carbonaceous residue. It forms a hydrate with three equivalents of water, which becomes yellow and is decomposed when exposed to the action of air and light. It combines with most acids, forming salts, which, with the exception of the hydrochlorate, are not crystallisable. They are, however, very soluble in water. The properties of pareira root are owing to this alkaloid. From recent investigations, Dr. Flückiger has expressed his belief that the *cissampelia* of Bödecker is in reality *beberia*, the same alkaloid as that obtained from bebeeru bark. (See *Beberiæ Sulphas.*)

Physiological Effects.—From its taste, botanical affinities, and effects in diseases, it appears to possess a tonic power, and occasionally to act as a diuretic. Furthermore, its efficacy in certain maladies of the urinary organs induces us to ascribe an almost specific influence to this root over the mucous membrane lining the urinary passages. It certainly does appear to have the power of altering the quality of the urinary secretion. Large doses prove aperient.

Therapeutics.—It was originally introduced into medicine as a lithontriptic. We now employ it almost wholly *in discharges from the urino-genital mucous membrane.* It has been used in gonorrhœa, leucorrhœa, and chronic inflammation of the bladder. In the latter of these diseases Sir B. Brodie states that he has seen more good done by this root than by uva-ursi. He recommends it to be taken in the form of a concentrated decoction, to which may be added some tincture of hyoscyamus ; and in those cases in which there is a deposit of the triple phosphates, dilute hydrochloric or nitric acid may be added.

Administration.—The *powder* has been given in doses of from 30 to 60 grains. But the *decoction*, *extract*, or *liquid extract* is to be preferred.

[§ **Decoctum Pareiræ.** *Decoction of Pareira.*

Take of

Pareira Root, sliced	$1\frac{1}{2}$ ounce.
Distilled Water	1 pint.

Boil for fifteen minutes in a covered vessel, then strain, and pour as much distilled water over the contents of the strainer as will make the strained product measure a pint.

Dose.—1 to 2 fluid ounces.]

[§ **Extractum Pareiræ.** *Extract of Pareira.*

Take of

Pareira Root, in coarse powder . .	1 pound.
Boiling Distilled Water . . .	1 gallon, or a sufficiency.

Digest the pareira with a pint of the water for twenty-four hours, then pack in a percolator, and adding more of the water, allow the liquor slowly to pass until a gallon has been collected, or the pareira is exhausted. Evaporate the liquor by a water-bath until the extract has acquired a suitable consistence for forming pills.

Dose.—10 to 20 grains.]

[§ **Extractum Pareiræ Liquidum.** *Liquid Extract of Pareira.*

Take of

Pareira Root, in coarse powder . .	1 pound.
Boiling Distilled Water . . .	1 gallon, or a sufficiency.
Rectified Spirit	3 fluid ounces.

Digest the pareira with a pint of the water for twenty-four hours, then pack in a percolator, and adding more of the water, allow the liquor slowly to pass until a gallon has been collected, or the pareira is exhausted. Evaporate the liquor by a water-bath to thirteen fluid ounces, and, when it is cold, add the spirit and filter through paper.

Dose.—$\frac{1}{2}$ to 2 fluid drachms.]

MAGNOLIACEÆ, *D.C.* The Magnolia Order.

ILLICIUM ANISATUM, *Linn.* The Star Anise.

Botanical Character.—A *shrub*, about 8 feet high. *Leaves* evergreen, obovate, obtuse, entire, smooth, dotted. *Flowers* solitary, stalked. *Sepals* 6, petaloid. *Petals* numerous, yellow, the outer oblong, the inner subulate. *Stamens* numerous. *Carpels* 8 or more, coherent by their inner edge, and arranged in a star-like manner; when ripe hard and woody, and opening near their upper end. *Seeds* 1 in each carpel, ovate, compressed, reddish-brown.—*Nees, Plant. Med.* pl. 371.

Habitat.—China and Japan.

[§ **Oleum Anisi.** *Oil of Aniseed.*

The oil distilled in Europe from the fruit of Pimpinella Anisum, *Linn.*, Anise. And the oil distilled in China from the fruit of Illicium Anisatum, *Linn.*, Star Anise.]

Commerce and Characters.—This oil is imported from China and Singapore in tins, packed in cases holding about sixty pounds. By far the greater part of the oil of aniseed consumed in this country is obtained from star anise fruit. It is sometimes known as *Oleum Badiani.* It is generally regarded as a superior oil to that obtained in Europe from the fruit of *Pimpinella Anisum*, Linn.

(For *General Characters*, *Physiological Effects*, *Therapeutics*, *Official Preparations*, &c. see *Oleum Anisi*, p. 758.)

RANUNCULACEÆ, *Lindley.* The Crow-Foot or Buttercup Order.

HELLEBORUS NIGER, *Linn.* Black Hellebore or Christmas Rose.

Botanical Character.—*Rhizome* several inches long, horizontal, scaly, blackish-brown externally, white internally, with many long simple rootlets. *Leaves* radical, on cylindrical stalks from 4 to 8 inches long, pedatisected, smooth; *lobes* ovate-lanceolate, serrate near the point. *Scape* shorter than the petiole, leafless, 1–2-flowered, bracteate. *Calyx* persistent, of 5 sepals; *sepals* roundish or ovate-obtuse, large, white, slightly tinged with pink, eventually becoming green. *Petals* very short, narrow, green, tubular. *Follicles* many-seeded. *Seeds* black, shining.

Habitat. — Sub-alpine woodland regions in the midland and southern parts of Europe.

Hellebori Nigri Rhizoma. *Hellebore Rhizome.*

The dried rhizome and rootlets of Helleborus niger, *Linn.*

(*Not official.*)

General Characters.—This drug, as met with in commerce under the name of black hellebore root, consists of two parts,—the rhizome, and the rootlets which arise from it. The rhizome is half an inch or less thick, several inches long, horizontal or contorted, knotty with transverse ridges and slight longitudinal striæ. The rootles are numerous, cylindrical, dark brown externally, internally whitish or yellowish-white, with a central undivided paler woody axis or meditullium. The odour is very feeble, but has been compared to that of senega root. Its taste is slight at first, then bitterish, acrid, and nauseous.

Adulterations and Substitution.—Black hellebore rhizome is very commonly adulterated, or the rhizomes or roots of other plants are substituted for it. Thus the rhizome of *Helleborus viridis* and *H. fœtidus* are sometimes substituted for, or intermixed with, black hellebore rhizome ; but as these would appear to be equal in activity to the genuine drug, this intermixture or substitution is of little importance. The substitution, however, of the rhizome of *Actæa spicata*, Baneberry, for that of black hellebore, which has been noticed on the Continent and in America, and also frequently by Professor Bentley in England, is a very serious one, as the properties of the two drugs are totally different. Their distinctive characters may be tabulated as follows :—

Black Hellebore.	*Baneberry.*
Rhizome variously twisted and knotted; and presenting on its upper surface, when of any length, short projections at intervals.	Rhizome twisted and knotted, but less so than black hellebore; and presenting on its upper surface large and long projections.
Greyish or brownish in colour, and without any perceptible red tinge.	Reddish-brown in colour.
No marked odour in a dried state.	Odour somewhat narcotic, especially when freshly dried or moistened.
Taste bitter, very acrid, biting, and nauseous, more especially so if freshly dried.	Taste bitter, but very slightly acrid, even when in a fresh state.
The transverse section of a rootlet exhibits an undivided, or but very slightly stellate meditullium.	The transverse section of a rootlet exhibits a meditullium, in which the woody bundles are arranged in a cruciate, triangular, or more or less radiate manner, according to their number.

The best of these distinctive characters is that presented by the transverse sections of the rootlets of the two rhizomes. (See *Pharm. Journ.* Aug. 1861.)

Composition.—The more important constituents are *acrid oil*, to which the properties of black hellebore are said to be due; and a *neutral crystallisable principle* extracted by Mr. Bastick, and termed by him *helleborine.*

Therapeutics.—Black hellebore, though greatly esteemed by the ancients, is but little valued by the moderns, which has probably arisen from the difficulty of obtaining the true rhizome. It is adapted for torpid, phlegmatic individuals, especially when the pelvic circulation is languid. On the other hand, in easily-excitable persons, and where any irritation of the pelvic organs (especially the uterus and rectum) exists, it proves injurious. *In affections of the nervous system*, especially mania, melancholia, and epilepsy, it has long been celebrated. *As an emmenagogue* it was formerly greatly esteemed. *In dropsy* its drastic operation renders it useful. Furthermore, when this disease depends on, or is connected with, a languid state of the portal circulation, black hellebore proves useful by the stimulus which it communicates to the hepatic vessels. Lastly, black hellebore has been used in *chronic skin diseases*, and as an *anthelmintic.*

Administration and Dose.—The dose of powdered hellebore is from 10 to 20 grains as a drastic purgative. When we require a milder effect, we may give it in doses of 3 to 8 grains. It has also been given in decoction; but the tincture is the most frequently employed preparation. The tincture may be thus prepared:—

Take of

Hellebore, bruised	5 ounces.
Proof Spirit	2 pints.

Macerate for seven days, and strain.

Dose.—From $\frac{1}{2}$ to 1 fluid drachm.

DELPHINIUM STAPHYSAGRIA, *Linn.* Stavesacre.

Botanical Characters.—A stout *herb*, 1 or 2 feet high, biennial. *Stem* and *petioles* hairy. *Leaves* broad, palmated, stalked, 5- to 9-cleft. *Racemes* lax. *Bractlets* inserted at the base of the pedicel. *Pedicels* twice as long as the flower. *Flowers* bluish or purplish. *Calyx* deciduous, petaloid, irregular; the *sepals* elongated at the base into a short spur. *Petals* 4, the 2 upper with spurs which are enclosed within the spurred calyx. *Follicles* 3, large.

Habitat.—South of Europe, Asia Minor, Levant.

Staphysagriæ Semina. *Stavesacre Seeds.*

The seeds of Delphinium Staphysagria, *Linn.* Imported from the south of Europe.

(*Not official.*)

General Characters.—Stavesacre seeds are irregularly triangular or sometimes quadrangular, slightly arched, blackish-brown, and wrinkled. They contain a white and oily nucleus. Their odour is slight but disagreeable; their taste bitter, very acrid, hot, and nauseous. Iodine colours them brown. Their watery infusion is darkened by perchloride of iron; infusion of nutgalls renders it turbid.

Composition.—The principal constituents are a *volatile acid*, and the alkaloid *delphinia* ($C_{27}H_{19}NO_7$). (See *Delphinia.*)

Physiological Effects and Uses.—The activity of stavesacre seeds depends partly on the delphinia, and partly on the volatile acid. The powder of the seeds readily excites nausea, vomiting, and purging. Orfila has shown that on dogs it acts first as an acrid, and afterwards as a narcotic poison. Stavesacre seeds have been used to destroy pediculi; whence the Germans term them *louse-seeds.* For this purpose they are employed in the form of ointment or acetous infusion. They have also been administered internally (in doses of from 3 to 8 grains) against worms; and externally in the form of decoction (prepared by boiling 1 ounce of the seeds in 2 pints of water) in inveterate itch.

Delphinia. *Delphinia.*

An alkaloid obtained from Stavesacre seeds.

(*Not official.*)

Preparation.—This alkaloid is obtained from the bruised seeds as follows:—They are treated with diluted sulphuric acid, and the filtrate is precipitated by ammonia or carbonate of potash. The precipitate (*impure delphinia*) is dissolved in hot alcohol, filtered and evaporated. The residue is dissolved in hydrochloric acid and the solution decomposed by magnesia. The precipitate by one or two digestions in alcohol is obtained pure.

General Characters.—Not generally seen crystallised but as a yellowish-white powder. Schwarzkopf procured it by spontaneous evaporation from its alcoholic solution in very minute crystals apparently belonging to the rhombohedral system. Delphinia, as a powder, is nearly white: it has an acrid, persistent hot taste, is almost insoluble in water but gives to it a decided taste. It is easily dissolved by ether and the oils. At 60° six parts of alcohol dissolve one part; at a higher temperature much more. The powder applied to the nose produces the most violent sneezing, and when applied to the eye, great irritation followed by inflammation. It melts at 248° and is decomposed at a higher temperature. Sulphuric acid gives an intense blood-red colour with delphinia, passing into a dirty brown, and ultimately becoming black from carbonisation. Cold nitric acid gives to it an ochreous, and, after a time, a dingy red colour; when heated it is destroyed, and changed to a bitter acid resinous-looking mass. An alcoholic solution of delphinia has an alkaline reaction. This alkaloid combines with the diluted acids to form very soluble salts.

Therapeutics.—Four grains of delphinia dissolved in a fluid drachm of rectified spirit produce, when rubbed on the skin, a sensation of burning and pricking, with tingling and slight redness. Taken internally, in doses of half a grain, it sometimes acts slightly on the bowels, and increases the flow of urine. In larger doses, as a few grains, it gives rise to sensations of heat and tingling in various parts of the body. The diseases in which it is chiefly successful are neuralgic cases. It has also been used in rheumatic affections with some benefit. It is employed externally in the form of ointment or alcoholic solution. Aconitia is, however, far more useful than delphinia, and has almost or entirely superseded it in general practice in this country.

ACONITUM NAPELLUS, *Linn.* Common Monkshood.

Botanical Character.—Perennial *herb.* *Root* tapering, and in the summer months having one or two lateral roots attached to it (fig. 119). *Stem* simple. *Leaves* with commonly 5 wedge-shaped segments, which are further incised in a pinnatifid manner; smooth and shining, dark green above, paler beneath. *Flowers* blue, or deep violet, racemose, or somewhat panicled below. *Calyx* of 5 petaloid sepals, irregular, upper one helmet-shaped (fig. 118); *helmet* semicircular, or rarely boat-shaped. *Petals* 5, 3 small and often abortive, 2 superior on long stalks, each expanded at the apex into a sac hidden beneath the helmet-shaped sepal; *sac* somewhat conical. *Stamens* with hairy filaments. *Carpels* 3, or rarely 5; when young, diverging. *Seeds* numerous, angular, wrinkled.—*Woodv. Med. Bot.* pl. 6.

Fig. 118.

The flowering stem of Aconitum Napellus.

Varieties.—This species is subject to great variation in the dense or loose condition of the inflorescence, in the form of the helmet, the colour and size of the flower, the breadth and the number of segments of the leaves, the downiness of the parts of the plant, and the condition of the stem.

Habitat.—Europe. It is not truly indigenous, but it may sometimes be found, apparently wild, on the banks of rivers and brooks.

[§ **Aconiti Folia.** *Aconite Leaves.*

The fresh leaves and flowering tops of Aconitum Napellus, *Linn.*, gathered when about one-third of the flowers are expanded, from plants cultivated in Britain.] (See p. 587 for the reasons why the leaves should be taken after the flowers have expanded.)

General Characters.—The characters have been given above in the botanical description; those given in the Pharmacopœia are not sufficiently precise, and, as distinctive characters, they are valueless. The leaves, when chewed, have a very slightly bitter taste at first, but after a few minutes they produce a remarkable feeling of numbness and tingling. They have no odour. Aconite leaves are far less active than the root.

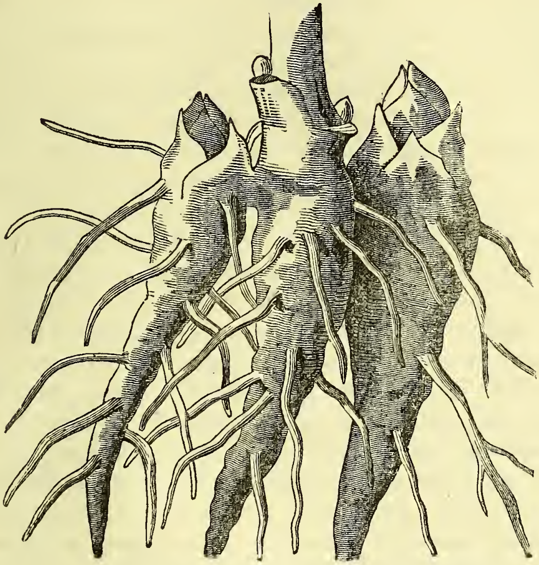
[§ **Aconiti Radix.** *Aconite Root.*

The dried root of Aconitum Napellus, *Linn.; Pharm. Journ.* vol. xv. p. 452, plate. Imported from Germany, or cultivated in Britain, and collected in the winter or early spring before the leaves have appeared.]

General Characters.—Aconite root, when fresh, is from 2 to 5 inches or more in length. In form it resembles the cultivated carrot, or more nearly the common parsnip, being broad at its upper extremity and tapering rapidly downward to a small thread-like point (fig. 119); the upper extremity, on an average, being about the thickness of the middle finger, but frequently an inch or more in diameter. Sometimes the main root divides into two or three divisions, each of which resembles the other (fig. 119). It passes perpendicularly into the earth, giving off from its sides numerous cylindrical rootlets, each being about the thickness of a common knitting-needle. Externally, the root and rootlets are coffee-coloured, dark brown, or some shade of brown; internally, they are white. The root has no particular odour, being merely earthy. Its taste is at first bitter, but in a few minutes a very peculiar feeling of numbness and tingling is perceived in the lips, cheeks, and tongue. By drying, the root shrivels, and becomes darker coloured. It should be gathered in the spring, just before the leaves appear. It is said to have six times the activity of the leaves and the other parts of the plant.

Distinctive Characters of Aconite and Horseradish Root.—Notwithstanding the marked difference in appearance, &c. between aconite root and horseradish root, several deaths have of late years occurred from the former having been substituted for the latter. Aconite root is most virulent in the winter months and early spring, when the leaves are absent, and it is only at such periods that it is

Fig. 119.



The Root of Aconitum Napellus (Monkshood).

likely to be substituted for that of horseradish. In a paper published in the fifteenth volume of the *first series* of the *Pharmaceutical Journal*, Professor Bentley has fully described the differences between the two roots, and given figures of them. He has tabulated their distinctive characters as follows:—

Aconite.	*Horseradish.*
Form.—Conical, and tapering rapidly to a point.	*Form.*—Slightly conical at the crown; then cylindrical, or nearly so, and almost of the same thickness for many inches.
Colour.—Coffee-coloured, or more or less brownish, externally.	*Colour.*—Externally white, or with a yellow tinge.
Odour.—Merely earthy.	*Odour.*—Especially developed upon scraping, when it is very pungent and irritating.
Taste.—At first bitter, but afterwards producing a disagreeable tingling and numbness.	*Taste.*—Bitter or sweet according to circumstances, and very pungent.

The marked difference in colour and form of the two roots should alone suffice as distinctive characters.

Composition.—All parts of the plant, and more especially the root, contain the alkaloid aconitia ($C_{30}H_{47}NO_7$), to which their activity is due. Aconitia is united with aconitic acid. (See *Aconitia*, p. 1005.) There appear to exist in aconite root two distinct substances, which possess, in different degrees, the physiological properties of this drug. One is amorphous aconitia, the other is a substance which is presented in the form of well-defined crystals, which, after three successive crystallisations and when evidently chemically pure, caused the same symptoms as amorphous aconitia, though in a much weaker degree. Messrs. T. and H. Smith, of Edinburgh, have isolated a new crystallisable alkaloid in aconite root, which they have termed aconella. It has a great resemblance to narcotine, indeed would appear to be that substance.

Physiological Effects of Aconite leaves and Aconite root.—The *topical effects* are peculiar, and most remarkable. If a leaf or a small portion of the root be chewed, or a few drops of the alcoholic tincture of the root be applied to the lips, there are produced in a few minutes numbness and a remarkable tingling sensation. These effects endure for many hours. If the quantity taken into the mouth be somewhat larger, the palate and throat are affected.

When *small and repeated doses* of the tincture are taken *internally*, they cause a sensation of heat and tingling in the extremities, and occasionally a slight diuresis.

In *poisonous doses* the effects of aconite are most striking. The following details of the effects produced on a family of three persons were furnished me, a few days after the accident, by one of the sufferers (Mrs. Prescott), and her account was confirmed by a very intelligent neighbour who witnessed the progress of the symptoms:—In December 1836, Mr. Prescott, aged 57, residing in the City Road, planted in his garden a few pieces of horseradish. On February 5, 1837, he observed some green shoots which he supposed to be those of horseradish. He dug up three of them. The roots (samples of which were given, and have yielded me thriving plants of Aconitum Napellus) were tap-shaped and small. Perhaps a very small walnut would exceed in bulk that of the whole root. These roots were washed, scraped, placed on a plate with some vinegar, and eaten at dinner (at 2 o'clock) with roast-beef, by Prescott, his wife (aged 57), and a child (aged 5). It was remarked at dinner that the root was very mild, and had not the pungency of horseradish. After the family had dined, about one root was left; so that two had been eaten at dinner, the greater part (perhaps one or one root and a half) by the husband. About three-quarters of an hour after dinner, Mr. Prescott complained of burning and numbness of the lips, mouth, and throat, which soon extended to the stomach, and was accompanied with vomiting.

The matters ejected were first his dinner, and afterwards a frothy mucus; but at no time was any blood brought up. The vomiting was very violent and constant for an hour, and continued more or less until within half an hour of his death. An emetic was swallowed at a quarter past four o'clock; and therefore the subsequent vomiting may be ascribed, in part at least, to this. His extremities were cold, but his chest was warm: the head was bathed in a cold sweat. His eyes, to use the expression of his neighbour, were 'glaring.' He complained of violent pain in the head, and trembled excessively. The last symptom might, perhaps, be in part owing to his terror of the mistake he had committed. The lips were blue. His mental faculties were not disordered: on this point I made particular inquiry, and I was assured that he was neither delirious nor sleepy, but was quite conscious until within two minutes of his death. He had no cramp, spasm, or convulsion; the only approach to it was trembling. He frequently put his hand to his throat. Though exceedingly weak he did not lose his power over the voluntary muscles; for within a few minutes of his death he was able, with the assistance of a neighbour, to walk to the water-closet. His bowels were acted on once only after dinner, and that on the occasion just mentioned, which was about an hour after he had taken the emetic and some castor oil. His breathing was apparently unaffected. On his return from the water-closet he was put to bed and within a few minutes expired, apparently in a fainting state. Death occurred about four hours after dinner. Mrs. Prescott was affected in a similar way. She had the same burning and numbness of the lips, mouth, throat, and stomach, and violent vomiting. She experienced a curious sensation of numbness in the hands, arms, and legs; and she lost the power of articulating, so that she was unable to tell the address of her son. Her attempts to speak were attended with unintelligible sounds only. She experienced great muscular debility, and was unable to stand. In this respect her condition differed from that of her husband, who could both stand and walk. She felt stiffness of, and difficulty in moving, her limbs. She had no cramps, spasms, or convulsions. The only approach thereto was the stiffness of the muscles when she attempted to put them in action, as in her attempts to wipe her face. Some of the external senses were disordered: thus, to use her own expression, though her eyes were wide open, her sight was very dim, and surrounding objects were seen indistinctly. The hearing was unaffected. The sensibility of the body was greatly impaired; her face and throat were almost insensible to touch. She felt very giddy, but was neither delirious nor sleepy. For the most part she was conscious, but at times scarcely knew what was passing around her. Her body and extremities were cold. She was frequently pulling her throat about, but she knew not why. Five or six hours after dinner she began to recover, and her natural warmth returned. The remedies employed were an emetic, castor oil, pediluvia, rum and water, and some 'warm' medicine given her by a neighbouring practitioner. The child was similarly but more slightly affected, except that she evinced a slight tendency to sleep. Like the others she was constantly putting her hands to her throat. Mr. Sherwen has published a most interesting case of a female poisoned by tincture of aconite. About five minutes after swallowing it, she was seized with a pricking and tingling down her arms and fingers, and a painful numbness across the wrists; the tongue and mouth next felt the same, then the legs and feet; and in less than ten minutes her face seemed to her feelings to be swelling, and the throat growing tight. She felt sick and made many efforts to vomit. Her legs failed, she was almost blind, but was conscious of her condition. When seen by Mr. Sherwen her eyes were fixed and protruded, with *contracted* pupils; countenance livid; jaws and fauces rigid; arms and hands quite cold and pulseless; the legs and trunk much in the same state; breathing short, imperfect, and laborious; while the heart fluttered feebly. She was sufficiently sensible to tell how the accident occurred. In an attempt to administer an emetic a strong convulsion occurred. Copious vomiting afterwards took place. Five hours after she had taken the poison the pulse was becoming full, only 58 per minute, and intermitting. There was less oppression at the præcordia, and the pupils were larger. She eventually recovered. These cases agree with the one detailed in the *Philosophical Transactions.* Pallas (quoted by Christison) and Delgland have published cases in which violent vomiting, purging, colic, and abdominal tenderness, are said to have been produced by aconite [?].

In comparing the operation of aconite with that of other cerebro-spinants, we observe that its most characteristic topical effect is *numbness and tingling.* Applied to the eye it causes *contraction of the pupil.* When the root or its tincture is swallowed, the most marked symptoms are *numbness and tingling of the parts about the mouth and throat, and of the extremities, vomiting, contracted pupil, and failure of the circulation.* The heart appears to be weakened or paralysed, and a state approaching to asphyxia is produced. *Convulsion* or *spasm* is not constantly present, and, when it does take place, is probably a secondary effect arising from the incipient asphyxia. In neither of the cases which I have above detailed, nor in that of Mr. Sherwen, did *stupor* occur. Yet in some recorded instances it has happened. According to M. Scroff, the pupil is not commonly contracted in cases of poisoning by this plant, for this experimentalist states that aconite in general, but especially aconitia applied to the exterior of the eye, or given internally in sufficient quantity, produces a *dilatation of the pupil*, a result which is opposed to the opinion generally entertained by pharmacologists. It would seem from recent investigations, that aconite first produces *contraction*, and subsequently *dilatation of the pupil of the eye*. Aconite and aconitia produce an extraordinary increase in the secretion of urine. Aconite, as well as aconitia, exerts a strongly depressive influence on the action of the heart and large vessels. This is observed either immediately, or after a short acceleration of the heart's action. This depressing effect is persistent, and consequently differs from the effects produced by atropia and daturia. These alkaloids, given in a much larger dose than aconitia, cause an acceleration of the pulse beyond the normal condition, although this is preceded by a short interval in which the pulsations are diminished.

Therapeutics.—A knowledge of the physiological effects of aconite suggests the therapeutical uses of this medicine. A benumber is obviously the physiological remedy for increased sensibility (pain) of the nerves. As a *topical remedy*, aconite is most valuable for the relief of neuralgic and rheumatic pains. In *neuralgia*, no remedy, I believe, will be found equal to it. In some cases the benefit seems almost magical. In others, however, the remedy entirely fails to give any permanent relief. The causes of neuralgia are, however, usually obscure, and therefore we are in most cases not able to determine *à priori* the probability or the reverse of the beneficial agency of aconite. Hence its employment must be, for the most part, empirical. I have observed, that when it succeeds, it gives more or less relief at the first application. When the disease depends on inflammation, aconite will be found, I think, an unavailing remedy. In a painful affection of the nerves of the face, arising from inflammation of the socket of a tooth, it gave no relief. Dr. Sydney Ringer believes that it can cut short and limit the intensity of *most acute inflammations*, if given sufficiently early, and in repeated small doses. In *rheumatic pains*, unaccompanied with local swelling or redness, aconite is frequently of great service. In painful conditions of the intercostal and other respiratory muscles, occurring in rheumatic individuals, I have found this remedy most valuable. In one case of *sciatica* it gave partial relief: but in most cases in which I have tried it, it has failed. In *acute rheumatism* its application has not proved successful in my hands; but I have been informed of cases occurring to others in which it has been of great service. Aconite has been administered *internally* in various diseases, principally on the recommendation of Störck. It has been employed with most success in *rheumatism* and *dropsies*.

Administration.—The *powder* is given in doses of one or two grains, gradually increased, until some effects are produced; but no reliance can be placed on it. When of good quality, it causes numbness and tingling of the lips and tongue a few minutes after its application to these parts. The *tincture* is the most reliable preparation for internal use.

Official Preparations.

1. *Of Aconiti Folia* :—

[§ **Extractum Aconiti.** *Extract of Aconite.*

Take of

The fresh Leaves and flowering Tops of Aconite . . . . . } 112 pounds.

Bruise in a stone mortar, and press out the juice; heat it gradually to 130°, and separate the green colouring matter by a calico filter. Heat the strained liquor to 200° to coagulate the albumen, and again filter. Evaporate the filtrate by a water-bath to the consistence of a thin syrup; then add to it the green colouring matter previously separated, and, stirring the whole together assiduously, continue the evaporation at a temperature not exceeding 140°, until the extract is of a suitable consistence for forming pills.]

When of good quality it causes numbness and tingling, within a few minutes after its application, in the mouth and lips.

Dose.—1 or 2 grains at the commencement, to be gradually increased until some obvious effect is produced.

2. *Of Aconiti Radix* :—

[§ **Linimentum Aconiti.** *Liniment of Aconite.*

Take of

Aconite Root, in coarse powder . . .	20 ounces.
Camphor	1 ounce.
Rectified Spirit	a sufficiency.

Moisten the aconite with some of the spirit, and macerate in a closed vessel for three days: then transfer to a percolator, and adding more spirit percolate slowly into a receiver containing the camphor, until the product measures one pint.]

A valuable preparation for external use. When intended to be used in a diluted form it may be mixed with soap liniment. It is invaluable in rheumatism and neuralgia.

[§ **Tinctura Aconiti.** *Tincture of Aconite.*

Take of

Aconite Root, in coarse powder . . .	$2\frac{1}{2}$ ounces.
Rectified Spirit	1 pint.

Macerate the aconite root for forty-eight hours in fifteen fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining five ounces of spirit. Afterwards subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient rectified spirit to make one pint. This tincture has one-fourth of the strength of Tinctura Aconiti, *Dubl.*, and one-third of the strength of Tinctura Aconiti, *Lond.*]

Dose.—From 5 to 15 minims or more, gradually increased, as its use requires great caution.

[§ **Aconitia.** *Aconitia.*

An alkaloid, obtained from aconite.

Take of

Aconite Root, in coarse powder . .		14 pounds.
Rectified Spirit . .	of each . .	a sufficiency.
Distilled Water . .		
Solution of Ammonia .		
Pure Ether . .		
Diluted Sulphuric Acid		

Pour upon the aconite root three gallons of the spirit, mix them well, and heat until ebullition commences; then cool and macerate for four days. Transfer the whole to a displacement apparatus, and percolate, adding more spirit, when requisite, until the root is exhausted. Distil off the greater part of the spirit from the tincture, and evaporate the remainder over a water-bath until the whole of the alcohol has been dissipated. Mix the residual extract thoroughly with twice its weight of boiling distilled water, and when it has cooled to the temperature of the atmosphere, filter through paper. To the filtered liquid add solution of ammonia in slight excess, and heat them gently over a water-bath. Separate the precipitate on a filter, and dry it. Reduce this to coarse powder, and macerate it in successive portions of the pure ether with frequent agitation. Decant the several products, mix, and distil off the ether until the extract is dry. Dissolve the dry extract in warm distilled water acidulated with the sulphuric acid; and, when the solution is cold, precipitate it by the cautious addition of solution of ammonia diluted with four times its bulk of distilled water. Wash the precipitate on a filter with a small quantity of cold distilled water, and dry it by slight pressure between folds of filtering paper.

Characters and Tests.—A white, usually amorphous, solid, soluble in 150 parts of cold, and 50 of hot water, and much more soluble in alcohol and in ether; strongly alkaline to reddened litmus, neutralising acids, and precipitated from them by the caustic alkalies, but not by carbonate of ammonia or the bicarbonates of soda or potash. It melts with heat, and burns with a smoky flame, leaving no residue when burned with free access of air. When rubbed on the skin it causes a tingling sensation, followed by prolonged numbness. It is a very active poison.] Aconitia is extremely light, is in the state of hydrate, and contains 20 per cent. of water; at 187° F. it melts and becomes anhydrous, and is then a transparent amber-coloured substance; at a higher temperature it is decomposed, without being sublimed: vapours of ammonia only being given off. It has no smell, but a bitter followed by a pungent taste; not, however, producing the strong and durable tingling hot sensation perceived when the plant itself is masticated—a fact which has led Geiger to believe that the peculiar taste is derived from some substance like ammonia combined with aconitia in the plant. Aconitia is dissolved by concentrated nitric acid without change. Strong sulphuric acid colours it at first yellow and then dirty violet-red. A diluted solution of it is precipitated by tincture of iodine, tincture of galls, the chlorides of gold and mercury, but not by chloride of platinum. Iodohydrargyrate of potassium gives a curdy yellowish-white precipitate, picric acid produces a dense yellowish precipitate insoluble in ammonia. Aconitia is completely neutralised by acids forming salts soluble in water and alcohol, but not procurable in a crystalline state. In a dry state they have a gummy consistency, a slightly bitter taste, and present in solution the same reactions as the pure alkaloid. They are intensely virulent poisons.

Physiological Effects and Uses.—The effects of this alkaloid are similar to those of aconite root, but of course much more powerful. If the ointment be rubbed on the skin, it causes intense heat, tingling, and numbness, which continue for more than twelve or eighteen hours. A minute portion of the ointment applied to the eye, causes almost insupportable heat and tingling, and contraction of the pupil. In very minute doses it has caused heat and tingling upon the surface of the body, and sometimes diuresis; but it cannot be administered internally with safety. In one case (an elderly lady), one-fiftieth of a grain had nearly proved fatal. I believe that the tincture of aconite is a perfect substitute for it; and the experience of others confirms my own observation. Of the great efficacy of aconitia, however, used externally in neuralgic and rheumatic affections, no one can entertain any doubt who has submitted the remedy to trial.

[§ **Unguentum Aconitiæ.** *Ointment of Aconitia.*

Take of

Aconitia	8 grains.
Rectified Spirit	½ fluid drachm.
Prepared Lard	1 ounce.

Dissolve the aconitia in the spirit, add the lard, and mix thoroughly.]

A valuable application in rheumatic and neuralgic pains. Care must be taken not to employ it where the skin is abraded.

PODOPHYLLUM PELTATUM, *Linn.* **May-Apple.**

Botanical Character.—Perennial *herb.* *Rhizome* creeping horizontally, usually some feet in length, enlarged at intervals into irregular more or less rounded tuberosities, from which the rootlets arise. *Stem* erect, annual, smooth, 8–12 inches high, bearing at its summit 2 dichotomously arranged leaves which are placed on petioles from 2–4 inches long, and a solitary flower in the fork thus produced. *Leaves* peltate, 5–7 lobed; *lobes* wedge-shaped, oblong, 2-toothed or bifid at the apex. *Flower* white; *peduncle* recurved. *Calyx* with 3 sepals. *Stigma* large, sessile. *Fruit* about the size of an egg, yellow, nearly oval, and crowned by the persistent peltate stigma, 1-celled, fleshy, indehiscent, and containing about 12 seeds. —*Bot. Mag.* pl. 1,819.

Habitat.—May-Apple is common throughout the United States of America, extending from New England to Georgia, growing usually in low moist shady woods, or in low newly-cleared ground, and generally in marshy situations.

[§ **Podophylli Radix.** *Podophyllum Root.*

The dried rhizome of Podophyllum peltatum, *Linn.* Imported from North America.]

General Characters.—[§ In pieces of variable length, about two lines thick, mostly wrinkled longitudinally, dark reddish-brown externally, whitish within, breaking with a short fracture; accompanied with pale brown rootlets. Powder yellowish-grey, sweetish in odour, bitterish, subacrid and nauseous in taste.] The following description of the rhizome is abridged from a detailed account of Podophyllum peltatum, by Professor Bentley, in the *Pharmaceutical Journal*, vol. iii. 2nd ser. p. 457:—Podophyllum root, as it is commonly termed, is in reality a rhizome, from which the true rootlets arise below. In commercial specimens these rootlets are sometimes absent altogether, but more commonly they are present in varying proportions, in which case they are either separated from and mixed in a loose state with the rhizomes, or firmly attached to them at the tuberosities. The *rhizome*, as imported, is either simple or branched. In length it varies from about an inch to six or eight inches, or even more. It is from two to four lines thick, averaging about that of a common goose-quill. At intervals, when not much broken up, it presents large irregular more or less flattened tuberosities, from the lower surface of which the rootlets arise, or, when these are detached, their position is marked by whitish more or less projecting scars. In form the rhizome is rounded or more or less flattened. The rounded portions are firm in texture, reddish or blackish-brown in colour externally, interspersed with lighter coloured markings, and nearly smooth. The flattened portions are more or less spongy in texture, lighter coloured, being of a reddish yellow-brown, and much wrinkled longitudinally. The rhizome breaks short, smooth, and close. The *rootlets* vary in length, in some cases being two or more inches; and in size averaging about that of a common knitting-needle. Externally they present a nearly smooth appearance, and are lighter-coloured than the rhizomes, being yellowish-red rather than reddish-brown. Their fracture is short and smooth. Both the rootlets and rhizome are easily reduced to powder, which is of a yellowish-grey colour, not very unlike that of jalap. The taste of both the rhizome and rootlets is at first somewhat sweetish, but afterwards by chewing, nauseous, slightly acrid, narcotic, and bitter. The odour is somewhat narcotic (in some specimens very strongly so), more especially when moistened with warm water.

Composition.—Podophyllum has been frequently analysed, but with somewhat conflicting results. The most important constituents are two resinous principles (see *Podophylli Resina*). Besides these resinous principles, the alkaloid berberia, together with another alkaloid, and saponin, have been discovered by Mayer in podophyllum rhizome.

Pharmaceutical Use.—Introduced into the Pharmacopœia for the preparation of resin of podophyllum.

[§ **Podophylli Resina.** *Resin of Podophyllum.*

Take of

Podophyllum Root, in coarse powder .	1 pound.
Rectified Spirit	3 pints, or a sufficiency.
Distilled Water	a sufficiency.
Hydrochloric Acid	a sufficiency.

Exhaust the podophyllum with the spirit by percolation; place the tincture in a still, and draw off the greater part of the spirit. Acidulate the water with one twenty-fourth of its bulk of hydrochloric acid, and slowly pour the liquid which remains after the distillation of the tincture into three times its volume of the acidulated water, constantly stirring. Allow the mixture to stand for twenty-four hours to deposit the resin. Wash the resin on a filter with distilled water, and dry it in a stove.]

General Characters.—[§ A pale greenish-brown amorphous powder, soluble in rectified spirit and in ammonia; precipitated from the former solution by water, from the latter by acids. Almost entirely soluble in pure ether.] The resin is said to be composed of two resinous substances, one of which, according to Lewis, is soluble in alcohol and insoluble in ether, and the other, constituting four-fifths of the whole, soluble in both alcohol and ether. There is some difference of opinion in America as to the relative medicinal activity of these two resins, for while Lewis found both to act as cathartics, the experiments of Mr. Harvey Allen led him to regard the resin which was soluble in both alcohol and ether, as alone possessing active purgative properties. In the British Pharmacopœia, as the resin obtained from podophyllum by means of rectified spirit is alone official, if the presence of two resinous principles of different degrees of activity be confirmed, the Pharmacopœia preparation will contain them both, as they are both soluble in alcohol.

Physiological Effects and Uses.—In America, podophyllum rhizome and its preparations, more especially that of the resin under the name of *podophyllin*, have long been held in high esteem as efficient purgatives. Wood and Bache describe podophyllum resin as an 'active and certain cathartic, producing copious liquid discharges without much griping, or other unpleasant effect. In some cases it has given rise to nausea and even vomiting, but the same is occasionally experienced from every active cathartic. Its operation resembles that of jalap, but is rather slower, and is thought by some to be more drastic. It is applicable to most inflammatory affections which require brisk purging, and is much employe l in various parts of the country, especially combined with calomel, in bilious fevers and hepatic congestions. It is also frequently used in connection with acid tartrate of potash, in dropsical, rheumatic, and scrofulous complaints. In minute doses, frequently repeated, podophyllum is said to diminish the frequency of the pulse, and to relieve cough; and for these effects is sometimes given in hæmoptysis, catarrh, and other pulmonary affections.' Many American physicians consider that they can use it with perfect safety and confidence, in all cases where mercury is indicated, as they say it produces all the good, and none of the evil effects of mercurial preparations. The resin of podophyllum has also been very extensively employed for some years in this country and in other parts of the world, and is now, by almost universal testimony, regarded as a most valuable cathartic and cholagogue. In many cases it is applicable with perfect safety where mercury has been hitherto indicated and alone used. The griping effects which are frequently experienced by its use may be readily prevented by combining it with small doses of extract of hyoscyamus. In America, the resin dissolved in alcohol has been employed as a counter-irritant. Resin of podophyllum should be handled with care, as should any particles come in contact with the interior of the eyes or nose, it will cause severe inflammation.

Administration.—Podophyllum rhizome has been given in powder, in doses of from 20 to 30 grains; but the resin is by far the best mode of administration. The *dose* of the latter is from a quarter to half a grain or one grain.

ACTÆA RACEMOSA, *Linn.* Black Snake-root or Cohosh.

Synonym.—Cimicifuga racemosa, *Torrey.*

Botanical Character.—Perennial *herb. Stem* simple, 3–8 feet high. *Leaves* more or less divided in a ternate manner, with oblong-ovate leaflets, which are serrated, toothed, or incised at their margins. *Raceme* much elongated. *Calyx* regular, deciduous, petaloid, with 4 or 5 sepals. *Petals* 4. *Carpel* solitary, dry, dehiscent, many-seeded.

Habitat.—Native of North America, growing in moist, shady, or mountainous woods; or in ground which has been recently cleared; from Canada to Florida.

Actææ Racemosæ Rhizoma. *Actæa Rhizome*, or *Cimicifuga.*

The dried rhizome and rootlets of Actæa racemosa, *Linn.*

(*Not official.*)

It is official in the United States Pharmacopœia under the name of 'Cimicifuga.'

Collection and Commerce.—The rhizome is collected for medicinal purposes in the autumn, as it is most active at this period. It is imported from the United States.

General Characters.—It has been fully described by Professor Bentley (*Pharm. Journ.* March 1861), and the following notice has been abridged from his paper. The so-called root, as imported, generally consists of pieces of, or the entire rhizome, from which a variable number of rootlets arise below; or separated portions of the latter are found mixed with the rhizomes; or the latter may be altogether absent. The *rhizomes* vary from about one-third to one inch in thickness; their average diameter being about half an inch. Their length varies from one to several inches, usually being from two to three inches. They have a somewhat flattened cylindrical form, and are more or less twisted; and when of any length, they are furnished above with several projections, which are the remains of the aërial stems. In colour externally, they are dark brown or blackish. Internally, they are whitish or yellowish, or sometimes with a darker central portion. They break with a close, somewhat resinous-looking fracture, and exhibit upon a transverse section, a large central pulpy portion, around which are disposed one or more annular layers of coarse more or less stellately-arranged woody bundles, separated by large medullary rays. In a dried state they have scarcely any odour, except when bruised or moistened with boiling water, in which case they possess a slightly narcotic one; but in a fresh state, or when recently dried, they have a peculiar, heavy, narcotic odour, somewhat resembling a mixture of aconite and liquorice roots. The fresh and recently dried rhizomes have a bitter, slightly acrid, and somewhat astringent taste, but if they have been long kept, these qualities are less evident. The diminished odour and taste of the long dried rhizomes, would lead to the conclusion that they are less active than the recently dried, or fresh ones, and this is fully borne out by the more satisfactory results obtained from the administration of the latter as remedial agents. The *rootlets*, which are, according to our experience, more powerful than the rhizomes, vary in length from one to several inches; in the latter case they form an interlacing twisted tuft, somewhat like those of the Virginian snake-root. Their average size is about that of a common knitting needle. They are smooth or irregularly striated externally, and of a blackish-brown colour. They present a close, somewhat resinous fracture; and consist of a dark cortical portion, surrounding a whitish meditullium. The lighter coloured woody bundles of the meditullium radiate from the centre, and are arranged in a radiate, cross-like, or triangular manner, according to their number. In odour and taste, they resemble the rhizomes. The radiate or cross-like character of the rootlets is one of the best characters by which to distinguish them from other rootlets. In this respect they resemble the rootlets and rhizome of *Actæa spicata*, which, as already described, are frequently substituted for black hellebore. (See *Helleborus niger*, p. 994.)

Composition.—No satisfactory analysis has, as yet, been made of cimicifuga, but its chief constituents appear to be a *volatile oil* and *two resins.* No alkaloid or analogous principle has been obtained from it, but a resinoid extract may be procured by precipitation from the concentrated tincture of cimicifuga by water. This has been termed *cimicifugin*, and possesses to some extent, but by no means entirely, the active properties of the root.

Physiological Effects.—But little is known of the effects of cimicifuga. The following is taken from Stille's *Therapeutics and Materia Medica*:—'Dr. Chapman says that, "given so as to affect the system, we find first, some nausea, followed by greater freedom of expectoration and more or less relaxation of the surface, with slight nervous tremors, and vertiginous affections. The pulse, during this state, is considerably lowered, and is apt to remain so for some time." This statement is essentially confirmed by Dr. Davis, of Chicago, who says: "In large doses it produces vertigo, dimness of vision, and a depression of the pulse, which continues for some time." In medicinal doses, Dr. Young did not find it either to vomit or purge, nor yet to increase the perspiration or the urine, nor did it affect the pulse, but produced only an uneasy feeling amounting to an ache through all the extremities, and lasting from one to four hours. Dr. Davis, like previous observers, could not detect any perceptible increase in any of the secretions, nor the manifestation of any stimulating qualities.'

Therapeutics.—With respect to its uses, Sir James Simpson, of Edinburgh, states that, 'The tincture has been long spoken of as a remedy for rheumatism, and particularly in the more acute forms of the disease. Latterly it has been employed by some American physicians as their most valuable remedy in acute rheumatic fever. My very intelligent and excellent friend, Dr. Varis, of Rochelle, New York, told me two years ago, that since employing the tincture of actæa in rheumatic fever—and it is a very common disease in his district—he had seen the disease almost always cut short before the eighth or tenth day; the drug acting apparently as a simple antidote to the rheumatic poison, and curing without diuresis, diaphoresis, or any other discharge. I have found it, in my own case, repeatedly cure an attack of lumbago with wonderful rapidity. Some of the American practitioners who have written upon actæa have spoken of its use in terms that are, no doubt, exaggerated. Thus, Dr. Davis of Chicago, says that, after much experience, he has no more doubt of the efficacy of actæa in the early stage of acute rheumatism, than he has of the power of vaccination as a preventive of small-pox. But our American brethren have used actæa with great success also in chorea and other anomalous forms of nervous disease; and in case of anomalous and severe chorea of long standing, which was under my care some months ago, the actæa was given with excellent effect. The patient had been previously treated, both in

France and in this country, with zinc, iron, arsenic, and all the usual remedies employed in this malady.' Besides the affections mentioned above, cimicifuga has been administered with, it is said, good effect in the early stages of *phthisis*, *chronic bronchial diseases*, *hysteria*, *nervous headache*, *epilepsy*, *dropsy*, and in certain *uterine disorders*, &c. It certainly deserves a more extended trial than it has at present received in this country.

Administration and Doses.—Cimicifuga may be administered in substance, or in the form of tincture, infusion, decoction, or extract. The resinoid principle (*cimicifugin*) is also sometimes given, in doses of from 1 to 2 grains. The dose of powdered cimicifuga is from 20 to 60 grains. This may be given in syrup, or simply suspended in water. The most active preparation appears to be the alcoholic tincture. The infusion and extract are, however, sometimes convenient forms of administration. For the formulæ for these and other preparations, Professor Bentley's paper before alluded to may be consulted.

Group III.

ANIMAL MATERIA MEDICA.

Under this head are included those animals with their educts and products (except those obtained as products of decomposition, which are treated of in Group I., among chemical compounds of definite composition), which are admitted into the British Pharmacopœia, together with such others as are usually employed in the treatment of disease.

Sub-kingdom I.—*INVERTEBRATA.—INVERTEBRATE ANIMALS.*

Class: PORIFERA, *Grant.*

SPONGIA, *Linn.* The Sponge.

Generic Character.—Body soft, very elastic, multiform, more or less irregular, very porous, traversed by numerous tortuous canals, which open externally by very distinct vents (*oscula*), and composed of a kind of sub-cartilaginous *skeleton*, anastomosed in every direction, and with or without spicules.

Species.—At least three species of *spongia* may be recognised in the sponge of commerce. The characters of these and other species can only be fully distinguished by the microscope. The best sponge is derived from *Spongia officinalis*, Linn., a native of the Red and Mediterranean Seas. It is chiefly collected about the islands of the Grecian Archipelago. Other inferior sponges are derived from species which are collected about the West Indian Islands.

Spongia. *Sponge.*

The dry skeleton of Spongia officinalis, *Linn.*, and other species.

(*Not official.*)

Collection and Preparation.—The inhabitants of the Greek Islands collect sponge by diving for it; and, by practice they are enabled to remain a considerable time under water. In their submarine operations the divers carry with them a knife, with which they detach the sponge which adheres to the rocks by a very broad base.

When first taken out of the sea sponge has a strong fishy odour. Its colour varies from pale to deep brownish-yellow. It often contains stony or earthy concretions, and shells. As soon as it is brought on shore, it is squeezed and washed to get rid of the gelatinous matters which it contains; or otherwise putrefaction speedily ensues.

General Characters.—Commercial sponge is the dry skeleton of the animal, from which the gelatinous flesh has been removed, as just mentioned. When deprived of the stony concretions, &c., found in the interior of the mass, it is soft, light, flexible, and compressible; and in yellowish-brown masses of various shapes and sizes. When burnt it evolves an animal odour. It absorbs water, and thereby swells up. Nitric acid colours it yellow. Solution of potash dissolves it: and the solution thus produced forms a precipitate on the addition of an acid. The finer sponges, which have the greatest firmness and tenacity, were formerly called male sponge; while the coarser portions were denominated female sponge.

Varieties and Commerce.—Two kinds of sponge are met with in English commerce, Turkey and West Indian. *Turkey Sponge.*—This is imported from Smyrna, and constitutes the best sponge of the shops. It occurs in cup-shaped masses of various sizes. Its texture is much finer than that of the West Indian kind. Mr. Bowerbank, by the aid of the microscope, found that it consisted of two species of *Spongia*, not distinguishable from each other by the naked eye. One of these is characterised by the presence of a beautiful, branched, vascular tissue, which surrounds, in great abundance, nearly every fibre of its structure, and is enclosed in an external membrane or sheath. In the other, and most common kind of Turkey sponge, no vascular tissue has yet been discovered. The common variety is called *honeycomb* sponge. *West Indian Sponge.*—The principal source of this is the Bahama Islands; whence it is commonly known as *Bahama Sponge.* Its forms are more or less convex, with projecting lobes. Its fibre is coarser than that of Turkey sponge. Its tissue has but little cohesion, and hence this kind of sponge is commonly regarded as rotten. Mr. Bowerbank states that it consists of one species only of *Spongia.*

Composition.—Mr. Hatchett found sponge to consist of *gelatine* (which it gradually gave out to water), and a thin, brittle, membranous substance, which possessed the properties of *coagulated albumen.* According to the experiments of Posselt, the substance of sponge is peculiar, and resembles horny tissue, from which, however, it is distinguished both in composition and properties. It, nevertheless, is not a proteine compound, nor does it contain a trace of such a body.

Uses.—The extensive economical uses of sponge are familiar to everyone. To the surgeon it is of great value, on account of its softness, porosity, elasticity, and the facility with which it imbibes fluids. Its use at surgical operations and for checking hemorrhage is well known. It has also been applied to wounds and ulcers for imbibing acrid discharges. The *sponge-tent* is usually made of compressed sponge impregnated with wax, which is called *prepared sponge.* It is prepared by dipping sponge into melted wax, and compressing it between two iron plates till the wax hardens. It was formerly much used for dilating sinuses and small openings, but it is seldom or ever resorted to now.

Spongia Usta. *Burnt Sponge.*
(*Not official.*)

Preparation.—This was formerly official in the Dublin Pharmacopœia, and directed to be prepared as follows:—Having cut sponge into pieces, beat it to free it from sand and stones; burn it in a closed iron vessel until it becomes black and friable, and reduce it to powder.

General Characters and Uses.—Burnt sponge, if good, should evolve violet fumes (*vapour of iodine*) when heated with sulphuric acid in a flask. A decoction of burnt sponge is, when filtered, colourless; but when treated with starch and chlorine it strikes a blue colour, showing the presence of an iodide, probably of sodium. Burnt sponge has been employed as a resolvent in bronchocele and scrofulous enlargement of the lymphatic glands. Its efficacy is referable to the presence of iodine and bromine. Iodine is now almost invariably substituted for it.—*Dose*, from 60 to 180 grains. It is given in the form of electuary or lozenge.

Class: ANNULOSA, *Macleay.*

SANGUISUGA, *Savigny.* Blood-sucking Leeches.

Generic Character.—*Body* elongated, insensibly widening backwards, plano-convex, composed of numerous narrow equal very distinct segments, and furnished with a disk or sucker at each extremity (fig. 120). The oral *sucker* with an entire thick plaited rim, the upper lip prominent. *Mouth* large, with three equal compressed cartilaginous *jaws*, each furnished with a double row of numerous pointed cutting *teeth.*

1. S. MEDICINALIS, *Sav.* **The English or Speckled Leech.**

Specific Character.—Belly greenish-yellow, spotted with black.
Habitat.—England, and most parts of Europe.

2. S. OFFICINALIS, *Sav.* The Green Leech.

Specific Character.—Belly olive-green, unspotted.

Habitat.—South of Europe.

Species.—The Pharmacopœia has followed Savigny in describing *S. medicinalis* and *S. officinalis* as distinct species. Savigny, however, though he describes *S. officinalis* as a distinct species, says that no author has yet clearly distinguished it from *S. medicinalis.* Grube also makes *Hirudo* (*Sanguisuga*) *officinalis*, Sav., a variety of *H. medicinalis*, Linn., and both Grube and Johnson, the best authorities on the subject, reject *Sanguisuga* as the generic name, and restore the older name *Hirudo.* These are the only species ordinarily employed in this country, but others have been described and figured by Brande and other writers. In the United States the American leech, *Sanguisuga* (*Hirudo*) *decora*, is the one most frequently used. *S. provincialis*, *S. Verbana*, *S. obscura*, and *S. interrupta*, are other species.

[§ **Hirudo.** *The Leech.*

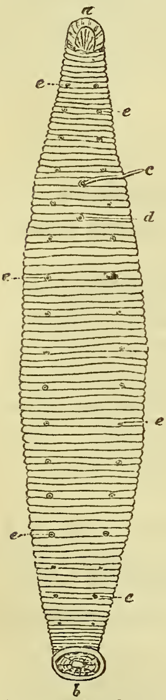
1. Sanguisuga medicinalis, *Savigny*, the Speckled Leech; and 2. S. officinalis, *Sav.*, the Green Leech. Collected in Spain, France, Italy, and Hungary.]

Collection and Commerce.—Leeches may be caught with the hand, or by a kind of net, or by the gatherers going into the ponds with naked feet, to which the leeches adhere; or by baits, especially the liver of animals. Leeches are largely imported from Hamburgh. They are also brought to England from Bordeaux, Lisbon, &c. They are imported in bags and small barrels, generally in the latter. Each barrel holds about 2,000, the head being made of stout canvas to admit the air.

General Characters.—[§ Body elongated, two or three inches long, tapering to each end, plano-convex, wrinkled transversely; back olive-green with six rusty-red longitudinal stripes. 1. Belly greenish-yellow, spotted with black. 2. Belly olive-green, not spotted.]

Preservation.—The best vessels for preserving these animals are unglazed brown pans, or wooden tubs. These pans should be very little more than half filled with soft water (pond, river, or rain water). This water should be changed at varying intervals, according to the season, &c.; thus, in very hot weather, or when the water has become bloody, every day or so; otherwise, in summer, every two or three days; and in winter, once a week will be generally found sufficient. In consequence of the great mortality which frequently occurs amongst leeches, various plans have of late years been adopted for more effectually preserving them. Mr. Allchin originally applied the principle of the aquarium to these animals, and these leech-aquaria, which are now frequently used, answer the purpose very well. A good plan of keeping leeches is to place them in an unglazed brown pan or glass vessel, at the bottom of which is a bed four or more inches thick, composed of a mixture of sand, moss, and fragments of wood below, and pebbles above. This vessel should be about two-thirds filled with soft water, and covered above with a linen cloth. Under such conditions, if the water be changed as just mentioned, and the leeches kept at a moderate temperature, and in a situation where they are not liable to sudden changes, they will thrive very well.

Fig. 120.



Ventral Surface of the Leech.

a. Anterior disk.
b. Posterior disk.
c. Penis.
d. Vaginal orifice.
e. Stigmata.

Mode of Biting.—Having fixed on a suitable spot, the animal applies its oval disk, and firmly fixes it (at first, perhaps, by atmospheric pressure; then by intimate contact), so that the anterior end forms an angle with the other portions of the body (fig. 120). The three cartilaginous jaws bearing the sharp teeth are now stiffened and protruded through the triradiate mouth against the skin, which they perforate, not at once, but gradually, by a saw-like motion. The wound is not produced instantaneously, for the gnawing pain continues for two or three minutes after the animal has commenced operations. Thus, then, it appears that the leech saws the skin; hence the irritation and inflammation frequently produced around the orifices. The flow of blood is promoted by the suction of the animal, which swallows the fluid as fast as it is evolved. During the whole of the operation the jaws remain lodged in the skin. In proportion as the anterior cells of the stomach become filled, the blood passes into the posterior ones; and when the whole of this viscus is distended, the animal falls off. On examination it will be found that not a particle of blood has passed into the intestine.

Physiological Effects.—There are two classes of phenomena observed in all modes of drawing blood; one of which has been termed *local*, the other *general.* In phlebotomy and arteriotomy, the first is trifling, and of no therapeutic value; and we resort to these operations only as means of affecting the general system. On the other hand, we obtain topical effects, both powerful and useful, from cupping and leaching; hence these are termed *local*, while the former are denominated *general* blood-lettings. It must, however, be remembered, that constitutional or general effects are also frequently obtained from both cupping and leeching.

The *Constitutional or general effects of leeching* are the same in kind as those caused by the loss of blood from other means. A moderate quantity of blood may be abstracted without any obvious effects on any of the functions; but, if the amount taken be increased, syncope results. The quantity necessary to produce this effect varies, however, considerably, and will depend on the mode of drawing it (whether rapidly or otherwise); the position, constitution, and age of the patient; the nature of the disease: and many other circumstances not necessary to enumerate. It is well known that a small quantity will, if taken rapidly, and the patient be in the erect posture, cause this result; whereas a considerably larger amount may be abstracted, if taken gradually, and the patient be in the recumbent position, without giving rise to it. Leeching, then, as being a slower mode of abstracting blood, is less likely to cause syncope than venesection, or even cupping. The constitutional or general effects caused by the application of leeches are best observed in children and delicate females—more especially the former. I have, on several occasions, seen infants completely blanched by the application of one or two leeches. Pelletan mentions the case of a child, six years old, who died from the hemorrhage occasioned by six leeches applied to the chest. Leeching, then, is here, to all intents and purposes, a mode of general blood-letting, arising in part from the powerful influence which the loss of a small quantity of blood produces in infants; and secondly, because one leech will cause the loss of more blood in them than in adults, owing to the greater vascularity of the cutaneous system. It is apparent, therefore, that in the diseases of infants, leeching may, in most cases, be substituted for venesection. But in disorders which are rapidly fatal, as croup, opening the jugular vein is undoubtedly to be preferred, since it is necessary to produce an immediate and powerful effect. As children advance in years they become capable of bearing larger evacuations of blood; and, therefore, leeching excites a less influential effect. It is quite impossible to say at what age venesection ought to be substituted, or, in infancy, what number of leeches should be applied; since they take away such unequal quantities of blood. These are points which must be decided by the practitioner in each case.

The local effects of leeching must now be noticed. The jaws of the leech may be compared to three saws, each armed with sixty teeth. It is, therefore, not surprising that pain and afflux of blood to the wounded part should be occasioned by the laceration of the skin by a single leech. I have sometimes seen some of these animals produce intense redness to the extent of an inch around the bite. This is best observed when the skin is delicate, like that covering the mammæ of the female. Now when a number of these animals are applied, their united local effects must have some influence over a neighbouring disease. There are also certain topical effects which occur subsequently, such as ecchymosis; the irritation and inflammation of the mouths of the punctures; the diffused redness and the soreness in the parts intervening between the bites, which cannot be without influence over morbid action. They act on the principle of counter-irritation. In taking into consideration the beneficial influence of leeches, we must, therefore, not forget these, nor the fomentations and poultices subsequently employed. I have only to add, in concluding these remarks on the local effects of leeches, that, independently of the local irritation caused by the puncture, I believe the evacuation of blood from an inflamed part may be more beneficial than the same quantity taken by the usual operation of venesection. In other words, I am disposed to admit what were formerly termed the *derivative* effects of local bleeding. The amount of benefit obtained by the application of leeches to parts that have been injured by falls, &c. as in fractures and dislocations, has frequently appeared to me much greater than could be referred to the combined influence of the quantity of blood lost, and the local irritation of the punctures; so, also, with respect to the good effects of leeching hemorrhoidal tumours.

Therapeutics.—The following are some of the uses of leeches:—

In children and delicate adults (*as females and aged persons*) *leeches often form an excellent substitute for general blood-letting*, when the object is not to occasion any immediate or sudden effect on the disease. In children it is necessary to avoid applying them to the neck, or other parts where compression cannot be conveniently made. *In local determinations of blood*, unattended with febrile symptoms, local blood-letting, when it can be resorted to, is generally, though not invariably, preferred to venesection. The advantages of leeching over cupping are, the less pain, and the ease with which blood may be procured; for it is evident that in swelled testicle, in inflammation attending fractured limbs, and in acute inflammation of the mammary gland, patients could not, in most cases, bear the necessary pressure of the cupping-glass; and in some parts of the body, as the abdomen, blood can only be procured from cupping by a very dexterous manipulation. *In internal and other inflammatory affections*, accompanied with constitutional disorder, the rule is to employ general in preference to local blood-letting. But circumstances occasionally render the reverse practice justifiable and proper, as where the disease is not active, and the patient delicate and weak. In many instances it will be found most advantageous to combine both modes of drawing blood: for example, in *abdominal inflammations*, the application of leeches, preceded by venesection, will sometimes do more good than the same quantity taken by the lancet alone. During the progress of *fever*, with determination of blood to the brain, the application of leeches to the temples, after the use of blood-letting, is often attended with the best effects. There are some diseases in which no substitute of equal efficacy to leeches can be found. Such, I conceive, are *hemorrhoidal tumours*, and *prolapsus of the rectum*. In these cases general is not equal to local blood-letting, and cupping is out of the question. *In various organic diseases* leeches will often be found an exceedingly useful palliative means. I would particularly mention as examples, affections of the heart and lungs.

There are few diseases in which loss of blood is required, where leeching is positively objectionable; indeed erysipelas is the only one that can be named. There are, however, numerous instances in which leeching is negatively objectionable: in some, the quantity of blood drawn by these animals is insufficient to make much impression on the disease, as in visceral inflammation of robust persons; in others, where the disease is very rapid and fatal, the effects of leeches are too slow, as in croup. Venesection is the remedy in all these instances.

Mode of applying Leeches.—Let the part be well cleansed (sometimes it may be necessary to shave it); then dry the leeches, by rolling them in a clean linen cloth; then, by grasping the body of the leech gently in a dry cloth, its head may be directed to any part where we wish it to be applied; and by gently withdrawing it as its head reaches the skin, we may compel the animal to fix its head to the spot, and insert its teeth. A narrow tube (called a *leech-glass*) will be found useful when we wish to affix one of these animals to the inside of the mouth, or any particular spot. Several circumstances influence the fixing of leeches; as the condition of the animal, whether healthy or otherwise; the nature and condition of the part to which it is applied: thus, leeches will not readily attach themselves to the soles of the feet, or the palms of the hands, or to the hairy parts—the presence of grease, vinegar, salt, and some other substances, will prevent them from biting; whereas milk, sugared water, and blood are said to have the contrary effect. Scarifying the part promotes their attachment. The condition of the patient also affects the fixing of the animal. Derheims says that leeches will not bite those under the influence of sulphur, on account of the evolution of sulphuretted hydrogen by the skin. The effluvia, or vapours of the room, as the fumes of tobacco, sulphur, vinegar, &c., will prevent them from biting, or even cause them suddenly to fall off.

Quantity of Blood Drawn.—The quantity of blood which a leech is capable of drawing varies considerably. I believe four fluid drachms to be the maximum. On an average I do not think we ought to estimate it at more than one fluid drachm and a half. Of course this has no reference to that lost after the animal has fallen off, and which varies according to the vascularity of the part; in children being oftentimes very considerable. When the leech has had sufficient it usually drops off; if, however, it fails to do so, or it is at any time desirable to detach it, this is readily effected by the application of salt to its body.

After-treatment.—When leeches have fallen off it is generally desirable to promote the sanguineous discharge. This is best done by the use of warm fomentations or poultices; or even, in some cases, by cupping-glasses. Great caution is necessary in the case of children. Some years since, the application of a leech was ordered to the chest of a child labouring under pneumonia; it was at the same time mentioned that the bleeding should be encouraged. The directions were literally fulfilled; the discharge of blood was assiduously promoted, until so large a quantity had been lost that death was the result. Other fatal cases arising in the same manner have also not unfrequently occurred. I have been called to many cases of hemorrhage after leech-bites, and have never failed in stopping it by compression. Sometimes mere exposure to the air will be sufficient; or, if this fail, we may apply a dossil of lint and a bandage. I usually employ compression, thus: roll a piece of lint into a fine cone, and introduce it into the bites by means of a needle or probe; over this lay a compress and bandage. Sponge may be substituted for the lint. Some employ absorbing powders, as gum arabic; or styptic washes, as a saturated solution of alum, or tannic acid. One very effectual means is to apply a stick of lunar caustic scraped to a point, or powdered nitrate of silver.

Accidents from Leeches in the mucous cavities. — Derheims relates a case of a young man, who had leeches applied to his anus, when one entered his rectum unnoticed. The animal made several punctures, and was not expelled till some hours after, when salt water injections were used. The wounds caused by the bites, however, did not heal for several months, during which time the patient suffered considerably, and constantly passed blood with the fæces. Whenever practicable, salt water injections should be resorted to in such cases. Ill effects have also resulted from swallowing leeches. A lady accidentally swallowed a leech she was applying to her gums. Acute cardialgia soon came on, with a feeling of erosion and creeping in the interior of the stomach; sometimes convulsive movements in the limbs and muscles of the face; frequency and irregularity of the pulse; universal agitation and paleness of the countenance. The physician who was called in, recollecting the fact ascertained by Bibiéna, that leeches could not live in wine, administered half a glass every quarter of an hour. The symptoms were soon alleviated; and the fourth dose caused vomiting, by which the dead leech was evacuated, with much glairy matter, mixed with clots of black blood. By a proper subsequent treatment the patient recovered in eight days. The following case is narrated by Drs. Taylor and Rees:—A lady was directed to apply a leech to the septum of the nose. By some accident the animal insinuated itself into the nasal cavities, and, reaching the posterior nares, the patient was irresistibly compelled to swallow it. No uneasiness was felt, probably owing to the leech having already drawn much blood. A moderately strong solution of salt was administered at short intervals. The leech was not discharged by vomiting, and it did not pass by the bowels. The patient suffered from no unusual symptoms, probably owing to the early administration of the solution of salt.

Class: INSECTA, *Goldfuss*. Insects.

COLEOPTERA, *Linnæus*. The Beetle Order.

CANTHARIS VESICATORIA, *De Geer*. The Blister Beetle, or Spanish Fly.

Zoological Character.—*Form* elongated, almost cylindrical (fig. 121); length six to eleven lines; breadth one to two lines; colour brass- or copper-green; odour nauseous, unpleasant. *Body* covered with

Fig. 121.

Cantharides.

whitish-grey hairs, which are most numerous on the thorax. *Head* large, subcordate, with a longitudinal furrow along its top. *Eyes* lateral, dark brown. *Antennæ* black, elongate, simple, filiform. *Maxillary palpi* with a somewhat ovate terminal joint. *Thorax* small, not larger than the head, rather quadrate, narrowed at its base, with a longitudinal channel. Wing-covers (*elytra*) of a shining golden-green colour, flexible, from four to six lines long, and from three-fourths to one line and a half broad; costa slightly margined (fig. 121, *b*). *Wings* two, ample, thin, membranous, veined, transparent, pale brown (fig. 121, *b*); tips folded. *Legs* stout, from four to six lines long, the hinder ones longest; *tibiæ* clavate, in the female all terminated by two small movable *spurs*; in the male the two hinder pairs of extremities alone have this arrangement, the anterior ones having but one spur; last joint of the *tarsi* with a pair of bifid claws; *tarsi* violaceous. *Abdomen* soft, broadest in the female, which has, near the anus, two articulated caudal appendages. (Fig. 121, *a*, *b*, *c*.)

Habitat.—Europe. Originally, perhaps, a native of the southern parts, especially Italy and Spain; now found in France, Germany, Italy, Hungary, Russia, Siberia, and England. With us, however, they are rare. They are generally found on species of *Oleaceæ* (as the ash, privet, olive, and lilac), and of *Caprifoliaceæ* (as the elder and honeysuckle); and rarely on the plum-tree, rose, poplar, willow, and elm.

[§ **Cantharis.** *Cantharides.*

Cantharis vesicatoria, *De Geer.* The Beetle, dried; collected chiefly in Hungary.]

Mode of catching and drying Cantharides.—In the south of France these animals are caught during the month of May, either in the morning or evening, when they are less active, by spreading large cloths under the trees, which are then strongly shaken, or beaten with long poles. The catchers usually cover their faces, and guard their hands by gloves. Various methods have been recommended for killing the insects; such as exposing them to the vapour of vinegar, or of hot water, or of spirit of wine, or of oil of turpentine. Geiger states, that if destroyed by dropping oil of turpentine into the bottle in which they are contained, they are not subject to the attack of mites; but they are more frequently destroyed by immersing the cloths containing them in hot vinegar and water, and then drying them as rapidly as possible in the sun, on hurdles covered with paper or cloths, or by other means of an analogous nature. The beetles are frequently turned over during the process of drying, in order to facilitate that process.

Commerce.—Cantharides are principally imported from Hungary, Russia, and Sicily. Those from Russia, which come by way of St. Petersburgh, are the largest and most esteemed.

General Characters and Tests.—[§ From eight to ten lines long, furnished with two wing-covers of a shining metallic-green colour, under which are two membranous, transparent wings; odour strong and disagreeable; powder greyish-brown, containing shining green particles. Free from mites.]

Preservation.—Cantharides should be preserved in well-stoppered bottles, and to prevent them from being attacked by mites (*Acarus domesticus*), a few drops of strong acetic acid should be added to them. I have found this a most successful mode of preservation. Camphor, petroleum, alcohol, and chloride of lime, have also been employed for a similar purpose. Besides mites, they are subject to the attacks of a moth (*Tinea flavifrontella*), and two coleopterous insects (*Anthrenus muscorum* and *Hoplia farinosa*).

Adulteration and Goodness.—The goodness or quality of cantharides may be recognised by their odour and freedom from other insects, especially mites. Coloured glass beads and tubes have sometimes been added to cantharides to increase their weight, but are easily detected. Sometimes the powder is adulterated with powdered euphorbium.

Composition. — The principal constituents of cantharides are, *cantharidin*, a *volatile odorous oil*, and *fatty matters*. *Cantharidin*, $C_5H_6O_2$.—Its specific gravity is 1·38. It constitutes about 0·4 per cent. of the cantharides. It crystallises in the form of micaceous plates, which are fusible, forming a yellow oil, which by a stronger heat — between 402° and 410° — is vaporisable, forming white vapours; these subsequently condense into acicular crystals of cantharidin. Gmelin's opinion, that it is a solid volatile oil, seems to be correct. When isolated, it is not soluble in water, but becomes so by combination with the other constituents of cantharides. This, then, is the reason why an aqueous infusion of the insects contains cantharidin in solution. Cold spirit, digested on cantharides, also extracts cantharidin; which it can only do by the agency of some of the other principles of the beetles. Cantharidin is easily soluble in chloroform, benzole, ether, oils (volatile and fixed), and hot spirit of wine; and from the latter it separates as the liquid cools. It is insoluble in sulphide of carbon, and this gives an easy mode of separating it from the fatty matters which frequently contaminate it. Boiling sulphuric acid dissolves cantharidin: the solution is slightly brown; when diluted with water it deposits small needle-like crystals of cantharidin. Boiling nitric and hydrochloric acids dissolve it without changing colour; the solutions, by cooling, deposit it. Cantharidin is dissolved by potash and soda; but when concentrated acetic acid is added to the solution, the cantharidin is precipitated. Ammonia is without action on it. Cantharidin is probably about fifty times stronger than cantharides, and Robiquet states that the 100th part of a grain, applied to the edge of the lower lip, caused, in about a quarter of an hour, small blisters. *Volatile Odorous Oil.*—Orfila asserts that volatile odorous oil is one of the constituents of the insects. The distilled water of cantharides is strongly odorous and milky, and its vapour affects the eyes and kidneys like cantharides.

The active and odorous principles of cantharides reside principally in the sexual organs of the animals. Both Farines and Zier tell us that the soft contain more active matter than the hard parts. It appears, also, that the posterior is much more acrid than the anterior portion of the body ; and Zier says the ovaries are particularly rich in this active matter. If so, it is evident that we ought to prefer large female to male insects. It is a well-known fact that the odour of these animals becomes much more powerful at the season of copulation than at other periods ; and that persons sitting under the trees in which these insects are found, at this season more particularly, are very apt to be attacked with ophthalmia and ardor urinæ.

Physiological Effects.—*The topical effects* of cantharides are those of a most powerful acrid. When these insects are applied to the *skin* the first effects noticed are, a sensation of heat, accompanied by pain, redness, and slight swelling. These phenomena are soon followed by a serous effusion between the corium and epidermis, by which the latter is raised, forming what is commonly termed a *blister*. The effused liquid has a pale yellow colour, with a very feeble taste and smell. If the cuticle be removed the subjacent corium is seen intensely reddened, and by exposure to the air oftentimes becomes exceedingly painful. Not unfrequently I have noticed ecthymatous pustules around the blistered surfaces, and sometimes the vesicles of eczema occur. Ulceration and gangrene are not uncommon : the latter effect is occasionally observed after exanthematous diseases, especially measles. I have seen death result therefrom in two instances. The constitutional symptoms frequently produced are excitement of the vascular system, denoted by the increased frequency of pulse, heat of skin, and furred tongue, and irritation of the urinary and genital organs, marked by heat and pain in passing the urine, which is usually high coloured, or by complete suppression. It not unfrequently happens that the part to which a blister has been applied remains considerably darker coloured than the surrounding skin. Rayer states that the disappearance of these discolorations is hastened by the use of sulphurous baths.

Action of small or medicinal doses.—In very small quantities there are no obvious effects. If we increase the dose, a sensation of warmth is felt in the throat, stomach, and respiratory passages, with increased secretion from the alimentary tube. By continued use a tickling or burning sensation is experienced in the urethra, with frequent desire to pass the urine, which may or may not be altered in quality and quantity. In some cases diuresis is observed, in others not: in the latter the urine is generally higher coloured than usual. *Action of larger doses: Subacute poisoning.*—The symptoms are, heat in the throat, stomach, intestines, and respiratory passages; pain in the loins, burning sensation in the bladder, with frequent desire to evacuate the urine, which is sometimes bloody, and passed with difficulty, and painful priapism, indicating inflammation of all the urinary organs. The pulse is harder and more frequent, skin hot, and the respiration quickened: the nervous system is frequently excited, and headache, delirium, convulsions, and coma may occur.

Action of poisonous doses.—In poisonous quantities cantharides excite inflammation of the mucous lining of the alimentary canal, with constriction and difficulty of swallowing, which is sometimes so great that not a particle of fluid can be got into the stomach without inexpressible anguish; violent burning pain, nausea, vomiting, frequently of bloody matters, sometimes with flakes like the inner lining of the alimentary tube, and great tenderness to touch. These phenomena sufficiently indicate the gastric inflammation. Ptyalism is not an uncommon occurrence. The enteritic symptoms are, abundant and frequent evacuations, sometimes of blood, with horrible griping and burning pain, and exquisite sensibility of the abdomen. The susceptibility to cantharides is by no means uniform. Amoreux says, in one case a pinch of the powder caused death; while in another a spoonful occasioned only slight heat in the throat, and ardor urinæ. Dr. Hosack has mentioned an instance in which a man took nearly six fluid ounces of the tincture with the view of self-destruction, yet no dangerous symptoms followed. In contrast with this, I may instance a case that came within my own knowledge, where one fluid ounce of the tincture produced serious symptoms. Orfila has seen twenty-four grains of the powder prove fatal.

Therapeutics.—External Uses.—Cantharides are frequently used as topical agents; sometimes as stimulants, or rubefacients, and at other times as vesicants. *To stimulate topically.*—Tincture of cantharides with water (in the proportion of three or four fluid drachms of the tincture to a pint of water) has been employed *to stimulate ulcers*; more especially sinuses and fistulous sores. In *alopecia* or *baldness*, when this is not the result of old age, ointments of cantharides have been employed to promote the growth of hair. Powdered cantharides have been advised as an application *to the parts bitten by rabid animals.* In China blistering insects are employed internally in cases of hydrophobia; and in parts of Europe, cantharides or some other blistering insect are also in some repute, for the same purpose. *To produce rubefaction.*—

For this purpose the tincture may be mixed with soap or camphor liniment; or, when it is desirable to limit the effect to a particular spot, and especially if friction be objectionable, the common blistering plaster may be applied, allowing it to remain in contact with the part for an hour or two only. Rubefacient liniments are employed to excite the sensibility of the skin *in numbness and paralysis*; as also to promote local irritation *in neuralgic and rheumatic pains.* In the *inflammatory affections of children* it will be occasionally found useful to employ the plaster as a rubefacient merely. *To excite vesication.*—On account of the facility of application, certainty of effect, and slightness of pain, no agents are equal to cantharides for causing vesication when applied to the skin. It was formerly supposed that the efficacy of blisters was in proportion to the quantity of fluid discharged. But the truth is, that the therapeutic influence is in proportion to the local irritation, and has no more relation to the quantity of fluid discharged than that the latter is frequently (not invariably) in the ratio of the former. In this country we generally apply them near to the morbid part. We employ blisters in inflammatory diseases, both acute and chronic; in chronic inflammatory disease we often resort to what is termed a perpetual blister, that is, the cuticle is removed, and the blistered surface dressed with ointment of savin or of cantharides, or blistering paper. This practice is advisable in chronic diseases of the chest, of the joints, of the eyes, &c. It is hardly safe to apply blisters to children immediately after exanthematous diseases, or when very feeble, sloughing being not an unfrequent result. If it be required to produce counter-irritation in children, the best plan is to dilute the common blistering plaster, by mixing with it three times its weight of soap plaster. Another plan, sometimes adopted, is to apply a common blister for an hour or two only, so that it shall merely produce rubefaction.

Internal Uses.— These will require examination under distinct heads, according to the particular object we have in view in employing cantharides. *To act specifically on the urinary organs.*—In *dropsy* they have been used to excite diuresis, though they frequently fail in producing this effect. In *paralysis of the bladder* they are frequently useful, when there are no marks of local irritation. Two opposite conditions may be the result of paralysis of this organ; namely, retention or incontinence of urine. The latter condition is not unfrequently met with in children, and is very likely to be relieved by cantharides. In incontinence of urine which occurs after lingering labours, from the long-continued pressure of the child's head, cantharides are sometimes serviceable. But their use must not be commenced until all the symptoms of local irritation have subsided. *To act on the organs of generation.*—In large doses they act as an *aphrodisiac. In discharges from the genital organs* beneficial effects are frequently obtained by the internal use of cantharides. In gleet they have been often found serviceable. I have frequently found equal parts of tincture of perchloride of iron and tincture of cantharides a successful combination in old-standing gonorrhœas. The dose is twenty minims at the commencement. *In chronic skin diseases.*—At the present time, tincture of cantharides is not unfrequently and successfully employed in *lepra*, *psoriasis*, *eczema*, and other skin diseases.

Administration. — Powdered cantharides are not unfrequently employed internally. The dose is one or two grains in the form of pill. The tincture is the safest preparation, and should, therefore, always be preferred.

Antidotes.—In poisoning by cantharides, remove the poison as speedily as possible from the stomach. If sickness have not commenced, the removal may be effected by the stomach-pump, emetics, or tickling the throat. Assist the vomiting by mucilaginous and albuminous demulcent liquids, as infusion of linseed, milk, white of egg with water, &c. Administer opiates to relieve pain. No chemical antidote is known.

[§ **Acetum Cantharidis.** *Vinegar of Cantherides.*

Take of

Cantharides, in powder	2 ounces.
Glacial Acetic Acid	2 fluid ounces.
Acetic Acid	18 fluid ounces, or a sufficiency.

Mix thirteen fluid ounces of the acetic acid with the glacial acetic acid, and digest the cantharides in this mixture for two hours at a temperature of 200°; then transfer the ingredients, after they have cooled, to a percolator, and when the liquid ceases to pass pour five fluid ounces of acetic acid over the residuum in the apparatus. As soon as the percolation is complete, subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient acetic acid to make one pint.

This preparation is rather stronger than the Acetum Cantharidis of the London Pharmacopœia. It is less active than the preparations ordered under the same name in the Edinburgh and Dublin Pharmacopœias.]

A useful vesicant. It should be applied with a camel's-hair brush, as directed with the Liquor Epispasticus. The latter preparation is, however, about four times as strong as this Acetum Cantharidis, and produces vesication more rapidly.

[§ **Charta Epispastica.** *Blistering Paper.*

Take of

White Wax	4 ounces.
Spermaceti	$1\frac{1}{2}$ ounce.
Olive Oil	2 fluid ounces.
Resin	$\frac{3}{4}$ ounce.
Canada Balsam	$\frac{1}{4}$ ounce.
Cantharides, in powder	1 ounce.
Distilled Water	6 fluid ounces.

Digest all the ingredients, excepting the Canada balsam, in a water-bath for two hours, stirring them constantly, then strain, and separate the plaster from the watery liquid. Mix the Canada balsam with the plaster melted in a shallow vessel, and pass strips of paper over the surface of the hot liquid, so that one surface of the paper shall receive a thin coating of plaster.

It may be convenient to employ paper ruled so as to indicate divisions, each of which is one square inch.]

This is a mild, yet generally efficient, blistering application.

[§ **Emplastrum Calefaciens.** *Warm Plaster.*

Take of

Cantharides, in coarse powder Expressed Oil of Nutmeg Yellow Wax Resin	of each 4 ounces.
Soap Plaster	$3\frac{1}{4}$ pounds.
Resin Plaster	2 pounds.
Boiling Water	1 pint.

Infuse the cantharides in the boiling water for six hours; squeeze strongly through calico, and evaporate the expressed liquid by a water-bath till reduced to one-third. Then add the other ingredients, and melt in a water-bath, stirring well until the whole is thoroughly mixed.]

Stimulant, rubefacient, and, in some cases, vesicant. Used in catarrh, local pains, &c.

[§ **Emplastrum Cantharidis.** *Cantharides Plaster.*

Take of

Cantharides, in powder	12 ounces.
Yellow Wax Prepared Suet	of each $7\frac{1}{2}$ ounces.
Prepared Lard	6 ounces.
Resin	3 ounces.

Liquefy the wax, suet, and lard together by a water-bath, and add the resin, previously melted; then introduce the cantharides, mix the whole thoroughly, and continue to stir the mixture while it is allowed to cool.]

The usual time requisite for a blistering plaster to remain in contact with the skin is twelve hours; the vesicle is then to be cut at its most depending part, and dressed with ointment of spermaceti. When the irritation caused by these plasters is excessive, it is sometimes necessary to substitute a poultice for the ointment. When we wish to make a perpetual blister, the ointment of cantharides is employed as a dressing; or if we wish to excite less irritation, and prevent the possibility of the urinary organs being affected, the ointment of savin. The danger of applying blisters to children after exanthematous diseases, especially measles, has been already noticed.

[§ **Liquor Epispasticus.** *Blistering Liquid.*

Synonym.—Linimentum Cantharidis, 1864.

Take of

Cantharides, in powder . . .	8 ounces.
Acetic Acid	4 fluid ounces.
Ether	a sufficiency.

Mix the cantharides and acetic acid; pack them in a percolator, and at the expiration of twenty-four hours pour ether over the contents of the percolator, and allow it to pass slowly through till twenty fluid ounces are obtained. Keep it in a stoppered bottle.]

This is a very efficient preparation. It is useful where rapid vesication is required, where the surface intended to be blistered is uneven, and for children or insane persons, who frequently pull off blistering plasters. It should be applied with a camel's-hair brush and the application repeated less or more frequently, according as gentle or rapid and strong vesication is desired.

[§ **Tinctura Cantharidis.** *Tincture of Cantharides.*

Take of

Cantharides, in coarse powder . . .	$\frac{1}{4}$ ounce.
Proof Spirit	1 pint.

Macerate for seven days in a closed vessel, with occasional agitation, strain, press, filter, and add sufficient proof spirit to make one pint.]

Dose.—5 minims, gradually increased to 20 minims. Its effects on the bladder must be carefully watched. It should be given in some demulcent liquid, as decoction of barley or infusion of linseed. It is sometimes employed externally as a rubefacient.

[§ **Unguentum Cantharidis.** *Ointment of Cantharides.*

Synonym.—Ceratum Cantharidis, *Lond.*

Take of

Cantharides, Yellow Wax	of each . . .	1 ounce.
Olive Oil		6 fluid ounces.

Infuse the cantharides in the oil, in a covered vessel for twelve hours, then place the vessel in boiling water for fifteen minutes, strain through muslin with strong pressure, add the product to the wax previously melted, and stir constantly while the mixture cools.]

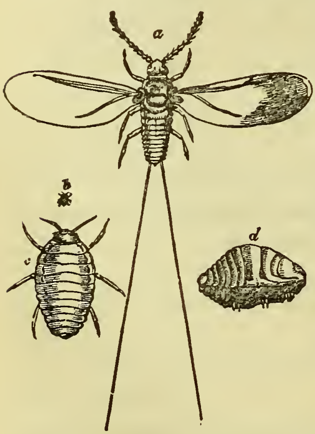
Useful as a counter-irritant, to keep open blisters, or to promote a discharge from issues, ulcers, &c.

HEMIPTERA, *Linn.* THE COCHINEAL ORDER.

COCCUS CACTI, *Linn.* Cochineal Insect.

Zoological Character.—*Tarsi* with 1 joint, terminated by a single hook. *Antennæ* of 11 joints, filiform and setaceous. *Male* (fig. 122, *a*) destitute of a rostrum, very small, with the *antennæ* shorter than the body. *Body* elongated, deep red, terminating by two long diverging *setæ.* *Wings* two, large, snow-white, crossed above the abdomen, which is terminated by two setæ. *Female* (fig. 122, *b*, *c*) apterous, furnished with a rostrum, nearly twice as large as the male, bluish-red, covered with a white farina. *Antennæ* short. *Body* flattened below, convex. *Feet* short.

[Fig. 122.



Cochineal Insects (*male and female*).

a. Male, with the wings expanded (magnified).
b. Adult female (natural size).
c. Adult female (magnified).
d. Impregnated female (natural size).

Habitat.—Mexico and Central America. It has been successfully introduced into the island of Teneriffe and Java.

[§ **Coccus.** *Cochineal.*

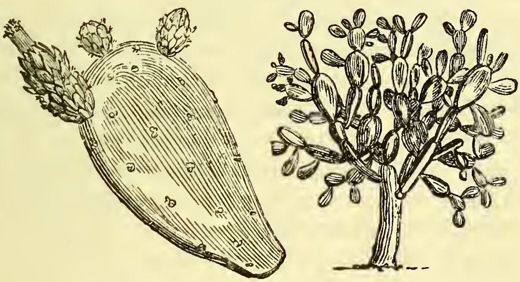
The dried female insect, Coccus Cacti, *Linn.* Reared in Mexico and Teneriffe.]

Rearing.—The cochineal insects feed on the *Nopal plant* (*Opuntia cochinillifera*). The animals are domesticated and reared with the greatest care; plantations of the Nopal being cultivated for their nourishment. Here the impregnated females (fig. 122, *d*) are placed; this operation being denominated *sowing*. Young ones are soon developed; and some months afterwards, when the females have become fecundated and enlarged, the harvest commences. The insects are brushed off, and killed by immersing them in hot water, and afterwards drying them in the sun, or by the heat of a stove. Three harvests are made annually; the first being the best, since the impregnated females alone are taken; in the second the young females also are collected; and in the third both old and young ones, and skins, are collected indiscriminately. Before the rainy season commences, branches of the Nopal plant, loaded with infant insects, are cut off and preserved in the houses of the Mexicans, to prevent the animals being destroyed by the weather.

Commerce.—Cochineal is imported in serons (here called *bags*), chiefly from Honduras, Mexico, and Teneriffe. The female only is of commercial value.

General Characters and Varieties.—Cochineal consists of the dried

Fig. 123.



Opuntia cochinillifera.

female insects, which are about one or two lines long, wrinkled, and of a somewhat ovate form, convex on one side, and flat or somewhat hollow on the other. In colour they are blackish or greyish-purplish-white, and yield, when crushed, a somewhat puce-coloured powder. The greyish insect becomes black when warmed before the fire. They are inodorous, have a bitterish warm taste, and tinge the saliva violet-red. In burning they evolve an animal odour, and leave a greyish-white ash. By infusion in water they swell up, show their ringed character, and even their feet, giving the liquid a red colour. Three varieties of cochineal are distinguished under the names of Honduras, Mexican or Vera Cruz, and Teneriffe. Both the Honduras and Vera Cruz kinds are distinguished into the silver and black varieties. Silver cochineal is said to be the matured and fecundated female; black cochineal the female exhausted by propagation; the first kind is the best. *Silver cochineal* has a purplish-grey colour; but in all the furrows and depressions we observe a whitish powder, which, examined by the aid of a lens, appears like fine down. This powder is melted by heat and appears to be wax. Silver cochineal, as already noticed, becomes black when warmed before the fire. *Black cochineal* is reddish- or purplish-black, and devoid or nearly so of the silvery character. An inferior kind of cochineal is called *Granilla*; this consists of very small cochineal insects, and smaller, wrinkled, globular or ovate masses (cocoons and new-born insects?), somewhat like fragments of the cochineal insect.

Adulterations.—An extensive system of adulterating cochineal was practised some years ago. The genuine article was moistened with gum-water, and then agitated in a box or leathern bag, first with powdered sulphate of baryta, then with bone or ivory-black, to give it the appearance of black cochineal. By this means the specific gravity of the cochineal was increased from 1·25 to 1·35. Powdered talc and carbonate of lead have also been used to give it a silvery appearance. But a lens will readily distinguish these powders from the real down which gives the true silvery character.

Composition.—The principal constituent is *cochenillin. Cochenillin (carmine).*—Obtained by digesting cochineal in ether, to extract the fatty matter, and then in alcohol, which dissolves the carmine. This colouring matter is a brilliant purplish-red substance, with a granular or crystalline appearance; unalterable in the air, easily soluble in water and alcohol, but insoluble in ether. It fuses at 112° F. Chlorine renders it yellow. Acids change its colour. The concentrated mineral acids decompose it. Alkalies render the watery solution of carmine violet. Solution of lime forms a violet precipitate with it. The affinity of hydrate of alumina for it is most remarkable; the compound formed by their union is called a *lake.*

Therapeutics.—It was formerly much used in hooping cough, and it has been reputed, but without the least evidence, to be diuretic, diaphoretic, antispasmodic, and anodyne. The only real value of cochineal is as a colouring agent.

Pharmaceutical Uses.—It is an ingredient in compound tincture of cardamom and compound tincture of cinchona.

[§ **Tinctura Cocci.** *Tincture of Cochineal.*

Take of

Cochineal, in powder	$2\frac{1}{2}$ ounces.
Proof Spirit	1 pint.

Macerate for seven days in a well-closed vessel, with occasional agitation; strain, press, filter, and add sufficient proof spirit to make one pint.]

This preparation is only useful as a red colouring fluid.

HYMENOPTERA, *Linn.* The Bee Order.

APIS MELLIFICA, *Linn.* The Hive Bee, or Honey Bee.

Zoological Character.—*Body* brownish-black, covered with hairs. *Abdomen* of the same colour, with a transverse greyish band. *Antennæ* filiform, and shorter than the combined length of the head and the thorax. *Labium* filiform, composing, with the jaws, a kind of *proboscis*, geniculate, and bent downwards. First joint of the posterior *tarsi* large, compressed; no *spines* at the extremity of the last two *legs*. *Upper wings* with one radial and three cubital cells.

Habitat.—Old continent. In a state of nature they reside in hollow trees; but they are almost universally domesticated, and are preserved in *hives*.

Official Products.—Bees furnish two official products, viz. *honey* and *wax*. Of the former, *common honey*, and *clarified honey* are official; of the latter, both *yellow wax* and *white wax* are also official.

[§ **Mel.** *Honey.*

A saccharine secretion deposited in the honeycomb, by Apis mellifica, *Linn.*, the hive bee.]

Production.—Honey is secreted by flowers, and is collected by the working or neuter bees, who take it by suction or lapping, and pass it into the dilatation of the œsophagus, denominated the *crop*, *sucking-stomach*, or *honey-bag*; beyond which, we presume, the honey does not pass, as it has never been found in the true stomach. While retained in the honey-bag it receives the addition of an acid which possesses all the reactions of formic acid. On arriving at the hive, the honey is disgorged by a kind of inverted peristaltic motion into the comb, where it remains till the stock is taken. It is used by the animal as food.

General Characters.—When freshly collected, honey is a viscid semi-translucent liquid, of a yellowish colour, with a peculiar heavy odour, and a very sweet taste. Its specific gravity, according to Stoddart, is 1·423. It does not become blue with the solution of iodine. By keeping, it becomes thicker, somewhat opaque, and of a brownish-yellow colour. Honey varies in its colour, taste, and odour, according to the age of the bees and the nature of the flowers on which they have fed. A hive which has never swarmed is considered to yield the best, which is therefore called *virgin honey*. The flavour of Narbonne honey, which is so much admired, is said to arise from the labiate flowers on which the animals feed. To imitate this a sprig of rosemary is sometimes added to the honey obtained from other places.

Adulterations.—Flour is sometimes mixed with honey. This adulteration may be readily detected by its insolubility in cold water, and by the following test:—boiled with water for five minutes and allowed to cool, it does not become blue with the solution of iodine. In an interesting communication 'On Honey,' by Mr. Stoddart of Bristol (see *Pharm. Journ.* vol. x. 2nd ser. p. 142), the author says, 'I have often examined specimens adulterated with pea- or bean-flour, turmeric, pipe-clay, brown sugar, treacle, gypsum, yellow ochre, fine sand, and water.' He also states that the honey which is imported from the Continent is largely adulterated with starch or sugar.

Composition.—The constituents of honey vary somewhat according to the food of the bees, the season, the age of the animals, the mode of extracting it from the combs, &c. It must, however, be regarded at all times as a concentrated solution of *sugar*, mixed with *odorous*, *colouring*, *gummy*, and *waxy* matters. The saccharine matter is, according to Stoddart, in fresh honey of three kinds, all of which are derived from the decomposition of cane sugar or sucrose: one kind is crystallisable, and analogous to *glucose* or the sugar of grapes; another is *uncrystallisable sucrose* or *inverted sugar*, and similar to the uncrystallisable brown syrup of the sugar-cane; and the third kind is *crystallised sucrose.* The proportions of these vary according to the age of the honey.

Physiological Effects.—Honey is emollient, demulcent, and laxative. When fresh, it is apt to occasion indigestion and colic.

Therapeutics.—Mixed with flour, and spread on linen or leather, it is a popular application to promote the maturation of small abscesses and boils. It sometimes forms a constituent of gargles, partly on account of its taste, partly for its emollient operation. It is also used as a vehicle for the application of other more powerful agents to the mouth and throat, especially in children. It is occasionally employed as an emollient and demulcent in inflammatory affections. In troublesome coughs, barley-water, mixed with honey, and sharpened with slices of lemon, and taken warm, forms a very agreeable and useful demulcent.

[§ **Mel Depuratum.** *Clarified Honey.*

Take of

Honey . . . . 5 pounds.

Melt the honey in a water-bath, and strain, while hot, through flannel previously moistened with warm water.]

The object of this process is to deprive honey of certain impurities, which render it apt to ferment; but the flavour and odour of the honey are somewhat injured by the operation.

Pharmaceutical Uses.—Clarified honey is an ingredient in borax honey, confection of pepper, confection of scammony, confection of turpentine, and oxymel of squill.

[§ **Oxymel.** *Oxymel.*

Take of

Clarified Honey	40 ounces.
Acetic Acid	5 fluid ounces.
Distilled Water	5 fluid ounces.

Liquefy the honey by heat, and mix with it the acetic acid and water.

Dose.—1 to 2 fluid drachms.]

It is employed as a detergent and pectoral. It is frequently added to gargles; but is more commonly used as an expectorant in slight colds and coughs. Diffused through barley-water, it forms an agreeable refrigerant drink in febrile and inflammatory complaints. It is sometimes used as a vehicle for other medicines.

[§ **Cera Flava.** *Yellow Wax.*

The prepared honeycomb of the hive bee, Apis mellifica, *Linn.*]

Secretion of Bees' Wax.—Yellow wax is secreted in glands placed on the ventral scales of the bee. With this wax the bees construct the *comb*, the cells of which are hexagonal with angular bottoms. The substance called *propolis* is collected by the bees from the buds of trees. It is of a resinous nature, and is used for lining the cells of a new comb, stopping crevices, &c.

Preparation.—The comb, from which the honey has been allowed to drip, is first subjected to pressure. It is then melted in water, by which means the impurities subside, and the wax is poured into moulds and left to cool.

General Characters.—Yellow wax has a remarkable, peculiar, and agreeable honey-like odour; its colour is more or less yellow, but varying in degree; it is firm and breaks with a granular fracture; its specific gravity varies from 0·960 to 0·965. It is not unctuous to the touch; does not melt under 140°; yields nothing to cold rectified spirit, but is entirely soluble in oil of turpentine. Boiling water in which it has been agitated, when cooled, is not rendered blue by iodine.

Adulterations.—It is said to be sometimes adulterated with suet, which gives it a fatty and disagreeable taste. Resin may be recognised by its solubility in cold alcohol; bean- or pea-meal, by its insolubility in oil of turpentine.

Pharmaceutical Uses.—Yellow wax is an ingredient in five of the official ointments and seven of the plasters.

[§ **Cera Alba.** *White Wax.*

Yellow wax, bleached by exposure to moisture, air, and light.]

Wax Bleaching.—This is effected by melting yellow wax, either in a copper vessel, or in a large vat or tub, by means of steam, running it off, while in the melted state, into a trough, called a *cradle*, perforated at the bottom with holes, and placed over a large water-tank, at one end of which is a revolving cylinder almost wholly immersed in water. By this means the wax is solidified, converted into a kind of ribbon, and conveyed on the surface of the water to the other end of the tank. These ribbons of wax are here lifted out, and carried in baskets to the bleaching grounds, where they are exposed to the air for one or two weeks (according to the state of the weather), being turned every day, and watered from time to time. The wax is then re-melted, re-ribboned, and re-bleached; it is subsequently refined by melting in water acidulated with sulphuric acid.

General Characters.—It is never perfectly white, but has always a yellowish tinge. It is hard, translucent, brittle, not unctuous to the touch, does not melt under 150°, its specific gravity is about 0·965, it is inodorous, or nearly so, and without taste. The circular cakes of commerce frequently contain spermaceti, which the dealers add to improve the colour.

Composition.—Wax is a compound of three substances—*myricin*, *cerin*, and *cerolein*; which are separable from each other by boiling in alcohol, in which the myricin is insoluble, and from which the cerin crystallises by cooling, while the cerolein remains in solution. *Myricin* ($C_{46}H_{92}O_2$).—It fuses at 149° F. According to Brodie it forms 73 per cent. of the wax. It is not saponifiable by potash. *Cerin* ($C_{54}H_{108}O_2$).—It fuses at 143½° F. It constitutes about 22 per cent. of wax. It dissolves in 16 parts of boiling alcohol. By saponification with potash it yields margaric acid, a minute portion of oleic acid, and a considerable quantity of a non-saponifiable fat. *Cerolein* constitutes about 5 per cent. of wax.

Physiological Effects and Uses.—Wax is an emollient and demulcent. It has been administered internally, in the form of emulsion (prepared with melted wax and soap, yolk of eggs, or mucilage), in *diarrhœa* and *dysentery*, especially when ulceration of the alimentary canal is suspected. Its principal use, however, is for *external application*, sometimes as a mild sheathing or protecting application, sometimes as a basis for the application of other agents.

Pharmaceutical Uses.—White Wax is contained in blistering paper, compound ointment of subacetate of lead, spermaceti ointment, and in the four suppositories of the British Pharmacopœia.

[§ **Unguentum Simplex.** *Simple Ointment.*

Take of

White Wax	2 ounces.
Prepared Lard	3 ounces.
Almond Oil	3 fluid ounces.

Melt the wax and lard in the oil on a water-bath; then remove the mixture, and stir constantly while it cools.]

A mild and cooling dressing. Used also as a basis for more active preparations, in a considerable number of the official ointments.

Pharmaceutical Uses.—Simple ointment is an ingredient in eight of the official ointments.

Sub-kingdom II.—*VERTEBRATA.*—*VERTEBRATE ANIMALS.*

Class: PISCES. Fishes.

ACIPENSER, *Linn.*

Generic Character.—*Body* elongated, angular, defended by indurated plates and spines, arranged in longitudinal rows. *Snout* pointed, conical. *Mouth* placed on the under surface of the head, tubular, and without teeth.

Species.—At least eight species are known, but they are not well determined. Four species appear to yield the commercial varieties of isinglass: these are, *Acipenser Huso*, Linn., the Beluga; *A. Güldenstadtii*, Brandt and Ratzeburg, the Osseter; *A. Ruthenus*, Linn., the Sterlet; and *A. Stellatus*, Pallas, the Sewruga.

Habitat.—The above species mostly inhabit the Black and Caspian Seas, and their tributary rivers.

[§ **Isinglass.** (Appendix I.).

The swimming bladder or sound of various species of Acipenser, *Linn.*, prepared and cut into fine shreds.]

Preparation.—The organ from which isinglass is usually procured is the *air-bag* or *swimming bladder*, or, as it is sometimes termed, the *sound.* It is a membranous sac filled with air, and placed under the spine, in the middle of the back, and above the centre of gravity. The mode of preparing the swimming bladder for sale as isinglass varies in different countries. Sometimes the bag is dried unopened, as in the case of the *purse*, *pipe*, and *lump* isinglass of the shops. At other times it is laid open, and submitted to some preparation, being either dried unfolded, as in the *leaf* and *honeycomb* isinglass; or folded, as in the *staple* and *book* isinglass; or rolled out, as in the *ribbon* isinglass. When the isinglass arrives in this country, it is soaked, scraped, and cleaned. Formerly it was picked into shreds by women and children, but it is now usually rolled and cut into filaments by machinery.

General Characters and Varieties.—Isinglass is whitish or yellowish in colour, light, coriaceous, semi-transparent, tasteless, inodorous, insoluble in cold water, readily soluble in boiling water, and forms a transparent jelly on cooling. Many varieties of isinglass are imported: the Russian kinds are the most esteemed, but the Brazilian, on account of its cheapness, is very extensively used. The source of Brazilian isinglass is unknown. The New York isinglass, Hudson's Bay isinglass, East Indian isinglass, and Manilla isinglass are not procured from species of Acipenser.

Composition.—Isinglass of fine quality consists principally of *gelatine* about 98 per cent., *albumen*, *membrane* insoluble in boiling water, with *salts of potash* and *soda*, and some *phosphate of lime.*

Physiological Effects and Uses.—The dietetical properties of isinglass are well known. Considered *medicinally*, it is an emollient and demulcent. It is employed, dissolved in water or milk, and rendered palatable by acid and sugar, as a nutritious substance for invalids and convalescents. A solution of isinglass, with tincture of benzoin, is brushed over black sarcenet to form *Court* or *Black Sticking Plaster*. Isinglass is also employed as a clarifying or fining agent (for coffee, wines, and beer). Some of the constituents of these liquors unite with the gelatine, and form insoluble compounds, which precipitate, and in the act of precipitation the gelatine incloses within its meshes the matters which rendered the liquid turbid. The great consumers of isinglass are the brewers, who employ principally the coarse Brazilian variety. Fifteen grains of good isinglass are sufficient to impart a firm consistence to one ounce of water.

Pharmaceutical Use.—Isinglass has been placed in the Appendix to the Pharmacopœia solely for testing.

[§ Solution of Gelatine.

Take of

Isinglass, in shreds	50 grains.
Warm Distilled Water . . .	5 fluid ounces.

Mix and digest for half an hour on a water-bath with repeated shaking, and filter through clean tow moistened with distilled water.]

Used as a test to distinguish gallic from tannic acid; the latter gives with it a yellowish-white precipitate; the former has no effect.

GADUS MORRHUA, *Linn.* The Cod.

Zoological Character.—Body moderately elongated, two or three feet long, slightly compressed, and covered with rather soft and small scales; back and sides greyish-brown with yellowish spots. *Fins* all soft; *ventrals* pointed and attached to the throat; *dorsal* three; *caudal* distinct. *Head* without scales. *Jaws* and front of the *vomer* armed with pointed, unequal, mostly small teeth, disposed in several rows like a rasp. *Branchiæ* large, with seven rays.

Habitat.—Abundant on the coasts of Norway, France, Britain and Ireland, but especially on the coasts of Newfoundland and Labrador.

[§ Oleum Morrhuæ. *Cod-Liver Oil.*

The oil extracted from the fresh liver of the cod, Gadus Morrhua, *Linn.*, by the application of a heat not exceeding 180°.]

Source.—Although the oil, as stated in the Pharmacopœia, is principally derived from *Gadus Morrhua*, other species such as *G. callarius*, *G. carbonarius*, *G. molva*, &c., also yield some of the oil.

Preparation.—In Newfoundland, where cod-liver oil is prepared in enormous quantities, the best oil is obtained by placing the perfectly fresh and cleaned livers, in a comminuted state, directly they are taken from the fish, in a boiler, and heating them, at as low a temperature as is required, by the application of steam heat. By this means the liquid oil separates and floats at the surface, from which it is laded and filtered into casks, with as little exposure to the air as possible. If much solid fat separates from this by cooling, it is again strained and is ready for use. This method of obtaining the oil is substantially that which has been adopted for many years in the establishment of J. Bell & Co. It is as follows:—The livers are obtained as fresh as possible, and, after careful inspection, all the inferior ones are removed, and the remainder are carefully cleaned, cut open, and washed two or three times in cold water. They are then exposed to a steam heat of about 180°, and occasionally stirred until all the oil has risen to the surface. This is filtered, and afterwards exposed to a temperature of about 50°, in order to congeal the more solid fat (*margarine*). The oil is then again filtered, and kept in jars well secured from the air.

[§ *Characters and Test.*—Pale yellow, with a slight fishy odour, and bland fishy taste. A drop of sulphuric acid added to a few drops of the oil on a porcelain slab developes a violet colour, which soon passes to a yellowish or brownish-red.]

Varieties.—Two varieties of oil are used medicinally in England. These are—1. Pale, or nearly colourless; Newfoundland, English and occasionally Norwegian. 2. Yellow, or light brown; Norwegian. These varieties owe their characters partly to their several modes of preparation, and partly to the state of the livers used for the extraction of the oil. The lightest coloured oil is that which is separated from the livers quickly, or before putrefaction has commenced. The light brown oil has either remained longer in contact with the livers, has been prepared by higher temperatures, or has been obtained from livers in which decomposition has commenced. A darker brown offensive oil, obtained from putrid livers, is largely employed by curriers, but is quite unfit for use in medicine. But between the finest pale yellow, or almost colourless oil, and the dark brown cod-oil used by curriers, there is an almost infinite variety of shade, so that no absolute difference can be founded on colour only. The pale yellow oil is the only kind ordered in the Pharmacopœia. The odour of this oil is not disagreeable; its taste is slightly that of the liver of the cod, and, when fresh, it leaves no acrid flavour in the throat. It reacts feebly as an acid, and has a specific gravity of 0·923 at 63·5° F. Cold alcohol dissolves from 2·5 to 2·7 per cent., hot alcohol from 3·5 to 4·5 per cent. In ether it is soluble in all proportions.

Composition.—Fresh cod-liver oil consists principally of *oleine* 80 per cent., *margarine* about 15 per cent., with a substance called *gaduin* very analogous to one of the bile acids, *cholic*, *acetic*, and *butyric acids*, and at times indications of *iodine* and *bromine.* Sulphuric acid, as stated above (*see* Characters and Test), has been employed as a test for cod-liver oil. Some samples of oil produce at once the red colour, without the preliminary violet tint. This coloration depends on the action of sulphuric acid on some one or more organic constituents of the oil, and the following facts lead me to infer that it is in part due to the presence in the oil of one of the constituents of the bile. Pettenkofer, in 1844, pointed out a new test for bile. If a liquid supposed to contain bile is mixed with about two-thirds of its volume of sulphuric acid, and if, to the liquid which has been kept cool, a few drops of a solution of cane sugar (four or five parts of water to one of sugar) be added, and the mixture shaken up, a violet-red colour is produced provided bile be present. Strecker has observed that acetic acid may be substituted for sugar. The colour developed agrees with that produced by the addition of sulphuric acid to cod-liver oil, which contains the essential constituents of the bile. Cholic acid produces the same colour with sugar and sulphuric acid as bile; so that the test doubtless acts on this acid. De Jongh has shown that cholic acid is contained in cod-liver oil, and, as the oil contains acetic acid, we have the requisite agent to enable the sulphuric acid to act on the cholic acid, and the development of the purple or violet-red colour is then readily accounted for. It follows, therefore, from what has now been stated, that sulphuric acid is a test for liver oils. It does not distinguish one liver oil from another, for it reacts equally with the oil of the liver of the ray, and with the oil of the liver of the cod. Neither does it distinguish good cod-liver oil from bad, for it produces its characteristic reaction both with common brown cod-oil and with the finest and palest varieties. But it serves to distinguish oil procured from the liver from oil obtained from other parts of the animal.

Purity and relative therapeutic value of the different varieties.—The oil as contained in the cells of the fresh liver is nearly colourless. It is obvious, therefore, that of the varieties of oil to which reference has been made, the most colourless, prepared entirely from fresh livers, must possess the constituents of the oil in their purest state. The darker varieties, which are obtained either at a higher temperature, or from livers in which putrefaction has made more or less progress, contain a large proportion of volatile acids and biliary matters; while the lighter sort is precisely the poorest in these bodies, but is richest in oleic acid and glycerine. Chemical analysis lends no support to the opinion, at one time entertained, that the brown oil is superior as a therapeutic agent to the pale oil, for no substances have been discovered in the darker oil which would confer on it superior activity as a medicine. Experience fully confirms the inference drawn from observation of the chemical constitution of these varieties of cod-liver oil, as to their relative therapeutic value. The pale oil is most readily tolerated by the stomach. On the other hand, the disgusting odour and flavour, and nauseating qualities of the brown oil preclude its repeated use. Moreover, there is reason to suspect that, if patients could conquer their aversion to it, its free use, like that of other rancid and empyreumatic fats, would disturb the digestive functions, and be attended with injurious effects. At the Brompton Hospital it has been found that the use of the darker kinds cannot be long continued; the clear and straw-coloured inodorous oil is that which is now administered in this institution. Dr. Williams, in his 'Principles of Medicine,' affirms the superiority of the pure fresh oil. Dr. Garrod likewise sums up his argument in favour of the pale oil thus:—' 1. It is the real oil, as contained in the liver of the cod-fish. 2. It contains no products of putrefaction, such as are found in the dark oils. 3. It sits more easily on delicate stomachs. 4. Experience has proved it to be a most effective therapeutic agent.'

Physiological Effects.—At the commencement of its use, cod-liver oil frequently causes nausea, disagreeable eructation, and occasionally vomiting; but when habit has surmounted the repugnance to it, these effects generally cease. In the dose of a table spoonful it acts as a laxative, diaphoretic, and diuretic. In several cases it has proved emmenagogue; and on some occasions it has given rise to a cutaneous eruption. Dr. Bardsley found that most persons were disposed to get fat under its use. Increase of weight has been strikingly shown to be the result of the use of cod-liver oil at the Brompton Hospital. This was observed in 219 cases of pulmonary phthisis, to the extent of 70 per cent., taking both stages of the disease and the sexes collectively; a loss of weight in 21 per cent.; while in $8\frac{1}{2}$ per cent. the weight remained stationary. The researches of Dr. Theophilus Thompson, Dr. Garrod, Dr. Williams, and others, with various substitutes, tend to the conclusion that this oil owes its action to its oleine, and that the presence or absence of iodine, bromine, &c. in the infinitely small proportions in which they are met with as constituents, cannot affect the results of its administration. Some chemists have failed to detect iodine in cod-liver oil. Other oils are not so readily digested as this oil, hence they are less suitable for medicinal use. Its superior therapeutic powers may possibly be owing to some peculiar constitution of its oleine. It is, however, certain that no other oil is equally adapted to the purposes for which this is used. In the opinion of Dr. Williams cod-liver oil is a nutrient, affording fat of a better kind, more fluid, less prone to change, and more capable of being absorbed into the structure of the body than other forms of fat. Dr. Theophilus Thompson has found that, during the administration of cod-liver oil to phthisical patients, their blood grew richer in red corpuscles, and he refers to a previous observation of Dr. Franz Simon to the same effect. The use of almond or olive oil did not produce this result, but cocoa-nut oil acted like cod-liver oil.

Therapeutics.—Although it has been used more or less successfully in a considerable number of diseases, the cases in which it has proved most beneficial are those of a gouty, rheumatic, scrofulous, or phthisical nature. But even in these it requires a long-continued use to prove successful. The oil is best adapted for relaxed, torpid, and phlegmatic temperaments. In plethoric habits, and where irritation of the stomach and bowels, or inflammation, exists, its use is contra-indicated. In *rheumatism* it is indicated in the chronic forms of this disease, where the muscles and tendons are rigid, and the joints nearly inflexible. In chronic *gout* it is said not to be so efficacious. In *scrofula* it has proved successful in most forms of the disease, but especially when the disease has affected the bones (as in rickets, caries, &c.), and in *tabes mesenterica*. In the latter intractable form its efficacy has been surprising. *Phthisis.*—The experience of the profession at large appears to have established the fact that cod-liver oil is one of the most efficacious of all remedies in arresting the progress of pulmonary phthisis; that it enables patients to struggle on longer against the inroads of the disease, and thus sometimes to obtain cicatrization and contraction of cavities which otherwise must have produced speedy death. In the second stage of the disease, Dr. Williams also states that he has seen a large number of cases very decidedly and lastingly improved; and even in the third stage, the progress of the disease has been arrested. *Chronic skin diseases.*—Cod-liver oil has been successfully employed both externally and internally in obstinate chronic skin diseases, especially if associated with scrofulous or other cachectic condition of the system.

Administration.—For an adult, the dose at the commencement is a table spoonful, which has sometimes been increased to six times this quantity. This dose is to be repeated two, three, or four times a day for several weeks or even months. The dose given at the Brompton Hospital is one fluid drachm at the commencement. In some few cases it has been increased to one fluid ounce and a half. Dr. Theophilus Thompson is of opinion that the action of cod-liver oil is promoted by the addition of solution of potash. Dr. Bardsley gave from half a fluid ounce to one fluid ounce and a half twice or thrice a day in warm table-beer. For children of twelvemonths or under, the dose is a tea spoonful night and morning. The addition of some aromatic oil (as of lemon, peppermint, cinnamon, or anise) partly covers the unpleasant taste and smell. It is sometimes taken in the form of an emulsion. Peppermint water and lozenges have been recommended for covering the unpleasant taste of the remedy. Orange wine has been very extensively employed as a vehicle for its administration. Various methods have been recommended for preventing the sickness which the oil occasionally produces. Perhaps the best is the addition of a small dose of hydrocyanic acid dissolved in mucilage, or of solution of potash, or of both these. A little magnesia taken shortly after the oil, or a minute portion of common salt taken both before and after it, often succeeds; a slice of lemon has a similar effect. The fact has now been repeatedly noticed, that patients, and more particularly children, after a time not only get accustomed to, but acquire a relish for, the flavour of the oil. It should be administered soon after a meal. When pure cod-liver oil is given immediately after a farinaceous meal without any vehicle, it rarely creates nausea, eructation, or vomiting. Much depends upon the quality of the oil. Where the stomach resists its use, it may be administered in the form of enema, the bowels having been previously emptied.

Class: AVES. Birds.

GALLINÆ, *Linn.* The Gallinaceous Order.

GALLUS BANCKIVA, *var.* DOMESTICUS, *Temminck.* The Domestic Cock and Hen.

Zoological Character.—*Bill* of medium size, strong, naked at the base; upper *mandible* arched, convex, bent towards the point. *Head* surmounted by a dentated *comb*. *Ears* naked. *Throat* wattled. *Comb* and *wattles* of the female less than those of the male. *Toes*, 3 anterior, united to the first joint; 1 posterior, raised from the ground. *Tarsus* with a long curved *spur*. *Feathers* of the neck linear, elongated: of the body elegantly variegated; of the wings short; of the tail compressed and ascending, middle ones arched.

Habitat.—Domesticated in all parts of the globe.

Galli Banckivæ Domesticæ Ovum. *The Egg of the Hen.*

General Characters.—The eggs of the hen are too well known to need much description. Their specific gravity varies from 1·080 to 1·090. The relative weights of the different parts of the egg are, according to Dr. Prout, as follows:—*shell and membrane* 106·9; *liquid albumen* 604·2; *yolk* 288·9 = 1000. The liquid white (*albumen*) and yolk are both official.

[§ Albumen Ovi. *Egg Albumen.*

The liquid white of the egg of Gallus Banckiva, *var.* domesticus, *Temminck.*]

Composition.—Glaire or white of egg consists, according to Gmelin, of *albumen* 12·0, *mucus* 2·7, *salts* 0·3, and *water* 85·0. According to Dr. Bostock, *white of egg* consists of *water* 80·0, *albumen* 15·5, *uncoagulable matter* 4·5 = 100. The coagulability of albumen by heat, and its incoagulability by acetic acid, distinguish it from caseine. Albumen is coagulated by corrosive sublimate. Albumen or glaire is distinguished from albumen of the serum of the blood by its being coagulated by ether.

Physiological Effects and Uses.—Highly nutritive, demulcent, and emollient. White of egg is a valuable agent in the treatment of poisoning by corrosive sublimate, sulphate of copper, and bichloride of tin. Its efficacy in these cases depends on the combination of the albumen with the oxide or chloride of the metal. It is used as a demulcent or sheathing agent in all cases of corrosive or acrid poisoning. The white or glaire is also employed as a clarifying agent for wines and some other liquids. Its efficacy depends on its coagulation, by which it entangles in its meshes the impurities with which it either rises to the surface or precipitates. When the liquid to be clarified does not spontaneously coagulate the albumen, it is necessary to apply heat. Bookbinders also use the glaire as a varnish.

[§ **Solution of Albumen** (Appendix II.).

Take of

The White of one Egg.
Distilled Water . . . . . 4 fluid ounces.

Mix by trituration in a mortar, and filter through clean tow first moistened with distilled water. This solution must be recently prepared.]

[§ **Ovi Vitellus.** *Yolk of Egg.*

The yolk of the egg of Gallus Banckiva, *var.* domesticus, *Temminck.*]

Composition.—The yolk consists, according to Dr. Prout, of *yellow oil with crystallisable fat* 28·75, *albumen* containing *phosphorus* 17·47, and *water* 58·8. The yellow (*oleum ovi*) may be obtained by boiling the yolk hard, and digesting in ether or alcohol, which dissolves the oil. By distilling off the alcohol from the filtered tincture, the oil is left behind.

Physiological Effects and Uses.—Highly nutritive like the white of egg, and also demulcent and emollient. It also exerts antidotal powers in poisoning by corrosive sublimate, sulphate of copper, and bichloride of tin, and may therefore be freely used like the white of egg. The yolk is also used for preparing emulsions.

Pharmaceutical Use.—It is a constituent of mistura spiritus vini gallici.

CLASS: MAMMALIA, *Linn.* MAMMALS.

CETACEA, *Linn.* THE CETACEAN ORDER.

PHYSETER MACROCEPHALUS, *Linn.* The Sperm Whale.

Zoological Character.—Length 45–60 feet. *Skin* smooth, without hair; of back and sides blackish or slate-blue, a little spotted with white; of belly whitish. A longitudinal *eminence* on the back over the anus. *Head* very large; superior portion consisting of large cartilaginous cavities filled with oily matter. *Teeth* of lower jaw 20–23 on each side, recurved and pointed, entering, when the mouth is closed, into corresponding cavities of the upper jaw; teeth of upper jaw small, conical, concealed in the gums. *Spiracular orifices* united at the upper part of the snout into a single spout-hole directed to the left side. *Tail* narrow, conical.

Habitat.—Pacific and Indian Oceans.

[§ **Cetaceum.** *Spermaceti.*

Nearly pure cetine, obtained, mixed with oil, from the head of the Sperm whale, Physeter macrocephalus, *Linn.*, inhabiting the Pacific and Indian Oceans. It is separated from the oil by filtration and pressure, and afterwards purified.]

Extraction.—In the right side of the nose and upper surface of the head of the whale is a triangular-shaped cavity, called by the whalers 'the case.' Into this the whalers make an opening, and take out the liquid contents (oil and spermaceti) by a bucket. The dense mass of cellular tissue beneath the case and nostril, and which is technically called 'junk,' also contains spermaceti, with which and oil its tissue is infiltrated. The spermaceti from the case is carefully boiled alone, and placed in separate casks, when it is called '*head matter.*'

Purification.— The substance called '*head matter*' consists of spermaceti and sperm oil. Its colour is yellow. Its consistence varies with the temperature. In cold weather it consists of a congealed mass (spermaceti) surrounded and infiltrated by oil. To separate the latter as much as possible, it is put into filter bags. The solid thus obtained is then submitted to compression in hair bags, placed in an hydraulic press. It is then melted in water, and the impurities are skimmed off. Subsequently it is remelted in a weak solution of potash. It is then fused in a tub by the agency of steam, ladled into tin pans, and allowed slowly to concentrate into large, white, translucent, crystalline masses. Commercial spermaceti usually contains a minute portion of sperm oil, which is best removed by boiling in alcohol. The cetine or pure spermaceti is dissolved, and is deposited on cooling. This process should be repeated so long as the alcohol extracts any oil.

General Characters.—Pure spermaceti is crystalline, pearly-white, glistening, and translucent, with little taste or odour, reducible to powder by the addition of a little rectified spirit. It is insoluble in water, and slightly soluble only in alcohol, even at a boiling temperature. It is scarcely unctuous to the touch; and does not melt under 100°.

Physiological Effects and Uses.—Emollient and demulcent. Internally it has been employed in irritation and inflammation of the alimentary canal (as diarrhœa and dysentery) and of the bronchial membrane (catarrh); but its internal administration is now nearly obsolete. Its principal use is in the preparation of ointments.

Administration.—When employed internally, it is generally exhibited in the form of an emulsion (*spermaceti mixture*) made with the yolk of egg; or with mucilage.

Pharmaceutical Use.—It is an ingredient in blistering paper.

[§ **Unguentum Cetacei.** *Ointment of Spermaceti.*

Take of

Spermaceti	5 ounces.
White Wax	2 ounces.
Almond Oil	1 pint, or a sufficiency.

Melt together with a gentle heat, remove the mixture, and stir constantly while it cools.]

Employed as a mild and simple dressing for blisters and excoriated surfaces.

RUMINANTIA, *Cuvier.* The Ruminant Order.

MOSCHUS MOSCHIFERUS, *Linn.* The Musk Animal.

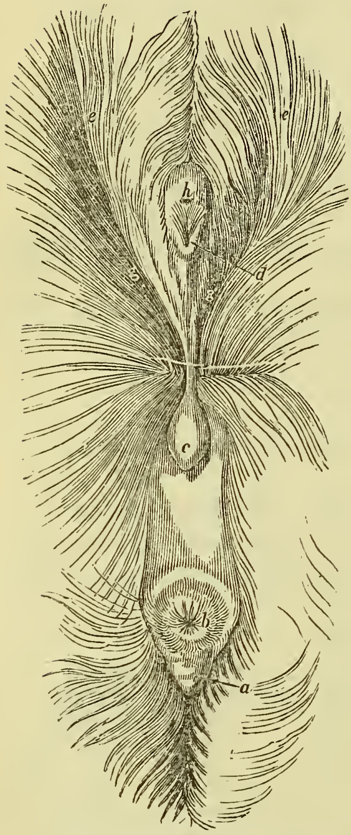
Zoological Character.—An elegant animal about the size of the roebuck or goat, with slender *body*, no *horns*, long and pointed *ears*, scarcely any *tail*, grey-brown *fur*, and very coarse hair (fig. 124). The *male* has two long *canines* in the upper jaw, and a *pouch* in front of the preputial orifice (fig. 125, *h*) filled with an unctuous musky secretion. The *female* has two inguinal *mammæ*.

Fig. 124.

Moschus moschiferus.

Anatomy of the Musk Sac.—The sac is peculiar to the male animal. If he be supposed to be laid on his back, and the belly examined (fig. 125) we observe behind the navel, and immediately in front of the preputial orifice (*d*), a small aperture (*h*) leading into the *musk canal*, which terminates in the cavity of the *musk sac.* The preputial orifice (*d*) is somewhat more prominent, and has a number of longish hairs projecting from it, in the form of a brush or hair-pencil; whereas the external musk aperture is placed in a depression, and is smooth. The *musk sac* is of an oval form, rather broader at the anterior than at the posterior part. It is flat and smooth above, where it is in contact with the abdominal muscles, but convex below (supposing the animal to be standing). Its breadth is from one inch and a quarter to one inch and three-quarters ; its length from two to two and a half inches ; and its depth varies, being greatest anteriorly, where it is about half or three-quarters of an inch. The *external aperture* of the musk sac is placed in the median line, but nearer to the anterior than the posterior extremity of the sac. The musk sac consists of an *outer* or *hairy coat or skin*, which is a continuation of the hide, and the hairs of which are disposed in a circular manner around the musk orifice, and within this, proceeding from without inwards, of four other coats, which are respectively, *muscular*, *fibrous*, *pearly*, and *epidermoid*. On the innermost coat are little depressions in which are small glandular bodies of a yellowish or reddish-brown colour, by which the musk is secreted.

Fig. 125.



Belly of Moschus moschiferus. (From Pallas.)

a. Tail. *b.* Anus. *c.* Scrotum. *d.* Preputial orifice. *e. e.* Abdomen. *h.* Orifice of the musk sac.

Contents of the Musk Sac.—Pallas found, that, in young animals, the sac was empty and contracted. In the adult animal, it contained from 60–90 grains of musk, and in old animals more than a quarter of an ounce. But these quantities must be below the average, since the dried pods or sacs of commerce contain on the average more musk than this. Mr. Campbell describes the musk found in the sac as soft, reddish-brown, granular, and having the appearance of soft ginger-bread.

Habitat.—Central Asia, especially on the Atlas and Himalayan ranges.

[§ **Moschus.** *Musk.*

The inspissated and dried secretion from the preputial follicles of Moschus moschiferus, *Linn.*; native of the mountainous regions of Central Asia. Imported from China and India.]

General Characters, Varieties, and Commerce.—Two kinds of musk are known in this country—viz. *China* or *Thibet musk*; and *Russian, Siberian*, or *Kabardine. China* or *Thibet musk.*—This is imported in small rectangular boxes, covered externally by silk, and lined with sheet-lead and paper. These boxes contain about twenty-five sacs or pods, each wrapped separately in paper. On the outside of the lid of some of the boxes is marked '*Lingchong musk*;' and on the inside of the lid is a rude Chinese representation of the musk hunters, some shooting the animal, others cutting out the musk sac. On the paper, which envelopes each pod, are similar rude representations in blue or red ink. *Pod Musk* consists of roundish, or somewhat oval, membranous sacs, which are generally broader at one end than at the other, and covered on the outer side with brownish-yellow, greyish, or whitish, bristle-like hairs, which are arranged in a concentric manner around the orifice of the sac. A careful examination will always discover the remains of the penis. The pods or sacs are about two and a half inches long, and one inch and three-quarters broad; their weight as well as that of the contained musk, is very variable. The average weight of the sacs is about three-quarters of an ounce, and that of the musk about 160 grains. *Grain musk* (the contents of the sac) is granular, unctuous to the feel, of a dark reddish-brown or reddish-black colour, a bitter aromatic taste, and a strong, remarkable, very persistent smell. Good musk will retain its odour for more than a century. The odour can scarcely be called peculiar, since it is common to several animals and vegetables. A few drops of solution of potash added to musk increases its odour, by setting free, it is supposed, ammonia. This kind is alone official.

Siberian, Russian, or *Kabardine musk.*—This is an inferior kind. The pods are said to be more oblong or oval than those of the China kind; the hairs longer and whiter. But I have examined large quantities of Siberian musk, the pods of which are not distinguishable from those of the China by any of these characters. The only invariable distinction I have observed is in the odour, which is remarkably different: it is much less powerful, and more nauseous and disagreeable, being somewhat empyreumatic. Dealers, we are informed, rely upon another difference, namely, the greater length of the Siberian compared with the China pods.

Adulterations.—The great adulterators of musk are the Chinese.

I have seen several *artificial* pods of musk which had been imported from Canton. T. W. C. Martius calls this artificial kind *Wampo musk*, and says that it has been extensively introduced into commerce. The hairy portion of these pods or sacs is formed of a piece of the skin of the musk animal (readily distinguishable by its remarkable hairs), coarsely sown at the edges to a piece of membrane, which represents the internal smooth or hairless portion of the sacs. These pods are distinguished from the genuine ones by the following characters:—the absence of any aperture in the middle of the hairy coat; the hair not being arranged in a circular manner; and the absence of any remains of the penis. These false sacs, as well as the genuine ones, are sometimes enveloped in papers marked '*Musk collected in Nankin by Jung-then-chung-chung-kee.*' The odour of the musk of the false sacs is ammoniacal. *Grain musk* is sometimes imitated by dried blood, and perhaps by other substances. The fraud is to be detected by a careful examination of the appearance and odour of the particles, and by their chemical characters. An infusion of genuine musk gives a precipitate with tincture of galls, and acetate of lead, but none with a solution of corrosive sublimate. By incineration genuine musk leaves behind a greyish-white ash, whereas blood yields a reddish one. *Artificial musk* is said to be prepared by rubbing in a mortar dried bullock's blood with caustic ammonia, and mixing it when in a half-dried state with genuine musk. According to Markham, 'the substances commonly used for adulteration, or to fill the counterfeit pods, are—blood boiled or baked on the fire, then dried, beaten to powder, kneaded into a paste, and made into grains and coarse powder to resemble genuine musk; a piece of the liver or spleen, prepared in the same manner; dried gall and a particular part of the bark of the apricot tree, pounded and kneaded as above. The dried paste from which common oil has been extracted, called peena' is also used; and lumps of this are often, without further preparation, thrust into a pod through the orifice in the skin, in order to increase the weight.'

Composition.—Musk has been several times analysed. The most important constituent is an *odorous principle.* This has not hitherto been isolated. The strong and diffusive odour of musk would lead us to expect that its odorous matter was highly volatile. Yet such is not the fact; for we cannot deprive musk of its peculiar odour by distillation, though the distilled liquid has a musky smell. As it is destructible by heat, it is obviously organic. Some have suggested that it is the result of putrefaction of one or more of the constituents of musk; and in support of this statement it is asserted that, by Leslie's method of desiccation, musk may be dried and rendered odourless. I have repeatedly performed this experiment with every care, but without obtaining odourless musk. Robiquet was of opinion that many odorous substances owed their scent to a certain quantity of ammonia, which, being disengaged, carried off with it substances not otherwise volatile, which masked the ammoniacal smell. In applying this hypothesis to musk, it must be admitted that it harmonises well with several of the circumstances observed. Thus musk evolves ammonia; water distilled from musk contains ammonia; and potash added to a solution of musk heightens its odour (by facilitating the evolution of ammonia ?).

Physiological Effects.—Musk disturbs the functions of the stomach, acts as a stimulant to the vascular system and brain, and afterwards proves narcotic. Its observed effects show that it belongs to the cerebro-spinants. Its effects are by no means uniform. Trousseau and Pidoux suffered from its use neither excitement of the vascular system nor sleep. Its influence is more manifest in some constitutions (those, for example, commonly termed nervous, in which there is a very sensitive or excitable condition of the nervous system), than in others (as the phlegmatic). Moreover, its effects are more marked in some morbid conditions of the cerebral functions (e.g. hysterical), than in the healthy condition of these functions. In some persons the nervous system appears to be peculiarly susceptible of the odour of musk; for it is reported that headache, giddiness, and even fainting have been induced by it. When the digestive apparatus is previously in a state of irritation, musk increases the local disorder, giving rise to pain, nausea, vomiting, and diarrhœa. The odorous principle of musk is absorbed, and subsequently thrown out of the system by the excretories.

Therapeutics.—The effects of musk show that it is a remedy which will be useful where we want to excite the nervous system; and *vice versâ*, that it will be hurtful where there exists a determination of blood to the brain, and in those constitutions denominated plethoric. The diseases in which experience seems to have shown that musk is sometimes useful are those which are attended with convulsive movements, and which, therefore, are called *spasmodic*; such, for example, as hysteria, epilepsy (especially of children, and where the disease does not depend on organic changes, or on plethora), chorea, and even some cases of tetanus. The employment of musk here has led to its denomination of anti-spasmodic. In *retrocedent gout*, as where gout attacks the stomach or the head, giving rise to headache or delirium, musk has been found beneficial.

Administration.—Musk should be given in substance, either in the form of boluses, or suspended in water by means of saccharine or mucilaginous substances. Its dose is from five to ten grains. In children it may sometimes be used in the form of enema.

OVIS ARIES, *Linn.* The Sheep.

Generic Character.—*Horns* common to both sexes, sometimes wanting in the female, strong, thick, angular, wrinkled transversely, turned backwards and outwards in a spiral manner. *Ears* small. *Legs* slender. No *beard.* Two *mammæ.*

Modern zoologists ascribe our domesticated sheep to *O. Ammon*, Linn., the *Argali* of Siberia; or to *O. Musimon*, Schraeber, the *Moufflon* of Sardinia.

Habitat.—Domesticated everywhere.

[§ Sevum Præparatum. *Prepared Suet.*

The internal fat of the abdomen of the sheep, Ovis Aries, *Linn.*, purified by melting and straining.]

Preparation and General Characters.—Mutton suet is the fat from the neighbourhood of the kidneys of the animals. It is prepared by melting it over a slow fire, and straining through linen or flannel in order to separate the membranous portions. When thus prepared it is white, smooth, almost scentless, and fusible at 103°.

Composition.—Suet is principally composed of *stearine* and *oleine*, with a little *margarine.*

Physiological Effects and Uses.—Like other fatty bodies, mutton suet is nutritious, but difficult of digestion. Its local effects are emollient and demulcent. It is sometimes employed as a basis for ointments and plasters, being preferred in certain cases to hog's lard on account of its greater consistence.

Pharmaceutical Uses.—It is employed in the preparation of ointment of mercury and cantharides plaster.

BOS TAURUS, *Linn.*

Zoological Character.—*Body* about 7 feet long, thick. *Limbs* strong. *Head* large; *forehead* flat, longer than broad; *muzzle* square. *Eyes* large. *Ears* funnel-shaped. *Horns* round, lateral, arched, arising from the opposite extremities of an occipital ridge, and directed laterally, with the points turned outwards or forwards. *Face* flat, or a little concave. *Mammæ* four, disposed in a square form. *Tail* long.

Habitat.—Domesticated everywhere.

[§ **Lac.** *Milk.*

The fresh milk of the Cow, Bos Taurus, *Linn.*]

General Characters.—Cow's Milk is an opaque, white, emulsive liquid, with a bland sweetish taste, a faint peculiar odour, and a specific gravity of about 1·030: the latter is, however, subject to considerable variation. When recently drawn from the animal it is slightly alkaline.

Composition.—Milk has been the subject of repeated chemical investigations. Its principal constituents are *casein*, *butter*, and *sugar of milk.* Subjected to a microscopical examination, milk is observed to consist of myriads of very minute *globular particles* floating in a serous liquid. They instantly disappear by solution on the addition of a drop of caustic alkali. Both Donné and Sir A. Cooper have separated the globules by repeated filtration; the filtered liquor was transparent. The milk globules consist essentially of *butter.* Donné denies that they contain any casein, since they are soluble both in alcohol and ether, which do not dissolve this principle. Being specifically lighter than the liquor in which they are suspended, they readily separate by standing. They therefore rise to the surface, carrying with them some casein, and retaining some of the serum, thus forming what is called *cream.* The milk from which the cream is separated is termed *skimmed milk. Cream* has a variable specific gravity; the average, perhaps, is 1·024. The upper stratum of cream is richest in butter, the lowest in casein. By agitation, as in the process termed *churning*, the fatty globules unite to form *butter*; the residue, called *butter-milk*, consists of casein, serum, and a little butter. *Skimmed milk*, like cream, has a variable specific gravity; perhaps the average may be taken at 1·030. If left to itself it readily acquires acid properties, while white coagula, commonly termed *curds*, separate from it. If an acid or rennet (an infusion of the fourth stomach of the calf) be added to it, this change is immediately effected. The curd thus separated is called *casein.* But after rennet has ceased to produce any more coagula, acetic acid will cause a further quantity to be formed. The *whey* left after the separation of the casein yields, on evaporation, sugar of milk, one or more nitrogenous substances, lactic acid, and some salts. *Casein.*—An albuminous substance, distinguished from the albumen of the egg and of blood by its not coagulating when heated, by its being coagulated on the addition of acetic acid, and by the products of its spontaneous decomposition. When dried, it is yellowish and transparent, like gum: it is odourless, and has a very slight taste. It is soluble in water. If its solution be boiled in contact with the air it becomes covered with a white pellicle insoluble in water. The acids unite to form with it, when they are in excess, insoluble compounds. Various salts (as sulphate of copper, corrosive sublimate, nitrate of silver, bichloride of tin, &c.) form insoluble compounds with it. *Butter.*—This well-known substance consists of three fatty bodies, *stearine*, *oleine*, and *butyrine*. The latter substance is characterised by yielding, by saponification, three volatile, odorous, fatty acids, viz. *butyric*, *capric*, and *caproic acids*. A small quantity of these acids exists in ordinary butter, especially when it has been exposed to the air, and gives butter its peculiar odour. *Sugar of milk* (see below).

Physiological Effects and Uses.—As a most valuable dietetical substance milk is well known. As a medicinal agent milk is regarded as demulcent and emollient. As a *demulcent*, milk is an exceedingly valuable substance in irritation of the pulmonary and digestive organs. It is an excellent sheathing agent in poisoning by caustic and acrid substances, and in some of these cases it acts as a chemical antidote; for example, in poisoning by corrosive sublimate, sulphate of copper, bichloride of tin, and the mineral acids. Milk is further employed on account of its emollient qualities in the preparation of the bread and milk poultice, which requires to be frequently renewed on account of the facility with which it undergoes decomposition, and acquires acrid qualities. *Whey* is an excellent diluent and nutritive. *Wine whey* taken warm, and combined with a sudorific regimen, acts powerfully on the skin, and is a valuable remedy in slight colds and febrile disorders.

Pharmaceutical Use.—Milk is an ingredient of scammony mixture.

[§ **Saccharum Lactis.** *Sugar of Milk.*

$C_{24}H_{24}O_{24}$ or $\mathbf{C_{12}H_{24}O_{12}}$.

A crystallised sugar, obtained from the whey of milk by evaporation.]

General Characters.—[§ Usually in cylindrical masses, two inches in diameter, with a cord or stick in the axis, or in fragments of cakes; greyish-white, crystalline on the surface, and in its texture, translucent, hard, scentless, faintly sweet, gritty when chewed.] It is very slightly soluble in alcohol. It is much less sweet, and less soluble in water, than common sugar. By the action of nitric acid it yields, like gum, saccholactic or mucic acid; so that it forms, as it were, a connecting link between sugar and gum. Owing to its presence the oxide of copper is reduced by Trommer's test on boiling milk with sulphate of copper and potash.

Uses.—It does not appear to possess any remedial activity, but it is useful as a means of giving in the form of powder, and of diluting, more powerful medicines.

Fel Bovinum. *Ox Bile.*

The fresh bile of the Ox, Bos Taurus, *Linn.*

(*Not official.*)

Characters of the fresh bile.—The fresh bile of the ox is a viscid ropy fluid of a greenish-brown colour, an unpleasant odour, and a taste at first bitter, but afterwards sweetish. It has an alkaline reaction, is miscible with water, and forms a froth when shaken with it similar to that produced by soap. It also resembles soap in its detergent properties. It yields, by evaporation, 9·2 per cent. of dry residue.

Composition.—Fresh ox bile consists principally of *cholic* and *choleic acids* in combination with *soda*, *cholesterin*, *green colouring matter*, *fats*, and *mucus* of the gall bladder. From the latter the bile is separated by solution in rectified spirit. (See *Fel Bovinum purificatum.*) *Cholic* or *glyco-cholic acid*, $\mathbf{C_{26}H_{43}NO_6}$.—This is obtained by the action of sulphuric acid on solution of the cholate of soda. It separates in groups of radiating crystals. It is soluble in alcohol, and is sparingly dissolved by water and ether. The salts are bitter and sweet, and resemble soap. *Choleic* or *tauro-cholic acid*, $\mathbf{C_{26}H_{45}NSO_7}$. This exists in the bile in combination with soda, and has not been obtained in a perfectly pure state. When boiled with alkalies it is converted into cholalic acid and taurin. *Cholesterin.*—Is a peculiar fatty body. It exists only in very minute quantity in the bile; but it forms the principal constituent of biliary calculi. Hot alcohol dissolves it, and, on cooling, deposits it in pearly scales. It is soluble also in pyroxylic spirit.

[§ **Fel Bovinum Purificatum.** *Purified Ox Bile.*

The purified gall of the Ox, Bos Taurus, *Linn.*

Take of

Fresh Ox Bile	1 pint.
Rectified Spirit	2 pints.

Mix the bile and the spirit by agitation in a bottle, and set aside for twelve hours until the sediment subsides. Decant the clear solution, and evaporate it in a porcelain dish by the heat of a water-bath, until it acquires a suitable consistence for forming pills.

Characters.—A yellowish-green substance, having a taste partly sweet, and partly bitter, soluble in water and in spirit. A solution of one or two grains of it, in about a fluid drachm of water, when treated, first with a drop of freshly-made syrup consisting of one part of sugar and four of water, and then with sulphuric acid cautiously added until the precipitate at first formed is redissolved, gradually acquires a cherry-red colour, which changes in succession to carmine, purple, and violet. Its watery solution gives no precipitate on the addition of rectified spirit.]

Therapeutics.—It is usually regarded as being slightly laxative in its action, and is said to be especially useful when there is a deficient secretion of bile.

Dose.—From five to ten grains or more in pills, or in gelatine capsules. It is sometimes administered in the form of an enema, for which purpose about sixty grains may be dissolved in four ounces of warm water.

PACHYDERMATA, *Cuvier.* The Pachyderm Order.

SUS SCROFA, *Linn.* The Hog.

Zoological Character.—*Body* covered with bristles. *Colour* blackish-grey in the wild animal, but varying much in the domesticated races. *Molars* 28, the posterior tuberculous; *incisors* 6 in each jaw; *canines* or *tusks* strong, triangular, inclined laterally. No protuberance under the eyes. *Toes* 4 on each foot, 2 middle only touching the ground, armed with strong *hoofs*. *Nose* elongated, cartilaginous. *Teats* 12.

Habitat.—Domesticated.

[§ **Adeps Præparatus.** *Prepared Lard.*

Synonym.—Axungia, *Edin.*

The purified fat of the hog, Sus Scrofa, *Linn.*

Take of

The internal fat of the abdomen of the hog, perfectly fresh . . . . . } 14 pounds.

Remove as much of the membranes as possible, cut the fat into small pieces, put it into a suitable vessel with about four gallons of cold water, and while a current of water is running through the vessel, break up the masses of fat with the hands, exposing every part to the water, so that whatever is soluble may be thus dissolved and carried away. Afterwards collect the washed fat on a sieve or in a cloth, drain away as much as possible of the water liquefy the fat at a heat not exceeding 212° and strain through flannel, pressing the residue while hot, then put it into a pan heated by steam and keep it at a temperature a little but not much above 212°, stirring it continually, until it becomes clear and entirely free from water; finally strain it through flannel.

Characters and Tests.—A soft white fatty substance, melting at about 100°. Has no rancid odour; dissolves entirely in ether. Distilled water in which it has been boiled, when cooled and filtered, gives no precipitate with nitrate of silver, and is not rendered blue by the addition of solution of iodine.] In the liquid state it should be perfectly clear and transparent; but if it be intermixed with water it has a whitish or milky appearance. By exposure to the air, it acquires an unpleasant odour and acid properties. In this state it is said to be *rancid.* As stearine does not become rancid in the air, while oleine does, the rancidity of lard is referred to the latter constituent. But it has been found that the purer the oleine the less readily does this change occur; whence it is assumed that some foreign substance in the oleine is the primary cause of rancidity, either by undergoing decomposition or by acting on the oleine.

Composition.—Fresh lard, according to Braconnot, contains 62 per cent. of *oleine* or *elaine*, and 38 of *margarine* and *stearine.*

Physiological Effects and Uses.—Lard, like other animal fats, is nutritious, but very difficult of digestion. Its topical effects are demulcent and emollient. In medicine lard is principally employed as a basis for ointments. It has been used, by friction, as an emollient; but the practice is now obsolete.

Pharmaceutical Uses.—Prepared lard is an ingredient of fourteen of the thirty-four official ointments, and of cantharides plaster.

[§ **Adeps Benzoatus.** *Benzoated Lard.*

Take of

Prepared Lard	1 pound.
Benzoin, reduced to coarse powder .	160 grains.

Melt the lard by the heat of a water-bath, add the benzoin, and, frequently stirring them together, continue the application of heat for two hours; finally remove the residual benzoin by straining.]

Pharmaceutical Uses.—Benzoated lard is an ingredient in all the suppositories, and four ointments.

Pepsina. *Pepsin.*

The digestive principle of the gastric juice of Mammalia; obtained chiefly from the mucous membrane of the stomach of the sheep or pig.

(*Not official.*)

Preparation.—Pepsin can hardly be said to have been obtained in a state of purity. The best method of effecting its isolation at present known, is that described in the French Codex, which is as follows. The inner coats of the stomachs of sheep or pigs (the latter are considered to yield the strongest pepsin) are macerated in water at 60° F. for about two hours. The liquor is then strained through a linen cloth, and to it is added a solution of neutral acetate of lead, which produces a copious precipitate. This precipitate, separated by decantation, and washed with two successive portions of water, is again mixed with water, and sulphuretted hydrogen passed through so as to decompose the whole of the lead compound. The liquid is now quickly separated by filtration and evaporated in shallow vessels at a temperature never exceeding 113° F. until it is brought to the consistence of a firm paste.

General Characters and Tests.—Pepsin when prepared from the stomach of the sheep or calf, is a greyish-white light powder, with an acid disagreeable odour, and bitter nauseous taste; that prepared from the stomach of the pig is somewhat darker, and has no acid odour, but its smell resembles baked flour. Pepsin is soluble in water and in weak spirit. It is decomposed by a temperature of 120°, and its digestive properties are then entirely destroyed. When pure its solutions are not acted upon by salts of mercury and lead, and tannic acid; but as usually met with its solutions are precipitated by these reagents. The pepsin, when prepared as directed above, and which in the French Codex is called *Medicinal Pepsin*, should, according to the test there given, be capable of effecting the solution of forty times its weight of moist fibrin of blood when mixed with water slightly acidulated with lactic acid, and maintained at a temperature of 113° F. The pepsin that has hitherto been generally used in medicine is mixed with starch, to facilitate its drying and promote its subsequent preservation. This has been called *amylaceous pepsin.* It is sometimes rendered acid by the addition of tartaric acid, and the French Codex indicates that this *acid amylaceous pepsin* may be considered good when fifteen grains of it, added to six fluid drachms of water, will effect the solution of ninety grains of moist fibrin of blood, when treated as in the other case.

Therapeutics.—Pepsin has been given with great advantage in cases of dyspepsia, more especially in atonic dyspepsia. It is most efficacious when administered in conjunction with dilute hydrochloric acid. It is said to be serviceable also in cases of *spasmodic asthma* when dependent on gastric irritation. In *vomiting* arising from debility of the stomach, it has also been found by Dr. Garrod a most valuable remedy.

Dose.—Of pepsin, as prepared above, from 10 to 15 grains taken with the meals. Of pig's pepsin, which is much stronger, from 3 to 5 grains.

Pancreatin and Pancreatic Emulsion.

(Not official.)

History, General Characters, Preparation, and Uses. — These remedies have been brought under the notice of medical men, first, by Dr. G. Harley, in 1858, and subsequently and principally by Dr. Horace Dobell in several publications on the subject. It has long been known that the fluid secreted by the pancreas possesses the property of converting amylaceous substances into glucose, and of forming with fat a sort of emulsion which mixes readily with water, and thus renders the fat susceptible of assimilation. It is for this latter purpose that the use of the pancreatic fluid has principally been recommended, as an aid to the process of digestion. Dr. Dobell has described numerous cases in which he has found benefit to result from the use of pancreatic emulsion of lard and other animal fats in cases of consumption. The substance to which the name *pancreatin* is applied, is an oil-like fluid which may be extracted from the pancreas of recently-killed animals by means of ether, those of pigs having been usually employed. If the fresh pancreas be cut into small pieces, digested in ether, and the ether afterwards distilled off from the filtered liquid, the pancreatin will be left as an oily product, which mixes with fat and water to form an emulsion. The *pancreatic emulsion* recommended by Dr. Dobell is usually prepared by melting the fat at a gentle heat with the chopped pancreas, digesting these in ether, straining the liquid, distilling off the ether, and adding water to what is left so as to form a thick emulsion. The ordinary dose of pancreatin is 10 grains taken in a glass of wine or water after a meal.

RODENTIA, *Cuvier*. The Rodent Order.

CASTOR FIBER, *Linn.* The Beaver.

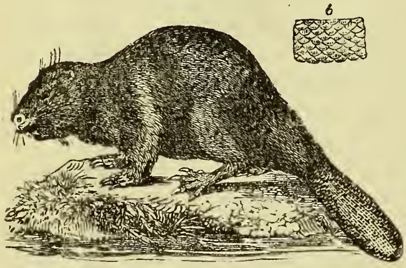
Zoological Character.—Body covered with a reddish-brown *fur*, and terminating in a long broad thick and horizontally flattened *tail* (fig. 126) of an oval form, which is covered with scales (fig. 126, *b*); *back* convex. *Toes* 5 on each foot; the posterior longer, and connected by membranes. *Canines* 0, *incisors* 2, *molars* 8, in each jaw = 20; *incisors* very powerful, orange-coloured anteriorly; *molars* with flat crowns, appearing as if formed of a double sinuous bony fillet.

Habitat.—North America, in Canada, and Hudson's Bay Territory. Scarce in the Northern parts of Europe.

[§ **Castoreum.** *Castor.*

The dried preputial follicles and their secretion, obtained from the Beaver, Castor Fiber, *Linn.*, and separated from the somewhat shorter and smaller oil sacs which are frequently attached to them. From the Hudson's Bay Territory.]

Fig. 126.



Castor Fiber.

b. Scales of the tail.

Anatomy of the Castor Sacs.—Both male and female beavers are furnished with castor sacs or follicles: hence it will be convenient to consider them in the two sexes separately. *Male Castor Sacs.*—If the animal be placed on his back, we observe, near the tail, a hollow (called by some a *cloaca*), inclosed by a large wrinkled somewhat hairy cutaneous protuberance, which, according to Perrault, is easily contracted and dilated, not only by a sphincter, as the anus, but simply like a slit. In this hollow the anus, the prepuce, and the oil sacs open. When the skin of the abdomen is removed, four eminences, covered by their appropriate muscles, are brought into view. They are placed between the pubic arch and the so-called cloaca. The two nearest the pubes are the *castor sacs*, while those next the cloaca are the *oil sacs*. Between the two castor sacs, in the male, lies the *penis*, with its bone; it is lodged in a long *preputial canal*, which terminates in the cloaca, and has some analogy to a vagina; so that there is some difficulty to determine, until the skin is removed, whether the individual be male or female. The penis points towards the tail, not towards the navel. The *castor sacs* open by a common aperture into the preputial canal. This aperture is about one inch in width, and is placed opposite the extremity of the *glans penis* in the relaxed condition of the organ, and about one inch from the orifice of the prepuce. The *castor sacs* are pyriform and compressed. They communicate with each other at their cervical portion; but their fundi diverge outwards and towards the pubes. Each castor sac is composed of an *external* or *cellular* coat, which incloses *muscular fibres*. Within these fibres lies a very *vascular coat*, which covers the scaly or glandular coat, and sends processes in between the convolutions of the latter. The *scaly* or *glandular coat* forms numerous folds or convolutions, which are largest and most numerous in the fundus of the sac. Externally, it is shining, silvery, and iridescent. Internally, it presents numerous small, lanceolate, oblong, or semilunar scales, which are mostly toothed at their margin, and envelope each a *brown body*, which is supposed to be a gland, and is lodged in a small cavity. The inner surface of the castor sacs is lined with *epithelium* (a continuation of the epithelium of the prepuce), which invests the glands and scales of the scaly or glandular coat. In the cavity of the castor sac is found the secretion, which, when recent, is thin, fluid, highly odorous, yellow or orange, and becoming deeper coloured by exposure to the air. The quantity of this secretion is liable to great variation. The *oil sacs* are pyriform conglomerate glands, placed one on each side between the castor sac and anus; their ducts terminate in the cloaca. The secretion of these sacs is a fatty matter, having the consistence of syrup or honey, a peculiar odour, and a yellowish colour. *Female Castor Sacs.*—We are less perfectly acquainted with the anatomy of the female beaver. It is said to be furnished with similar, though smaller, castor sacs and oil sacs; but it is probable that the male alone yields the castor sacs of commerce.

General Characters.—[§ Follicles in pairs, about three inches long, fig-shaped, firm, and heavy, brown or greyish-black; containing a dry resinous reddish-brown or brown highly odorous secretion, in great part soluble in rectified spirit, and in ether.]

Varieties.—Two varieties of castor have long been known, viz. Russian and American. The latter, however, is the only one now found in commerce. Two kinds of this American castor have also been distinguished, viz. Hudson's Bay and Canadian. The former has been usually considered the finest variety, but there is no essential difference between them. All the castor of commerce which is now imported is obtained from the Hudson's Bay Territory, and is probably the produce of that territory. It usually consists of two isolated sacs, which are connected so as to form two parts, like a purse, or like two testicles connected by the spermatic cords. The size of the sacs varies considerably. They are elongated and pyriform, and frequently wrinkled. The penis, or the oil sacs, or both, are sometimes attached to them. The colour and other external characters are variable. In 1834 I examined between three and four thousand pounds of castor, which was offered for sale by the Hudson's Bay Company. A considerable quantity of it was covered externally with a bluish-white mouldiness, while the remainder was of a brownish colour. The brown colour, however, was sometimes dark, and in other cases yellowish, or even reddish. Some castor sacs are found nearly empty, and present, in their dried state, a very fibrous character; these are of inferior quality. Others are found gorged with unctuous matter, and, when quite dry, break with a resinous fracture, presenting no fibres until they have been macerated in spirit of wine. These alone correspond to the official character. In sacs which have been recently taken the contents are still soft.

Composition.—Canadian castor, from the best results of chemical analysis, appears to contain *volatile oil*, *resin*, *castorin*, with *animal* and *saline matters*. *Volatile Oil.*—This is obtained by distilling successive portions of castor with the same water. It is colourless, or pale yellow, has the odour of castor, and an acrid bitter taste. Wöhler has announced that this oil contains carbolic acid and salicin. *Resin.*—This is dark brown, and has an acrid bitter taste. It is insoluble in ether, but dissolves readily in alcohol. Water precipitates it from its alcoholic solution. *Castorin.*—Is a white, crystalline, fatty, non-saponifiable substance, analogous to cholesterin. It is soluble in ether and boiling alcohol, separating in crystalline scales as the solution cools.

Physiological Effects.—Castor is usually denominated a stimulant and antispasmodic. Since the time of Hippocrates it has been regarded as endowed with a specific influence over the uterus. From various experiments of different observers, it would seem however, that castor possesses but little medicinal power; yet Dr. Cullen declares that on many occasions it is certainly a very powerful antispasmodic. Its odorous particles become absorbed, for they have been recognised in the urine by their smell.

Therapeutics.— Castor was formerly in great repute in those affections of the nervous system denominated *spasmodic*, such as hysteria, epilepsy, and catalepsy, more especially when these diseases occurred in females, and were attended with uterine disorder. In those kinds of fever called *nervous*, this medicine has also been recommended. In the northern parts of Europe it is used for its supposed *uterine influence*, to promote the lochial discharge, and the expulsion of retained placentæ. It is, however, little employed, partly, perhaps, in consequence of its disagreeable taste and smell, its variable quality, and its high price; but, for the most part, because practitioners consider it an almost inert remedy.

Administration.—It is best given in substance, either reduced to powder or in the form of pill. *Dose.*—5 to 10 grains or more.

[§ **Tinctura Castorei.** *Tincture of Castor.*

Take of

Castor in coarse powder	1 ounce.
Rectified Spirit	1 pint.

Macerate for seven days in a closed vessel, with occasional agitation; strain, press, filter, and add sufficient rectified spirit to make one pint.

Dose.—½ to 1 fluid drachm.]

The quantity used in this preparation is much too small. A fluid ounce of the tincture contains less than twenty-two grains of castor.

Official Preparations Omitted.

[§ **Solution of Tartaric Acid.**

Take of

Tartaric Acid, in crystals	1 ounce.
Distilled Water	8 fluid ounces.
Rectified Spirit	2 fluid ounces.

Dissolve the tartaric acid in the water, add the rectified spirit, and preserve the solution in a stoppered bottle.]

[§ **Unguentum Hydrargyri Compositum.** *Compound Ointment of Mercury.*

Take of

Ointment of Mercury	6 ounces.
Yellow Wax, Olive Oil, of each	3 ounces.
Camphor	1½ ounce.

Melt the wax with a gentle heat and add the oil, then, when the mixture is nearly cold, add the camphor in powder, and the ointment of mercury, and mix the whole thoroughly together.]

[§ **Unguentum Plumbi Acetatis.** *Ointment of Acetate of Lead.*

Take of

Acetate of Lead, in fine powder	12 grains.
Benzoated Lard	1 ounce.

Mix thoroughly.]

INDEX.

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