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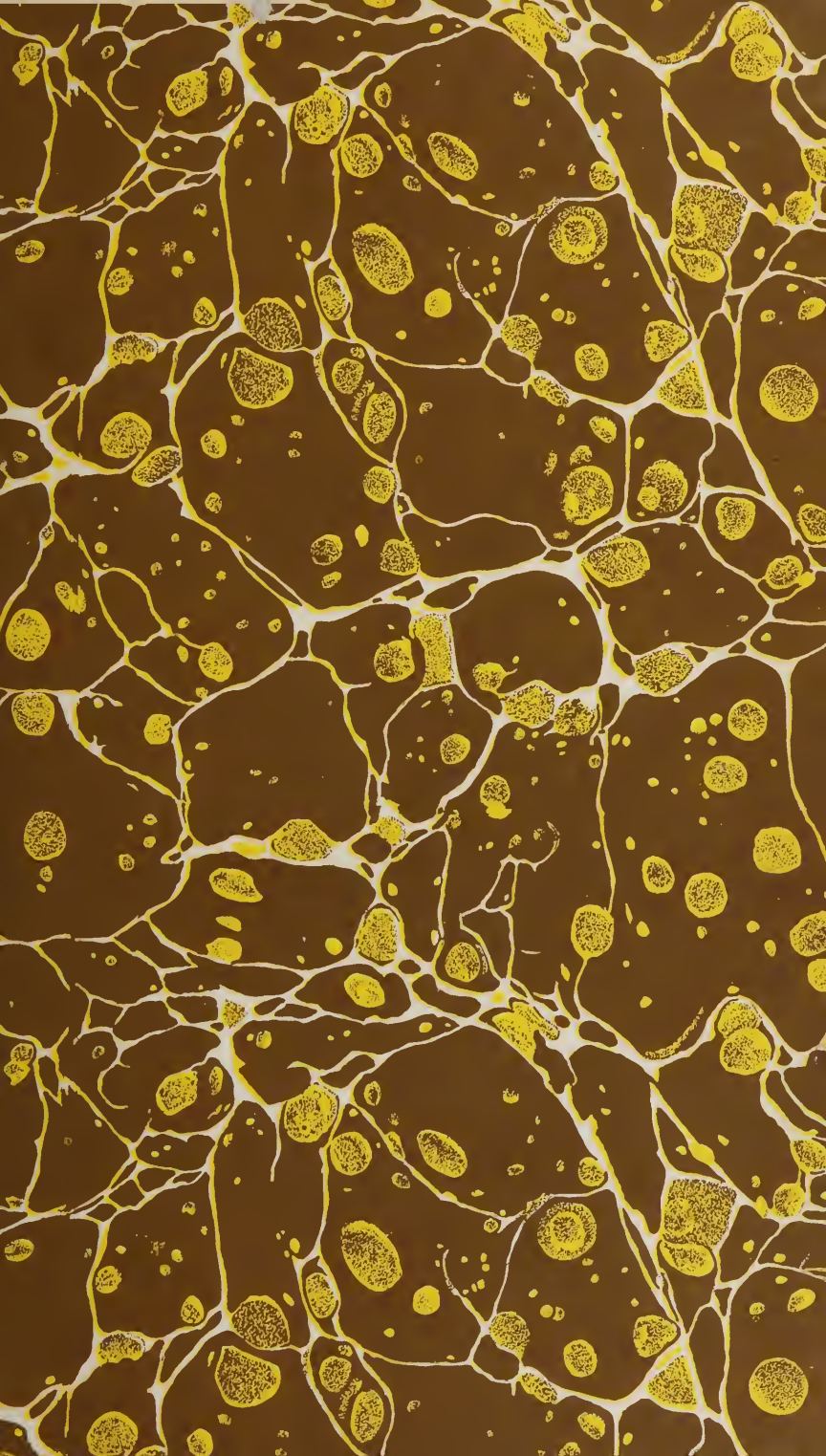


AN

INTRODUCTION

TO

PRACTICAL PHARMACY:

DESIGNED AS A

TEXT-BOOK FOR THE STUDENT,

AND AS A

GUIDE TO THE PHYSICIAN AND PHARMACEUTIST.

WITH

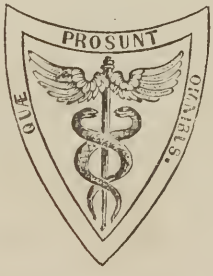
MANY FORMULAS AND PRESCRIPTIONS.

BY

EDWARD PARRISH,

GRADUATE IN PHARMACY; MEMBER OF THE PHILADELPHIA COLLEGE OF PHARMACY, AND OF THE AMERICAN PHARMACEUTICAL ASSOCIATION; AND PRINCIPAL OF THE SCHOOL OF PRACTICAL PHARMACY, PHILADELPHIA.

WITH TWO HUNDRED AND FORTY-THREE ILLUSTRATIONS.



PHILADELPHIA:
BLANCHARD AND LEA.
1856.

PHILADELPHIA:
T. K. AND P. G. COLLINS, PRINTERS.

TO

WILLIAM PROCTER, Jr.,

PROFESSOR OF THEORY AND PRACTICE OF PHARMACY IN THE PHILADELPHIA COLLEGE OF PHARMACY,
EDITOR OF THE AMERICAN JOURNAL OF PHARMACY, ETC.

This Work is Inscribed

AS A TESTIMONIAL TO HIS ZEAL AND ABILITY

IN

PROSECUTING THE SCIENCE AND ART OF PHARMACY,

AND AS A

TRIBUTE OF THE ENDURING FRIENDSHIP AND ESTEEM

OF

THE AUTHOR.

PREFACE.

THE labor of writing, arranging, and correcting for the press, the facts and observations embodied in these pages, is at length at an end, and the final duty is reached of explaining the design and arrangement of the whole, and of commending it, by a suitable prefatory address, to those for whom it has been written.

As a teacher of pharmacy to medical students, I long since experienced the want of a book which should contain the leading facts and principles of the science arranged for study, and with special reference to those features of the subject which possess a practical interest to the physician; there are in the United States some thousands of practitioners of medicine, to whom pharmacy is necessarily a collateral pursuit; to many of these and to the numerous students under their charge, an elementary work, designed as an introduction to pharmacy, has been felt to be a desideratum.

To prepare such a work has been the primary object of the undertaking now brought to a conclusion.

The large and increasing class of students who are qualifying themselves for an honorable position in the profession of pharmacy, has, however, been kept steadily in view. Identified by kindred pursuits and interests with the pharmaceutical fraternity, it would not be expected that in a treatise, however elementary, on the special subject of our study and practice, I should overlook those branches of the general subject which specially interest the pharmaceutist. With a high appreciation of the value of a systematic arrangement of subjects, I have attempted a pharmaceutical classification of the materia medica, which, however imperfect as here produced, cannot fail to be of use to the student who would master the science of pharmacy.

To the practical pharmaceutist, also, I have endeavored to render this work valuable by the introduction of a large number of formulas for new and improved remedies, obtained chiefly, though

not entirely, from the *American Journal of Pharmacy*, to whose contributors we are indebted for most that is new in strictly Galenical pharmacy. There are few apothecaries who may not derive advantage from this compilation of the "new remedies" in a compact form.

By the attempt to adapt the work to both the physician and pharmaceutist, the student of medicine and of pharmacy, the undertaking has been rendered difficult of execution, and as a whole somewhat incongruous, and yet I believe in some respects its value is increased. So little is the scope and meaning of the subject, in its relations to the healing art, understood by many who assume its duties, especially throughout the more newly settled sections of the country, that a work which presents a general, though perhaps defective outline, may serve a better purpose than one devoted to special departments of the subject, and to full and scientific details. We are already supplied with ample works of reference: in this we have a text book for study and practice.

In Part I. are grouped several chapters of a preliminary character, among which, metrology, including weights and measures, and specific gravity, holds a prominent place; it is treated with an effort at simplicity, which should attract the student to its careful study.

Galenical Pharmacy occupies Part II.; the mode of preparing each of the various classes of permanent vegetable preparations prefaces a tabular statement of the relative strength, doses, and medical properties of the individual members.

This compact form of displaying the leading facts of the subject will be observed as a conspicuous feature of the work, and is designed to adapt it particularly to the use of the student. For making the officinal preparations, distinct and definite formulas are omitted, being given in the *Pharmacopœia*, which, as now published in a cheap form, it is presumed every physician and apothecary will possess and use. Unofficinal preparations are treated of more in detail, and hence occupy relatively a larger space. The order in which the preparations are introduced, is that which experience in the "School of Practical Pharmacy" has indicated as best for the student; those most easily prepared are first treated of, and by gradations the more complex are brought forward; the whole arrangement of Galenical preparations being thus founded primarily upon the several processes of pulverization, solution, maceration, displace-

ment, evaporation, and distillation, and secondarily upon the menstrua used in making them, their medical properties and uses.

Part III. is devoted to the classification of plants, giving in extensive syllabi almost all the leading articles of the materia medica, arranged on the basis of chemical composition.

The vague and uncertain analysis of many plants, and parts of plants, and our ignorance in regard to the real composition of many of their active principles, takes from this part of the work much of the value it would otherwise possess. Advantage is taken of these headings to introduce a variety of secondary organic products of great interest and importance, among which are the entire classes of vegetable acids and alkaloids.

In Part IV. the essential facts in regard to the inorganic medicines are briefly stated, and shown also in syllabi.

Part V. contains practical directions for prescribing, selecting, combining, and dispensing medicines, illustrated by a considerable number of formulas or prescriptions variously written in Latin and English, abbreviated and unabbreviated. The attention of physicians is asked to this part of the work as showing the best modes of prescribing many of the more important drugs; it will be observed, that in the selection of prescriptions for publication in this connection, I have availed myself of the skill of numerous practitioners of medicine, some of whom are well known, besides introducing many standard extemporaneous preparations which the physician often finds occasion to prescribe, and the pharmaceutist to prepare and dispense.

The chapter devoted to dispensing is less in detail than was originally intended, as the limits assigned to the work had been greatly exceeded before reaching that important practical branch; the instructions under that head will, however, be found useful to the country practitioner, for whom, especially, they were written.

That the work contains errors of omission and of commission, the author is well aware. It has been written during hours literally stolen from cares and duties which none but the pharmaceutical reader can appreciate; it is the production of a practical man, who, amid various difficulties, has earnestly aimed to add a useful and substantial contribution to the much neglected literature of his profession; as such, let it go forth to meet its fate.

Before closing this preface, it is proper to remark that I have freely used all the latest works upon materia medica and phar-

macy, among which, Dr. Garrod's Essentials of Materia Medica, Dorvault's l'Officine, Gmélin and Loëwig's works, and the late editions of Pereira's Materia Medica and Therapeutics, and Wood and Bache's Dispensatory, may be mentioned.

To my pharmaceutical friends who have aided me in the analysis of prescriptions, contained in the chapter on that subject, and to several medical friends, whose criticisms on the proof-sheets have added finish and accuracy to some of the concluding chapters, I must acknowledge my obligations, while to the publishers, the printer, and the engraver, my acknowledgments are due for many valuable suggestions in regard to the mechanical execution of the work.

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PART I.

PRELIMINARY.

CHAPTER I.

ON THE FURNITURE AND IMPLEMENTS NECESSARY TO THE DISPENSING OFFICE OR SHOP.

The various forms of apparatus required by the apothecary and physician in the preparation and dispensing of medicines, will be brought into view in connection with the pharmaceutical processes, successively described and illustrated throughout this work. In the present preliminary chapter, it will suffice to describe those most simple kinds of apparatus which are indispensable to the country practitioner in the performance of the manipulations coming within the range of his office practice, and are also useful as part of the necessary outfit of the apothecary.

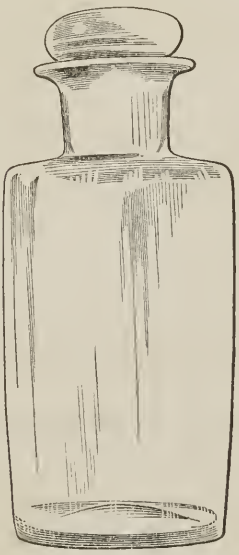
The Furniture Bottles.—Much depends upon the selection of suitable bottles to contain a stock of medicines. They should be of flint glass, and fitted with well-ground glass stoppers. Recently our market has been supplied extensively with German glassware, which possesses the advantage of cheapness and excellence of quality. German bottles are generally of greater diameter in proportion to their height, and those designed for solids, possess wider mouths, and consequently larger stoppers than American bottles of the same capacity. Fig. 1 represents one of this description. They are preferred by many for ordinary purposes, and are certainly well adapted for putting up specimens of the materia medica, for the purpose of study and

Fig. 1.

Broad German salt-mouth, adapted to materia medica specimens.

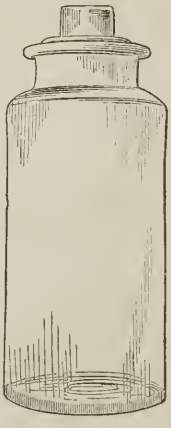
illustration. Besides these, there is a variety of German bottles known as mushroom stoppers, shown in Fig. 2, which are of a very different shape, being tall, and of small diameter. The stopper is less liable to be broken in loosening it when it has become tight in its place, and the shape is considered by many as in better taste.

Fig. 2.



German mushroom stopper.

Fig. 3.



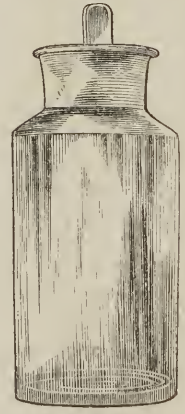
American blown salt-mouth.

The American made bottles are of two kinds, those blown and finished without a mould (Fig. 3), which are the most transparent

Fig. 4.

Moulded salt-mouth, showing hollow stopper.

Fig. 5.



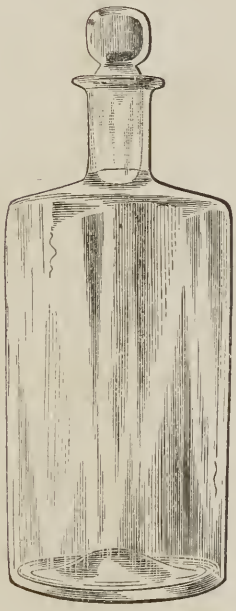
Moulded salt-mouth.

and smoothest kind, and those blown in a mould (Figs. 4 and 5), to which I usually give preference from their greater uniformity of size and shape, adapting them to the furniture of a physician's office or shop. The hollow stopper, shown in Fig. 4, is also moulded and afterwards ground; it has advantages over any other description of stopper.

Bottles with wide mouths and ground glass stoppers, used for solids, are called salt-mouths; those with narrow mouths and ground glass stoppers, used for liquids, are called tinctures.

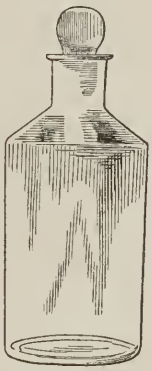
Tinctures, with very long necks and narrow mouths, as shown in Fig. 6, though desirable sometimes for containing very volatile liquids, are inconvenient for syrups and the fixed oils, and very ill adapted to dropping. They are also less readily cleaned than the ordinary tincture bottles, shown in Figs. 7 and 8, which have necks

Fig. 6.



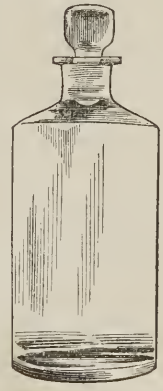
Long-neck German tincture.

Fig. 7.



American moulded tincture.

Fig. 8.



Ordinary American blown tincture.

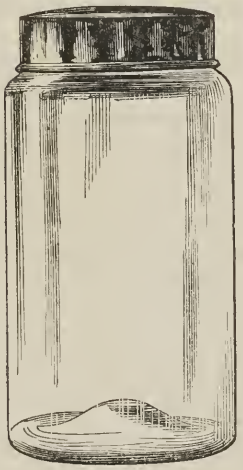
no longer than that of a salt-mouth; it is necessary, however, that the stoppers of these should be well fitted and ground.

Besides the foregoing, there are two kinds of bottles frequently employed in furnishing the physician's outfit, where cheapness is the chief consideration, viz:—

The *specia jar*, which consists of a wide-mouth bottle without a lip, the mouth of which is covered by a tin top. This is objection-

able as not excluding the air, and it is also less cleanly and neat than the salt-mouth. It is rather cheaper.

Fig. 9.



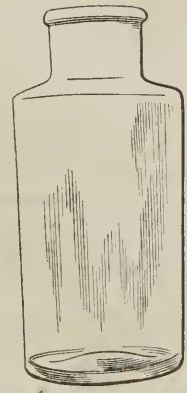
Specia jar.

Fig. 10.

Common wide-mouth packer.

Packing bottles are made, either with a wide mouth for solids, as in Figs. 10 and 11, or a narrow mouth for liquids, as in Figs. 12 and 13; these are stopped by corks, and are the least desirable

Fig. 11.

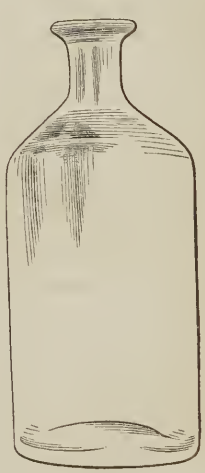


Extra wide-mouth packer. Flint glass.

Fig. 12.

Common packing bottle.

Fig. 13.



Extra packing bottle.

kind of furniture bottle, though very useful for transporting medicines, or for keeping extra supplies with which to replenish the regular furniture bottles. Packing bottles are comparatively cheap, and are generally stronger than salt-mouths or tinctures. They are usually made of green glass, and may be formed without a lip, called common (Fig. 12), or with a lip, called extra (Fig. 13). Those with the lip are the most approved; they hold somewhat more than their nominal capacity.

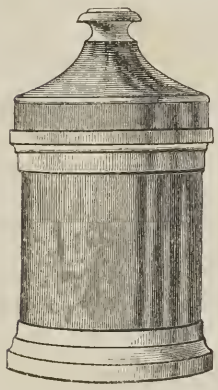
Uniformity in the size and shape of the furniture bottles, adds much to the completeness of the physician's outfit. Care should be taken to apportion the different sizes, so that there will be enough of each to fill a shelf in the medicine case allotted to them. Thus, if there are twelve quart bottles, there should be fourteen pint, sixteen half pint, twenty four-ounce, or in about this proportion. In view of this fact, I have prepared catalogues which will be found in the appendix, embracing assortments more or less complete of the most prominent articles of the Materia Medica, so apportioned as to quantity as that each shall constitute a uniform and well-arranged collection of medicines, and at a certain definite price, according to the extent and completeness of the outfit.

It is the practice of some druggists in furnishing physicians' outfits to label the furniture bottles with the common English labels used in ordinary dispensing operations. This is quite objectionable, for reasons which are sufficiently obvious. Others, though employing Latin labels, printed for the purpose, disfigure each bottle by a conspicuous card, announcing their name, occupation, and address. In order to insure, as far as in their power, the use of correct nomenclature in labelling furniture bottles and drawers, the Philadelphia College of Pharmacy have published two sets of Latin labels, each containing an assortment, embracing several different sizes, according as the articles are kept in large or small quantity. These are sold by our principal druggists, and from their completeness, elegance, and cheapness, commend themselves to all who are about fitting up a shop or dispensing office. The yellow labels are sold at $1 25 per set; the bronze at $10. Specimen labels, such as shown in Fig. 1, are also published by the College.

After having pasted the label on to the bottle or drawer, by means of mucilage of tragacanth, or other convenient paste, and stretched it tightly over the part, it should be smoothed by laying a piece of thin paper upon it, and pressing it uniformly with the thumb. When it has become dry, it may be sized by painting over it a thin coating of clear mucilage of gum Arabic. This should extend a very little over the edges of the label. It should be then dried again, and varnished with spirit varnish. This not only improves the appearance of the label, but renders it durable and impervious to moisture.

JARS.—Ointments and extracts are usually kept in jars made of porcelain or queensware. These vary in quality, in color, and in shape. They should not be made of a very porous material, especially if designed for ointments, and should be well glazed, both on the inside and outside surfaces. The best are imported from England.

Fig. 14.



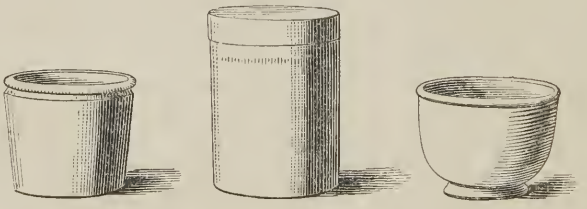
Canopy-top jar.

In regard to the shape of jars; the variety called canopy-top (Fig. 14) is generally preferred, as having a more finished appearance than the flat-top (Fig. 16).

Jars of this kind should never be labelled on the top, as is the custom with some; the tops being about of the same size, are liable to be misplaced, and mistakes occasionally occur in this way.

Ointments and extracts are also frequently put into queensware jars without tops, called *gallipots* and *tie-overs* (Figs. 15 and 17). These are cheaper than covered jars, but are inconvenient and ill adapted to the preservation of the substances kept in them. They are usually tied over with kid, bladder, or parchment, the latter substance being the best. Extracts

Fig. 15. Fig. 16. Fig. 17.



Tie-over jar. Flat-top covered jar. Gallipot.

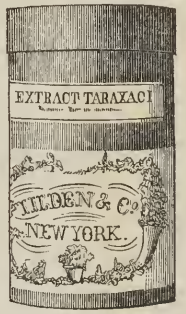
rapidly lose their moisture when kept in tie-overs or gallipots, and those which contain volatile active principles, as extract of conium, soon become deteriorated. Ointments also undergo a change under these circumstances, frequently becoming rancid. When tie-over jars are used, it is well to cover the top with a piece of tin-foil, previous to securing the skin over it; this obviates in part the disadvantages to which they are liable.

Tilden & Co., of New Lebanon, N. Y., of whose extracts I shall have occasion to speak again, have introduced the fashion of putting them into wide-mouth bottles of various sizes, containing from one ounce to a pound of extract, with cork stoppers, capped by thick tin-foil. Each bottle is inclosed in a paper box of the proper size. Figs. 18 and 19 represent the arrangement. This is, undoubtedly, an improvement upon the old method of keeping extracts, and has

but one objection, that owing to the comparative depth of the bottle and smallness of its mouth, it is sometimes difficult to get at the last portions of extract.

Fig. 18.

Fig. 19.



PACKAGES.—Besides the medicines usually kept in bottles and jars, there are many in the physician's outfit which are adapted to drawers; these are sent to him in paper packages, and as he is not always provided with a sufficient number of drawers to appropriate one to each article, they are frequently thrown together. Where this is the case, he should take care to have all those substances possessing a strong odor, as, for instance, valerian and serpentaria, kept separate from the others if not put into bottles; here the specia jars will be found useful. Packages of this description should be secured in two distinct papers, one of which should be thick and well glazed.

When drugs are to be preserved in packages, and have to be unwrapped every time a portion is taken out, they should be tied with good linen twine, passed at least twice around the package in the same direction, and connected by a bow knot.

The mode of folding, tying, and labelling paper packages, will be spoken of under the head of dispensing medicines.

IMPLEMENTS.

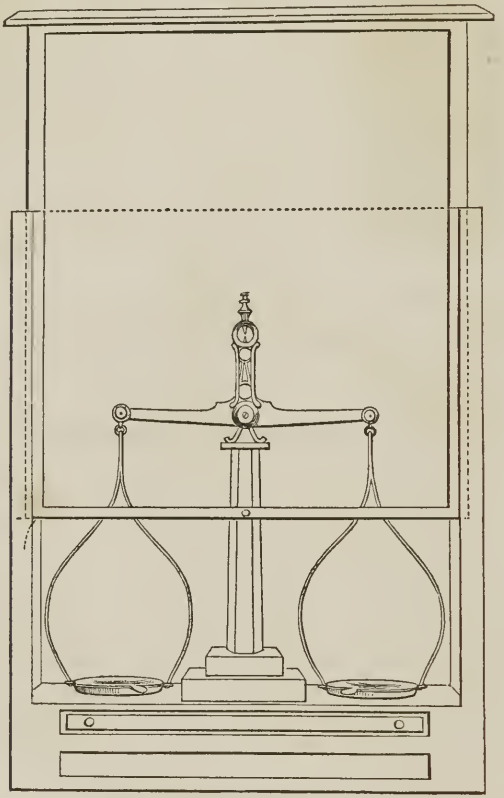
Of the necessary implements for preparing and dispensing medicines in their more ordinary forms, I shall speak in this place, leaving a reference to some of those not usually met with in the physician's office, to subsequent parts of the work.

SCALES.—The scales should be two in number. The pair for prescriptions, suitable for weighing one drachm and under, and the pair for weighing two drachms and upwards.

There are many different varieties of prescription scales in use; the most approved is that with an upright pillar, into the top of which is set a fulcrum, containing planes of hard steel, on which

rest knife edges of the same material, placed at the centre of gravity of the beam; such scales are usually made of brass, the beam and scale dishes being frequently of silver. They vary in price according to their material and workmanship, from ten to twenty-five dollars. To preserve their delicacy, they should be kept in a suitable case,

Fig. 20.



Prescription scales and case, with the sash raised to the proper height for use.

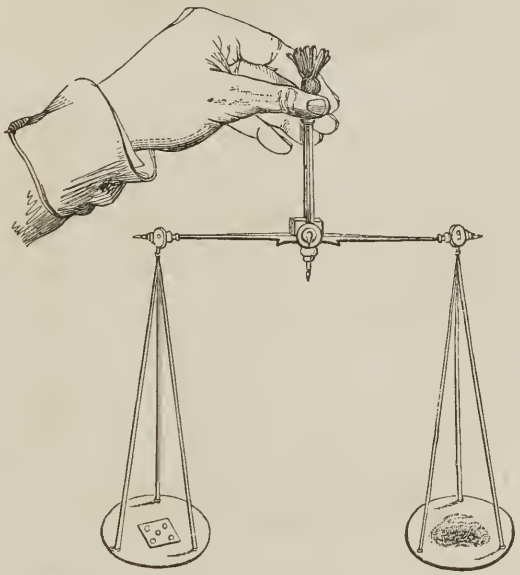
and in a position where they are not liable to a jarring motion, so prejudicial to the sharpness of the knife edges. In cleaning them, care should be taken to avoid bending in the slightest degree, one or other arm of the lever, which is thin and flexible. It is well to try the accuracy of the scales occasionally, as well by weighing exceedingly small quantities upon them when balanced by heavy weights, as by weighing the same quantity successively on the opposite plates, by which means the least deflection in one or other arm of the lever may be ascertained.

Owing to the comparative expensiveness of these scales, another

kind is more extensively purchased by physicians, in which the upright pillar is omitted. These are usually imported either from England, France, or Germany. They come in boxes of wood or tin, and have the advantage of being much more portable. The best are received from England, and have steel beams. The German variety is very inferior, and, indeed, is frequently worthless. The physician who administers strychnia, veratria, or morphia in his practice, may as well judge of the quantity by the eye as by the use of a pair of common German scales, which frequently fail to indicate it within half a grain or even a grain.

Very good scales in boxes are made in this country, at prices varying from three to five dollars each; some have glass plates,

Fig. 21.



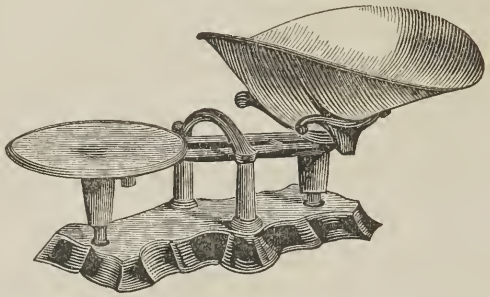
Prescription scales without upright.

adapting them to weighing corrosive substances. Fig. 21 exhibits this description of scales, with the manner of holding them.

Fig. 22 represents a kind of scales for weighing ℥ss and upwards, which are less in use among medical practitioners than they ought to be; until recently it has been customary to guess at quantities which were too large for the prescription scales, the expense of the larger kind of scales being a great objection on the part of the young practitioner to purchasing them. A pair of large brass scales, made on the principle of those in Fig. 20, costs from twelve to thirty dollars. The kind here shown is selected on account of its cheapness; it is manufactured of iron, varnished, to protect it from rust,

with a movable tin pan or scoop, and a platform arrangement of the beam. It is furnished the country physician or storekeeper for one dollar and twenty-five cents, and answers a good purpose.

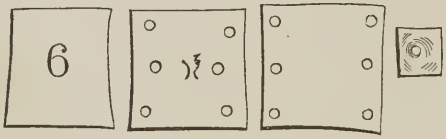
Fig. 22.



Cheap tea scales.

Weights, although sometimes made in this country, are usually imported, of the smaller kinds, with the box scales. Those for ten grains and upwards are made of brass cut into squares, and marked with the officinal signs for denoting the different denominations of weight. Those for six grains and under, are of sheet brass cut into squares and variously marked with the number of grains, as shown in Figs. 23, 24, 25, and 26.

Fig. 23. Fig. 24. Fig. 25. Fig. 26.



Weights of sheet brass.

The inexperienced operator is liable to error in using these small weights from the fact that they frequently have, besides the marks denoting the number of grains, a stamp placed on them by the manufacturer, which is the German sign corresponding with our gr. (grana). (See Fig. 24.) This is liable to be counted with the other indentations, and to add one to the actual number of grains; a two grain weight is liable to be taken for a three grain, a three grain to be used instead of a four, and so on. Close observation, however, will exhibit a decided difference between the two kinds of indentations.

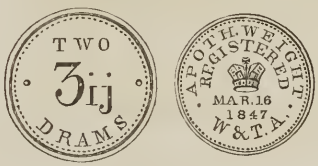
The mode of marking shown in Fig. 23, is more liable to error than the others, especially when the weights become soiled and a little corroded by use.

In regard to accuracy, it must be admitted that most of the

imported weights are very faulty; those made by our own scale makers are generally to be preferred.

Within a few years past a description of weights from ℥ij to ℈ss has become common in our market, quite preferable to the German square weights of the same denominations. These are round, and stamped out of brass plates, with very distinct inscriptions, as shown in Figs. 27 and 28. They are imported from England, being the manufacture of W. and T. Avery, of Birmingham.

Fig. 27. Fig. 28.



Avery's weight.

Some trials recently made with common German weights, convince me that few of those commonly met with are even reasonably accurate; a ℥j weight was found to weigh as high as 69.8 grains, and a gr. vj weight weighed 6.75 grains; others approximated more nearly; a ℥ss weighed 30.25 grains, a ℥j 60.1 grains, a ℈ss 10.1 grains, a ℥ij 120.5 grains, &c. None of Avery's that were tried, varied more than $\frac{1}{10}$ grain from their nominal weight.

The larger apothecaries' weights are almost invariably in the shape of cups, fitting into each other, the two inmost ones (Fig. 29) representing each two drachms; the next a half ounce, the next an ounce, and so on up to sixteen ounces in the larger nests. Now, as each cup represents a certain weight by itself, and as each is double that inside of it (excepting the two smallest, which are equal), the sum of any nest will be equal to that of any weight into which it fits; thus, the 16 oz. weight will balance the nest within it, which consists of an eight ounce, a four ounce, a two ounce, a one ounce, a half ounce, and two quarter ounces, and the entire nest will weigh thirty-two ounces.

Fig. 29.

Series of apothecaries' or cup weights.

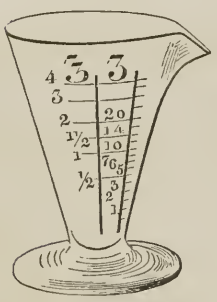
This arrangement of weights, though very compact and convenient, and furnishing a prominent distinction between the officinal and ordinary commercial weights, is more expensive than might be

desired, considering the great utility to the apothecary and physician of having a good supply of such important implements of his art.

The physician about commencing practice in the country, and desirous of economizing in this department of his outfit, may procure sets of these weights ascending as high as four ounces, the nest weighing eight ounces. They will be found to answer his purposes in preparing tinctures, syrups, &c., in small quantities; in dispensing the vegetable medicines for infusions; and in his weighing operations generally, less disadvantage would flow from the exclusive use of apothecaries' than of avoirdupois weights. The subject of weights and measures is more fully presented in the next chapter, where drawings will also be found of the avoirdupois weights in use.

MEASURES.—As all liquid substances are generally dispensed by measure rather than by weight, and as our Pharmacopœia directs the use of the officinal standard of measurement in preparations containing liquids, with but few exceptions, one or more graduated measures are necessarily embraced in the physician's outfit. The most convenient for dispensing operations, is either a four or eight ounce conical measure, such as is shown in Fig. 30. These are of flint or of green glass, and are graduated down to one fluidrachm or half a drachm, which are the lowest denominations we generally wish to measure, and they can be filled several times in succession when it is desirable to measure a pint or quart.

Fig. 30.

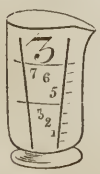


f℥iv. graduated measure.

These measures are either made by our own glass manufacturers, and graduated here by persons following it as a business, or they are imported from Germany. The German measures are not to be relied on for accuracy, though from the quality of the glass, they are generally believed to be less liable than our own to break in measuring hot liquids.

In selecting a measure, the chief points to be observed are, to have a good lip for pouring the liquids from, and clear and distinct marks both on the fluidrachm and fluidounce columns; the glass should not be very thick, as, by refracting the light, it interferes with accuracy in the measurement of small quantities. Large measures, which are not to be used for quantities under an ounce, may be made of the form shown in Fig. 31. These are less liable to be broken by careless handling. One ounce graduates of this description are sometimes made for medicine-chests or saddle-bags where great economy of space is necessary.

Fig. 31.



Medicine chest measure.

Minim Measures.—For the divisions of a fluidrachm, the minim measure is employed. This is usually an upright cylinder of glass, with a lip at one extremity, and a glass pedestal at the other, and is graduated from sixty minims (one fluidrachm) to five minims. The inconvenience of employing a measure of this kind has led to the use of drops in prescription, instead of minims, and as essential oils and spirituous liquids drop so differently from aqueous liquids, and as the same liquid drops very differently from different vessels, discrepancies are likely to occur, unless the dispenser sufficiently understands and observes the distinction. (See tables of approximate measurement in next chapter.)

Fig. 32.

Minim measure.

Tin Measures.—Tin and copper measures of half pint, one pint, or two pints capacity, will be found very useful to the dispensing physician. They may be used for water, alcohol, syrups, and most tinctures, whenever the full quantity they will contain is prescribed.

Mortars.—Mortars are necessary in so many processes of pharmacy, as to be among the most important items of an outfit. I shall describe the kinds usually sold, with their different uses, leaving to the physician the choice of one or more varieties, according to circumstances.

Wedgewood mortars are imported from England, and an inferior quality of similar ware is made in this country. They differ somewhat in their texture, though generally possessed of sufficient roughness to adapt them to the powdering of substances by trituration. The best varieties are glazed enough to prevent their absorbing or becoming permanently stained by chemicals triturated in them, and yet are not so smooth as to allow substances to slip about instead of being retained under the pestle. At least one good wedgewood mortar is necessary. It should be of the shape indicated in Fig. 33, perfectly flat on its base, so that it will stand firm during the process, and furnished with a good lip. The pestle should be, in shape, precisely adapted to the interior surface of the mortar; neither flattened nor pointed at its lower extremity, as is frequently the case. As the larger sized pestles always consist of two pieces, a wooden handle, and the rounded portion, which is of wedgewood ware, care should be taken to have the connection between them, which is made with cement, perfectly tight. When they become loosened, they may be secured by a cement made of resin, two parts; yellow wax, one part; and Spanish brown, three parts; melted together by heat.

For the purpose of solution, a *porcelain mortar* is convenient;

such are frequently more shallow than the wedgewood variety. They are perfectly smooth, and highly glazed, and are not liable to be stained by chemical substances dissolved in them. They will

Fig. 33. Fig. 34.

Wedgewood mortar and pestle.

also be found convenient in preparing such ointments and cerates as require to be introduced into a mortar, being more readily cleansed than wedgewood ware. The one shown in Fig. 35 has a pestle of the same material.

Fig. 35.

Porcelain mortar.

Glass mortars are frequently found in the office of the physician, and the shop of the apothecary. They are too soft as well as too smooth for use in reducing hard substances to powder. The principal use to which they are appropriate, is in forming solutions of readily soluble materials, and in making ointments. The small

sizes are much employed in fitting up medicine-chests and medical saddle-bags.

For large operations, as, for instance, in making syrup of bitter almonds, confection of roses, or mercurial ointment, a *marble mortar* is most convenient; a perfect block of hard and close grained marble of requisite size, is cut out into a shape corresponding with that of the perfect wedgewood mortar, represented in Fig. 33. The pestle is made of the same material, fastened upon a long wooden handle, which may be projected into an iron ring above, secured properly over the centre of the mortar, so that while the operator gives the requisite grinding motion to the lower extremity of the pestle, the upper is held securely in its place.

Mortars of the kinds described are not adapted to contusing substances, either with a view to obtaining powders, or to employing them in a bruised condition. If used for this purpose, they are very apt to be broken on the first trial.

For contusion, an *iron, brass, or bell-metal mortar* of the shape here shown is best suited. Unlike mortars for trituration, these

Fig. 36.

Mortar and pestle for contusion.

are flat at bottom, and the pestles terminate in a flattened ball; they are tall in proportion to their diameter, as seen in the drawing.

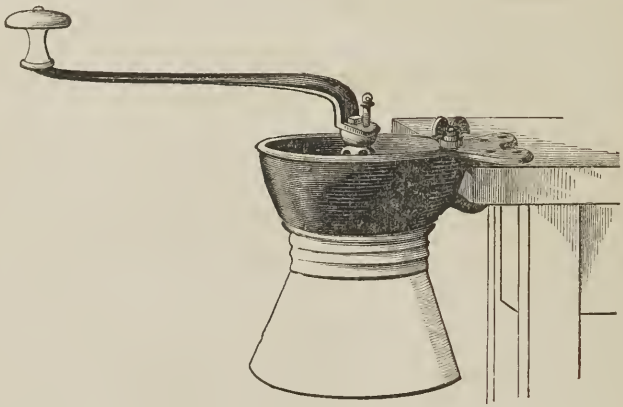
The laborious process of powdering drugs is greatly facilitated by the employment of mills; some of the varieties of coffee and spice-mills met with in iron or hardware stores are exceedingly useful in the comminution of vegetable substances, for the prepara-

tion of tinctures, infusions, &c., and even, assisted with suitable sieves, in their reduction to powder.

A very excellent mill, called Swift's drug-mill, is figured and described in the chapter on powdering.

Fig. 37 represents a spice-mill, which will be found convenient

Fig. 37.



Spice-mill.

where the drug is not too large to be introduced into it, in which case I use a stout pair of shears, a tobacco knife, or a large iron mortar, for its previous reduction. This has the advantage of being secured to a table by a clamp, so as to be removable at pleasure.

To the physician who prepares his own powders, one or more sieves will be found very useful. The most permanent and desirable kind is that made of wire gauze, though hair and bolting-cloth sieves are somewhat less costly. The latter answer very well if kept clear of moths; a sieve with a covering at top and bottom is preferable. These coverings should be made of leather, stretched over hoops rather than of wood, which is liable to warp and crack.

I shall have occasion to speak of the employment of coarse sieves in the preparation of powders for displacement, and need only mention them in this place, to refer to the article on displacement.

Spatulas.—Of these there are several kinds. The plain steel spatula, or palette knife, shown in Fig. 40, is, perhaps, best adapted to the general purposes of dispensing. In selecting them, care should be taken to have one very flexible, and another quite stiff, while, of course, they should be of two or more sizes. The balance handle spatula (Fig. 39) is also useful in dispensing operations, being generally reserved for folding powders, and for other neat manipulations. It has the merit of lying on the table or

counter without the blade coming in contact with it, a convenience when employed with pill masses or ointments. Three inch spatulas may be made with a tapering blade, as shown in Fig. 38, so

Fig. 38.

Fig. 39.

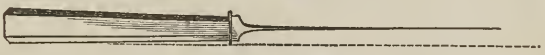


Fig. 40.

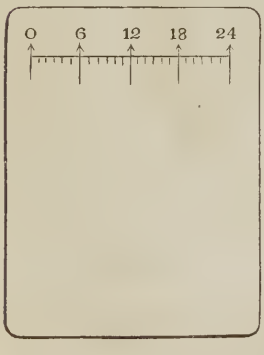
as to allow of their being introduced into rather narrow-mouthed bottles, such as are usually put into saddle-bags.

Spatulas of glass, ivory, and bone are sometimes, though rarely, employed. They are useful in manipulating with corrosive substances which would act upon steel.

A *pill tile* (Fig. 41), made of porcelain or queensware, is a useful utensil in preparing certain ointments and pills. Tiles are made of various sizes, and are sometimes graduated, as seen in the drawing, to facilitate the division of masses into twelve or twenty-four pills.

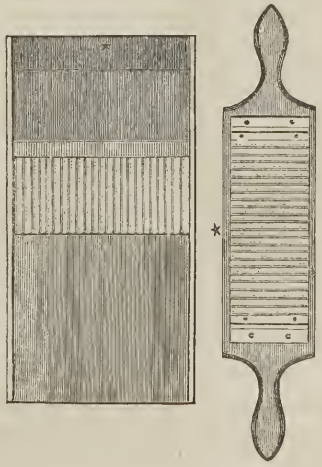
The division of pill masses, however, is better accomplished by the aid of the machine, shown in the accompanying drawing. The

Fig. 41.



Graduated pill tile.

Fig. 42.

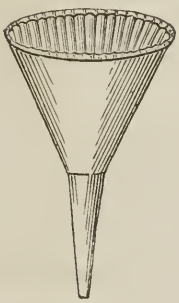


Pill machine.

mode of using this most useful instrument, is described in the chapter on dispensing medicines.

The *funnel*, sometimes called tunnel, is an article of every-day use in the dispensing shop or office. A porcelain or wedgewood funnel is represented in the plate. The sides should be straight, and at an angle of 60° to each other. The tube should be smallest at its lowest extremity, and should have one or more grooves upon its outer surface, to allow of the egress of air from a bottle, into the mouth of which it is fitted. Funnels which are grooved on their inner surface, are generally preferred for filtration, as allowing a more ready downward passage of the liquids, especially when the plain filter is employed. They may be made of glass, porcelain, Berlin or queensware, and tin; those of glass are generally furnished physicians in their outfits; but the porcelain variety is far less liable to breakage, and is equally cleanly.

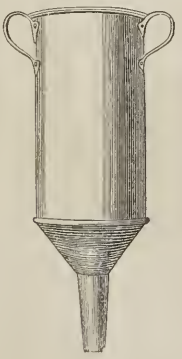
Fig. 43.



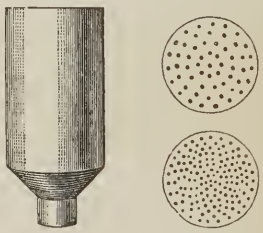
The porcelain funnel.

The *displacement apparatus* is now almost indispensable to the physician who prepares his tinctures, infusions, &c. The kind best adapted to a physician's outfit is a tin tube, of about 8 inches long, and $3\frac{1}{2}$ inches in diameter, terminated by a funnel, and containing one or two perforated diaphragms, fitting loosely into the tube, so as to be readily removed for cleaning (Figs. 44 and 45). There is also

Fig. 44. Fig. 45. Fig. 46. Fig. 47.



Tin displacers, with upper and lower diaphragm.



Porcelain displacer, with two diaphragms.

a kind made of porcelain or earthenware resembling the preceding in shape, and containing diaphragms of the same material (Figs. 46 and 47). Under the head of the displacement process, the mode of preparing and using apparatus of this kind is more fully described.

Vials.—The physician's outfit usually contains from a half gross to a gross of prescription vials, varying in size from f℥viij to f℥ss.

As more of the smaller sizes are used than of the others, it is desirable to have about the following proportions in a gross: One doz. f℥viij, one doz. f℥vj, two doz. f℥iv, three doz. f℥ij, three doz. f℥j, two doz. f℥ss. Several of the larger sizes should have wide mouths, for convenience in bottling solid substances, and also to adapt to the displacement apparatus. Vials in commerce are classified as flint, German flint, and green glass; as fluted and plain; and as long and short. Flint vials are considerably more expensive than the green, though they are far more elegant for prescription purposes. They are generally made in a mould. Of the fluted vials, the long (Fig. 48) are the most convenient for ordinary purposes; they admit of a larger label being pasted on them, which is sometimes desirable in case of prescriptions, and they are more convenient for medicines that are to be administered by drops.

Fig. 49 represents a short fluted vial of the same size, and having a wide mouth, adapting it to solid substances. Fig. 50 is a flint

Fig. 48.

Fluted long prescription vial, of flint glass.

Fig. 49.

Wide-mouth flint fluted vial.

Fig. 50.

Plain prescription vial, of flint glass.

vial, now very much in vogue, intermediate between the two preceding in height, and without the fluted surface; these are apt to show a crease down their whole length, at the point where the two halves of the mould, in which they are made, come together in shutting it, a common feature in all bottles made in moulds, which

Fig. 51.

Plain German flint vial.

Fig. 52.

Old fashioned long green vial.

Fig. 53.

Short prescription vial, green glass.

open and shut by what may be called a lateral suture. Figs. 51, 52, and 53 represent vials blown without a mould, or in an open clay

mould, and finished by hand. These have a handsomer and smoother surface, though less regular and uniform in shape, as here the shape depends on the skill of the finisher, not the construction of his tools. German glass vials are intermediate in price, between those of flint and common green glass. They are very well adapted to ordinary dispensing purposes, and, as made by our best manufacturers, leave little to desire.

The shape of the lip is one of the most important considerations in the selection of vials; if the lip is too narrow and rounded, a constant source of annoyance will occur, from the liquid trickling down the neck and sides of the vial after pouring from it, and it will be impossible to drop from it at all. Figs. 52 and 53 represent the old fashioned cheap green glass blown vials; that shown in Fig. 52 has the disadvantage of not standing up, and is usually suspended by a string.

Corks.—These are exceedingly variable in quality; the softest and most perfectly shaped varieties are expensive, and sometimes difficult to procure. This remark is especially true of the larger sizes, called bottle corks; of these we have pint corks, quart corks, demijohn corks, and flat or pot corks; the last being used chiefly for wide-mouth packing bottles and earthen jars. It is well for the physician to be supplied with a few of these, though vial corks constitute by far the largest proportion of the whole number required.

Paper of different kinds should not be overlooked in making up an outfit. The most useful are druggist's white wrapping-paper, which should be fine without being heavy, or spongy in its texture; it should not crack at the edges when turned over sharply. The sizes met with in commerce are medium, about 19 × 24 inches, and double medium, 24 × 38 inches. For directions in regard to dividing the sheets, for dispensing medicines in packages, see chapter on dispensing. The kind of paper called flat cap will be found very convenient in addition to the above, for putting up powders, especially in very small doses.

Filtering paper should be without color, and of a porous texture, and yet sufficiently firm to sustain the weight of the liquid placed upon it.

Fancy paper, employed for capping corks, or as a very nice outer wrapping to packages, is recommended to those who expect to observe neatness and elegance in dispensing. Tin-foil will also be required by such for covering jars of ointment, &c.

Pill Boxes.—These are of three kinds: 1st. Paper pill boxes, which are adapted to dispensing pills. 2d. Wooden pill boxes, or chip boxes, made of shavings, and best suited for ointments, confections, &c.; of this article, a very beautiful style is imported from England,

which commands nearly double the price of the American kind. 3. Turned boxes. These have been recently introduced for dispensing pills, and are certainly more substantial than either paper or chip boxes. They do not, however, serve so good a purpose for ointments, the bottom, being cut across the grain of the wood, soon becomes saturated with the grease, and soils everything it is set upon. Pill boxes are usually sold by the dozen nests, wrapped in paper. Sometimes a nest contains three, and sometimes four boxes, ranging from about an ounce capacity to one-fourth that size.

The physician should provide himself with a tin case, in the shape of a closed cylinder, in which to carry his gum catheters and bougies, and another for adhesive plaster cloth, which otherwise will soon become useless in our climate.

The other items to be mentioned are a few pieces of fine Turkey sponge for surgical use, and one for the inhalation of ether, if a friend to anæsthesia in surgery and obstetrics. A corkscrew, a ball of fine linen twine, a pair of scissors, a few coarse towels for wiping mortars, a tin cup for heating liquids, a sheepskin for spreading plasters, &c.

The apparatus and furniture here described, are such as may be regarded as necessary to the outfit of a country practitioner. I shall find occasion to refer to many implements in the subsequent parts of this work which it would be superfluous to describe in this place, though frequently included in the outfit.

CHAPTER II.

ON WEIGHTS AND MEASURES, AND SPECIFIC GRAVITY.

METROLOGY embraces the science of determining the bulk, or extension of substances, called measurement, and their gravitating force, called weight, and the relation of these to each other, called specific gravity.

In the present essay, it is not designed to enter into the subject further than is necessary to the student of medicine and pharmacy; and hence I shall avoid all investigations into the origin of the standards of measurement and weight in use in this country and in England, a subject which is full of difficulty and complexity, and refer the reader to an able essay on its historical bearings, compiled by the late Dr. Benjamin Ellis (see *American Journal of Pharmacy*, vol. ii. pp. 111 and 188), from the *Report on Weights and Measures*, made by Hon. J. Quincy Adams, when Secretary of State, to the U. S. Senate in 1821.

WEIGHTS AND MEASURES.—So difficult has it been found to modify or materially alter the systems of measurement and weight handed down from the earliest antiquity, and tenaciously adhered to by the mass of the people, and so inadequate have been the efforts of the British Crown and Parliament to supply proper and invariable standards, that the present Troy and Avoirdupois weights are believed to be even less perfect and consistent with each other than the very ancient standards from which they were derived. The inconveniences attendant on the use of separate sets of weights and measures for different kinds of commodities, has probably always been felt, and is only partially remedied by adapting these to one common unit to which all can be reduced. This adaptation, in the case of our different standards, is through the grain or unit of weight. The systems of Troy, Apothecaries', and Avoirdupois weights, and of wine measure, which are in most common use in this country, are all readily compared through this common standard —the *grain*.

Troy Weight is used by jewellers, and at the mints, in the exchange of the precious metals. Its denominations are the pound, ounce, pennyweight (= 24 grs.), and grain.

Apothecaries' Weight is used by apothecaries and physicians in mixing and prescribing medicines, and is officinal in the United States, London, and Edinburgh Pharmacopœias (not in that of Dublin). In buying and selling medicines, not ordered by prescription, the avoirdupois weight is used.

The denominations of the apothecaries' weight are pounds, ounces, drachms or drams, scruples, and grains. Its pound, ounce, and grain, correspond with the Troy weight.

Avoirdupois Weight is used in general commerce, and by apothecaries in their strictly commercial transactions, as in buying and selling medicines without the prescription of a physician, and also in compounding recipes for domestic purposes, and for use in the arts. Its higher denominations need not be named. As at present used, it has pounds, ounces, and fractions of the ounce.

Synonyms.—The names given above may be substituted, with advantage, by *officinal* for the apothecaries', and *commercial* for the avoirdupois, as more definite, and less likely to be confounded in the mind of the student.

A knowledge of these, and of their relations to each other, is of the highest degree of importance to the physician and apothecary, and, for want of giving due attention to them at the outset, many students are continually confused in the practice of pharmacy.

In the following table, I have endeavored to display, in the simplest and most comprehensive manner, the value of each denomination in the respective weights, and the relation of these to each other:—

Table of the Officinal Weights (*Apothecaries'*).

20 grains = ℈i	(one scruple)	= gr. xx.
60 grains = ʒi	(one drachm)	= ℈iij (3 scruples).
480 grains = ℥j	(one ounce)	= ʒviii (8 drachms).
5,760 grains = ℔i	(one pound, U. S. P.)	= ℥xii (12 ounces).

Table of Commercial Weights (*Avoirdupois*).

437.5 grains = 1 oz. (one ounce).
7,000 grains = 1℔ (one pound, Com.) = 16 oz.

Table of the Value of Officinal in Commercial Weights.

℥j	(officinal) =	1 oz.	(commercial)	+ 42.5 grs.,	or about	℈ij.
℥ij	" =	2 oz.	"	+ 85 grs.	"	ʒiss.
℔i	" =	13 oz.	"	+ 72.5 grs.	"	ʒi.

The *use of signs* is here seen to be of importance, as designating, when correctly used, to which system of weights the particular denomination refers; thus, ℥j means 480 grains—the officinal ounce; while 1 oz. means 437.5 grains—the commercial ounce. The sign for designating the pound is not so distinctive; ℔i is applied equally to the officinal pound, 5,760 grains, and to the commercial, 7,000 grains; so that, when a doubt may arise as to which is intended, the prefix *U.S.P.* would be well adapted to designate the officinal, and *Com.* or *Av.*, the commercial.

The *comparative value* of the different parallel denominations may be thus expressed:—

The officinal ounce contains 42½ grains more than the commercial.

The officinal pound contains 1,240 grains less than the commercial. Or, thus:—

The officinal has the largest ounce, and the commercial has the largest pound, the former containing ℥xij (each 480 grains) in a pound, and the latter 16 ounces (each 437.5 grains) in a pound. Or thus:—

480 × 12 = 5,760 (officinal).
437.5 × 16 = 7,000 (commercial).

Scales and Weights.—The balance, or scales, is of course indispensable to the idea of metrology, and the possession of masses of previously ascertained gravitating force, called weights, is equally necessary. Scales are of various styles, although, for use in pharmacy, the simple kinds figured among the necessary implements for furnishing the physician's office, answer every purpose. In this place, it will be proper to call attention especially to the usual forms of *weights* of the different systems. The apothecaries' weights are invariably, for all denominations, made of brass or copper. The larger weights come in the cup form, as shown in Fig. 54. Each cup is equal to the sum of all those which fit in it, or is twice the sum of

the next smaller. These weights are expensive, and, unfortunately, too little used by physicians, and even by some apothecaries. The

Fig. 54.

Series of apothecaries' or cup weights.

small weights which accompany the box scales, and which are figured, in the last chapter, are used for all denominations up to 2 drachms, and then the common commercial or avoirdupois weights, which are cheaper than the brass cup weights, are frequently brought into play.

These are usually in piles of iron, brass, or zinc, of the form shown in the annexed figure, each weight being half that of the one below it. The table of the value of the officinal in the commercial weights given on the last page, is designed to indicate a ready means of executing the officinal formulæ with the common commercial, and small officinal weights. In a large number of processes, one ounce, or two ounces, are ordered, and in these cases, if the avoirdupois weight is used, a ℈ij or ʒj, and ʒss weight must be added from the small set. In the case of a pound being ordered, as there shown, 13 ounces from the pile, and a ʒj from the small set, will nearly approximate the required weight.

Fig. 55.

Commercial or avoirdupois weights.

Measures of capacity are used for liquids, and, in the higher denominations, for corn and the cereal grains, but the only table of these we need present is that employed in medicine, called Wine Measure. The unit of this system has no convenient relation to the unit of the systems of weight; it is called a minim, and is equal to about .95 of a grain of pure water at 60° F.

Table of the Officinal, or Wine Measure.

60 minims	= fʒj	(one fluidrachm)	= ♏ lx	= grains of water		56.9
480 "	= fℨj	(one fluidounce)	= fʒviij	= "	"	455.6
7,680 "	= Oj	(one pint)	= fℨxvj	= "	"	7,291.1
61,440 "	= Cong. j	(one gallon)	= Oviij	= "	"	58,328.8

Or, thus:—

60 minims are one fluidrachm.
8 fluidrachms are one fluidounce.
16 fluidounces are one pint.
2 pints are one quart.
4 quarts are one gallon.

Besides the discrepancy occasioned by the minim not being

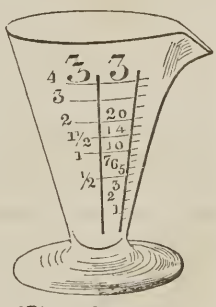
equal to one grain of the natural liquid standard, it will be perceived at once that a wide variance exists in the denominations above an ounce. The fluidounce contains 480 minims, as the officinal ounce contains that number of grains; but, in the pint, are 16 fluidounces, while the corresponding pound contains only 12 ounces. From these causes, the adjustment of proportions of solids to liquids, when accuracy is required, is a matter of no little calculation. In England, this system of measures has been revised of latter years, so as to bring about a close relation between the solid commercial ounce and the fluidounce. In the imperial measure, the minim is equal to .91 of a grain, and it is multiplied as follows:—

Imperial Measure.

60	minims = f℥j	(one fluidrachm)	= ♏ lx	= grains of water	54.6
480	" = f℥j	(one fluidounce)	= f℥viij	= "	"	437.5
9,600	" = Oj	(one pint)	= f℥xx	= "	"	8,750[1]
76,800	" = Cong. j	(one gallon)	= Oviij	= "	"	70,000

Graduated measures of Oj, f℥viij, f℥vj, f℥iv, f℥ij, f℥j, f℥j capacity are manufactured and sold by druggists; these are sometimes quite inaccurate, but may be readily verified by balancing them on the scales, and gradually adding pure water until the required weight in grains, as shown in the table, is attained. In the same way we may graduate our own measures, marking the denominations by the following ready process.

Fig. 56.



f℥iv grad. measure.

Having coated one side of the glass with a thin coating of wax, balance it on the scales, adjust the weights, and add the required number of grains of pure water, observing to add it drop by drop toward the last; as soon as the weight is accurately counterpoised, remove it to a level table or counter, so high that it will be on a line with the eye, and carefully, with the point of a pin, mark the line formed by the surface of the liquid, and opposite this the appropriate sign; this may be rendered more clear and distinct afterwards. In the same way mark the various other denominations, having an eye to the temperature, which should not vary far from 60°. Now form a paste, by mixing a sufficient quantity of finely powered fluor-spar with sulphuric acid, and spread this over the marked surfaces, and set the measure aside for a day or two, after which, wash it off and remove the wax; the graduated measure is now indelibly and distinctly marked, and, if we have used the proper care, more accurately than is usual with those sold. I have compared two, in which the one fluidrachm mark of one corresponded nearly with the two fluidrachm of the other, and in other respects they were almost as much at variance.

[1] Equal to 1 lb. 4 oz. avoirdupois weight.

A precaution to be observed, whether in graduating or using a measure, particularly of small capacity, may be appropriately mentioned here.

Owing to the adhesion of the liquid to the sides of the measure, its surface is concave, and shows, from a side view, two lines: one where the edge of the liquid adheres to the glass, and the other, the line of the lower surface of the concavity. Now, in order to fix the true line in this case, it must be intermediate between the upper and lower edge of the liquid, and not at either surface. This is more obvious the smaller the diameter of the measure, and, in the accompanying drawing, the dotted line has been made at the proper point for measurement.

Fig. 57.

Minim measure.

Approximate Measurement.—The approximate standards of measurement are very inaccurate, but they have no wider range than the doses of medicines, so that they are for the most part satisfactory. The following table exhibits those in common use:—

A gill mug, or teacupful . . .	f℥iv.
A wineglassful	f℥ij.
A tablespoonful	f℥ss.
A dessertspoonful	f℥ij.
A teaspoonful	f℥j.
A drop	from $\frac{1}{3}$ to $1\frac{1}{2}$ minims.

Of the above, it may be remarked that the wineglassful is frequently less than 2 fluidounces, although the champagne glass is nearer 4 fluidounces. I have observed that the modern teaspoons are larger than formerly, and that the more expensive silver spoons are larger than those of common metal of the same nominal size.

The size of drops varies from various causes, of which the nature of the liquid, the size and shape of the lip of the vessel from which dropped, and the extent to which the lip is moistened, are the most important. The following lists of liquids, with the number of drops in a fluidrachm, may be considered as furnishing good approximations to the relative size of their drops:—

Three lists are appended: 1st. That by Elias Durand, originally published in the *Journal of the Philadelphia College of Pharmacy*, vol. i. p. 169, and copied into most of our standard works; from this I have omitted several items, on account of their standard strength having been very much altered since the period of his experiments. 2d. That of Prof. Procter, published in the tenth edition of the *United States Dispensatory*, and confined to different essential oils. 3d and 4th. Lists I have prepared as the result of my own observations, chiefly confined to medicines not included in the foregoing.

1*st. Durand's Table of the number of Drops of different Liquids equivalent to a fluidrachm.*

	DROPS.		DROPS.
Acid, acetic, crystallizable	120	Tinctures of assafœtida, foxglove, guaiacum, and opium	120
" hydrocyanic, medicinal	45	Tincture of chloride of iron	132
" muriatic	54	Vinegar, distilled	78
" nitric	84	" of colchicum	78
" sulphuric	90	" of squill	78
" " aromatic	120	Water, distilled	45
Alcohol	138	" of ammonia, strong	54
" diluted	120	" " weak	45
Arsenite of potassa, solution of	57	Wine, Teneriffe	78
Ether, sulphuric	150	" antimonial	72
Oils of aniseed, cinnamon, cloves, peppermint, sweet almonds, and olives	120	" of colchicum	75
		" of opium	78

2*d. Procter's Table of the number of Drops to a fluidrachm of Essential Oil, as dropped* A, *from the bottles from which they are commonly dispensed, and* B, *from a minim measure.*

	A.	B.		A.	B.
Oleum anisi	85	86	Oleum menthæ pip.	103	109
" cari	106	108	" " viridis	89	94
" caryophylli	103	103	" rosmarini	104	105
" chenopodii	97	100	" sabinæ	102	108
" cinnamomi	100	102	" sassafras	102	100
" cubebæ	86	96	" tanaceti	92	111
" fœniculi	103	103	" valerianæ	116	110
" gaultheriæ	102	101	Creasotum	95	91
" hedeomæ	91	91			

3*d. Table of the number of Drops of different Liquids equivalent to* f℥j, *as dropped from pint and half pint tincture bottles, and from a minim measure. Thermometer* 80° F.—E. PARRISH.

Those marked *av.* are averages of several droppings.

	FROM ℥ MEASURE.	FROM Oj OR Oss TR.
Acetum opii	69	90
Acidum aceticum (commercial)	102	73
" " dilutum, *av.*	52.5	55
" nitricum dilutum	44	62
" sulphuricum dilutum	49	54
" " aromaticum	148	116
" hydrocyanicum dilutum, *av.*	52	[1]
Alcohol	143	118
" dilutum, *av.*	124.5	98
Aqua, *av.*	46	64.5
Chloroformum, *av.*	276.5	180
Extractum valerianæ, Fld.	126	115
Glycerina (first dropping)	135	53
" *av.*	84.7	55
Infusion digitalis, *av.*	60	62.5
Liquor ammoniæ	62	49
" iodinii compositus	75	75

[1] From f℥i Tr. bot. 53.

	FROM ℿ MEASURE.	FROM Oj OR Oss TR.
Liquor hydrarg. et arsen. iodid.	52	52
" potassæ arsenitis	63	60
Oleum menthæ viridis, *old*	103	110
" olivæ	99	76
" tiglii	92	80
Spiritus ætheris nitrici	148	90
" " compositus	140	90
Syrupus acaciæ	56	58
" scillæ	88	85
Tinctura aconiti radicis	130	118
" ferri chloridi	151	106
" iodinii	144	113
" opii	147	106
" " camphorata	110	95
" tolutani	138	120
Vinum antimonii, *av.*	84	62
" opii	92	78

4th. Number of Drops of Water equivalent to f℥j *dropped from* f℥j *vials.*

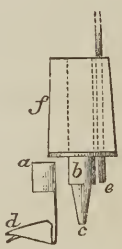
1st trial 34.	2d trial 48.	3d trial 32.	4th trial 48.
5th trial 60.	6th trial 50.	7th trial 65.	Average 48.1.

The drop machines here figured, are contrived to obviate, to a certain extent, the inequalities given in the above table; they are

Fig. 58.

Bottle with drop machine.

Fig. 59.



not generally known, though quite useful to the physician and apothecary who has occasion to drop a large number of drops in succession. Their construction will be obvious from the drawing. A perforated cork with a tube, either of glass or metal, drawn out to a small orifice, and a capillary tube of metal passing above the surface of the liquid in the inverted bottle, so as to supply air to the vacuum created by the liquid as it drops out, constitutes all that is essential to the apparatus.

SPECIFIC GRAVITY.—In accordance with the general plan of this work, I shall endeavor to simplify this subject, and to divest it of unnecessary details, so as to leave no excuse to the student for neglecting to acquaint himself with it, so far as it is necessarily connected with his pursuits. In all chemical works, the subject of specific gravity is treated of as related to solids, liquids, and gases, but inasmuch as we seldom are under the necessity of trying the specific gravity of solids or gases except in experimental research, and as this text-book is designed merely to direct the practitioner of medicine and pharmacy in the every-day pursuits of his office or shop, I shall confine this essay to the specific gravity of liquids, which is the easiest and most useful branch of the general subject.

It has been said at the commencement of this chapter that while extension and gravitation or weight, are each capable of a separate standard of measurement, it is impossible to bring them to a common standard—they are only capable of being *compared* with each other. To this comparison of the quantity of matter with its extension, we direct our attention under the head of specific gravity.

If we take a vial which will hold an ounce of water by weight, we find it will hold about an ounce and a-half of nitric acid, and about three-quarters of an ounce of ether; hence we may say, approximately, that nitric acid is twice as heavy as ether, or that it is half as heavy again as water, while ether is only three-quarters as heavy. We thus compare these two liquids with a common standard, and one which, being universally diffused in a state of tolerable purity, furnishes the most ready means of comparing solid or liquid substances together. The relation which the weight of a substance bears to that of water is, therefore, called its specific gravity. Water being assumed as 1 in the illustration just given, nitric acid would be $1\frac{1}{2}$ or 1.5, and ether $\frac{3}{4}$ or .75. Upon this principle we may ascertain the specific gravity of all liquids by having a bottle, the capacity of which is well and accurately determined, filling it with these various liquids at a certain normal temperature, ascertaining their weight, and by a simple calculation bringing them to this common standard. The specific gravity of substances, when accurately ascertained, constitutes one of the most important items in their history. In pharmacy, it is much employed to indicate the strength and purity of medicines, particularly acids, alcohol, the ethers, and essential oils; and a physician is deficient in one of the most important aids to diagnosis who has not at hand the means of taking the specific gravity of *urine*.

The apparatus for ascertaining the specific gravity of liquids are of two kinds: first, specific gravity bottles; and second, hydrometers, or loaded tubes which mark the density of liquids by the depth to which they sink in them, according to known and purely artificial standards. The most convenient specific gravity bottles are graduated to hold 1,000 grains, or 100 grains of pure water at 60° F. Those made by Dr. W. H. Pile, of Philadelphia, are accurate and

reliable; they are of two kinds, stoppered and unstoppered; the former are most approved: they are accompanied by a little counter-

Fig. 60.

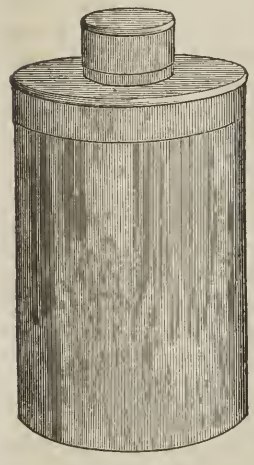
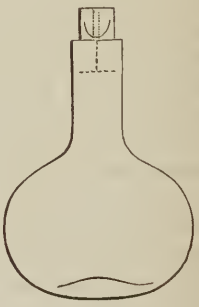


Fig. 61.

Fig. 62.



Stoppered specific gravity bottle, tin box, and counterpoise.

poise to be placed on the opposite scale plate, which exactly balances the empty bottle, so that the weights which balance it when filled and placed on the scale indicate the weight of its contents.

In filling the stoppered thousand grain bottle, it requires to be filled a little above the point in the neck to which the stopper will reach when replaced, so that this shall force out the air and a small portion of the liquid into the capillary tube drilled through it. The whole bottle is then wiped clean and dry, and weighed. The unstoppered thousand grain bottle is marked by the scratch of a file opposite the point in the neck to which the liquid must reach: this line should be intermediate between the upper and lower edge of the concave surface of the liquid in the neck when filled (see Fig. 57). The hundred grain bottles are of the same description, and used in the same way; they are convenient when only very small quantities can be obtained for testing, but are, of course, not quite so accurate. The particular merit of these bottles is, that the weight of a liquid, as obtained by filling them, expresses its specific gravity.

Fig. 63.

Specific gravity bottle, unstoppered.

The equation used is this: as the weight of a certain bulk of water is to the weight of the same bulk of the liquid being tested, so is the specific gravity of water, which is unity, to the specific gravity of the liquid; or, as 1,000 is to the weight of the liquid, so is 1 to the specific gravity of the liquid. Having obtained

the weight of this quantity of a liquid, we have its specific gravity; attention being required to the decimal mark merely. If, for instance, we fill the 1,000 grain bottle with alcohol, and find it weighs 835 grains, we write its specific gravity .835, placing the decimal mark before the figures, because the weight is less than the unit adopted. If we fill it with chloroform, and find the weight to be 1,490 grains, we state the specific gravity at 1.490, placing the decimal after the first figure; or, if we find it to hold 13,500 grains of mercury, we state the specific gravity 13.5, the decimal being varied for obvious reasons, but no calculation being necessary to ascertain their relation to water.

The specific gravity bottle I next proceed to describe does not exhibit the specific gravity of the liquid without a previous calculation, but possesses the advantage of being cheap and extemporaneous, and, if carefully made, is nearly as accurate.

Select a smooth and clean bottle, not too thick or clumsy, with a ground glass stopper; after first filing down the side of the stopper a small groove to subserve the purpose of the capillary orifice in the stopper of the 1,000 grain bottle, adjust it to one or more weights which counterpoise it, and put these aside for that use. Now find, by several trials, the exact weight of water it will hold at the proper temperature, and mark this on the bottle, or on a paper in which it is constantly wrapped; this is used in the same way as the 1,000 or 100 grain bottle, except that it is necessary to make a calculation after each weighing, to ascertain the specific gravity of the liquid. Suppose it to be a f℥ss bottle, and to contain, say 242.5 grains of pure water, and the liquids tested to have weighed 256 grains; now, to ascertain its specific gravity, a sum must be made as above stated: as the weight of a certain bulk of water is to the weight of the same bulk of this liquid so is the specific gravity of water to the specific gravity of this liquid:—

$$242.5 : 256 : : 1 : 1.055, \text{ or thus } \frac{256}{242.5} = 1.055.$$

I have, though rarely, been able to select f℥ss bottles, which, by modifying their size by filing the stopper, would hold exactly 250 grains, or $\frac{1000}{4}$, so that it was only necessary to divide the ascertained weight by 4 to get the specific gravity. This plan of taking the specific gravity is so much more accurate than that by hydrometers, that these extemporaneous or home-made bottles, when well made, and used with good scales, are more to be relied on than the best hydrometers. These rarely mark with precision more than the second decimal, which is reached without difficulty with a bottle, even when the scales do not indicate the fractions of a grain: unstoppered specific gravity bottles are still more readily made.

The greatest practical difficulty in accurately adjusting a specific gravity bottle, and in taking the specific gravity of liquids, has relation to the temperature. The proper temperature for liquids to be

measured by the specific gravity bottle is 60° Fahrenheit's scale, which at certain seasons of the year, in our climate, is readily attainable, but in hot weather the temperature of water will reach 90° or more; the dew-point then rises above 60°, so that if the water be brought to that temperature artificially and put into the bottle, the moisture deposited upon the outside of the bottle while weighing it will sensibly increase its weight. In order to obviate this difficulty, it is more convenient to have tables giving the variations of specific gravity by elevation or depression of temperature. The tables of this description now in use are very unsatisfactory and conflicting, and have led Dr. Pile to attempt an original table, founded upon many hundred trials at all temperatures from 50° to 93°. This he has kindly furnished me for publication. The utility of this table in verifying the accuracy of the specific gravity bottle at any temperature will be apparent.

It may be remarked that as the glass bottle itself expands and contracts, experiment has shown it will contain about .013 grains more for every degree above 60°, and as much less below it. In weighing liquids above or below that temperature, we do not obtain directly the true specific gravity, but the conjoined result of the expansion or contraction of the water and the glass bottle. If the actual specific gravity is sought, it will be necessary to make the proper corrections both for the liquid on trial and for the glass bottle. This has been done in the following table.[1]

Table of Apparent Specific Gravity of Water as observed in a Glass Bottle at different temperatures; also its true Specific Gravity. By W. H. Pile, M. D.

Temp. Fahr.	Sp. Gr. in Glass Bottles.	True Sp. Gr.	Temp. Fahr.	Sp. Gr. in Glass Bottles.	True Sp. Gr.
50°	1000.54	1000.67	72	998.94	998.78
51	1000.50	1000.62	73	998.83	998.66
52	1000.46	1000.56	74	998.72	998.53
53	1000.41	1000.50	75	998.60	998.40
54	1000.36	1000.44	76	998.48	998.27
55	1000.30	1000.37	77	998.35	998.13
56	1000.25	1000.30	78	998.22	997.99
57	1000.20	1000.23	79	998.08	997.84
58	1000.14	1000.16	80	997.94	997.68
59	1000.07	1000.08	81	997.79	997.52
60	1000.00	1000.00	82	997.64	997.36
61	999.92	999.91	83	997.49	997.20
62	999.84	999.82	84	997.35	997.04
63	999.72	999.72	85	997.20	996.87
64	999.68	999.63	86	996.94	996.60
65	999.60	999.53	87	996.78	996.43
66	999.51	999.43	88	996.62	996.26
67	999.42	999.33	89	996.46	996.08
68	999.33	999.23	90	996.29	995.90
69	999.24	999.12	91	996.12	995.72
70	999.14	999.01	92	995.96	995.54
71	999.04	998.90	93	995.79	995.36

[1] For tables showing the variation in specific gravity of alcohol by changes of temperature, see Booth's *Encyclopædia of Chemistry*, Art. Alcoholometry, Tab. III. and IV.

HYDROMETERS.—These are instruments designed to be plunged into liquids to ascertain their comparative density or specific gravity: although not capable of the same accuracy as the specific gravity bottles above described, they have the advantage of great convenience, and answer well for approximate results.

The application of this instrument depends upon the well ascertained law that a body immersed in any liquid sustains a pressure from below upwards equal to the weight of the volume of the liquid displaced by such body, and the use of the hydrometer dates back to the discovery of that principle, a period about three hundred years before the Christian era.

Hydrometers are now named with reference to the class of liquids for which they are designed, and to the scale upon which graduated. The kinds most sold in this country are imported; they are called Baumé's hydrometers or areometers, sometimes saccharometers, when adapted to the measurement of syrups; acidometers, to acids; also elæometers for oils, and urinometers for urine.

Cartier's hydrometer, which is somewhat used in France, is only applicable for light liquids; it is a modification of Baumé's Pése Esprit, and, having some points in the scale which correspond, is generally confounded with it. Without intending to confuse the student with unnecessary details, I shall give in a few words the method of obtaining the standards on the respective scales, and the mode of converting them into specific gravity and the reverse rule, omitting the tables, which will be found in the *Dispensatory* and the chemical works.

Baumé had two instruments, one for liquids heavier than water, and one for liquids lighter than water; the former called *Pése Acide*, or Pése Sirop, and the latter *Pése Esprit.*

The zero for heavy liquids was water, and the point to which the instrument would sink in a solution containing fifteen per cent. of salt was marked 15°. The interval doubled gave 30°, the next 45°, and so on. The zero for lighter liquids, or *pése esprit*, was obtained by immersing the tube in water containing 10 per cent. of salt in solution, and the point to which it would sink in pure water he made 10°; dividing the stem into like intervals, he obtained 20°, 30°, &c., the intermediate degrees by subdivision.

Now it will be at once perceived that the slightest error made in obtaining the first interval by this process becomes increased in every extension, so that with all care and precaution to insure accuracy, scarcely any two instruments could be made to correspond precisely.

This mode of graduating hydrometers has long since been superseded by the equally practicable and more accurate method of obtaining the specific gravity of two known liquids at a certain fixed temperature. These are placed at the extremes of the scale, and the intermediate space is accurately subdivided into the requisite number of degrees.

The liquids ordinarily used for this purpose are, for liquids heavier than water, sulphuric acid and water; for those lighter than water, ether (highly rectified) and water. The specific gravity of these being of course ascertained before each trial by a standard hydrometer, or by the use of the 1000 grain bottle, but authorities are not agreed precisely in fixing their specific gravities, so that even the most accurate manipulators are liable to error from this fact, unless by having a common definite rule accuracy is ascertained. Another difficulty in regard to Baumé's hydrometers as usually imported, is, that they are marked by arbitrary numbers, which have no necessary connection with the specific gravity, and they can only be used with facility when access can be had to the tables published in chemical works, in which the degrees of Baumé, with their corresponding specific gravity numbers are represented.

The following simple formula has been contrived for the purpose of finding the specific gravity of any liquid, the degree of Baumé being known, or the reverse.

For Liquids heavier than Water.

1. To reduce Baumé to sp. gr. Subtract the degree of Baumé from 145, and divide into 145; the quotient is the specific gravity.

2. To reduce specific gravity into Baumé. Divide the specific gravity into 145, and subtract from 145; the remainder is the degree of Baumé.

For Liquids lighter than Water.

1. To reduce Baumé to sp. gr. Add the number of the degree to 130, and divide into 140; the quotient is the sp. gr.

2. To reduce sp. gr. to Baumé. Divide the sp. gr. into 140, and subtract 130 from the quotient; the remainder will be the degree of Baumé. In this manner, the tables at the end of this article were calculated.

The rationale of this formula is more difficult to understand than its application. The modulus or constant number here used, is the proportion which the space of one degree (or the bulk which one degree occupies) bears to the space or bulk of the whole hydrometer below the water line.

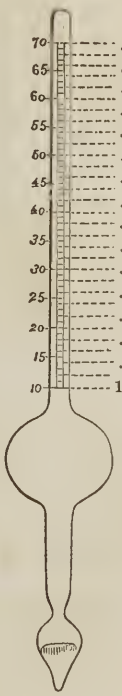
Or, it may be stated to be the proportion, which the weight of water displaced by the hydrometer when floating in water, bears to the weight of water equal in bulk to one degree.

For example, suppose the weight of a hydrometer to be 200 grs., it is floated in water and marks the water line (10° B. in pése esprit, or 0° B. in pése acide); now to sink it one degree in the first case, $\frac{1}{140}$ of its weight must be added, or 1.428 grs.; 140 is therefore the modulus of the scale for light liquids; in the other case, we must withdraw $\frac{1}{145}$ of its weight, or 1.38 grs., to enable the

hydrometer to rise one degree; 145 is therefore the modulus of the pése acide: from this it will appear that the modulus determines the size of the degrees. That here presented was selected (as most consistent with the practice of manufacturing chemists, and according with the tables published in the *United States Dispensatory*) by Henry Pemberton, Practical Chemist, of this city, to whose able article showing the inconsistency of the standards in use, published in the *American Journal of Pharmacy*, vol. xxiv. p. 1, the reader is referred.

The inconvenience of an arbitrary scale, as that of Baumé, has long been felt, and has led to the manufacture of the new style of hydrometer which is here figured; these have the scale of Baumé, with the actual specific gravity corresponding to it written opposite each other on the tube.

Fig. 64.



Hydrometer for liquids lighter than water.

This article, as manufactured by Dr. W. H. Pile, before referred to, is unexceptionable. He makes a large size containing two in a series, one for liquids heavier, and the other for liquids lighter than water, each having an extensive range, and also a small size consisting of two for light, and three for heavy liquids. The advantage of the series of five small instruments is, that the scales having a much less range, are capable of exhibiting more accurately slight differences in sp. gr. than in the other case. In the drawing, one of the large instruments is exhibited, considerably reduced in size; and as the scales with the two sets of figures could not be represented in a single view of the tube, the printer has appended on either side the figures representing the degree of Baumé, and a part of those representing the sp. gr.

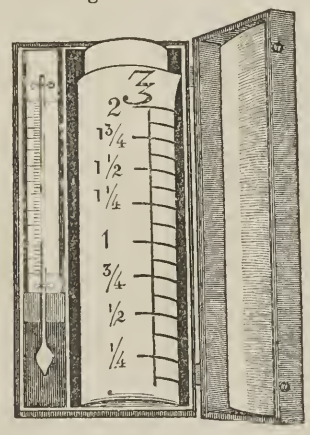
Besides these hydrometers, Dr. Pile makes others for special applications, and graduated to suit particular objects; one of the most curious of these is the Lactometer, for the measurement of milk, which, as we get it in large cities, is liable to adulteration, and especially to dilution with water. Pure milk has the average sp. gr. 1.032, skim milk 1.037.

Of all the practical applications of the art of determining specific gravity, none is more important and interesting than its use in ascertaining the qualities of urine. The urinometer is the most delicate of this class of instruments; it is a hydrometer tube with a very small range only, going from 1.000 to 1.060 specific gravity; within these limits, all the variations of urine from its normal standard may be ascertained. So delicate are these determinations, that the variations of temperature, important in all cases, here require special attention; and accordingly many of the urinometers are accom-

panied by a little thermometer to be plunged into the urine simultaneously with the tube; sometimes the thermometer is inclosed in the tube, and at others, as in the apparatus, Fig. 65, accompanies it in a neat box containing also a graduated glass for containing the urine.

The thousand grain bottle, with proper observance of the thermometer, is, however, in this as in all other cases, the surest test of specific gravity.

Fig. 65.



Urinometer box containing thermometer, graduated glass vessel, &c.

Fig. 66.

Urinometer in use.

Fig. 66 represents the urinometer removed from the box and floated in the vessel accompanying it (in which the graduation marks are not seen). The graduation of the urinometer is such, that each degree represents 1-1000, thus giving the actual specific gravity by simply adding the number of degrees on the scale corresponding with the surface of the liquid, to 1000. Thus, supposing the number cut by the surface of the fluid to be 30, as shown in the figure, the specific gravity would then be 1.030. The average density of healthy urine is about from 10° to 25° of this scale, at 60° F., or sp. gr. 1.010 to 1.025. That of diabetic urine ranges from 30° to 60°, or sp. gr. 1.030 to 1.060.

Figs. 67 and 68 represent a hydrometer with the glass jar adapted to containing the liquid to be tested; unless this vessel has considerable depth, the hydrometer is liable to touch the bottom, which would prevent its measuring. These vessels are sold by the principal dealers in chemical apparatus.

Sometimes hydrometers for liquids heavier than water are manufactured of small size, for the special purpose of measuring the strength of syrups. Fig. 69 represents one of these, which is gra-

duated to Baumé's scale. It floats at 30° in a solution of the sp. gr. 1.26, the density of saturated simple syrup when boiling.

Fig. 67.

Hydrometer, with vessel for floating it.

Fig. 68.

Fig. 69.

Saccharometer.

BAUME'S DEGREES, WITH THEIR CORRESPONDING SPECIFIC GRAVITY.

Table for Liquids lighter than Water. Temp. 60° Fahr.

Degrees of Hydrom.	Specific Gravity.	Degrees of Hydrom.	Specific Gravity.	Degrees of Hydrom.	Specific Gravity.
10	1.000	31	0.870	51	0.773
11	0.993	32	0.864	52	0.769
12	0.986	33	0.859	53	0.765
13	0.979	34	0.854	54	0.761
14	0.972	35	0.848	55	0.757
15	0.966	36	0.843	56	0.753
16	0.959	37	0.838	57	0.749
17	0.952	38	0.833	58	0.745
18	0.946	39	0.828	59	0.741
19	0.940	40	0.824	60	0.737
20	0.933	41	0.819	61	0.733
21	0.927	42	0.813	62	0.729
22	0.921	43	0.809	63	0.725
23	0.915	44	0.805	64	0.722
24	0.909	45	0.800	65	0.718
25	0.903	46	0.795	66	0.714
26	0.898	47	0.791	67	0.711
27	0.892	48	0.787	68	0.707
28	0.886	49	0.782	69	0.704
29	0.881	50	0.778	70	0.700
30	0.875				

Table for Liquids heavier than Water. Temp. 60° Fahr.[1]

Degrees of Hydrom.	Specific Gravity.	Degrees of Hydrom.	Specific Gravity.	Degrees of Hydrom.	Specific Gravity.
1	1.007	26	1.218	51	1.543
2	1.014	27	1.229	52	1.559
3	1.021	28	1.239	53	1.576
4	1.028	29	1.250	54	1.593
5	1.036	30	1.261	55	1.611
6	1.043	31	1.272	56	1.629
7	1.051	32	1.283	57	1.648
8	1.058	33	1.295	58	1.667
9	1.066	34	1.306	59	1.686
10	1.074	35	1.318	60	1.706
11	1.082	36	1.330	61	1.726
12	1.090	37	1.343	62	1.747
13	1.098	38	1.355	63	1.768
14	1.107	39	1.368	64	1.790
15	1.115	40	1.381	65	1.813
16	1.124	41	1.394	66	1.835
17	1.133	42	1.408	67	1.859
18	1.142	43	1.422	68	1.883
19	1.151	44	1.436	69	1.908
20	1.160	45	1.450	70	1.933
21	1.169	46	1.465	71	1.959
22	1.179	47	1.480	72	1.986
23	1.188	48	1.495	73	2.014
24	1.198	49	1.510	74	2.042
25	1.208	50	1.526		

CHAPTER III.

ON THE PHARMACOPŒIA.

THE want of a national standard for the preparation of medicine had been felt for some time by practitioners of medicine and pharmacy, when, in 1818, a practicable plan for originating such a work was proposed at the suggestion of Dr. Lyman Spalding, by the New York State Medical Society. This was so generally acceptable to physicians, that in accordance with it, on the first day of the year 1820, a convention of medical delegates met in the city of Washington, over which Dr. Samuel L. Mitchell, of New York, presided, and Dr. Thomas T. Hewson, of Philadelphia, acted as secretary, in which the essays prepared by the district conventions previously held in the Eastern and Middle States were duly considered, and the first edition of the *Pharmacopœia of the United States* was adopted, its publication being intrusted to a committee, who issued

[1] These tables accompany Dr. Pile's hydrometers on the label.

it before the close of the same year. This work, from the respectable authority which issued it, and from its general adaptation to the wants of physicians and apothecaries, was calculated to supersede the various and conflicting standards previously in use, although its general adoption was not rapidly brought about.

With a wise forethought to correct the imperfections of their work, and to adapt it to the future progress of pharmaceutical knowledge, the convention of 1820 provided for the choice of delegates to meet in convention after the lapse of ten years for revising the *Pharmacopœia*. The convention of 1830 elected Dr. Lewis Condict, of New Jersey, its president, and, after discussing the proposals submitted to them, referred the work of revision to a committee, of which the late Dr. Thomas T. Hewson was chairman, which met in Philadelphia, and by general correspondence and comparison of views with those residing in other localities, were enabled to add much to the value of the work. No small share of the labor of this committee was borne by Drs. Wood and Bache, who, by the publication, in 1831, of the *U. S. Dispensatory*, a work of great utility, in which the pharmacopœia was fully explained, commented on, and compared with similar foreign works, aided greatly in giving it the character it has ever since enjoyed, of a national standard for the preparation of medicine. The decennial revisions, in 1840 and 1850, were accomplished under similar auspices. The conventions which assembled at the capital in those years were presided over by Drs. Lewis Condict and George B. Wood, respectively, and the committees charged with carrying out the views of the body met in Philadelphia.

In the three decennial revisions, the Colleges of Pharmacy of Philadelphia and New York have borne an active, though not a conspicuous part; only in the last convention were they officially represented. There can be little doubt that the excellence of most of the formulæ of the *Pharmacopœia* is due in great measure to the valuable practical suggestions of the committee of apothecaries appointed by those useful organizations. Previous to the conventions of 1840 and 1850, large and efficient committees of practical pharmaceutists subjected all the proposed changes to the most rigid experimental scrutiny before submitting them to the convention, and through Professor Procter, their representative in the committee of revision and publication, their influence was made available in the final arrangement and completion of the work.

Upon the object and scope of the *Pharmacopœia* little need be said; its influence in producing uniformity in nomenclature, and in the strength and efficiency of medicinal preparations, has been widely and increasingly felt, although it is to be regretted that, owing to the comparatively high price of the work and the smallness of the edition issued, it is far less in the hands of physicians and apothecaries than its importance demands. In this connection it may be proper to speak of the comparative utility of the *Pharmacopœia* and

Dispensatory, especially as so many students of medicine and pharmacy confound the two works with each other. Every physician who practices pharmacy, as most country practitioners do, and every apothecary, should possess a copy of each of these works. The *Pharmacopœia* for use as a guide book in making preparations, and the *Dispensatory* for reference as an encyclopêdia of materia medica, therapeutics, and pharmacy.

While the *Dispensatory* is justly regarded as indispensable, and has certainly contributed more than any other work to the general diffusion of pharmaceutical knowledge, those very qualities which give it its true value unfit it to substitute the *Pharmacopœia* as a recipe-book. The conciseness and brevity of the latter work, the clear and conspicuous type, and the absence of unnecessary detail, adapt it especially to the purpose named, that of indicating the ingredients, the proportions and the mode of preparation of the officinal preparations. The liability to mistakes is greatly lessened by the clearness and accuracy of a recipe, which should always be open before the operator, and should be continually consulted in the course of his manipulations. It will be in place to explain, in this connection, the use of the term *officinal* in this work. While by some, this word is meant to apply to all permanent preparations; by others, it has an application to those only which are generally known and recognized by physicians and pharmaceutists in the particular locality referred to and spoken of in the *Dispensatory*, or in foreign *Pharmacopœias*. I have preferred to follow those who restrict the use of the term to those drugs and preparations mentioned in the *U. S. Pharmacopœia;* and I have carefully distinguished these throughout the work, from such as are either new remedies, since the *Pharmacopœia* was last revised, or were omitted from the work from any other cause. It appears to me that this is the only limit of the term *officinal* which renders it definite and precise, and with this meaning it certainly is most useful in a work like the present.

To lay before the student the whole plan of the *Pharmacopœia*, and especially the principles which have regulated its nomenclature, the following extract from the preface to the last edition is inserted here:—

"The contents of the work are arranged in the two divisions of Materia Medica and Preparations; the former enumerating and defining medicines as they are derived from nature, or furnished by the manufacturer, the latter containing formulæ, or rules, by which they are prepared for use. The propriety of such a division is too obvious to require comment. It is the basis of arrangement in most Pharmacopœias.

"The subdivision of the Materia Medica into a primary and secondary list, is a peculiarity of our national standard. It has the advantage of permitting a discrimination between medicines of acknowledged value, and others of less estimation, which, however,

may still have claims to notice. Many substances, at one time much employed, are passing out of use, without having been wholly discarded; while others are brought to the notice of the profession, and are undergoing trial, without having been generally adopted. It is very convenient to have a section into which such doubtful medicines may be thrown, to await the decision of experience for or against them. Without being entirely lost sight of, they are thus kept in a subordinate position, which may prevent misapprehension as to their real or estimated value. It is necessary to be understood, that the primary list contains not only all substances of recognized efficacy, but others of little or no apparent importance as medicines, which, however, are employed in some one or more of the 'preparations,' and are therefore essential. Without this explanation, the propriety of introducing such bodies as *Animal Charcoal*, *Bone*, *Cochineal*, *Marble*, and *Red Saunders*, into the primary list might be disputed.

"Both in the Materia Medica and the Preparations, the alphabetical arrangement has been adopted. In a work intended not for regular perusal but for occasional reference, it has the great merit of convenience. It has, moreover, the advantage that, making no claim to scientific classification, it is not liable to the charge of failure, so often and so justly urged against more ambitious systems. In relation to the preparations, it will be noticed that they are arranged in groups, the titles of which are placed in the alphabetical order. The pharmaceutical processes naturally throw themselves into such groups, which could not be divided and otherwise distributed without great inconvenience. Their affinity consists either in closely analogous modes of treatment, as in the decoctions, extracts, infusions, &c.; in having some common base, as in the preparations of the different metals; or in a certain resemblance of character, as in the acids and ethers. It happens, fortunately, that the several individuals in these groups are so named, that they fall into the general alphabetical order, with but very few and insignificant exceptions. It is proper to observe that the order of succession is based on the Latin names throughout the work.

"The Pharmacopœia was originally published both in the Latin and English languages. This was, at the time, an innovation upon general usage; as codes of this kind had been almost always issued by the dignified bodies from which they emanated, exclusively in the Latin, which was considered as the language of science. In the revision of 1840, the Latin was dropped; as it did not offer advantages equivalent to the trouble of adapting a dead language to facts and processes for which it had no terms, and to the double cost of the work which it occasioned. As stated in the Historical Introduction, the recent National Convention was unanimous in their decision in favor of the English exclusively. The Latin names, however, of the medicines and preparations, have been retained, as they are still generally, and often very conveniently, used

in prescription; and it is desirable that medicines should have designations by which they may be recognized in all civilized countries.

"The system of nomenclature of the Pharmacopœia of the United States is one of its chief merits. Adopted at a period when it was without example in other works of the kind, and improved with each successive revision, it now prevails to a considerable extent in all the Pharmaceutical codes recognized where our vernacular tongue is spoken. Its aim is to be simple, expressive, distinctive, and convenient. In relation to medicines of vegetable origin, it adopts for those which have been long and well known, the names by which they have at all times been recognized, and which have withstood, and will no doubt continue to withstand all the mutations of science. In this category are such titles as *Ammoniacum*, *Camphora*, *Galla*, *Opium*, *Senna*, *&c.* For medicines of more recent origin, which had received no distinctive officinal designation, it takes either the generic or specific title of the plant or animal from which the medicine is derived. Thus, we have the generic names *Anthemis* from Anthemis nobilis, *Chimaphila* from Chimaphila umbellata, *Eupatorium* from Eupatorium perfoliatum, *Gillenia* from Gillenia trifoliata, *Lobelia* from Lobelia inflata, &c.; and the specific names, *Senega* from Polygala Senega, *Serpentaria* from Aristolochia Serpentaria, *Taraxacum* from Leontodon Taraxacum, &c. A very large proportion of the names have been formed in this way; and, as the generic or specific title of the plant had its origin, in many instances, in the vernacular name, the original designation is thus fixed and perpetuated. When it happens that two different medicines are obtained from different species of the same genus, it becomes necessary to adopt either for both, the whole botanical title of the plants, or for one of them the generic or specific name, and for the other the whole name. Thus, we have *Cassia Fistula* and *Cassia Marilandica*, *Quercus alba* and *Quercus tinctoria*, as titles both for the plants and their medicinal products; and, in the case of the different species of Gentiana, the generic name *Gentiana* for the product of G. lutea, and the whole name, *Gentiana Catesbœi*, for that of the species so designated in scientific arrangements. When different parts of the same plant are recognized as distinct medicines, they are designated by attaching to the generic or specific title, the name of the part employed. Thus are formed the names *Colchici Radix* and *Colchici Semen* from Colchicum autumnale, and *Stramonii Folia*, *Stramonii Radix*, and *Stramonii Semen* from Datura Stramonium. When these names become established in pharmacy, it does not follow that they are to be changed with the changing scientific titles. On the contrary, it is generally best to retain them, unless, by doing so, injurious confusion may be occasioned. Thus we have *Prunus Virginiana* as the name of wild-cherry bark, though the plant from which it is derived is now usually designated by botanists as Cerasus serotina. It will be noticed that the Latin names are generally used in the

singular number, even though the idea of plurality may be essentially connected with the medicine. Thus, *Cantharis*, *Caryophyllus*, *Ficus*, *Galla*, *Limon*, &c., are used instead of the plural of these terms respectively; and, in reference to the names derived from the part of the plant employed, the same plan is mostly followed, as in the case of *Stramonii Semen*, *Colchici Semen*, &c. In this the example of the Roman medical writers, particularly of Celsus, has been followed. The leaves, however, are expressed in the plural, as *Stramonii Folia*, &c., which is also in accordance with the practice of the same classical author.

"In the use of English names, it is not deemed necessary that they should be literal translations of the Latin terms; but that title is preferred which custom and the genius of the language seem to sanction. Thus, the English name corresponding to *Linum* is not *flax*, but *Flaxseed;* and, on the same principle, *Fœniculum* is called *Fennel-seed; Ulmus*, *Slippery Elm Bark; Glycyrrhiza*, *Liquorice Root*, &c. Nor are the English names always in the same number as the Latin. We may correctly say, *Caryophyllus*, *Galla*, *Prunum*, and *Rosa;* but the genius of our language requires that we should translate these terms *Cloves*, *Galls*, *Prunes*, and *Roses*.

"The plan of nomenclature in relation to medicines of mineral origin is to give the proper scientific name, when convenience, or some higher principle does not call for a deviation from that rule. Hence, the names of most mineral medicines are in strict accordance with existing scientific usage. But, in some instances, short and old established names are preferred to the scientific, especially when these happen to be somewhat unwieldy. Thus, *Alumen*, *Calamina*, and *Creta* have been preferred to the chemical names *Aluminæ et Potassæ Sulphas*, *Zinci Carbonas Impurus*, and *Calcis Carbonas Mollis*. In other instances, the chemical designation is more or less unsettled, or the composition of the substance has not been decisively determined. In such cases, either an old name is retained, as *Acidum Muriaticum* instead of either *Acidum Hydrochloricum* or *Acidum Chlorohydricum;* or some name is preferred generally expressive of the composition without aiming at chemical accuracy, as *Calx Chlorinata*, taken from the London Pharmacopœia, and *Ferrum Ammoniatum*. In other cases, it is considered safest to designate very active medicines, which, if their strict chemical titles were used, might be dangerously confounded, by names which, though upon the chemical basis, have some epithet attached expressive of their distinctive character, as *mild chloride of mercury* and *corrosive chloride of mercury*, instead of *protochloride of mercury* and *bichloride of mercury*. Sometimes, for convenience sake, when no risk of confusion can possibly arise, names are adopted sufficiently expressive of the nature of the substance, though not precisely so; as *sulphate of iron* instead of *sulphate of protoxide of iron*, *hydrated oxide of iron* instead of *hydrated sesquioxide of iron*, &c. If any part of the nomenclature of mineral bodies should seem at first sight somewhat incongruous,

it will be found to have been adopted in accordance with some one of the principles here stated, or in some other way to have the advantage of convenience or utility. Not a single name has been given or retained without careful consideration.

"When the officinal names of particular medicines may be supposed not to have yet become universally known, and the old names are still extensively used, the latter are given as synonymes in a subordinate type and position; and those officinal titles which have been superseded by others adopted at the present revision, are inserted beneath, with a reference to the Pharmacopœia of 1840.

"In the MATERIA MEDICA, the Latin and English officinal names are first given, and immediately afterwards, in a distinct paragraph, a definition fixing the precise character of the substance referred to; designating, for example, the plant or animal from which it is derived, and the part employed, if it be of vegetable or animal origin; and defining it by the precise chemical name, if mineral. When the officinal name sufficiently explains itself, as in the case of *Magnesiæ Sulphas*, *Potassæ Nitras*, and *Sodæ Carbonas*, no definition is given. To most of the mineral substances brief notes are appended, containing, in short and precise terms, an enumeration of those properties by which their identity can be determined, and of the tests by which their freedom from adulterations or accidental impurities may be ascertained. The same plan has been extended to many of the chemicals among the preparations. In relation to most of the medicines of organic origin, it has not been thought advisable to offer similar tests of genuineness and purity; as the means of judging are much less precise, and could not be readily expressed in a few brief rules.

"Among the PREPARATIONS will be noticed several substances which are now seldom made by the apothecary, being obtained almost exclusively from the manufacturing chemist. They have been retained in their present position, because, in our widely-extended country, circumstances may not unfrequently render it desirable that the apothecary should be able to prepare them in the absence of a due supply; and, though the processes might not have been introduced if now claiming admission for the first time, yet, having a place already in the Pharmacopœia, it has not been deemed advisable to omit them, and transfer their products to the Materia Medica. The circumstance that these substances are placed among the preparations does not preclude their purchase from the manufacturer when they can be procured of the proper quality.

"Another feature of the second part of the Pharmacopœia which requires a brief notice, is the introduction of double processes for many of the preparations, the apothecary having the choice between them. This might seem objectionable, as leading possibly to difference in the preparations; but care has been taken to guard against this disadvantage, the processes being such as, if properly executed, must yield preparations either identical in character, or sufficiently

alike for all practical purposes. It is only in cases to which the mode of filtration denominated *displacement* is adapted, that this duplication has been introduced; as in the preparation of some of the Vinegars, Extracts, Infusions, and Tinctures. Displacement affords so many advantages, both in an economical point of view, and in the character of the resulting preparations, and has, besides, been practically adopted to such an extent, that it could not, with propriety, be excluded from a Pharmacopœia which claims to be on a level with the improvements of the times. Yet the process requires considerable skill and experience for its proper management, and, if conducted without due regard to the requisite cautions, will necessarily lead to imperfect and unequal results. Thus, if the substance to be acted upon be not in a suitable state of comminution, or be not sufficiently compacted in the instrument, the liquid will be apt to pass through it unequally and in distinct channels, so as not to come into proper contact with all parts of it, and therefore not completely to exhaust its soluble principles; while, on the other hand, if it be too fine and too close, the percolation may be prevented, or so much retarded as to deprive the process of its advantages. Now, to many of those who will adopt the Pharmacopœia as their guide in the preparation of medicines, the method of displacement is probably not yet familiar. If, therefore, it were exclusively adopted in the officinal processes to which it is applicable, there would be danger that the resulting preparation would, in some instances, be very different from the one contemplated. By leaving to the operator the choice between the former simple methods and the new, this danger is in a great measure avoided; and it is strongly recommended to those who have not made themselves practically familiar with the various sources of error in the method of displacement, to postpone its application, whenever an alternative is given in this work, until they shall have acquired the requisite skill.

"Finally, to one familiar with the British Pharmacopœias, it will be obvious that, in the preparation of our own, many of the processes have been taken from them with little alteration. This has been done advisedly. It is of the highest importance that medicines having the same names should have the same composition; and, as British works on medicine are much read in this country, it would lead to never-ending confusion if the substances they refer to by name should differ materially from those known by similar names with us. It has, therefore, been a general aim to bring our pharmacy into as near a correspondence as possible with that of Great Britain; but in all cases in which greater purity or efficiency in the medicine, or greater convenience and economy in the process, or any peculiarity in the relation of the preparation to our own circumstances and wants, called for deviation from the British standards, modified or wholly original processes have been adopted."

PART II.

GALENICAL PHARMACY.

CHAPTER I.

ON THE COLLECTION AND DESICCATION OF PLANTS.

But little space need be occupied by this subject, although the proper time for collecting, and the right mode of drying and preserving the vegetable products used in medicine, are occasionally of importance to the pharmaceutist and physician.

Roots should be gathered when richest in the peculiar juices of the plant: in annuals, this generally occurs immediately before the time of flowering; in biennials, or perennials, late in the fall, or very early in the spring, before the plant has commenced to grow.

Fleshy, or succulent roots, require to be cut previous to drying, so as to expose a large surface to the air; the mode in which they are sliced, whether longitudinally or transversely, is of some interest in judging of certain foreign drugs, but is little regarded by herbalists in preparing the indigenous roots for market.

In all cases, it is important that the root, or other part of the plant, should be thoroughly dried. In the case of taraxacum, parsley, &c., it is necessary to apply artificial heat, in order to destroy the eggs deposited by insects, which, through neglect of this precaution, may occasion the speedy deterioration of the root by worms.

The smaller and more fibrous roots, and especially those containing essential oils, should be less thoroughly dried, and, as soon as their condition will admit of it, should be carefully put away into tight drawers, bottles, or tin cans.

Barks are best gathered in the spring or autumn; they should be generally deprived of their epidermis, and dried by a moderate heat, their porous texture and comparative tenuity facilitating, very much, the process. Wild-cherry bark is often deficient in quality, from being gathered at the wrong season, and from the wrong part of the plant. The bark should be taken from the root in the

eighth month—August. When of fine quality, it has a strong and characteristic odor.

Leaves, *herbs*, and *flowers*, require considerable care in their collection and drying, to obtain them in perfection.

Leaves should be gathered when fully developed, and before they have commenced to wither and fall; those of biennial plants during the second season. Herbs, in which term are included whole plants, and such parts of the same plant as are collected and sold together, should be gathered when in flower. Plants which have thick and branching stems, should be deprived of these before being put up for sale. Flowers may be gathered as soon as perfectly developed. A clear, dry morning, after the dew is dissipated, is to be preferred in either of these cases. They are dried in the shade, without artificial heat; the floor of a garret, through which is a draft of dry air, is well adapted to this purpose. *Seeds*, which are the least perishable of vegetable productions, should be perfectly ripe when collected; they require very little drying.

The "United Brethren," called Shakers, at their settlement in New Lebanon, New York, have very extensive and convenient arrangements for drying these vegetable materials. A series of shelves of wire network is disposed in layers at suitable distances from each other, in large and well ventilated apartments; upon these the herb is carefully placed, and allowed to remain subject to the desiccating action of the air, circulating below as well as above it, until completely dried. It is then removed to a capacious bin, of which many are arranged along the sides of the room, and preserved until nearly ready for pressing—an operation which, in common with some other cultivators, the Shakers practice upon every article of the vegetable Materia Medica which they cultivate or vend.

This, while it has its advantages, is liable to some objections. It has been said that, owing to the moist condition to which the plants require to be brought before pressing, the packages are liable to become mouldy in the middle. I have never met with an instance of this kind, however, and have no doubt but that the excellent reputation the Shaker herbs have attained is well founded. Another objection to these herbs, of a very different character, is, that they are not adapted to the examination of the physical characteristics of the plants; a pharmaceutical student, placed in an establishment where they are sold to the exclusion of the dried plants in bulk, enjoys no opportunity of familiarizing himself with this extensive class of medicines, at least so far as their physical and botanical characters go: to this may be added the difficulty in noticing any deficiency in quality, any intentional or accidental adulteration, or error in labelling the articles. The business of collecting and drying medicinal plants is still pursued in the vicinity of our large cities by herbalists, who realize a living from it. These have it in their power, by taking students of Medicine and Pharmacy with them on their excursions into the woods and fields, to

extend a knowledge of medical plants among a class to whom it cannot fail to be in the highest degree useful and interesting.

There are few pursuits better calculated to relieve the monotony of a student's life, or to impart healthfulness and variety to the sedentary occupations of the apothecary, than a systematic out-door pursuit of the useful and ennobling science of botany; and the apothecary or physician, by giving it a practical application to his business, may, in many instances, combine pecuniary with mental and physical advantage. For the benefit of students residing or sojourning in Philadelphia, a catalogue is inserted in the appendix, containing the name, time of flowering, and precise habitat of all the wild plants growing within a few miles of the city.

The *cultivation* of medicinal plants in this country is mainly confined to the beautiful valley in Columbia County, N. Y., already referred to, where it is pursued by the Shakers, and by Tilden. This district seems especially adapted to the purpose, and, like the celebrated "Physic Gardens" of Mitcham, in England, furnishes a great variety of medicinal plants, and in large quantity.

For an interesting account of the "Physic Gardens of Mitcham," see *American Journal of Pharmacy*, vol. xxiii. p. 25; and for some details in regard to the N. Lebanon Gardens, see the same *Journal*, vol. xxiii. p. 386.

The question of how far the cultivation of plants diminishes or modifies their medicinal activity, is at present an undecided point; it is, however, universally admitted, that climate and soil exercise an important influence on their virtues.

The opinion seems to be also generally adopted that most plants are more fully developed in the country in which they are indigenous, than in any to which they may be transplanted; but that there are very many exceptions to this rule, if it be a general rule, must be quite apparent.

In the present state of our knowledge upon this subject, we cannot go further than to say that of plants indigenous to the temperate zones, some flourish equally on either continent, while others, owing to some want of congeniality in climate and soil, will only develop their peculiar properties fully in the localities to which they are indigenous.

At the gardens in New Lebanon, the narcotic herbs indigenous to Europe are cultivated with apparent success, and the extracts prepared from them are among the best manufactured in the world.

On the Powdering of Drugs and on Powders.

According to the plan adopted in this work, the first class of preparations to be treated of is that of powders.

The preparation of the material for powdering, consists of gar-

bling or sorting, and drying it. The former process pertains to the druggist, and the latter to the drug grinder.

The object of garbling is to separate any impurities or adulterations, and any decayed or deteriorated portions of the drug. In nearly all foreign drugs imported into this country, especially those of vegetable origin, there are great variations in quality, and even in the same lot there are frequently very good and quite worthless specimens. As an illustration of this, Chinese rhubarb may be instanced: the roots, when broken, are found to vary exceedingly in quality, even in the same case; some are heavy and compact in their structure, breaking with a very uneven fracture, presenting a red and yellow marbled appearance, giving a gritty impression between the teeth, and the peculiar bitter, astringent taste, characteristic of the drug, while other roots are light, fibrous, and spongy in their internal structure, and almost destitute of the peculiar color and taste; some are worm eaten, others, which have the requisite specific gravity and the external appearances indicating a good article, are dark colored within and quite inferior. The custom of some, when about to send a lot of rhubarb to the drug-mill to be ground, is, either to send it in the mixed condition above described, in which it is imported, or to select from it the choicest pieces for separate sale, and for a sample, and send all the inferior roots, and perhaps only a small portion of the best to be powdered.

A druggist who exhibits the best roots, selected in this way, as a sample of the kind powdered, cannot be acquitted of a gross and unpardonable fraud upon his customers. If he sends the whole case, containing good, bad, and indifferent, as originally imported, he may at least claim that, though he has not improved the quality of the medicine in reducing it to powder, he has not rendered it worse. But, with a view to furnishing a good and reliable medicinal agent, without regard to price, he would garble his rhubarb, by cracking each root, rejecting the decayed and otherwise defective pieces, and preserving in the form of powder only that which is of value. This is done by some druggists and pharmaceutists, who are more careful of their reputation for the quality of their drugs than for cheapness.

In a subsequent part of this work, I shall have occasion to refer to the variable quality of powdered gum Arabic; this is mainly owing to the neglect of garbling, or to the use of the rejected portion after garbling, for reduction to powder. It is desirable to have whole gum Arabic free from dusty and gritty particles for sale. When in this condition, it is more elegant and convenient for chewing, and for solution in making the nutritive mucilaginous drinks, so much used by invalids, and it commands a better price. It is therefore customary to sift gum, as at first taken from the case, and the inferior kinds of powder are made from these siftings.

The best powdered gum Arabic is fully worth a handsome advance

on the price of the whole gum, as any one may see, who will estimate the cost of powdering, waste, delays, &c.

The chief reason for the deficiency in the quality of medicinal powders, is found in the reluctance manifested by the public, and retail apothecaries and physicians, to pay a liberal price for them. It will be found, on examination, that powders are not unfrequently sold at a less price than the whole drug, especially when the article is costly, and of variable quality in commerce. This is true, especially of rhubarb, jalap, gum Arabic, and the spices, which, as a general thing, cannot be recommended in powder with the same confidence as in the unpowdered condition, or in the form of one of the Galenical preparations, prepared from the whole or contused drug.

In garbling digitalis, hyoscyamus, and some other leaves, whether for powdering, or for use in making tinctures, as before stated, care should be taken to remove the midribs and petioles, which are comparatively inactive.

Drying.—When a drug is sent to be ground in its ordinary condition, it generally requires drying, previously to being submitted to the action of the mill.

Moist and tenacious substances, such as the gum resins, opium, aloes, squill, and jalap, rhubarb, colocynth, and all fresh roots and herbs, require this treatment to a certain extent, and the drug-mills are supplied with apartments, or steam baths, adapted to it. These are heated, by steam-pipes, to a temperature of about 120° F., and the drug is allowed to remain in them as long as is deemed necessary to deprive it entirely of water.

Some drugs are injured by this process; the volatile ingredient, so often the active principle, suffers great loss, and the resulting powder is comparatively inefficient. Myrrh and assafœtida furnish good illustrations of this.

On the other hand, substances possessed of no active volatile ingredient, but containing a large amount of water, as, for instance, opium, are enhanced in value by drying and powdering. Some specimens of opium diminish in drying and powdering, to the extent of 20 per cent., which, if the process is properly conducted, increases the efficiency and value of the drug in that proportion. Experiments under my own supervision show about an average loss of 9 per cent., in reducing tolerably hard opium to the pulverulent condition. It is on this account, and from the fact that the powder, when unadulterated, is more nearly uniform in its composition than the drug in mass, that the U. S. Pharmacopœia directs the use of powdered opium in making all the Galenical preparations of that drug.

Elecampane root is said to lose seven-eighths of its weight in drying; stramonium leaves, nine-tenths; hyoscyamus and belladonna leaves, nearly as much. If these plants lose nothing but moisture in the process, and retain all their active medicinal properties un-

impaired, it is obvious that they are seven or eight times stronger when in powder, or in a dry condition, than when recent.

A difficulty, liable to occur in powdering drugs at the mills, is due to the accidental admixture of foreign substances with them. The extensive grinding surface employed becomes so completely covered with the fine powder, that it is cleaned with great difficulty; so that the next substance introduced becomes contaminated with it, sometimes to its great disadvantage. I have repeatedly observed this in the cases of certain articles of delicate flavor, as orris root and vanilla.

The plan of *dusting* powders, which insures their extreme fineness, and the separation of any earthy impurity, has greatly gained in favor of recent time. The apparatus now used is not figured in any of the books, as far as I have observed; it is constructed so that the powdered drug, when it has passed between the grinding surfaces, is thrown by a draught, artificially created below, to a height of about five feet, and is then allowed to settle upon the adjacent parts, from which, after it has collected in sufficient quantity, it is removed.

It will be appropriate, in this place, to give some observations upon powdering, as practised, on a small scale, in the shop and laboratory. This is accomplished by means of mortars, suited to the different processes of contusion and trituration, and by mills.

Mortars for contusion are usually made of iron, brass, or bell-metal, of the shape shown in Fig. 70. Contusion is employed for

Fig. 70.

Mortar and pestle for contusion.

powdering and bruising ligneous substances generally, being adapted to breaking apart their fibres, and, by the violent attrition of the

coarser particles with each other, reducing the whole to a more or less fine powder.

Care must be taken to avoid treating any corrosive substance in the iron mortar, thus allowing it to become rusty; or, if this should occur, it should be carefully washed out with diluted muriatic acid, and scoured with clean sand, to fit it for use. Any adhering material should be cleaned away immediately after the mortar is out of use, as it is then more easily removed than if allowed to remain and harden. The mortar is then always ready for use.

In powdering substances by contusion, a small quantity should be introduced into the mortar at one time; if the mortar is small, sufficient to cover the bottom for about the depth of an inch; the flattened extremity of the pestle is then to be brought into direct and violent contact with it, each successive stroke being aimed at the same spot in the centre of the circle formed by the sides and bottom of the mortar. When a part of the contents under treatment assumes the condition of a fine powder, which is exhibited by the air becoming charged with the dust, it is well to sift it, and thus separate the fine from the coarser particles, these last being returned to the mortar, and further contused until a second sifting becomes necessary, and so on till it is finished. A small portion of the drug is usually left in powdering, which it seems impossible to reduce sufficiently; this is part of the ligneous portion, which is frequently inert; the drug-grinder who obtains a considerable quantity of this *gruff*, as it is called, usually retains it for admixture with the next lot of the same drug he is called upon to grind, in this way reducing somewhat the loss upon it: he is usually allowed a small percentage for this necessary deficiency in the powdered product.

The operation of sifting may be varied according to the degree of fineness required in the powder. To procure the finest impalpable powder, the sieve should be gently agitated, the powder being laid lightly upon it, and the operation being suspended as soon as it has ceased to pass through readily; the plan of rubbing the powder over the sieve with the hand, thus using more or less pressure to force it through the meshes, may be pursued when the fineness of the powder is not so much desired as the rapidity of the process.

The mortar and pestle adapted for trituration are shown in Figs. 71 and 72. Such a mortar requires to be more carefully handled than one for contusion. It is adapted to the reduction of saline substances and chemicals generally to powder, by the friction of their particles with each other, between the hard and rough surfaces of the mortar and pestle. The ware being brittle, should not be subjected to blows with the pestle; it should be carefully wiped out and laid away, after using, so as to be dry and clean whenever needed.

The mode of manipulating with the wedgewood mortar and pes-

tle, after placing in it the material to be ground to powder, is to grasp the pestle firmly with the right hand, holding the mortar

Fig. 71. Fig. 72.

Wedgewood mortar and pestle.

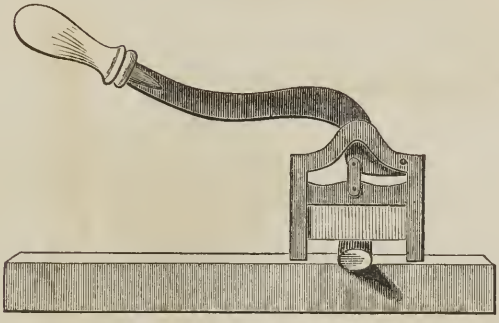
with the left if necessary, and gradually to traverse the mortar with the pestle from the centre outwards, reaching the circumference gradually, by a series of rotary motions; and then, by reversing the direction of these motions, to bring the pestle again to the centre; in this way all parts are brought fully and equally under the action of the pestle. When any portion of the contents of the mortar becomes caked, and ceases to fall towards the centre, when agitated, which often happens when the powder becomes very fine, a spatula should be occasionally run around the sides and bottom, to loosen and mix together the different portions.

A loose and careless way of triturating substances, is productive of no saving of labor; the conditions most favorable to pulverization by trituration are a constant, uniform, and hard grinding motion communicated to the pestle, the layer of powder intervening between it and the mortar being thin, and the mortar so shaped as to present all parts of it equally to the action of the pestle.

Many substances can neither be reduced to powder by the process of contusion nor by that of trituration; of these, nutmeg may be instanced as one which is most conveniently grated, or scraped off with the blade of a knife; orange-peel, slippery elm, mezereon bark, liquorice root, are best comminuted by cutting them with a pair of shears, or a knife fastened on a lever, such as tobacconists use for cutting tobacco into plugs. The mode of cutting a piece of

liquorice root into convenient pieces for chewing, is shown in the drawing.

Fig. 73.



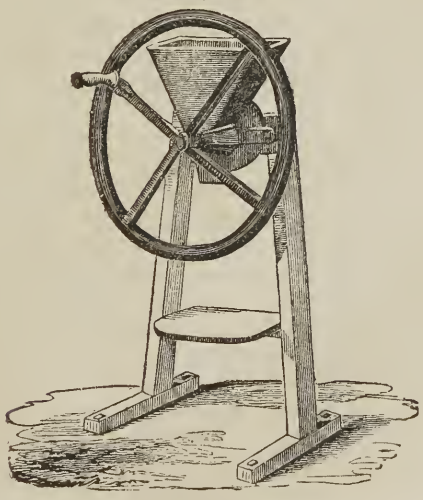
Tobacco knife.

Quassia, guaiacum, logwood, and red saunders, are chipped by machinery, the two latter especially, for use in the arts.

Camphor is easily reduced to powder, by adding to it a small portion of some liquid in which it is soluble, as, for instance, alcohol, and triturating to dryness; the proportion of alcohol proper to be added to camphor for this purpose, is about one minim to three grains.

Figs. 74 and 75 represent very convenient forms of labor-saving

Fig. 74.

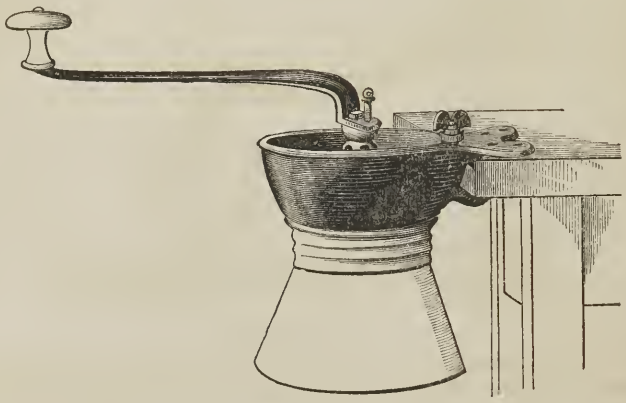


Swift's drug-mill.

apparatus for the physician and apothecary. Swift's drug-mill is in very common use, both for fine and coarse powders; and the

spice-mill here represented will often do to substitute it, being more portable, and readily removed and replaced again upon the

Fig. 75.



Spice-mill.

edge of the counter or office table. The grinding surfaces in both are of cast iron, in the one case toothed, and in the other grooved, so as to tear apart the substances with facility. In each case, the coarseness of the product may be varied by the use of a screw, which is so arranged as, by tightening it, to approximate the grinding surfaces, and effect a finer division, or, by loosening, to furnish a coarser powder, by removing the comminuting surfaces further apart. The article to be powdered should be well dried, and, for grinding in the small mill, should not be in pieces larger than a hickory-nut.

Muriate of ammonia, and carbonate and nitrate of potassa, and other saline substances, are conveniently reduced by the process of granulation, which consists in dissolving the salt in water, and evaporating to dryness, constantly stirring. The process is only applicable to a few articles which are freely soluble, and are not readily decomposed by heat; the granulated powders thus produced, are generally quite different from those made by mechanical means; they are neither so fine nor so free from water.

Many of the insoluble powders are obtained by precipitation; as, for example, precipitated sulphur, prepared by dropping muriatic acid into a solution of bisulphuret of calcium and hyposulphite of lime; the calcium and chlorine present, uniting with the acid, form chloride of calcium and water; the former being extremely soluble, the sulphur, which is insoluble, is thus precipitated as a fine powder. (See *Sulphur*.)

On the same principle the precipitated carbonate of lime is prepared, by adding a solution of carbonate of soda to a solution of

chloride of calcium. As a result of the reaction, the insoluble carbonate of lime is produced, and is thrown down in the form of a powder. (See *Alkaline Earths.*)

It is worthy of remark, in regard to these powders generally, that they are composed of very small crystals. Their fineness is dependent upon the temperature and degree of concentration of the liquids when mixed. When the solutions are hot and concentrated, the reaction takes place suddenly, and the powder is very fine; when they are cold and more dilute, the precipitate is gradually deposited, and more perfectly assumes the crystalline form.

Tartar emetic is obtained in a very fine powder, suitable for preparing the ointment, by dissolving it in water, so as to form a strong solution, and then adding alcohol to this. The strong affinity of water for alcohol causes it to unite with it, and the tartar emetic being less soluble in the alcoholic liquid is thrown down in an impalpable powder.

Powders, as a class of medicinal remedies, possess the advantage, when skilfully prepared, of uniting all the proximate principles of the plant, in their natural condition, and may be administered without the intervention of any menstruum. They may be used in bulk, taken into the mouth with water or some viscid liquid; or may be made into pills; or suspended in liquids in the form of mixtures.

The disadvantages attendant upon their use, are these: they are frequently too bulky for convenience, the dose being so large as to be repulsive and disgusting to the patient; they generally contain a considerable proportion of inert ligneous matter; many of them are liable to undergo an unfavorable change by exposure to the influence of the atmosphere, especially when it is charged with moisture; and, as is generally believed, they are injured by light. Vegetable powders are subject to adulteration without the possibility of detection.

Except in the few cases, such as opium and cinchona bark, where we may isolate the active principle, and ascertain the proportion contained in a given sample, it is impossible to judge with certainty of the quality of a powdered drug; the only safeguard of the physician against fraud or the effects of carelessness, where the vegetable powders are concerned, is to buy them of careful and conscientious druggists, who either powder them, or exercise a strict supervision over the process as conducted by the druggrinder.

Extreme fineness is very much sought after in powders, especially of latter times; and we are certainly not without evidence of its conferring great superiority in some cases. Ferri pulvis of the U. S. Pharmacopœia is an instance of this.

The fineness of a powder affects its color, as is manifest in the case of white saline substances, which become whiter as they are reduced to very fine powders.

There is no separate class of simple powders in our Pharmacopœia; it is understood to be included in the Materia Medica list. The compound powders which are officinal, are included in this work under the general head of extemporaneous powders and pills, and designated by U. S. P.

The necessary practical hints in regard to the mode of preparing and dispensing them, are given under their appropriate head in the chapter on Dispensing.

CHAPTER II.

ON SOLUTION, FILTRATION, AND THE MEDICATED WATERS.

THERE are two objects in view in this process, and the principal feature in the classification of solutions is founded on this fact.

The simplest kind is that in which, by the use of an appropriate liquid, we overcome the attraction of aggregation in a solid body, rendering its particles more susceptible to chemical action, and more readily assimilated when taken into the stomach. The liquid used for this purpose is called a solvent; and water, the great neutral solvent, is most used in preparing this class, which may be designated *simple solutions.*

When we speak of the solubility of any substance, we have reference to its relation to water, the term being an approximate one. Very few substances exist in nature wholly insoluble; and as there is no line between the least soluble, and those which are freely dissolved under ordinary circumstances, the term is not adapted to use where accuracy or precision of language is required.

Solution is accomplished by bringing the material under treatment, into contact with the solvent under favorable circumstances; these relate, 1st, to temperature; 2d, to the state of aggregation of the solid; 3d, to its position in relation to the solvent.

Hot liquids dissolve substances with greater facility than do cold; with the well-known exceptions, lime, magnesia, and chloride of sodium. In addition to the greater solvent power of hot liquids, the currents produced by the process of heating them, favor the more rapid solution of the contained solids, as shaking up the vessel favors the same result.

To facilitate solution in a small way, mortars are much employed; they serve the double purpose of reducing the solid to powder, and of promoting its intimate mixture throughout the liquid.

Mortars of porcelain ware (Fig. 76) are most suitable for this purpose; they are used as follows: The substance to be dissolved, is first placed in the mortar and rubbed into a powder more or less fine; a small portion of the solvent is now added and triturated with the powder; as soon as this first portion seems to be nearly saturated, it is poured into another vessel, and an additional portion of the solvent added, triturated, and poured off in the same way; a fresh portion again being added, the process is repeated, and so continued till the powder has disappeared. The liquids thus obtained, being mixed, furnish a far stronger solution than could be prepared in the same length of time under the ordinary circumstances of contact.

Fig. 76.

Porcelain mortar.

When a weak solution is to be made, especially of delicate chemical substances, like nitrate of silver, a good way is to drop the crystals or powder into the liquid previously placed in a clean vial of suitable size, to which a cork has been fitted, and to shake it up until dissolved. This should only be done in the case of very soluble substances, and the shaking should be continued as long as any portion remains undissolved.

A good arrangement for effecting solution is to place the solid on a perforated diaphragm resting beneath the surface of the liquid, or to inclose it in a bag of some porous material, and suspend it by a thread in the vessel near its top. By this contrivance, that portion of the liquid having the greatest solvent power, because the least saturated, is always in contact with the solid; the solution, as it becomes saturated, sinks to the bottom, and displaces the portion less charged with the solid ingredient, which, in consequence of its less specific gravity, seeks the top, thus keeping up a continual circulation in the fluid favorable to the object in view. In large operations in the arts where it is impossible to shake or to stir the liquid conveniently, an arrangement based upon this principle is adopted.

The term saturated, besides its application as above, is employed to signify that an acid is neutralized by an alkali, or *vice versa;* or, in other words, that an equivalent proportion of one substance has combined with an equivalent proportion of another, for which it has an affinity; they are then said to have saturated each other. The term, when used for this purpose, may be said to be a strictly chemical one, but when employed as above, to designate the point at which a liquid ceases to dissolve a solid body, it is used in a pharmaceutical sense.

Rapid solution, even when not accompanied by chemical reac-

tion, generally causes a reduction of temperature, and thus retards the process to a certain extent, so that, in arrangements for solution on a large scale, it is important to counteract this effect by contrivances for keeping up the temperature of the liquid.

A large number of the solutions used in medicine, are effected by inducing chemical changes among the ingredients introduced into them, sometimes yielding soluble compounds, where one or more of the original ingredients were insoluble.

The solutions officinal in the U. S. Pharmacopœia, are not arranged as a separate class of preparations, but being generally composed of the metallic salts dissolved in water, they are dispersed throughout the work under the heads of the salts themselves, and will be noticed either in the consideration of the extemporaneous combinations, or under separate and appropriate heads, being designated by the initials U. S. P.

The Medicated Waters.

Closely resembling the solutions proper, are the medicated waters. —*Aquæ Medicatæ, U. S. P.*

These are generally solutions in water of the essential oils, made by triturating the latter with a third substance (carbonate of magnesia, usually), which, either by dividing them mechanically, and thus presenting them to the water under favorable circumstances, or by a chemical union with them, renders them soluble to a limited extent, and imparts their sensible properties to the medicated waters thus formed.

The same result is obtained by mixing the fresh herb with a quantity of water in an apparatus for distillation, and allowing them to remain in contact until the water has, to a certain extent, dissolved out the essential oil, extractive matter, coloring principle, &c.; and then, by the application of heat, volatilizing the water and the essential oil, and collecting them in a refrigerated receiver. If the oil is in excess, it will be found on standing to collect on the surface of the liquid in the receiver, but a certain amount is retained in solution by the water, imparting to it the fragrance peculiar to the herb employed. (See Chapter on *Distillation.*)

A third method of preparing medicated waters is to impregnate pure water with gases, either by the aid of pressure or by simple absorption. Most of those prepared in this way are appropriately classified as *chemical preparations.*

In the tabular view appended, the officinal medicated waters are classified according to the methods of preparing them:—

Aquæ Medicatæ, *U. S.*

First Class.—*By trituration with an insoluble substance which is afterwards separated by filtration.*

Officinal name.	Proportions.		Comp.	Dose.
Aqua Camphoræ,	Camphor ʒj, Carb. Magnes.	ʒij to Oj=3	grains to fʒj	fʒss.
" Amygdalæ Amaræ,	Oil ♏xvj, do.	ʒj to Oij=1	drop to fʒj	fʒj.
" Cinnamomi,	Oil ♏xvj, do.	ʒj to Oj=2	drops to fʒj	fʒij.
" Fœniculi,	do. do.	do.	do.	do.
" Menthæ Pip.,	do. do.	do.	do.	do.
" " Virid.,	do. do.	do.	do.	do.

Second Class.—*By distillation.*

Aqua Rosæ,	Rose petals lbj to Oj.

Third Class.—*By charging water with gas.*

Aqua[1] Acidi Carbonici,	5 parts of CO_2 to 1 of water.

The manipulation in preparing those of the first class is quite simple, and, except in the case of camphor water, is precisely uniform. The carbonate of magnesia is removed by filtration, and only serves the purpose of dividing the oil and rendering it more soluble in the water. It may be substituted by prepared chalk, powdered silica, or some other insoluble substance in very fine powder.

In making camphor water, the chief point to be observed is to secure the complete division of the camphor; this is accomplished by triturating it with alcohol, which brings it into a pasty mass; this mass must now be brought completely between the triturating surfaces of the pestle and mortar, for if any portion escapes it will be lumpy and granular, and not in a favorable condition for solution. The carbonate of magnesia may be triturated with the moist camphor before it has passed into the condition of a powder, and after thorough incorporation the whole may be passed through a fine sieve; the water is then gradually added. The undissolved carbonate and camphor should be thrown on the filter with the first portion of the liquid, so that it may be percolated by the liquid during its filtration.

In the preparation of extemporaneous solutions or mixtures, the medicated waters of the first class are very convenient; but where the one required is not at hand, it may be substituted by dropping the essential oil on a small piece of sugar, or, if in a mixture containing gum, upon the powdered gum, and triturating with a sufficient quantity of water. The proportion of the oil used, as shown in the table, is in all cases, excepting that of the bitter almond water, one minim (which is frequently substituted by two drops) of the oil to one fluidounce of the liquid.

[1] For Liquor Ammonia, and other medicated waters not classified under this head, see Part IV.

FILTRATION.—In this place, it is not inappropriate to introduce some account of the process of filtration. The object of this is to separate any undissolved or precipitated substance suspended in a liquid from the liquid itself; as in preparing the medicated waters, a filter is employed to separate the carbonate of magnesia from the solution of the essential oil in water, and thus to obtain a clear fluid. When the liquid is viscid, and contains only motes of an appreciable size, as, for instance, when a syrup has been prepared from sugar contaminated with insoluble impurities, a sufficient filter may be constructed of flannel or Canton flannel, by folding over a square piece in the manner indicated in the figure; the line *c d* being laid over the line *c a*, and united by a seam; the bag thus formed is pointed at *c*, and open from *a* to *b*, the line *a c* being lapped over to

Fig. 77.

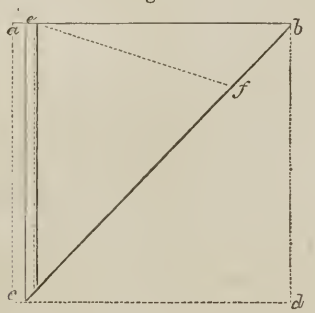
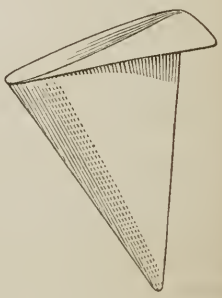


Fig. 78.



form the seam. In using this strainer, the long end projecting toward the point *b*, beyond the dotted line *e f*, may be turned over the side of the vessel, by which the strainer will be kept in its place while the liquid is poured into the opening at the top.

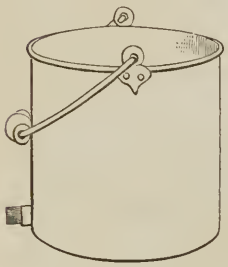
This process is called *straining*, though a kind of filtration. Infusions, decoctions, syrups, fixed oils, and melted ointments, are subjected to it in order to separate foreign ingredients. They pass through the strainer with much greater facility when quite hot, though in the case of the fixed oils a clearer product is obtained by conducting the operation in the cold, and by using several thicknesses of the flannel, or by employing Canton flannel with the nap on the inside. Coarse linen is sometimes better than flannel, especially when considerable pressure is to be employed, as in extracting the juice from the pulp in making fruit syrups.

Figs. 79 and 80 represent an apparatus I have been using for some time past for straining syrups. Fig. 79 is a tin bucket, into which a funnel-shaped wire support, Fig. 80, is suspended, resting on the bucket by a projecting rim at the top; a jelly bag is here unnecessary, as a sufficiently large square or round piece of flannel laid upon the wires will assume a convenient position for use.

Fig. 81 represents in section a contrivance for straining jellies, attributed to the late Dr. Physick, and made by Isaac S. Williams, of Philadelphia; a wire support fits into a funnel, which is soldered into a vessel designed to be kept full of hot water so as to prevent the cooling and thickening of the jelly during straining.

For ordinary aqueous, alcoholic, and ethereal liquids, the process of *filtration*, employing the term in its more limited sense, is used,

Fig. 79.



Apparatus for straining syrups, &c.

Fig. 80.

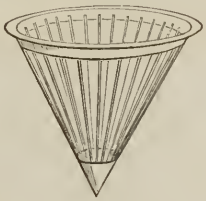
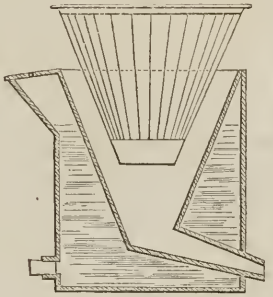


Fig. 81.



Physick's jelly strainer.

the filtering medium being paper. The best filtering paper is porous and free from any kind of glazing; that made from cotton or linen rags is the best for ordinary purposes; the kind made from woollen materials seems better adapted to viscid liquids, being thicker and more porous, but seldom free from coloring matter. It is, also, more soluble in alkaline solutions, and unfit for filtering such.

It is often difficult to meet with paper combining the requisite strength, permeability, and freedom from coloring principles to answer a good purpose for filtering. The best that I have seen is imported, and is almost too expensive for common use.

The construction of paper filters is an extremely simple thing when once learned, and is easily taught the student by a practical demonstration; it is, nevertheless, a difficult thing to describe clearly without giving to it more space than may appear at first sight due to so small a matter.

There are two kinds of paper filters, the *plain* and the *plaited;* the use of the plain filter is in cases where we desire to collect the solid ingredient present in the liquid, and to remove it afterwards from the paper. It allows the passage of the liquid through it with less rapidity, and yet, owing to its being so readily folded, it is in very common use. The method of folding the plain filter is similar to the first steps to be taken in folding the plaited filter.

In the following description I have endeavored to convey an idea of this process.

A square piece of filtering paper, *a b c d*, Fig. 82, is folded over in the middle so as to form a crease at the line *e f;* the edge *c d* being laid directly over *a b*. The parallelogram, *a b e f*, represents the paper thus folded; the line *b f* being now laid upon the line *a e*, a crease is formed as represented by the line *g*

Fig. 82.

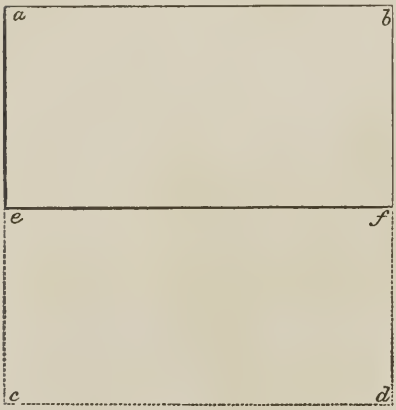
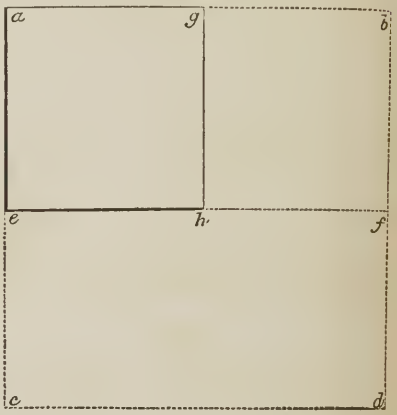
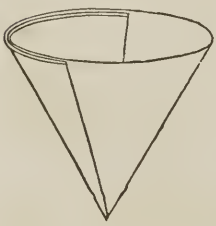


Fig. 83.



h, Fig. 83; the folded paper, if opened, makes a cone, having the point *h* at its base, and by cutting off the projecting angle *a*, by a curved line from *e* to *g*, a plain filter will be the result, as shown in Fig. 84.

Fig. 84.



The *plaited filter* is made as follows: Take the paper before being cut, as above, and having opened it again so as to expose the parallelogram, the line *e h*, Fig. 85, is laid upon the line *c h*, forming a crease at *a h*. This being opened again, the line *e h* is laid upon the line *a h*, producing an additional crease at *g h*, Fig. 86. The crease *j h*, Fig. 87, is next to be formed by folding *a h*, upon the middle dotted line, Fig. 87, as shown in Fig. 88.

Fig. 85.

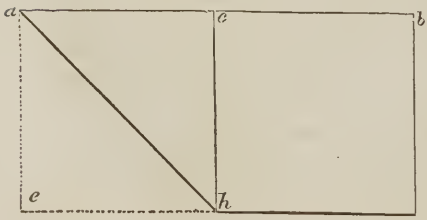
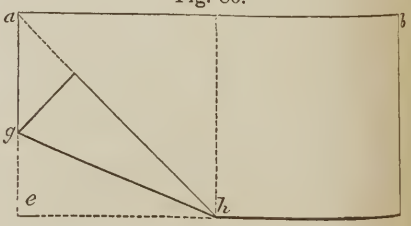


Fig. 86.



One-half of the parallelogram having thus been creased, we proceed to form on the other the corresponding creases *m h*, *b h*, and

Fig. 87.

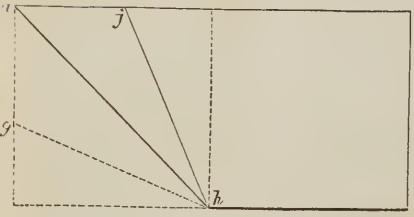
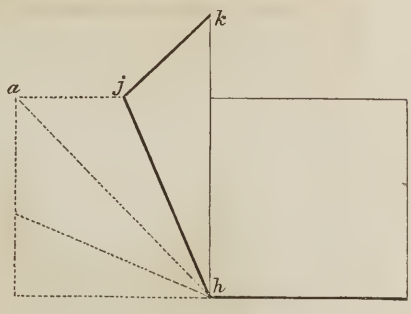


Fig. 88.



k h, Fig. 89, all of which are in one direction, forming receding angles. The next thing to be done is, to divide the eight sections

Fig. 89.

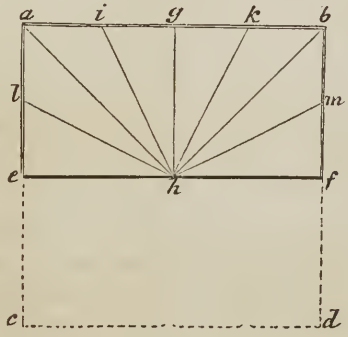
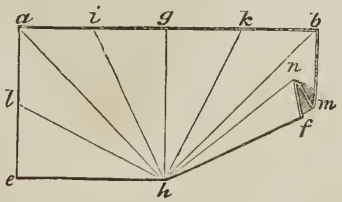
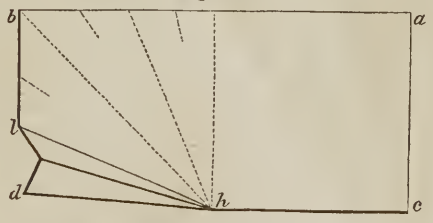


Fig. 90.



thus formed, by a crease through each in the opposite direction. To do this, the edge *f h* is laid in the crease *b h*, and then turned

Fig. 91.



back, as shown in Fig. 90, producing the crease *n h*. In the same way an intermediate crease is formed in each of the spaces. This

is better accomplished by turning the paper over, so that each of the receding angles shall project upward, and in this way be more readily brought together, as shown in Fig. 91, producing a receding angle in forming the intermediate creases.

The paper will now have the appearance of a fan, represented by Fig. 92, folding it up in each of its creases like a shut fan, Fig. 93.

Fig. 92.

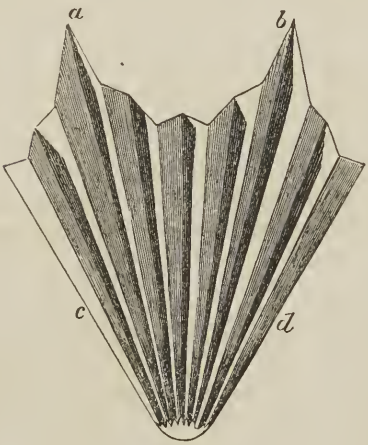
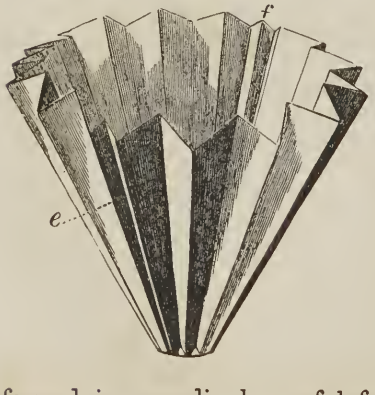


Fig. 93.

The projecting points, *a* and *b*, may be clipped off with a pair of scissors at the dotted line, and upon opening the originally doubled halves made by the first fold at *e f*, Fig. 82, it will be found to present the appearance indicated in Fig. 94.

Fig. 94.



In the filter, as thus constructed, the creases occur alternately, except near the line *e f*, where the two creases occurring next each other are in the same direction. Sometimes, to obviate this, the space intervening between these is folded backwards, as shown in the figure, so as to make a narrow crease in the opposite direction.

The plaited filter, as thus formed, is exceedingly useful for general purposes, exposing the

entire surface of the paper to the action of the liquid, and allowing the process to proceed far more rapidly than in the case of the plain filter, first described, where one-half of the paper being doubled, the other half only is permeated by the liquid.

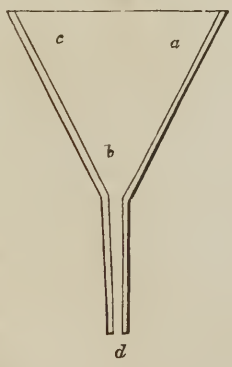
A funnel, such as described and figured on page 34, is employed for supporting a filter of either kind, and is, as there stated, better adapted to ordinary use when grooved on its inner surface, so as to allow the free downward passage of the liquid, after it has permeated the paper, and a groove on the outside of the tube, so that when inserted tightly into the neck of a bottle, the air within may find ready egress.

If the tube of the funnel is smooth and ungrooved, a small plugget of folded paper, a piece of thick twine, or a small wedge-shaped splinter of wood, should be inserted in the neck of the bottle, along with the tube of the funnel; this will obviate one of the most common annoyances connected with filtration.

In filtering into an open vessel, it is a good plan to place the lower extremity of the funnel in contact with the side of the vessel, thus preventing any inconvenience from the liquid splashing on the sides or over the top, and by creating a downward stream, promoting the free and rapid passage of the filtrate.

The paper, of which the filter is formed, especially if very porous, is liable to be weakened by being plaited as above described; it is therefore advised not to make the creases firmly down to the very point, but rather to leave the terminus of an undefined shape; and when there is danger of breakage, either from the great weight of the liquid, or from the weakness of the paper at its point, a very small plain filter may be advantageously placed under the point at the lowest extremity of the funnel; this acts as a support to the weakest and most exposed part of the filter.

Fig. 95.



Section of a well-formed funnel.

Fig. 96.

Filter support.

The proper shape of a funnel for filtration is shown in section at Fig. 95. The lines *a b* and *c b* are straight, and *a b c* and *a c b*

are angles of 60°, making an equilateral triangle into which the filter just described will fit perfectly.

Fig. 96 is a filter support adapted to the rapid passage of liquids in filtration; it, however, requires to be used in connection with an open or wide mouth receiving vessel or a funnel, otherwise the liquid might not be perfectly collected as it passes downwards.

In filtering very volatile liquids, particularly in hot weather, some contrivance must be resorted to, to prevent evaporation from the wide surface exposed, while, at the same time, the escape of air from the receiving vessel must be provided for. The drawing here given, Fig. 97, from Mohr & Redwood, represents an arrangement of the kind. The glass funnel is fitted by a cork into the receiving vessel; its top is ground to a smooth surface, on which is laid a plate of glass, *c*; a little simple cerate will furnish a good luting; *b*, is a very small glass tube laid down the inside of the funnel between it and the filter, and so twisted at its lower end as to be supported in its place; this forms a connection between the air below and that above the liquid, without allowing any evaporation.

Fig. 97.

Filter for volatile liquids.

Fig. 98.

Pouring with a guiding rod.

The use of a guiding rod in pouring a liquid upon a filter is found a great convenience: a glass rod is well suited to this purpose. The lower extremity is directed against the side of the filter near the apex, while the middle portion is placed against the mouth of the vessel, as shown in the drawing; by this means the stream is made to fall steadily, and not with too great force, and against the strongest part of the filter; the liquid being poured, is also prevented from running back upon the containing vessel, and thus

wasting, a very annoying circumstance, which is especially liable to occur when the vessel, whether a flask, a vial, or an evaporating dish, is furnished with no lip, or a very poor one, for pouring.

A useful precaution in pouring liquids from bottles may be mentioned in this connection. It nearly always happens that the last drop or two of the liquid being poured remains on the lip of the bottle, and is liable, if the lip is ill formed, to run down the outside; this may be obviated by touching the stopper to the edge where the liquid is collected, thus transferring it to the stopper previous to inserting it in the neck of the bottle.

Much of the filtration in pharmacy has for its object the separation of the insoluble ligneous portions of vegetable medicines, after they have been sufficiently macerated. A practical difficulty in this case is deserving of mention here. If a measured portion, say one pint of liquid, has been macerated with two, four, or six ounces of a vegetable substance for the purpose of making a tincture or infusion, and, after the proper lapse of time, the whole is thrown upon a filter, the clear liquid that will pass will measure as much less than a pint as the vegetable substance holds by its capillary attraction. In order to obtain the whole quantity desired, some have diluted the filtered liquid till it reached precisely the required measure; but by the discovery of the principle of displacement (see chapter on *Displacement*), it is found that if an additional portion of a liquid be presented to the saturated powder, under favorable circumstances, it will displace the original menstruum remaining in its pores. To secure this is more important, from the fact that it is usually most highly impregnated with the active principles of the plant; and, therefore, in transferring the macerated preparation to a filter, the swollen mass of powder should be carefully compacted into the filter, and after the liquid has drained off, a fresh portion of a similar liquid should be added till the preparation measures the quantity originally intended.

Rose-water is the only medicated water directed by the *Pharmacopœia* to be made by distillation. This is very much employed in prescription, for the preparation of solutions of nitrate of silver, as a substitute for distilled water. It is liable to undergo a change, depositing a sediment, and becoming quite sour if long kept, especially in warm weather. On this account, and in consequence of the greater facility and cheapness of the process, some pharmaceutists make rose-water in the same way as the other medicated waters, by triturating the oil or attar of rose with magnesia, and then with water, and afterwards filtering. The proportions usually employed are four drops of the oil to a pint of water; when made in this way, however, it is not so well adapted to the uses above mentioned, though preferred for flavoring pastry, &c.

Carbonic acid water is frequently, though incorrectly, called soda water; its proper synonym is mineral water. In most large

cities, the manufacture of this is a separate branch of business, and it is purchased by the apothecary in copper fountains lined with tin, holding about 15 gallons. The chief impurities to which it is liable are the carbonates of copper and lead, derived from the fountain and pipe from which it is drawn. These, particularly the former, render carbonic acid water not only worthless, but absolutely injurious; they may be detected by the metallic taste they impart to it, by the addition of ammonia, which gives a blue tint to the salts of copper, and by the ferrocyanide of potassium, which gives a garnet-colored precipitate, if copper is present. Iodide of potassium indicates the presence of lead by a yellow precipitate.

The chief use of carbonic acid water in prescription is for dissolving saline substances, in making aperient draughts, for suspending magnesia, for making solutions of citrate of potassa, and, occasionally, for use by itself as a grateful drink to allay thirst and lessen nausea. As a vehicle for magnesia or saline cathartics, eight fluidounces are usually prescribed, to be taken at once, or in divided portions frequently repeated. It parts with the gas upon exposure, and should, therefore, be used as soon as possible after the cork has been drawn. Sometimes, when prescribed in small doses, it is dispensed in one ounce or two ounce vials, the contents of each being taken separately, while cold and in a state of effervescence, preferably, directly from the mouth of the vial.

Chlorine water, which is officinal in the Dublin and Edinburgh *Pharmacopœias*, and in the Appendix to the London, is made by connecting a bottle adapted to generating chlorine gas, and containing muriatic acid and binoxide of manganese, with a vessel of pure water. It is used chiefly as an antiseptic, and resembles our officinal liquor sodæ chlorinatæ, though stronger.

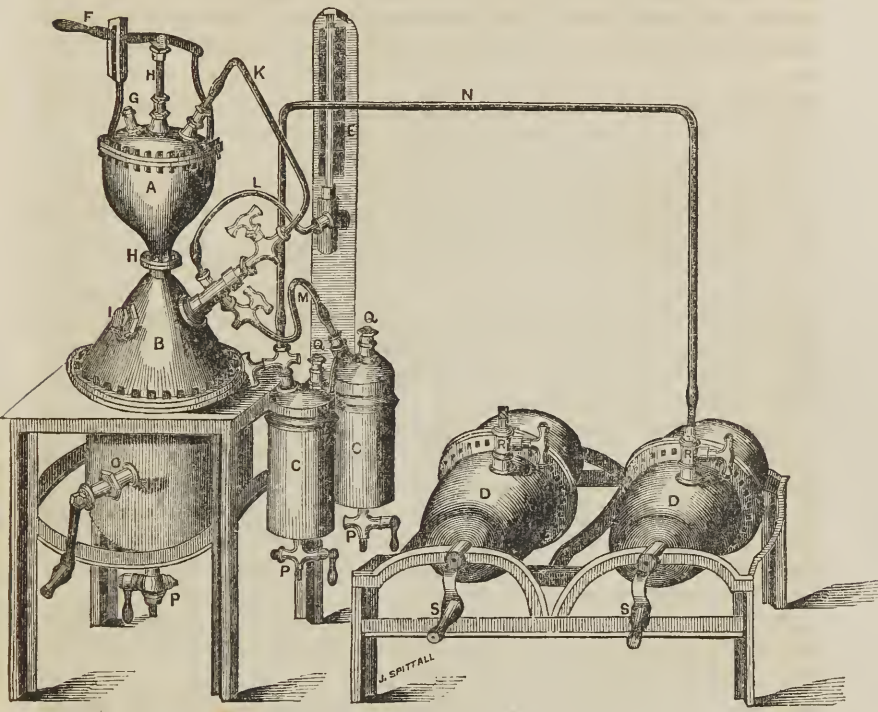
The medicated waters of this class seem to belong properly to the chemical preparations, with liquor ammoniæ, &c.; but, in the *Pharmacopœias*, carbonic acid water and chlorine water are exceptions, and placed among aquæ medicatæ.

The great interest that attaches to mineral water from its very general and increasing use as a beverage, induces me to introduce in this place a notice of some of the forms of apparatus adapted to its preparation, since the invention of which many apothecaries have commenced to prepare the article for themselves.

Fig. 99 represents *Bernhard's apparatus and fountains*. *A* is the acid ball. *B* is the generator, in which the gas is generated for charging the fountain. *C C* two washers for purifying the gas as it passes from the generator to the fountains. *D D* the two fountains; these fountains differ from all others; being composed of iron with the inside surface enamelled, making it impossible for the mineral water manufactured in them to be contaminated with copper salts. *E* is the gauge for ascertaining the pressure of gas on the machine. *F* is the lever attached to the rod *H*, which connects with a glass valve at *H*, between the acid ball *A*

and the generator *B*. *G* is the opening through which the acid ball is supplied. *H* shows the position of the improved glass valve. The advantages of this valve over those of lead, are, that it is per-

Fig. 99.



Bernhard & Co.'s mineral water apparatus.

fectly tight, and more durable. *I* is the opening to supply the generator. *K* is the pipe connecting the acid ball and generator for equalizing the pressure. *L* is the pipe connecting the generator and gauge, for ascertaining the pressure of gas in charging it. *M* is the pipe through which the gas passes to the washers. *N* is the pipe through which the gas passes from the washers to the fountains. *O* is a shaft that passes horizontally through the generator, with paddles attached for the purpose of mixing the ingredients in the generator. *P*, attached to the generator, is a waste cock through which the sulphate of lime is drawn off. *P P*, attached to the washers, are waste cocks through which the impure water is drawn off. *Q* is the opening to supply the washers with pure water. *R* is the stopcock on fountains. *S* is the crank by which the fountains are turned in the operation of mixing the gas with the water.

Bernhard's apparatus has the great advantage of enamelled cast iron fountains, which produce water invariably free from copper and lead, and of an improved glass valve, which appears to possess the merit of durability, besides resisting the solvent action of the acidulated water. A number of them are used with success by apothecaries, who find them a source of no small profit. The price of the apparatus varies from $235 to $400, according to size.

Quantities of Ingredients required for the manufacture of from five to six Fountains of Mineral Water.

For acid ball, 32 lbs. acid.
" generator, 40 lbs. carbonate of lime or whiting, 15 gals. water.
" each washer, 1½ gal. water.
" each fountain, 12 gals. water, or two-thirds full.

Instructions for Operating.—Mix the whiting with a portion or the whole of the water intended for the generator, so as to have it in a perfectly fluid state; be careful to have it free from stones or any other hard substances.

Then pour the mixture through the opening in generator marked *I* in the plate. Pour the acid into the ball through the opening marked *G*. See that the valve *H H* is perfectly closed before pouring, and that the acid is free from any foreign matter, such as the substance with which the neck of the carboy is sealed, &c. &c. Fill the washers with water through the opening *Q* about two-thirds full, say 1½ gal. to each.

Unscrew the cocks *R* on the fountains, and fill them with water through the opening, about two-thirds full, or about 12 gals. to each, which done, replace the cocks.

Screw up all the caps, connecting-screws, &c., perfectly tight; open the cocks on pipes *K* and *M*; shut the cock on pipe *N* and washer *C*—the apparatus is then ready for operating. Then, with the left hand, raise the valve *H* by means of the lever *F* about one-quarter inch, at the same time turn the crank on *O* with the right hand very slowly (this is for the purpose of mixing the acid with the whiting in the generator), keeping your eye on the pressure gauge, in order to ascertain at what rate the gas is generating, until it indicates a pressure of 120 lbs.

(It is very requisite that the gas should not generate too fast, in which case the whiting, &c., is very apt to rise in the generator, and flow over into the washers. The gas should not be generated faster than at the rate of about 20 lbs. per minute. Too much care cannot be exercised in observing these particulars.) When the gauge shows a pressure of 120 lbs., close the valve *H*, and cease turning the crank at *O*; open the cock *R* on fountain, and open very gradually the cock on pipe *N* and washer *C*. When the gas is equalized in generator and fountain, which is known by its

ceasing to flow through pipe *N*, turn the cocks at *C* and *R*, disconnect the pipe *N* from the cock *R*, and turn the fountain by the crank *S* for about five minutes, for the purpose of mixing the gas with the water. Then connect pipe *N* and cock *R*, and proceed to generate gas as before until the guage indicates a pressure of 130 lbs. Draw over gas, until it equalizes; disconnect, turn, &c., as before. Repeat the operation for the third time, and the fountain of soda water is ready for use.

To clean the generator internally, open the cock *P* under it while the pressure of gas is on; when empty, rinse out with clean water.

The water in the washers need not be changed each time of manufacturing, but it is better to do so.

Care should be taken that the stuffing-boxes at *H* and *O* are at all times perfectly tight.

Nichols's Patent Mineral Water Apparatus.—This is a much smaller, more compact, and cheaper apparatus than the foregoing. It is a combination fountain made of copper, lined with tin, contains the generator of carbonic acid within the water fountain, and occupies very little more space than an ordinary fountain, such as are charged by the mineral water manufacturers and sold to dealers. It is best adapted to small establishments, where the demand is limited. The price for the 18 gallon size is $150, 10 gallon size $125, 7 gallon size $100, for the three gallon supplementary fountain $15. Figs. 100 and 101, drawn by Baxter for this work, will exhibit its construction. *A* is the body of the fountain, lined on the inside with *pure block-tin; R*, the strong metallic cylinder passing through the entire centre of the fountain, lined on the inside with *lead*, and on the outside, where the water comes in contact with it, with *block-tin;* this cylinder has a nut screw, *F*, on the bottom, which is unscrewed after charging to let out the sulphate of soda formed in the chamber; into this cylinder the sulphuric acid is poured when about to charge the fountain; upon this acid, bicarbonate of soda is allowed to fall from the soda chamber *I*. *E* is the valve through which the soda falls from the soda chamber upon the acid; *J* is the handle of the rod connected with this valve, by which the valve is pushed down and opened, or drawn up and closed; this rod extends down into the acid cylinder to act as a stirrer of the acid and soda; the lines at *Q*, represent strong wires in the soda chamber, which revolve with the valve rod and aid in throwing down the soda. *H* is a strong copper vessel, called the *purifier*, lined with block-tin; this being filled two-thirds full of water, the gas, after being formed in the deep cylinder, passes through this water, and is thereby washed and cooled. *C* is the handle connected with the "water agitator" rod. *D D D* are strong metallic rings, passing around the acid cylinder and fastened to the rod; by taking hold of the handle *C*, and drawing up and

down rapidly in the same way as one would make use of the old fashioned churn, the water and the gas in the fountain are mixed

Fig. 100.

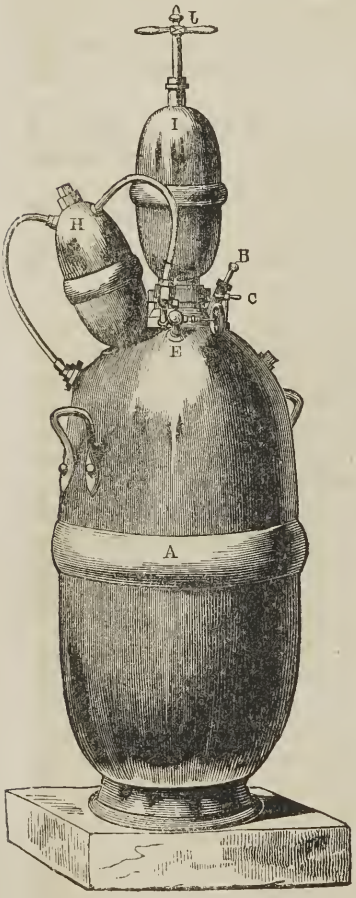
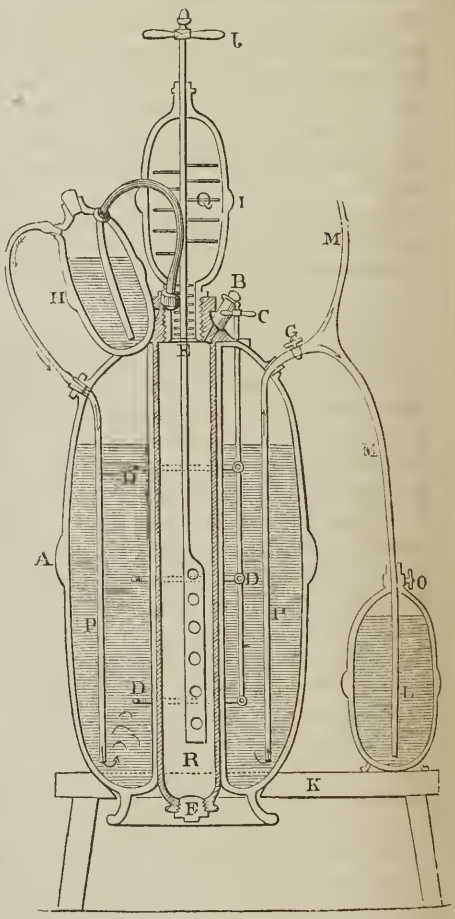


Fig. 101.



Nichols's patent mineral water fountain.[1]

and intimately blended together. *P P* are block tin pipes, passing to the bottom of the water in the fountain; one carries the gas from the purifier *H* into the water, and through the other the charged water is conveyed out of the fountain to the drawing apparatus. *B* is a safety-valve, which allows the escape of the gas when it reaches a pressure that would endanger the apparatus. *G* and O are

[1] These instruments are made for the inventor in Boston, and can be procured of the agents, T. Morris Perot & Co., Philadelphia.

stopcocks, to shut off or let on the water and gas, as occasion may require; the pipe *M*, *leading up*, conveys the charged water up to the counter; the pipe *M*, *leading down*, to the supplementary fountain *L*. The *supplementary* is a small fountain, holding about three gallons, and is filled with the charged water from the large fountain, and then shut off by the stopcock *O*; in process of drawing from the large fountain, it becomes in time exhausted, and must be recharged; while charging it, which takes about twenty minutes, close the stopcock *G*, on the right, and open the stopcock *O*; this will afford a constant supply of water, so that the operator need not stop a moment in drawing. *K* is a stool or bench upon which the fountain is to be placed, made high enough to allow a pail to go under to catch the contents of the acid cylinder, which are to be let out after charging.

Directions for using.—In using this apparatus, unscrew the soda chamber *I* from the acid cylinder below it, fill it with bicarbonate of soda (which should be granulated, not finely powdered); close the valve *E*, then pour into the deep cylinder *R* about three pints of sulphuric acid, and screw the soda chamber again in its place, fill the purifier two-thirds full of water, the fountain three-fourths full. Now open the stopcock *G*, on the left, press upon the handle *J*, and rattle some of the soda down into the acid; a brisk action commences in the deep cylinder, carbonic acid gas is liberated, which accumulates under great pressure; it is forced through a pipe into the water of the purifier, and from thence into the water of the fountain. The soda is to be let down somewhat gradually, which should take about fifteen or twenty minutes.

It is stated that a gauge, applied to this machine, marked a pressure of 180 lbs. to the square inch in fifteen minutes; 120 lbs. is high enough to produce excellent water.

Bicarbonate of soda has the advantage over whiting or marble dust of yielding a much larger proportion of gas; six pounds of bicarbonate should yield, upon decomposition, 180 gallons of pure gas, while the same quantity of marble dust yields about 80 gallons.

The cost of charging a twelve gallon fountain is about fifty cents.

Artificial Saratoga water may be made as follows: Into a Oj tumbler introduce f℥j of the following mixture, fill it up with carbonic acid water, and drink immediately.

Mix	Chloride of sodium	℥j.
	" magnesia, solution[1]	f℥ij.
	Bicarbonate of soda	℥j.
	Solution of iodine (Lugol's)	f℥ss.
	Tincture of chloride of iron	f℥ss.
	Carbonic acid water	Oiss.
	Filter.	

[1] Commercial muriatic acid saturated with magnesia.

CHAPTER III.

ON MACERATION AND THE INFUSIONS.

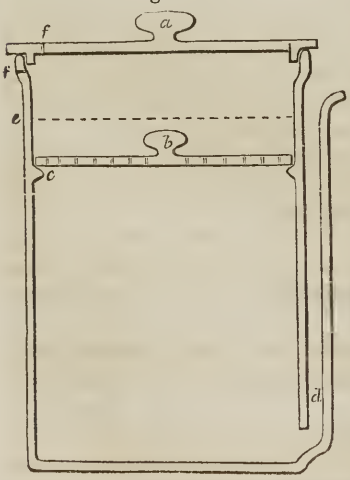
The kind of solution spoken of heretofore is quite simple, and in most cases easily accomplished; but substances which are soluble only to a limited extent, or are composed of proximate principles associated mechanically, some of which are much more soluble than others, as the bark, leaves, wood, &c., of plants, require different and less ready modes of treatment.

The first thing to be done is to reduce the drug to a more or less fine powder, or to bruise it, after which the liquid, which in this case is called the menstruum, is brought into contact with it.

When the quantity of the medicinal agent is small in comparison with the menstruum, as in most of the infusions, and where rapidity is not an object, the process of *maceration* is chiefly resorted to.

This is accomplished in a covered queensware vessel, a common pitcher or bowl, for instance, or sometimes in a tin cup or measure, care being taken in the case of astringent infusions to avoid the use of a defective tin or an iron vessel. Maceration consists in pouring the liquid upon the medicinal substance previously bruised or coarsely powdered, and allowing it to stand for a greater or less period of time, according to circumstances. The longest period directed in the *Pharmacopœia* for infusions is twenty-four hours, as in the case of infusion of wild cherry; the shortest, ten minutes, as in the case of infusion of chamomile. In preparing tinctures, wines, vinegars, &c., seven or fourteen days are generally prescribed.

Fig. 102.



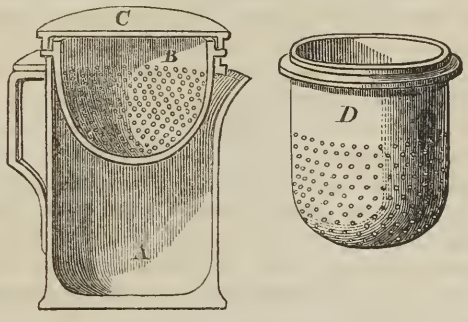
Section of Alsop's infusion mug.

Infusions are best prepared in a vessel made for the purpose, figured in the drawing, called Alsop's Infusion Mug, which contains a perforated diaphragm *b*, near the top, on which the substance to be macerated is placed, and the liquid introduced so as barely to cover this, reaching, perhaps, to the line *e*; a circulation is thus induced and continued in the liquid by which the least im-

pregnated portions are brought constantly in contact with the drug, and the most completely saturated portion, by its greater specific gravity, sinks to the bottom.

Squire's Infusion Pot is an improvement on Alsop's; it is a very neat pharmaceutical implement adapted to making the galenical liquid preparations generally. In Fig. 103, we have a section, *B* and *D*, being two cup-shaped perforated diaphragms, either of which may

Fig. 103.



Section of Squire's infusion pot.

be used at pleasure. The vessel must be of such capacity that the substance placed on the diaphragm shall be under the surface of the liquid when properly filled. A modification of this apparatus is used in some large establishments for the preparation of tinctures; it has many advantages over ordinary apparatus for maceration, and is not unlike displacement in the beauty and efficiency of the preparations made in it.

Digestion differs from maceration in being confined to elevated temperatures, yet below the boiling point of the menstruum; as the term is generally employed, it means maceration with continued application of heat, and is synonymous with simmering.

The term *infusion* includes both maceration in its more limited sense and digestion. It is often applied to the ordinary mode of making infusions, which is to pour the hot liquid on the bruised drug, and allow it to remain until cool. In a recipe worded with due regard to accuracy, if we are directed to *macerate* for any given time, we know that *cold* infusion is intended; if to *digest*, we understand that *hot* infusion is desired.

In making tinctures, digestion is often very useful, particularly where rapidity is an object, and where we wish to form a very concentrated preparation.

Of the proximate principles of plants, it may be remarked that hot water has the property of dissolving the starch, and cold water the vegetable albumen, and both dissolve the gum, sugar, extractive,

and other principles liable to fermentation; the absence of any antiseptic in infusions and decoctions renders them extremely prone to undergo change on exposure to the atmosphere.

When it is desirable to preserve these aqueous solutions for a longer period than a day or two, they should be bottled while hot, the bottle being filled completely and corked tightly, so as to exclude the air, and then set aside in a cold place in an inverted position. The addition of small quantities of alcohol, or of some tincture not interfering with the medical properties of the infusion, is recommended where not objectionable. The compound infusion of gentian and infusion of digitalis are rendered permanent preparations by this means. The infusion of wild cherry bark will keep for some days without any addition to it, owing to the antiseptic influence of hydrocyanic acid it contains.

The following substances should not be prescribed mixed with or dissolved in infusions, being incompatible with one or more of the proximate principles usually present in them: Tartrate of antimony and potassa, corrosive chloride of mercury, nitrate of silver, acetate and subacetate of lead; in some cases, the alkalies, lime-water, and tincture of galls, and, in the instance of astringent infusions, the salts of iron.

When mixed with either of the tinctures made with strong alcohol, a resinous precipitate is deposited, and the mixture if strained loses much of its activity; the same is the fact, to a less extent, with many of the tinctures made with diluted alcohol.

Many of the infusions which are clear when freshly prepared, become turbid soon after by the deposition of vegetable albumen, apotheme, and other insoluble principles; these are likely to carry down with them a portion of the active ingredients. The infusions of cinchona prepared by maceration with hot water do not become clear, even by filtration through paper.

Infusions made by maceration may frequently be poured off clear from the vessel in which they were prepared, leaving the dregs in the bottom; this, however, is always attended with the loss of the last portion of the liquid; they may be strained through a muslin or flannel strainer, and, by using a little force in expressing the dregs, very nearly the whole portion of liquid may be obtained, or more satisfactorily, by displacement, in filtering them.

This class of medicinal preparations is the least elegant in use, and is mainly confined in this country to domestic practice. Even when prescribed by physicians, the infusions are generally made by the nurse or attendant upon the sick, rather than by the apothecary. The infusions of cinchona bark, infusion of digitalis, and compound infusion of gentian, form the chief exceptions to this rule.

The process of displacement, treated of in the next chapter, is applied with great advantage to some of these preparations, and I believe, in a majority of cases, the substitution of cold water for

hot, and of displacement for maceration or digestion, would be found to produce a more elegant and equally efficient infusion, and one which, from containing less coloring matter, fecula, resinous, and other inert principles, would keep better, and be more acceptable to the stomach. Some experiments, recently reported, tend to show the superiority of cold infusion of senna over that made by the officinal process.

When an infusion is intended as an emetic draught, or to promote the operation of emetics, or as a diaphoretic, it is usually given while hot, and, of course, to all such cases the above remark does not apply. Nor is it equally applicable to some of the demulcent infusions of flaxseed, buchu, and slippery elm, although the former may be made very well with cold water, and is then less disagreeably oily in its character.

The following syllabus is offered as presenting the whole officinal class of infusions, so that the student may conveniently study their composition, proportions, mode of preparation, and uses.

SYLLABUS OF INFUSIONS.

Infusa, *U. S. P.*

First Class.—*Made with boiling water, by maceration.*

Group I.—℥j to Oj.

Infusum Cinchonæ Flavæ,	Tonic.
" " Rubræ,	do.
" Cascarillæ,	Stimulant, tonic.
" Eupatorii,	Tonic.—Given hot as a diaphoretic and emetic.
" Krameriæ,	Astringent.
" Sarsaparillæ,	Alterative, diaphoretic.
" Ulmi,	Demulcent.
" Buchu,	Demulcent, diuretic.
" Armoraciæ (with Mustard-seed, ℥j),	Stimulant, diuretic.
" Sennæ (with Coriander, ℥j),	Cathartic.

Group II.—℥ss to Oj.

Infusum Angusturæ,	Stimulant, tonic.
" Anthemidis,	Tonic; emetic, when hot.
" Colombæ,	Tonic.
" Serpentariæ,	Tonic.
" Valerianæ,	Stimulant; antispasmodic.
" Capsici,	Arterial stimulant. Dose, f℥ss.
" Zingiberis,	Carminative.
" Humuli,	Tonic; mild narcotic.
" Spigeliæ,	Anthelmintic.
" Catechu Comp. (Cinnamon, ℥j),	Astringent.
" Lini Comp. (Liquorice Root, ℥ij),	Demulcent.

GROUP III.—Proportions varied.

Infusum	Caryophylli,	℥ij to Oj.	Stimulant.
"	Rhei,	do.	Cathartic.
"	Tabaci,	℥j to Oj.	Sedative injection in hernia.
"	Digitalis,	℥j to Oss,	+ Tr. Cinnam. f℥j.—Narcotic. Dose, f℥ij. (Withering's.)
"	Rosæ Compositum,	℥ss to Oiiss,	+ Sugar, Diluted Sulphuric Acid, Water.—Adjuvant to astringent gargles.
"	Taraxaci,	℥ij to Oj.	Diuretic.

SECOND CLASS.—*Made with cold water, by maceration or displacement.*

Infusum	Cinchonæ Comp.,	℥j to Oj,	and Aromat. Sulph. Acid, fj℥. —Tonic.
"	Pruni Virginianæ,	℥ss to Oj.	Sedative, tonic.
"	Quassiæ,	℥ij to Oj.	Tonic.
"	Gentianæ Comp.,	℥ss to Oj.	+ Bitter Orange-peel, Coriander, Dil. Alc., Water.—Tonic.
"	Sassafras Medullæ,	℥j to Oj.	Demulcent.

The general dose of infusions is f℥ij, or a wineglassful frequently repeated. This is to be varied in the case of infusion of senna, compound infusion of flaxseed, and others, in which a much larger quantity may be taken at a draught.

There are two infusions which it would be improper to give in the above general dose; these are infusion of digitalis, and infusion of capsicum; both are given in doses of a tablespoonful or less. The chief use of infusion of sassafras pith is as an external application to inflamed eyes.

Compound infusion of rose is said to be an excellent addition to Epsom salts in solution, for overcoming its bitterness.

UNOFFICINAL INFUSIONS.

An immense number of substances are frequently prescribed in the form of infusion, which it would be unnecessary to introduce here; in fact, it is a common way of prescribing most of the vegetable tonics and alteratives. The following compounds are sometimes prescribed, and seem to belong in this place:—

Dr. Mettauer's Aperient.

Take of Aloes (soc.)	℥v.
Bicarb. soda	℥xj.
Valerian (contused)[1]	℥j.
Water	Oj.
Comp. spirit of lavender . . .	f℥vj.

Make an infusion.

DOSE.—A tablespoonful containing about 9 grs. aloes, 20 bicarb. of soda, and 14 of valerian. As a laxative for constipation, &c.

[1] Some recipes omit the valerian.

Elixir Clauderi.

R. Carbonate potassa	℥j.
Aloes	℥ij.
Guaiacum	℥ij.
Myrrh	℥ij.
Saffron	℥ij.
Rhubarb (contused)	℥ij.
Water	f℥xviij.

Macerate a few days and decant. Dose, a tablespoonful.

Physick's Medicated Lye, or Alkaline Solution.

Take of Hickory ashes	℥viij.
Soot	℥j.
Water	Cong. j.

Digest for 24 hours and strain. Dose, a wineglassful.

CHAPTER IV.

PERCOLATION, OR THE DISPLACEMENT PROCESS.

THE displacement process is the neatest, most rapid and productive method for extracting the soluble principles from vegetable substances. It is directed in the United States Pharmacopœia, for preparing a large number of the officinal tinctures, wines, vinegars, syrups, fluid extracts, extracts, and some of the infusions. It is frequently coupled, however, with directions for the employment of maceration, so that a physician or pharmaceutist, who may not have acquired a practical knowledge of its details, may choose the older and more familiar process for their preparation.

As a number of the most concentrated officinal preparations cannot be made by any other process, and as this possesses advantages in nearly every case, a knowledge of it is justly regarded as indispensable to the pharmaceutist, and the physician who may be called upon to practise pharmacy.

History.—The process of displacement has been employed from time immemorial, in the preparation of coffee in the celebrated *Cafetière de Doubelloy*, an instrument much used in France, and occasionally in this country at the present time. It consists of an ordinary tin coffee-pot, surmounted by a movable cylinder, usually varying from 3 to 5 or 6 inches in diameter, and from 8 to 10 inches in length, and which contains two perforated diaphragms,

one permanent and soldered on to the lower extremity of the cylinder, and the other movable, so as to be supported either upon the top of the mass of coffee in using the apparatus, or upon a projection in a movable upright tube, open at both ends, and so situated as to allow the free passage of the air from the lower to the upper part of the vessel.

The French coffee-pot is a displacement apparatus of convenient construction, and had been long celebrated for the production of a clear and strong coffee, possessing a finer aroma than that made by decoction, but, until the year 1833, the idea seems not to have occurred of applying it to the production of pharmaceutical preparations. This application is due to M. Boullay and Son, French pharmaciens, who, by their admirable and well conducted experiments, first demonstrated the adaptation of displacement to the general purposes of the shop and laboratory, drew the attention of the profession to its merits, and pointed out the best forms of apparatus, and the best modes for using them.

In 1838, Augustine Duhamel, a scientific apothecary of Philadelphia, since deceased, published in the *American Journal of Pharmacy*, vol. x. p. 1, the first communication upon the new process accessible to American pharmaceutists. In the following year, in connection with William Procter, Jr., now Professor of Pharmacy in the Philadelphia College of Pharmacy, he engaged further attention to the subject, in an able article of the same *Journal*, vol. xi. p. 189, in which a series of careful experiments in the preparation of extracts, tinctures, infusions and syrups were detailed, which so conclusively proved the superiority of this over the ordinary processes in use, that intelligent apothecaries generally were induced to try and eventually to adopt it.

The process of displacement so far found favor with the Committee having under care the decennial revision of the *Pharmacopœia* in 1840, that it was sanctioned to a considerable extent in the edition of our national standard of that year. At the present time, displacement is so extensively employed in the preparation of the Galenical solutions, as to a great extent to supersede the old process of maceration.

The Apparatus.—In describing the common forms of displacement apparatus, I shall confine myself chiefly to the more simple and extemporaneous kinds adapted to the physician's office.

The common *tin displacer* consists of a cylinder varying in size, but at least twice as long as its diameter, terminated at one end by a funnel, the neck of which is made small enough to insert conveniently into a common tincture or narrow mouth packing bottle; two perforated diaphragms of the size of the cylinder, and loosely fitting into it; each of these has a small ring of wire soldered on to it to facilitate its removal. Sometimes these cylinders are made larger at top, tapering toward the lower end, but there is

no advantage in this shape over straight sides, as shown in the drawings. The lower diaphragm should be of finely perforated tin plate; the finest sold is not objectionable, while the upper may be made of ordinary tinned iron, pierced with comparatively large holes. Occasionally the lower diaphragm is soldered to a very small tin tube, open at both ends, of nearly the length of the cylinder, near the top of which is a ledge on which the upper dia-

Fig. 104.

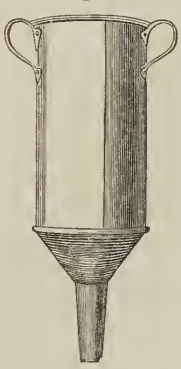
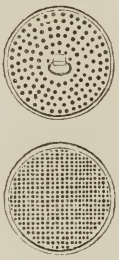


Fig. 105.



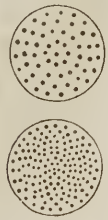
Tin displacer, with upper and lower diaphragm.

phragm is made to rest, as in the French coffee-pot and in the air-tight displacer, Fig. 111; the object of this is to allow the passage of air from the lower or receiving vessel into the top of the cylinder.

The Queensware Displacer.—This is the same as the above, in shape; the material is considered more cleanly; it is not liable to corrosion with acid liquids, nor to impart a black color and metallic taste to solutions of the vegetable astringents.

Fig. 106.

Fig. 107.



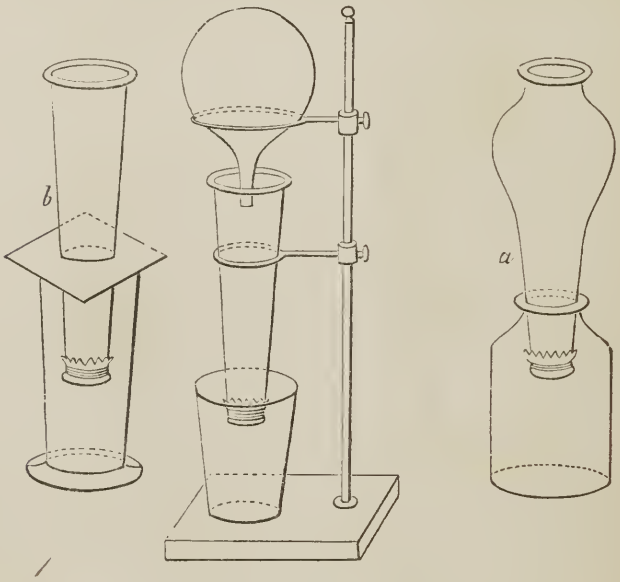
Porcelain displacer, with two diaphragms.

The Common Funnel.—This may be employed for displacement, by inserting a plug of carded cotton, or of fine sponge into the neck, and by using a piece of perforated paper, or some thin cotton cloth, or other fabric for the upper diaphragm.

Lamp-Chimney Displacers.—No form of apparatus is so cheap and convenient for small operations as ordinary lamp-chimneys, either plain (Fig. 108) or with bulb (Fig. 109). The smaller end of the chimney is filled with a cork cut so as to allow the free passage of the liquid, at the same time that it affords a mechanical support to the mass, or covered with a piece of gauze, book-muslin, or other coarse fabric, tied securely by a string round the chimney

near its lower edge, and a little carded cotton being placed on it, the under diaphragm is rendered complete; the upper one may be made of paper, when necessary, as before described, or, where the diameter is small, may be omitted.

Fig. 108. Fig. 109.



Lamp-chimney displacers with supports.

These having no funnel-shaped terminations, require to be inserted in a wide mouth bottle; one which answers the purpose should be selected and always kept at hand; a piece of thick pasteboard, or other firm substance, may be used as a support for an apparatus of this description, by cutting a hole in it of the required size, so as to suspend it over a dish, or by the aid of a retort stand into a suitable jar or measure, as shown in Figs. 108 and 109. Lamp-chimneys with bulbs are still more convenient in this respect.

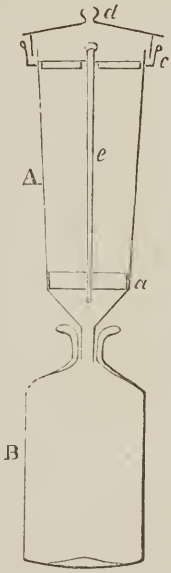
Fig. 111 represents a tin displacer with a water joint near the top for covering and preventing evaporation, in making ethereal or other very volatile preparations; the little tube *e* serves for the escape of the air from the lower vessel *B*, so as to equalize the atmospheric pressure between the top of the air-tight displacer and the receiving bottle; the lower diaphragm *a*, is soldered on to the top of this tube, and the upper diaphragm rests on it; *c* represents the gutter into which the top *d* fits, and which, being filled with water, constitutes an air-tight connection. The displacer fits into the narrow mouth bottle either by the aid of a cork or not, as the case may require.

Broken Bottles.—A portion of the broken bottles in a shop have the bottom cracked uniformly off, which is likely to occur when hot liquids are poured into them: they furnish a cylinder-shaped

Fig. 110.

Receiving bottle for displacement.

Fig. 111.



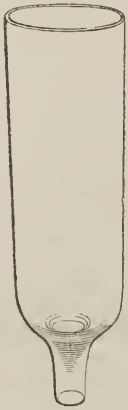
Tin displacer for volatile liquids.

vessel not unlike the tin displacement apparatus above described; a plug of cotton is used for a diaphragm, as in the case of the funnel. The bottoms of bottles may be cracked off for this purpose by passing gradually round them a red-hot rod of iron in contact with the glass, and removing the sharp edge by a file; or by inserting the bottle in a shallow vessel of cold water, so as to be immersed just up to the line to be fractured, and filling it to the same line with water, then pouring in a sufficient quantity of oil of vitriol suddenly to raise the temperature on the inside, the bottom will generally drop out.

I have recently had made the very convenient and economical glass displacement funnel (Fig. 112). These are made of three sizes, the larger three and a-half inches in diameter, and eight inches in length, exclusive of the neck; it is in shape like a broken bottle, but thicker and more uniform, and with a smooth edge at both ends; the neck is drawn out with the view to inserting it into a bottle, and it may be conveniently covered with a suitable piece of glass when desirable. No diaphragms accompany the apparatus; sponge, cotton, or broken glass is invariably used.

Availing ourselves of the very cheap and common production of syringes from glass tubes, which extend to one and a-quarter inch

Fig. 112.



Glass displacer.

Fig. 113.

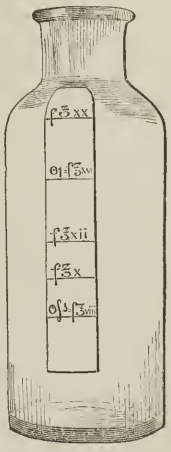
Small syringe pattern displacer.

in diameter, and can be furnished at a very low price, we have procured the apparatus represented in Fig. 113. It is a glass syringe of the largest size, without the piston or cap. It can only be used for small operations, for which, however, it is well adapted. In treating Spanish flies and other substances with ether, we have found it convenient from the facility with which the top can be corked up, preventing evaporation; a variety of preparations may be conveniently made with the syringe pattern displacer.

For reasons that will more fully appear when speaking of the process, it is necessary that the receiving vessel should be of such size as to hold precisely the quantity it is proposed to make, or be suitably graduated to this quantity. A convenient plan adopted in the school of practical pharmacy, where a variety of preparations are going on at the same time, is to mark upon a narrow slip of paper, the name and quantity of the preparation about being made, and paste this upon the receiving vessel, before commencing the process, in such a position that when the required quantity has passed it will just reach the top of the slip of paper; if a graduated measure of sufficient capacity is used, the necessity of this is obviated. It is convenient to a physician for his office purposes to keep one or more graduated bottles, made by pasting a slip of

paper longitudinally on the bottles marked with a pen, to the f℥viii, f℥x, f℥xii, Oj, and f℥xx denominations, as shown in this cut: the paper may be rendered impervious to moisture by collodion or other varnish.

Fig. 114.



Graduated receiving bottle.

The Process.—The following may be given as a general direction for the treatment of substances by displacement:—

Saturate the substance in the form of powder, with the appropriate menstruum, and after maceration (if necessary) transfer it to the apparatus for displacement; pack it more or less tightly in the cylinder, and gradually add sufficient of the menstruum to make, when it has passed, the required quantity of the preparation, care being taken to return the first portions of the liquid till it passes clear, and not faster than drop by drop.

Notwithstanding the apparent simplicity of this manipulation, skill in managing it is only attainable by experience, and hence the care observable throughout the *U. S. Pharmacopœia* of 1840, and even in that of 1850, to present directions for maceration with those for displacement, thus giving to the operator a choice of either process, and also enjoining a more or less protracted maceration previous to displacement.

With a view to imparting a preliminary knowledge of this process, which will facilitate the attainment of a practical familiarity with its details, I proceed to state the principal facts and circumstances which experience has suggested as important to be observed.

The *fineness of the powder* must be regulated by the nature of the substance and the menstruum; very porous and mucilaginous substances, as rhubarb, squill and gentian roots, senna, conium, and buchu leaves, colocynth pulp, &c., are treated most conveniently in coarse powder, such as will pass through a sieve of six meshes to the square inch, or still coarser. While hard and close-grained drugs, such as stramonium, and most other seeds, quassia wood, serpentaria, valerian, and black snakeroots, and aconite and matico leaves, should be in comparatively fine powder. Water and diluted acetic acid, as a general rule, require coarser powders than diluted alcohol, and the latter menstruum coarser than alcohol and ether.

Previous maceration, though directed in nearly every instance in the *Pharmacopœia*, is not necessary, except in a few cases; the direction is there given for the purpose of guarding against the effects of careless manipulation, and it is an excellent precaution to insure the material being thoroughly permeated by the fluid, which may otherwise fail of taking place, owing to careless packing, or to a too partial division of it.

Porous materials, such as swell very much on the addition of a liquid, and some ligneous powders, which part with their active principles with difficulty, require to be previously moistened and allowed to macerate as designated in the *Pharmacopœia*, while many barks, roots, and leaves, may be introduced in the state of dry powders, and small portions of the menstruum being successively added with judgment and care, the preparation may be quite as thoroughly made as by the first named process.

One of the best criterions by which to measure the completeness of the process is its *rapidity;* if the addition of a portion of the menstruum above is accompanied by a brisk stream running from the lower end of the apparatus into the vessel below, the process of displacement is going on but partially or not at all; it will then be necessary either to repack it again, or to cork it up below, and allow the material to macerate until it has fully swelled up, and the fine particles have settled more completely into the interstices of the mass.

If, on the contrary, the addition of the fresh fluid fails to displace any portion of that with which the mass has been saturated, the whole may require to be removed from the apparatus and more loosely packed; or, as is sometimes done, the addition of a considerable column of the liquid, by its greater hydrostatic pressure, may be made to overcome the difficulty; and after it has once commenced to pass slowly, it will increase in rapidity until the whole of the preparation is obtained.

The *packing of the powder* in the apparatus, whether it be dry or previously moistened, is an important point in conducting displacement; in this, as in regulating the fineness of the powder, reference must be had to the nature of the substance treated, and of the menstruum. Drugs of a porous structure, when dry, require to be rather loosely packed to allow for the swelling produced on the addition of the liquid, though, if previously moistened, they may be somewhat compressed: hard, ligneous seeds or roots, should be tightly packed. The packing should be accomplished at intervals, during the filling in of the powder, so as to be uniform throughout the cylinder.

Repassing the first portions of the Liquid.—In a majority of cases the liquid first passes clouded, portions of powder sometimes being found in the receiving vessel, or the soluble principles, partially dissolved, having escaped through the diaphragm. In these instances, the liquid should be returned into the cylinder until it passes perfectly clear; it is, also, a good precaution in almost every case, where maceration has been omitted, to return the first portions of the liquid until they appear nearly saturated, reserving a portion to be added after the strength of the mass is nearly extracted. In making the saturated preparations, such as tincture of aconite root and wine of colchicum root, this precaution is especially important, and the necessity for its observance is increased in proportion to

the rapidity with which the process is conducted, and to the quantity of material to be exhausted.

When a substance in sufficiently fine powder has been macerated (if necessary), and then properly packed in an apparatus, so that on the addition of the liquid above it will pass drop by drop, and, the first portions being returned, give a clear and very strong preparation, *the last portions of liquid will pass almost destitute of the soluble principles* contained in the drug. This is the clearest indication of the success of the experiment; it also proves that, by displacement, we may entirely obviate the necessity of any means of expressing the last portions of liquid from a porous mass.

In making preparations by displacement, we should aim by skilful manipulation to extract nearly all from the drug that is soluble before adding the last few ounces of the menstruum, which may be used to displace the last portion held by the dregs, and to dilute the liquid to the proper point.

After maceration, the dregs are almost always saturated with the strongest portion of the liquid, which is wasted unless some means of expression are resorted to; but, if the dregs be thrown upon a filter, and a portion of water or other convenient liquid be poured upon it, the last drop may sometimes be forced out without a resort to the troublesome process of expression.

If the liquid thus added to the dregs is different from the menstruum originally employed, and especially if it is a heavier liquid, it is liable to mix with it, and sometimes results in injury to the preparation. By adding about one-third less of the displacing liquid than the supposed quantity of menstruum remaining in the dregs, this inconvenience is generally obviated.

In the preparation of a tincture it will sometimes happen that the last portion cannot be recovered by adding water. In making large quantities of alcoholic extracts or tinctures, made with strong alcohol, this is a great loss, and requires the use of a press. Convenient screw-presses are made in this city, and sold at eight dollars. The cylinder is of tinned iron, with strong bands to give it strength, and the screw is of wood. This is a useful instrument to the pharmaceutist in several processes.

Of the Solution of Gum Resins, &c., in Displacement Apparatus.— This class of vegetable products are usually so soluble in the menstrua employed for their extraction as to render it a matter of little importance whether they are treated by maceration or displacement. They should be thoroughly divided in order to expose an extended surface to the action of the liquid, and, if displaced, should be mixed with an equal bulk of sand to facilitate the process; when made by maceration, they require to be filtered to free them from impurities suspended in them, the necessity of which is obviated when they are treated by displacement. It has been stated that tincture of kino made by the displacement process is less disposed to gelatinize than that made by maceration, and there can be little doubt of this,

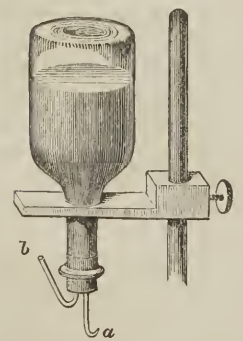
especially when the macerated article is allowed to stand in its dregs.

The management of this process requires the frequent attention of the manipulator to add fresh portions of the menstruum from time to time; but, if displacement is fairly commenced, the first portions having been returned as often as necessary, and coming through slowly and clear as above described, the following arrangement for *continuous displacement* may be adopted:—

A bottle or globe, capable of containing the quantity of menstruum necessary to complete the preparation, is fitted with a perforated cork, in which is inserted a glass tube of such length as that, being inverted over the displacement cylinder, the tube will descend below the surface of the liquid contained in it. The lower end of the tube should have a short curve turned on it; the bottle or globe being filled and arranged in this manner will not discharge any of its contents into the displacer until the surface of the liquid contained in it falls below the extremity of the tube; a bubble of air will then pass up into the bottle, and a corresponding portion of the liquid will descend. In this way the supply in the displacer will be kept up until the bottle has emptied itself; and, if the quantity of the liquid has been accurately estimated, the preparation will be finished without further attention.

Instead of having merely a straight piece of tube inserted in the mouth of the bottle from which the liquid is supplied, two tubes may be used, as shown in Fig. 115. In this case, the afflux tube *a* is turned up at the end, as recommended above, and as the liquid runs out here air enters at *b*. The surface of the liquid into which *a* is immersed, must, however, be so far below the lowest point of *b* as to enable the air to depress the liquid in the external ascending part of *b*, and thus to enter the bottle.

Fig. 115.



Bottle for continuous filtration and displacement.

The size of the tubes must be also so arranged that the liquid will not run from *a* unless the orifice of the tube be in contact with the contents of the filter, so that the cohesive attraction of the liquid may overcome the capillary attraction.

The process of displacement is very similar in its *modus operandi* to that of filtration; both are due to capillary attraction. In ordinary filtration the capillarity of the paper causes the absorption of a certain quantity of liquid, but, on more than enough to wet it being added, the pressure of this drives out the first, taking its place and so on. Precisely the same thing occurs in displacement; a porous substance being saturated with any liquid for which it has an affinity will yield this up, if a portion of liquid be poured on above, from the

force of gravitation merely; and hence, in proportion to the height of the column of liquid, other things being equal, will be the rapidity of the process.

The fact that alcohol and ether pass through most plants so much more rapidly than water, is due, perhaps, in part to these liquids being less forcibly held by this species of attraction; but mainly to their dissolving less freely the organic proximate principles most abounding in plants, and which render aqueous liquids so thick and viscid as to pass with difficulty.

Rhubarb, senna, squill, and a few other porous substances, containing a large proportion of mucilaginous and extractive matters, cannot be conveniently treated by displacement with aqueous liquids owing to this cause; in treating these, either by water, diluted alcohol, diluted acetic acid, or any other menstruum containing a considerable proportion of water, the following points are to be observed:—

a. The powder must not be too fine.

b. The coarse powder must be macerated with the menstruum before being introduced into the displacer; or, when it is introduced dry, it must be at first loosely packed, otherwise, being swelled very much on the absorption of the liquid, it may become too tight.

c. The displacer must have a wide, and rather coarse diaphragm; it would be impossible to manage the process in a common funnel with a plug of cotton in the tube, as described on p. 99.

d. When the process proceeds with difficulty, from the causes above described, or from otherwise defective manipulation, it may be partly obviated by adding a considerable column of the menstruum above the mass; this, as already stated, acting by hydrostatic pressure, forces the liquid through with increased facility.

e. Time and patience will to a certain extent correct the same difficulty; after the first portions of the liquid, which pass so slowly from being highly charged with the soluble principles, and from the continued swelling of the powder, the remaining volume will come through more readily, increasing in rapidity to the end.

f. The admixture of sand serves a good purpose in this case, as in that of the gum resins.

g. Alcohol, diluted in various quantities with water, is used instead of water alone, in making by displacement fluid extract of senna, fluid extract of pink-root and senna, syrup of rhubarb, syrup of seneka, compound syrup of squill, and perhaps some other preparations, mainly on account of the difficulty above referred to.

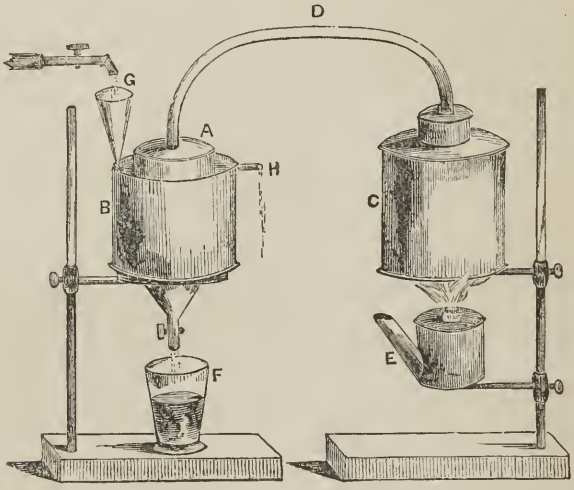
Displacement, applied to hot liquids, requires some modification, both as regards the apparatus and the manipulations which next claim attention.

The deterioration to which vegetable infusions are liable, by boiling, is adverted to under that head; the chief use of displace-

ment with steam or hot liquids is to obviate this, at the same time that the advantages of high temperature are secured.

The steam displacement apparatus, invented by C. Augustus Smith, late of Cincinnati, Ohio, here figured, consists of two distinct parts, *B*, the displacer, and *C*, the boiler, connected by a tube of tin or lead, *D*. *A* is a tin cap luted on to the top of a common

Fig. 116.



Smith's steam displacer.

displacement tube terminating in the funnel-shaped appendage below. This is surrounded by a tin jacket, into the bottom of which the conical tube *G* conducts cold water, while the spout *H* discharges the warmed water from the top. The substance to be treated being placed in the displacer, and the liquid designed to be applied to it put into the boiler, the connections are luted on, and heat applied by the lamp *E*, or preferably by a gas furnace. The vapor which is generated passes through the tube *D*, and penetrates the whole mass in the displacer, the jacket being now filled with cold water, the steam is condensed and passes out below, where it is collected in the receiver *F*. The advantage is thus gained of penetrating the powder thoroughly by the aid of heat, while the deteriorating influence of decoction is avoided.

Repeated experiments with this instrument have convinced me that it possesses advantages over the ordinary means for extraction with hot liquids, which should recommend it to general favor; it is not only useful as a substitute for decoction, but obviates the difficulty above adverted to of extracting certain porous and largely soluble vegetables with water. The steam, whether of water or alcohol, being generated in the boiler and passed into the displacer,

before the addition of cold water to the cooler, is maintained at an elevated temperature, until it has thoroughly permeated the mass; it is then, by refrigeration, converted into liquid, which finds ready egress through the lower orifice of the displacer, and is highly charged with the soluble vegetable principles present. The removal of these added to the pressure of the steam continually kept up from the boiler as fast as it is condensed, renders the flow rapid, and the preparation concentrated.

Fluid extract of senna can be prepared in the steam displacer, in less than twelve hours, without the use of alcohol as a menstruum; so concentrated is the decoction obtained in the first instance, as to require comparatively little evaporation to bring it to the officinal standard.

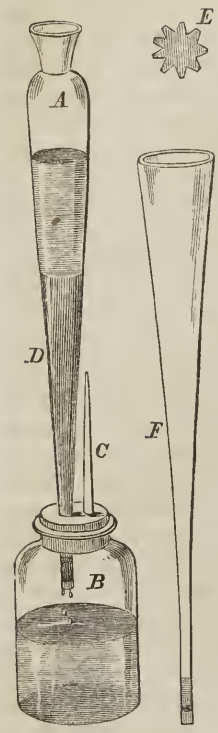
The apparatus, as above described, is not adapted to treating substances with diluted alcohol; if that liquid be placed in the boiler, the effect of the heat applied is to drive over the alcohol first, and then the water, so that the first portion being stronger of the resinous principles, and the latter of the starch and extractive, the mixture of the two would be turbid, and the extract not freely soluble. To obviate this, two boilers are sometimes adapted to one cylinder, one for alcohol, and the other for water, and by a proper regulation of the heat to each, the vapors may be brought over in nearly equal proportions at the same time. The cylinder should not be made of too great diameter, nor length; but I am informed by the inventor, that he uses cylinders of the capacity of a barrel; this is perhaps the largest size that would answer well in practice; where larger quantities of the same substance are to be treated at once than will fill such a cylinder, or where several different operations requiring the same menstruum are to be conducted simultaneously, two or more cylinders may be attached to the same boiler, and placed in the same cooler.

Substances heretofore digested in hot alcohol, a very inconvenient process, may be treated with that menstruum, with great facility, by using this apparatus as above described.

For *displacement with ether*, an ingenious apparatus, invented by Prof. Mohr, is figured in his work. It combines the advantages of a good air-tight displacer with that of a still for recovering the ether; it is, however, a complex apparatus, and rather expensive. I omit a drawing of it, as being accessible in that work, and not likely to be generally useful to the class for whom this is mainly designed.

For displacement with ether at ordinary temperatures, especially where a small amount of the medicinal substance is to be treated, a common displacer may be used, care being taken to cover it and the receiving vessel, to prevent evaporation; a narrow lamp-chimney, fitting below into a wide-mouth bottle, will be found to serve a good purpose, or, if large enough, a syringe pattern displacer. An adapter, such as is used in retort operations (Fig. 117, *A*), may

Fig. 117.



Extemporaneous glass displacers.

be inserted through a perforated cork into a convenient bottle, the top being covered with a piece of bladder pierced with pin-holes, or fitted rather loosely with a cork to prevent evaporation.

Fig. 117 represents two forms of displacers for ether and other volatile liquids: *A* is an adapter. The tube *C* is drawn out into a fine point, so as to admit the passage of the air without favoring evaporation. *E* represents a notched cork diaphragm, *F* a broken retort beak, suited to similar operations.

The application of a vacuum to promote the rapidity of the displacement process, is an important improvement in certain cases, and several very ingenious forms of apparatus have been contrived by the French with this end in view; perhaps the best of these are the coffee-pots, in which the pressure of steam is first brought to bear in penetrating the mass with the hot liquid, and then by the withdrawal of the source of heat, the steam is immediately condensed, creating a vacuum which hastens the downward passage of the liquid. In using Smith's steam displacer, though at no time a very complete vacuum is formed, yet this principle comes into play, and undoubtedly facilitates the percolation of the mass under treatment, in the same way that it operates in a vacuum displacer.

CHAPTER V.

TINCTURES.

THE consideration of the process of displacement has prepared the student to enter upon those Galenical solutions in the preparation of which it is employed. Prominent among these, as the most numerous and most varied, is the class of tinctures.

The study of these and other Galenical solutions is less attended to by students than their importance demands; in some respects a knowledge of pharmaceutical preparations is more important than

a familiarity with the drugs themselves. It is the preparations that enter into the prescriptions of the physician almost exclusively; he should be acquainted not only with their doses, but with their proper therapeutical and pharmaceutical adaptations, as modified by the menstrua employed in their preparation, by their degree of concentration, their miscibility with other liquids, &c.

With a view to conveying this knowledge, as far as practicable, I shall devote the present chapter to the consideration of the tinctures officinal in the *U. S. Pharmacopœia*, and those unofficinal tinctures which are commonly used in this country.

Tinctures invariably contain alcohol, more or less diluted, as the vehicle for their active ingredients.

Alcohol, as officinal in the *U. S. Pharmacopœia*, is a colorless, limpid, very volatile liquid, of a peculiar penetrating odor, and burning taste, having a specific gravity of .835. Its chief impurities as found in commerce, are as follow: Water, which increases its specific gravity in the ratio of its proportion; fusel oil, a constituent of whiskey, which being volatile, though less so than alcohol, is generally imperfectly separated in the distillation: this may be detected, by its imparting the peculiar odor of whiskey to the alcohol, and particularly by the odor left on the hand, after the alcohol has evaporated from it; and coloring matter, which is generally derived from the casks in which it is kept.

Alcohol, of .835 sp. gr., called druggist's alcohol, contains 85 per cent. of pure or absolute alcohol; it is an excellent solvent for a large number of vegetable substances, as resins, camphor, benzoic acid, tannic acid, the balsams, grape sugar, the vegetable alkalies, castor oil; also for some inorganic substances, as iodine, carbonate and muriate of ammonia, caustic potassa and soda, nearly all deliquescent, and a few other salts. It mixes freely in all proportions with water, ether, acetic acid, and most of the essential oils, and reacts with several acids, forming ethers.

Besides its extensive solvent powers, qualifying it for so many uses in pharmacy, it is a most convenient antiseptic, effectually preventing fermentation in organic solutions to which it is added.

By the low temperature at which it evaporates, it is well suited to the preparation of certain concentrated medicines, requiring long evaporation, and containing volatile ingredients.

In connection with these valuable physical properties, its therapeutical relations should not be overlooked. Alcohol is a very powerful arterial stimulant; even in small quantities it produces fulness of pulse, and a general excitant influence on the system; and hence the tinctures, especially those given in large doses, should not be used in the treatment of inflammatory diseases, and should be employed with prudence in all chronic cases, lest the continual stimulus derived from the alcohol they contain, should lead to the habitual use of intoxicating drinks.

The use of this strong alcohol in the preparation of tinctures, is

confined to a comparatively small number of medicines, chiefly such as contain a considerable proportion of essential oil, of resin, or of resinoid principles.

Diluted Alcohol—Alcohol Dilutum, U. S. P.—This is more extensively employed as a menstruum for tinctures; it consists of equal parts by measure of alcohol and water; its specific gravity is .935. Containing water, the great natural solvent, in so large proportion, this liquid is capable of extracting from plants, gum, extractive matter, vegetable albumen, and most coloring matters which are soluble in that menstruum, and to a certain extent, resinous matters, essential oils, and vegetable alkalies, soluble in alcohol; also sugar and tannic acid, soluble in both.

It has been supposed that the affinity for each other of the two ingredients in this liquid, interferes somewhat with the solvent powers of each; so that substances wholly insoluble in water are not so thoroughly extracted by a given quantity of diluted alcohol, as they would be by half the quantity of strong alcohol; and so in the case of substances insoluble in alcohol, they will not be so thoroughly extracted by the mixture as by water alone; but, according to the experiments of M. Jaques Personne, published in the *American Journal of Pharmacy*, vol. xviii. pp. 21, 103, the reverse of this is the fact, and a mixture of alcohol and water is stated to be a better solvent of the resinous and extractive principles of plants, than the same quantity of these two liquids separately employed.

Whatever may be the truth in theory, diluted alcohol is found in practice to answer an excellent purpose; furnishing tinctures which are entirely permanent, at the same time that they are less stimulating than those made with strong alcohol, and are also miscible with aqueous solutions without any portion of their active principles precipitating.

There are, no doubt, advantages gained by varying the proportions of water and alcohol to suit particular drugs.

There are three preparations officinal in our own *Pharmacopœia*, which are exceptions in the proportion of alcohol contained in them. The infusion of digitalis, and compound infusion of gentian, as before stated, are rendered permanent by small quantities of alcohol added to them, or by being made with very weak diluted alcohol. (See *Syllabus of Infusions*.)

The other is one of the tinctures which I shall for convenience notice here, omitting it in the syllabus which follows.

	Composition.		Dose.	Medical Properties.
Tinctura Aloes—	Aloes, ℥ss Liquorice, ℥iss	Alcohol, f℥iv Water, f℥xii.	f℥ss	Mild cathartic.

With the object of presenting to view the composition, doses, and medical properties of the officinal tinctures, I have prepared the following series of Tables.

SYLLABUS OF TINCTURES.

Officinal in the *U. S. P.*[1]

Class I.—*Made with Diluted Alcohol.*

Group 1.—These are all made in the proportion of two ounces of the active ingredient to one pint of diluted alcohol. They may be nearly all classed as narcotics, though with properties modified in each case. Doses vary from 10 drops to f℥j.

Officinal Name.	Med. Properties.	Dose.	Remarks.
Tinctura aconiti foliorum	Nervous sedat.	20 to 30 drops	See tinct. aconiti radicis.
" belladonnæ	Narcotic	do.	
" stramonii	do.	do.	Made from the seeds.
" conii	Alterat., narcot.	30 to 60 drops	Misnamed tinct. cicutæ.
" hyoscyami	Narcotic	do.	
" digitalis	Diuret., narcot.	10 drops	English leaves preferred.
" lobeliæ	Emetic, stim., narcotic	f℥ss to f℥j	Emetic dose, f℥ss.
" sanguinariæ	do.	do.	do.
" scillæ	Emetic, diuret., expect.	10 to 30 drops	See Acet. scillæ.
" colchici seminis	Diuretic, &c.	10 drops to f℥j	See Vin. & Acet.

Group 2.—These are made in varying proportions. They are generally quite incompatible with salts of iron, forming inky solutions. They are all astringents or tonics, or both. Doses, from f℥j to f℥ss.

Officinal Name.	Proportions.	Dose.	Med. Properties.
Tinctura gallæ	℥ij to Oj	f℥ij	Astringent.
" catechu	℥iss to Oj with ℥j cinn.	do.	do.
" kino	℥iss to Oj	f℥j	do.
" krameriæ	℥iij to Oj	do.	do.
" cinchonæ	do. yellow bark	f℥ss	Tonic.
" " comp.	red bark, B. orange peel, serpentaria, saffron, saunders	do.	do. aromatic. (Huxham's.)
" colombæ	℥ij to Oj	do.	Tonic.
" gentianæ comp.	gentian, B. orange peel, cardamom	do.	do. aromatic.
" quassiæ	℥j to Oj	f℥ij	do. do.
" humuli	℥ijss to Oj	do.	do. sedative.

[1] See Galenical preparations of opium.

Group 3.—Of varying proportions, chiefly stimulants and aromatics. Doses, generally from f℥j to f℥ij.

Officinal Name.	Proportions.	Dose.	Med. Properties, etc.
Tinctura valerianæ	℥ij to Oj	f℥ij	Tonic, antispasm. (See ext. fld.)
" serpentariæ	℥iss do.	do.	Stimulant tonic.
" cubebæ	℥ij do.	do.	Stimulant (added to copaiba mixt.).
" cantharidis	℥ss do.	gtt. xx	Stimulant, to be diluted largely.
" capsici	do. do.	f℥j	do. do.
" cinnamomi	℥iss do.	f℥ss	Carmin., adjuvant.
" cardamomi	℥ij do.	f℥j	do. do.
" cinnamomi comp.	cinnamon cardamom ginger	f℥ss	do. do.
" cardamomi comp.	cardamom cinnamon caraway raisins cochineal	f℥ss	do. do.

Group 4.—Of varying proportions. Cathartics with modified properties. Chiefly compound. Doses generally, f℥ss.

Officinal Name.	Proportions.	Dose.	Med. Properties, etc.
Tinct. hellebori	℥ij to Oj	f℥j	Emmenagogue, cath.
" jalapæ	℥iij to Oj	do.	Cath., always used in combination.
" rhei	℥iss do. with cardam. ℥ij	f℥ss	Tonic, cathartic.
" " et aloes	rhubarb aloes cardam.	do.	Mild cathartic. (Elixir sacrum.)
" " et gentianæ	rhubarb gentian	do.	Laxative, tonic.
" " et sennæ	rhubarb senna coriander fennel saunders saffron liquorice raisins	do.	Carminative, laxative. (Warner's Cordial.)
" sennæ et jalapæ	senna jalap coriander cardamom caraway sugar	do.	Carminative, laxative. (Elixir salutis.)

Remarks.—The tinctures made with diluted alcohol, are here found to be susceptible of division into four groups, arranged chiefly with a view to their medical properties, but generally having other features in common. Thus the majority of the narcotic tinctures (Group 1) are given in the dose of from 20 to 60 drops, and they are all made in the proportion of two ounces of the drug to one pint of the menstruum. The six first named in the table form a very natural group; the remaining four have fewer points of resemblance, and several cannot be classed with narcotics without doing some violence to their true position. The tincture of digitalis is not only peculiar in its therapeutical action, but forms an exception in the dose.

The tonic and astringent preparations are appropriately associated in one group, though differing among themselves. Tincture of quassia is *sui generis* in containing no astringent principle. The dose of these will be observed to be much larger, ranging from two fluidrachms to half a fluidounce.

The third group has less points of resemblance among its members than either of the others. The last four of this group are, however, all used for the same purposes, as adjuvants to other medicines, in extemporaneous solutions and mixtures. The compound tincture of cardamom is a very rich and elegant one for this purpose.

With the exception of tinctures of hellebore and jalap, the fourth group is a very natural one; these are what are called stomachics, and are much used in debilitated states of the stomach and bowels, following protracted illness. They should be used with caution, for fear of inducing intemperate habits.

The doses named in the tables may be considered as average adult doses; it is impossible to state their variations in a table.[1]

Class II.—*Made with Officinal Alcohol, sp. gr. .835.*

Group 1.—Saturated tinctures, or nearly so.

Officinal Name.	Proportions.	Dose.	Med. Properties.
Tinctura aconiti radicis	℥vj to Oj	gtt. v to x	Nervous, sedative.
" nucis vomicæ	℥iv do.	do. v to xv	do. stimulant.
" zingiberis	do. do.	f℥j	Carminative.

[1] See unofficinal tinctures.

Group 2.—Resinous tinctures.

Tinctura myrrhæ	℥ij to Oiss	f℥j	Astringent, emmenagogue.
" aloes et myrrhæ	aloes ℥iss, saffron ℥ss, tr. myrrhæ Oj	f℥j	Laxative, do. (Elixir proprietatis.)
" guaiaci	℥iij to Oj	f℥ij	Alterative, diaphoretic.
" assafœtidæ	℥ij do.	f℥j	Antispasmodic.
" castorei	℥j do.	f℥ss	do.
" lupulinæ	℥ij do.	f℥j	Tonic, narcotic.
" tolutani	℥iss do.	f℥ss	Stimulant, expectorant.
" benzoini comp.	benzoin, storax, bals. tolu, aloes	do.	do. do. (See Turlington's balsam.)

Group 3.—Simple solutions in alcohol.

Tinct. camphoræ	℥ij to Oj	gtt. xx	Stimulant.
" ol. menth. pip.	f℥ij to do.	do.	Carminative.
do. sativæ	do. do.	gtt. xxx	do.
" iodinii	℥j to do.	gtt. xv	Alterative.
" " comp.	iodine ℥ss, iodide potass. ℥j	do.	do.
" saponis camphorata	soap, camphor, oil rosemary		Used externally. (Liquid opodeldoc.)

Remarks.—It will be observed that tinctures of this class are generally given in smaller doses than those of the first class.

They are as a class more active preparations.

The first group in this series, except tincture of ginger, are difficult tinctures to prepare properly. It is best to macerate the substance in the alcohol, previously to the employment of the displacement process, and the frequent repassing of the liquid through the powder to insure its saturation. I have found advantage in these cases, from employing the heat of a sand-bath during the maceration, and then displacing with great care to extract the whole of the active virtues.

This class, especially the 2d group, and tinctures of camphor and iodine of 3d group, are all incompatible with aqueous liquids, which, by rendering the basis insoluble, precipitate it. Notwithstanding this apparent disadvantage, these tinctures are sometimes added to mixtures containing a large proportion of water, and answer a very good purpose, especially where sugar or gum are added as ingredients. Some of the resinous tinctures are much given on sugar, which being allowed to dissolve slowly in the mouth, is well calculated to develop their taste and odor.

The tinctures of essential oils, of which those of peppermint and spearmint are officinal, are commonly known as essences; but most of the essences sold are much below the officinal standard, as might be inferred from their price. (For a further account of this class of tinctures, see chapter on *Distillation*.)

Tinctures of tolu and ginger are used in the preparation of the officinal tolu and ginger syrups. The latter is extensively known as essence of ginger, and is one of the most popular of carminatives.[1]

Class III.—*Made with Aromatic Spirit of Ammonia.*

AMMONIATED TINCTURES.

Tinct. guaiaci ammoniata	℥iv to Oiss	Stimulating diaphoretic,	Dose, f℥j.
" valerianæ "	℥ij to Oj	Antispasmodic,	do.

Aromatic spirits of ammonia, itself an admirable stimulant and antacid, and extensively used as a remedy for sick-headache, is used as a menstruum in this class of tinctures; it has the advantage, from the quantity of volatile alkali it contains, of increasing the solubility of resinous bodies, and also adding to their stimulating effects and comparative medicinal efficiency in certain cases.

Tinctures not Officinal in *U. S. P.*

Under this head only a few of the more important will be introduced. The reader is referred to Medical Formularies for such as are not selected for insertion here.

Tinctura Cinchonæ et Quassiæ Composita.—Tonic Tincture.

Take of Cinchona, in coarse powder,		
Quassia,	"	
Colombo,	"	
Gentian,	"	
Serpentaria,	"	
Chamomile, of each	. . . .	℥ss.
French brandy	. . . . .	Oij.

Macerate 14 days, and extract by displacement. A very valuable combination of bitters, which, by the absence of the disagreeable

[1] I do not see the propriety of the use of strong alcohol in all the tinctures of this class; in several of those of the 2d group, diluted alcohol would seem to be the proper menstruum. In myrrh, there are 44 parts of gum to 40 of resin, and 2 of essential oil, so that one would suppose the proportion of diluted alcohol would be exactly suited to its solution.

Experiment proves that in assafœtida there are about 65 parts of resin and 31 of gum, which would seem to indicate the use of about 2 parts of alcohol to 1 of water.

resinous coloring matter of saunders, and by the employment of an acceptable form of alcohol as the menstruum, is adapted to supersede Huxham's tincture of bark. Dose, f℥j to f℥ss.

Bitter Tincture of Iron. (Dr. Physick.)

Take of Iron filings	. . . . .	℥iij.
Bruised ginger,		
" gentian, of each	. . .	℥j.
" orange-peel	. . . .	℥ss.

Infuse in one pint of old cider for two weeks, in a bottle without a stopper, and filter. Dose, 30 drops, three times a day.

Although not an elegant preparation, this is an efficient and popular chalybeate tonic.

Tinctura Cinchonæ Ferrata.

On account of the large number of cases in which the tonic effects of cinchona and aromatics are indicated with ferruginous preparations, it is desirable to contrive a method of combining these without producing the inky and grumous appearance resulting from the diffusion of tannate of iron in the preparation. A tincture, with the above title, was announced some time since by Samuel Simes, of this city, as combining the advantages of cinchona and iron. A specimen of this being examined by Alfred B. Taylor, was pronounced to contain less than half a grain of the iron salt to an ounce; this occasioned the publication of a recipe by S. Simes, directing the precipitation of the cincho-tannin, from the tincture made with brandy, by an excess of hydrated sesquioxide of iron; after filtration, and washing the precipitate with alcohol to recover any alkaloid which might otherwise be lost, 16 grains of ammonio-citrate of iron were directed to be dissolved in each fluid-ounce, and, according to the statement, would produce no precipitation of the inky tannate.

Experiments carefully performed by myself and others, show that this result is not attainable, except by the presence of a considerable excess of citric acid, which will very much diminish the tendency of the tincture to blacken on the addition of the iron salt, even without the previous treatment prescribed in the recipe of Simes. This preparation, then, is conveniently prepared extemporaneously by the proper admixture of compound tincture of cinchona, or preferably tinctura cinchonæ et quassiæ composita, with citrate of iron, and an excess of citric acid (gr. iv to f℥j). (See *Extemporaneous Prescriptions.*)

Tinctura Matico. (Dublin Ph.)

Take of Matico leaves, in coarse powder,		8 ounces (avoirdupois).
Proof spirit	. . .	2 pints (imp'l measure).

Macerate 14 days, strain, express, and filter.

Dose, from f℥j to f℥iij. Used as an alterative stimulant and hæmostatic.

The solution of the alkaloids in alcohol constitutes a class of tinctures which are convenient and very readily prepared, though none of them are officinal in the *U. S. Pharmacopœia.*

Tinctura Quiniæ Composita. (Dublin Ph.)

Take of Sulphate of quinia . . ℥v, ℈j.
Tincture of orange-peel . Oij (imperial measure).
Digest for 7 days, or till dissolved.
Dose, f℥j, containing a grain of the quinia salt.

The tincture of orange-peel, which is not officinal here, may be substituted by tinct. gentianæ comp., *U. S.*

Tinctura Strychniæ.

Take of Strychnia . . . . . gr. iij.
Alcohol . . . . . f℥j.
Make a tincture.
Dose, ♏v to xvj.

This is perhaps about the strength of tincture of nux vomica (as shown below), for which it is sometimes substituted.

Name.	Proportions.	Dose.
Tinctura nucis vomicæ, *U. S.*,	℥iv to Oj alc.,	5 to 15 drops.
" strychniæ,	gr. iij to f℥j,	16 drops = $\frac{1}{10}$ grain.

Tinctura Cannabis Indicæ. (Dublin Ph.)

[1]Take of Purified extract of Indian hemp . . ℥ss.
Alcohol (Oss, imperial measure) . . f℥ixss.
Dissolve the extract in the alcohol.
Dose, as a narcotic about 40 drops.

Flemming's Tincture of Aconite.

Take of Aconite root (dried and finely powdered) ℥xvi (Troy).
Rectified spirits . . . . Sufficient.

Macerate for four days with sixteen ounces of the spirits, then pack into a percolator, add more until twenty-four ounces of tincture are obtained.

This is the strongest of the tinctures of aconite, and is compared with the others in the following syllabus.

Name.	Proportions.	Dose.
Tinctura aconiti foliorum, *U. S.*,	℥ij leaves to Oj dil. alc.,	20 to 30 drops.
" " radicis, *U. S.*,	℥vj root to Oj alcohol,	5 drops.
" " (Flemming's),	℥viij root to f℥xij do.,	3 to 5 drops.

[1] See Extracta.

There is not so great a difference between the last two as their relative proportions would indicate, both being nearly saturated. Great care should be taken to distinguish these by their full name in prescribing.

Dewees's Tincture of Guaiac.

Take of Guaiacum resin	℥iv.
Carbonate of potassa	℥iss.
Pulv. pimento	℥j.
Diluted alcohol	Oij.

Digest for two weeks. Dose, from f℥j to f℥ij.

Tinctura Rhei Aromaticus.

Take of Rhubarb,	
Caraway,	
Orange-peel, of each	℥ij.
Brandy	Oij.

Macerate for two weeks or displace. Dose, f℥j to f℥ss.

CHAPTER VI.

MEDICATED WINES AND VINEGARS.

These two classes of Galenical solutions are less numerous, and generally less important, than the tinctures, to which they are closely allied.

Vina Medicata, *U. S. P.*

There are two kinds of wine officinal in the *U. S. Pharmacopœia:* vinum album (vinum of the older Pharmacopœias), which is sherry wine (Teneriffe and Madeira are sometimes used in its stead), and vinum rubrum, which is port wine. The former contains near 20 per cent. of alcohol, sp. gr. .825, and the latter near 26 per cent.

In all the medicated wines which are officinal, white wine is directed as the menstruum. This is a clear, amber colored liquid, having an agreeable pungent taste, and destitute of acidity. It possesses the advantage over either alcohol or diluted alcohol, of being less stimulating, and more agreeable in its taste and in its effects on the system. It is chiefly objectionable as a substitute

for diluted alcohol, from its liability to decompose when impregnated with the soluble principles of plants. To meet this objection, it is customary with some to add from one to two fluidounces of alcohol to a pint of the wine, and this course is directed in the Pharmacopœia in the case of vinum rhei.

SYLLABUS OF OFFICINAL MEDICATED WINES.

White or Sherry Wine, used in making them.

Officinal Name.	Proportions.	Dose.	Med. Properties.
Vinum aloes	℥j + cardamom, ginger, āā ℥j } to Oj	f℥ij to f℥ij	Carminative, aperient.
" rhei	℥ij + canella ℥j dil. alc. f℥ij } do.	f℥j to f℥ss	do.
" colchici rad.	℥vj do.	gtt. x to f℥j	Diuretic, nerv. sedat.
" " seminis	℥ij do.	f℥j to f℥ij	do.
" ergotæ	℥ij do.	f℥j	Excito-motor stim.
" ipecacuanhæ	℥j do.	f℥j to f℥ss	Expectorant.
" tabaci	℥j do.	gtt. xx.	Diuretic.
" veratri albi	℥iv do.		
" antimonii	2 grs. tart. emet. to f℥j	f℥j to f℥ss	Expect.,emet.

Wine of ipecac is an elegant and very popular preparation, being much used by itself, and along with other expectorant and diaphoretic remedies; it is not as depressing in its effects as wine of antimony, and yet about equally efficacious as an emetic and nauseant. It has just double the strength of the syrup of ipecac.

Wine of ergot is perhaps more used than any other preparation of that drug; it has no other fault than its proneness to decompose in hot weather, which makes it necessary to add a little strong alcohol, or to keep it in a cool place, and in well-stopped bottles.

Wines not Officinal in *U. S. P.*

Aromatic Wine.

Take of Wormwood,
Peppermint,
Rosemary,
Thyme,
Hyssop,
Sage,
Lavender,
Sweet marjoram, of each . . . . ℥ij.
Port wine . . . . . Oij.

Macerate 7 days and displace.

The principal use of aromatic wine is as an astringent and stimulating wash, applied particularly to buboes.

Wine of Tar—Tar Beer—Jews' Beer.

A formula for this preparation was published in the 14th volume of the *American Journal of Pharmacy* (p. 281), by the late Augustine Duhamel, in which a quart of bran, a pint of tar, half a pint of honey, and three quarts of water, are mixed together in an earthen pipkin, allowed to simmer over a slow fire for three hours, then suffered to cool, half a pint of yeast added, and after it has stood thirty-six hours, strained for use.

If these directions are followed to the letter, the product is exceedingly unsatisfactory, will not keep well, and is impregnated with but a small amount of the medical virtues of the tar. The addition of the tar at the first part of the process is the chief objection to this formula, as by its antiseptic properties it checks the fermentation, and thus diminishes the production of alcohol, and consequently the amount of tar dissolved.

The office of the bran is to disintegrate the tar so that the water may act on a largely exposed surface. Ground malt answers this mechanical purpose equally well, and as it is acted on by ferment when placed in water, this is an additional reason why it should be preferred to the bran. When, therefore, malt is substituted for bran, and the mixture of malt, honey, water, and yeast, is suffered to react for thirty-six hours before adding the tar, so much alcohol is generated, that it enables the fluid to dissolve a much larger proportion of that substance, and to keep perfectly well. The following is the formula proposed by Professor Procter:—

Take of Ground malt, honey, and tar, of each one pound;
Yeast, half a pint;
Water, a sufficient quantity.

Mix the malt, honey, and three quarts of the water in an earthen vessel, keep them at the temperature of 150° F. (about), with occasional stirring for three hours, then suffer the whole to cool to about 80° F. and add the yeast.

Fermentation soon sets in, and should be promoted by maintaining the temperature between 70° and 80° F. during thirty-six hours. The supernatant fluid should then be decanted from the dregs of the malt, and the tar added gradually to these in a small stream, stirring constantly so as to distribute it uniformly among them, and prevent its conglomerating in masses. The decanted fluid is then returned to the vessel, and the whole well stirred up from time to time for several days or a week, observing to add water occasionally to keep the original measure. The whole is then thrown on a piece of Canton flannel or other close strainer, the fluid allowed to pass, and the dregs expressed strongly to remove as much as possible of the fluid inclosed. The expressed

liquid is then filtered for use: there is an advantage in allowing it to stand, until it gets nearly clear by subsidence, before filtering it. When first made, before filtering, wine of tar has but little color, but soon acquires a reddish-brown hue by exposure. It smells and tastes strongly of tar, is slightly acid, is not unpleasant to most persons, and, when prepared as above, is undoubtedly a valuable auxiliary to the physician in pulmonary diseases.

The dose of wine of tar is a tablespoonful.

Brandy (distilled wine) is occasionally used as a menstruum instead of diluted alcohol, which it resembles in strength. It is a pleasanter spirit in its effect, though too expensive and too much adulterated to be generally substituted. A tincture is much prescribed as a fine tonic under the name Tinct. cinchonæ et quassiæ comp., introduced in the last chapter; it is made with brandy.

ACETA, *U. S. P.*

In the list of the Pharmacopœia, Acetum, vinegar, is described as impure diluted acetic acid, prepared by fermentation. One fluidounce of it is said to be saturated by about 35 grains of crystallized bicarbonate of potassa. From this is prepared—

Acetum destillatum, officinal among the preparations, prepared by distilling vinegar, rejecting from each gallon the last pint, which contains the impurities. This liquid, which is nearly pure *weak* acetic acid, is about the same strength as the crude vinegar from which it is obtained, and possesses the same saturating power.

Distilled vinegar was directed in the Pharmacopœia of 1840, as the menstruum for the preparation of the officinal *aceta*, but in the last edition, it has been substituted by acidum aceticum dilutum.

The chief reason for this change has been that the latter liquid is cheaper and much more easily obtained. The immense production of *acetic acid* for use in the arts as well as in medicine, has reduced its price to a much lower point than formerly. The small bulk of the strong acid recommends it for transportation, and it may be readily and immediately diluted to the point desired. It is free from organic impurities, while the ordinary product of the distillation of vinegar is not, as shown by the fact that, while the latter is apt to turn brown on the addition of an alkali, the former remains clear and colorless.

The chief impurities likely to be present in acetic acid of commerce, are sulphuric, nitric, and muriatic acids, and traces of acetates of lead and copper.

Sulphuric acid is detected by the addition to a quite dilute solution of a small portion of a solution of chloride of barium, or nitrate of baryta, which will form a white precipitate of sulphate of baryta, if sulphuric acid be present. *Muriatic acid*, by the addition to another portion of a very dilute solution of nitrate of silver, will throw down white chloride of silver. *Nitric acid* is known to be pre-

scnt when, upon the addition of a small piece of metallic silver, a portion of the latter is dissolved, and may be precipitated as a white chloride upon adding a drop of muriatic acid. *Acetate of lead*, if present, may be detected by adding to a small quantity of the diluted acid, saturated with ammonia, a solution of iodide of potassium, which will give the bright yellow iodide of lead; it being insoluble, will separate as a precipitate. *Acetate of copper*, if suspected, may be proved to be present when a precipitate falls after the addition of a solution of ferrocyanide of potassium to a portion of the dilute acid, saturated with ammonia.

Acetic acid of commerce, sometimes designated as "No. 8," has, or should have, the sp. gr. of 1.041. The best method, however, of ascertaining its strength, is to saturate a given portion of it with bicarbonate of potassa in crystals: if of standard strength, 100 grains by weight of the acid will be accurately saturated by 60 grains of the crystals. The point of saturation is ascertained by the use of litmus paper, which should not change to a decided red color on immersing it in the liquid, after the addition of the bicarbonate. This experiment requires care, in order to secure a satisfactory result; if it should be found that the solution is decidedly acid, when tried by the test-paper, a further addition of bicarbonate should be made, noting the quantity. If considerably more than 60 grains are required to make it neutral, it is too strong, and generally the presence of some foreign acid may be suspected. If the proportion of bicarbonate is more than sufficient to make the solution neutral, the acid is then deficient in strength. Owing to the delicacy of the test by litmus paper, a specimen of acetic acid will seldom be found which will be *accurately saturated* by the required quantity of this or any other salt, and in estimating the value of the sample, the experimenter must be satisfied if the result is approximately correct, especially as carbonic acid, being liberated by the bicarbonate, is present in the solution, and is liable to influence slightly the behavior of the test-paper. Practically, no material disadvantage results, in the preparation of medicated vinegars, if the acetic acid happens to vary somewhat from the standard strength, provided it be free from foreign substances.

Acidum Aceticum Dilutum.—This liquid is made by adding to one part of acetic acid seven parts of water (making eight parts), so that the proportions may be stated as one part of strong acid in every eight parts of diluted. As 60 grains of bicarbonate of potassa saturate 100 grains of the strong acid, $7\frac{1}{2}$ grains (one-eighth of sixty) will saturate the same quantity of the diluted acid; or, observing very nearly the same proportion, 35 grains will saturate one fluidounce.

The use of diluted acetic acid as a menstruum is confined by the *U. S. Pharmacopœia* to colchicum, squills, and opium. In the preparation of emplastrum ammoniaci, it is employed to dissolve the

gum, and afterwards evaporated so as to leave it in a pure and softened condition suitable for spreading on kid. (See *Emplastra.*)

In the case of colchicum, it is used with a view to furnish the active principle colchicia in the form of acetate; it is milder in its action than the wine, and is suitable for combining with magnesia and sulphate of magnesia.

It forms an admirable menstruum for squill, its acid taste recommending it over both water and alcohol, and its medical action promoting that of squill in most cases to which that medicine is adapted.

In the case of opium, the object in employing this acid is to assist in dissolving and extracting the morphia, with which it combines, furnishing a soluble salt, and one which is considered more agreeable in its action than the meconate as it exists in the drug.

The antiseptic properties of diluted acetic acid are inferior to those of diluted alcohol, and on that account these preparations are more liable to change than the tinctures. A small addition of alcohol is sometimes made, to obviate this. I have never known either of the officinal "aceta" to ferment by keeping. A syllabus of this class is appended.

Aceta, *U. S. P.*

Officinal Name.	Proportions.	Dose.	Med. Properties, &c.
Acetum colchici	℥i to Oj : Alc. f℥ss	gtt. xxx to f℥ij	Diuretic, sedative.
" scillæ	℥ij to Oj	do.	do. do.
" opii	℥viii to Oiij f℥iv	gtt. v to x.	See preparations of opium.

Unofficinal Ethereal Tinctures.

The use of ether as a menstruum in tinctures is objectionable, owing to the great variations in strength to which these are liable from the rapid evaporation of the ether, even at ordinary temperatures, and in the transfer of the liquid from the bottles.

Several preparations, used by Dr. Mettauer, of Virginia, containing less volatile ethereal liquids, as spt. ætheris nitrici, and spt. ætheris compositus, have been made public, from which the following are selected:—

Mettauer's Ethereal Tincture of Cantharides.

℞. Cantharid.	℥iij.
Spt. æther. nit.	Oiiss.

Macerate for eight days, and filter.

The ethereous menstruum seems to promote the tendency of the flies to the genito-urinary organs without producing strangury.

It is also used as a blister for the scalp of infants. Dr. M. also uses spirit of nitric ether as a menstruum for colchicum, guaiac, squill, ergot, ipecac, &c.

Mettauer's Ethereal Tincture of Cubebs.

R.	Cubebæ pulv.	℥iv.
	Spt. ætheris nit.	Oij.

Macerate for eight days, and filter.

Used for subacute inflammation of the bladder, urethra, &c., and of the mucous lining of the stomach and bowels. (See *Virginia Med. and Surgical Journal*, Nov. 1853.)

Asiatic Tincture for Cholera.

This is a most valuable application of the Ethereal Liquor of Hoffman, the diffusible character of which is admirably adapted to heighten the effect of the powerful stimulants prescribed. It has attained considerable celebrity within several years past.

Take of	Opium	℥j.
	Camphor	℥j.
	Oil of cloves	f℥j.
	Capsicum	℥j.
	Hoffman's anodyne	Oj.

Macerate 10 to 20 days, or prepare by displacement.

Adult dose, 20 to 60 drops every second, third, or fourth hour, according to circumstances, in a little sweetened water.

CHAPTER VII.

GALENICAL PREPARATIONS OF OPIUM.

THESE preparations assume an importance to the student not belonging to others, from the extensive use made of opium in almost every form of disease, and from the unusual number and variety of Galenical solutions made from it.

No student should neglect to study these especially and carefully, so as to be familiar with their relative degrees of activity, and their effects as modified by the menstrua employed. On this account I have devoted a separate chapter to their consideration.

The following syllabus embraces the officinal Galenical solutions of opium, and also the solution of sulphate of morphia.

	Composition and Relative Strength.		Dose.
Tinct. opii camphorata, (Paregoric),	Opium ʒss Camphor ℈j Benzoic acid ʒss Oil of aniseed fʒss Honey ℥j	1 gr. in 256 ♏ to Oj dil. alc.	fʒj to fʒss.
Tinct. opii (Laudanum),	Opium ℥j, ʒij to Oj	= 1 gr. in 13 ♏	gtt. xxv.
Tinct. opii acetata,	Opium ℥j Alcohol fʒiv Vinegar fʒvi	1 gr. in 10 ♏	gtt. xx.
Vinum opii, (Sydenham's Laud.),	Opium ℥ij Cinnamon, Cloves, āā ʒj	1 gr. in 8 ♏ to sherry, Oj.	gtt. xx.
Acetum opii, (Black Drop),	Opium ℥viij Nutmeg ℥iss Saffron ℥ss Sugar ℥xij	1 gr. in 6½ ♏ to Oiij fʒiv when fin'd.	gtt. v to x.
Liquor morphiæ sulphatis,	⅛ gr. morphia	= 1 gr. opium to fʒj	fʒj.

The mode of preparation and uses of each of these will require separate mention.

All the preparations of opium are directed to be made from the powdered drug; this is designed to prevent variations in strength, resulting from the different degrees of dryness of different specimens, as found in commerce. In most instances, however, the apothecary or physician prefers to select the drug in its crude condition, and in the absence of conveniences for drying and powdering it in large quantities, uses it in lump. I shall, therefore, describe the processes with reference to both the powdered and the crude opium, premising that the manipulator should always make the preparation with the Pharmacopœia before him, in this as in all other cases.

Camphorated tincture of opium is made by dropping the opium as finely divided as its condition will admit of, the benzoic acid, camphor, and oil of aniseed, into a suitable bottle, and pouring the diluted alcohol upon them; after standing for two weeks, with occasional agitation, the tincture is filtered and the honey is added to complete it. The chief use of paregoric is for children, to whom it is given in doses varying according to the age of the child from ten drops to a teaspoonful. The adult dose is as stated in the table. It is used in mistura glycyrrhizæ comp., and in other expectorant medicines.

This tincture, in the Pharmacopœia of 1830, was directed to be made with a portion of extract of liquorice, which, as it gave it a dark color, resembling that of laudanum, was substituted in the two last editions by honey. It has a rich brown color, and a rather agreeable aromatic taste.

Tincture of opium is directed to be made by macerating powdered opium in diluted alcohol for fourteen days, expressing and

filtering through paper. If the drug in powder is not at hand, the following formula may be used: Take of opium, sliced, one ounce and two drachms, add to it two fluidounces of water, and by the aid of a pestle and mortar, work it into a uniform pasty mass; to this add six fluidounces of water, and eight fluidounces of alcohol, making in all one pint of diluted alcohol; allow it to macerate for two weeks, occasionally shaking it, and throw the whole upon a filter—to the pulp, remaining after the liquid has drained off, add about two fluidounces of water, which will displace the last portion so as to make the whole of the tincture measure exactly the pint.

Laudanum is more used than any other preparation of opium. It is employed internally in small doses, combined with stimulants, and frequently repeated to excite the nervous and arterial systems, as in the typhoid forms of disease. (See *Prescriptions.*) It is also used by itself or in combination to allay nervous irritation, and to promote sleep and relieve pain; for these purposes, it generally requires to be given in full doses, especially when the case is urgent. It is sometimes employed in cancerous and other very painful diseases, and in mania-a-potu, in doses of half a fluidrachm to one fluidrachm (60 to 120 drops), and repeated. Camphor water and compound spirit of ether are much used with it in its more strictly anodyne and sedative applications. In nervous and spasmodic affections, it is given with other antispasmodic medicines, or by itself. To expectorant mixtures it is a very frequent addition, though the camphorated tincture is generally preferable in this instance. Combined with astringents and chalk, it is much used in the treatment of diarrhœa, dysentery, and cholera morbus, and is a frequent addition to mistura cretæ. For its diaphoretic effects, the best combinations contain an emetic, as wine of ipecac or of antimony, or frequently spirit of nitric ether. It is often added to castor oil, to correct griping or excessive purging from its use.

Laudanum is much used in enemeta, collyria, and in lotions of various kinds. In an enema it may be used in three times the quantity employed by the mouth, with a view to the same effect. In an eye wash, wine of opium, or a solution of the aqueous extract, is preferred, as obviating the stimulant effects of the alcohol. It is frequently added to cataplasms or poultices.

Laudanum is made of deficient strength by some druggists, in order to sell it cheap; the usual wholesale price for a good article is from sixty-two to seventy-five cents per pint, or by retail, twelve to eighteen cents an ounce. If it has become turbid from the evaporation of a portion of alcohol, it is above standard strength, and should be filtered to free it from the precipitate.

Acetated tincture of opium is not commonly designated by any synonym, and must be carefully distinguished from black drop, to be noticed presently. It may be prepared by macerating the opium

in powder with the vinegar and alcohol for two weeks. If the opium is in mass, it may be worked into a paste with a small portion of the vinegar, after which the remainder of that liquid and the alcohol may be added, macerating for two weeks as in the other case.

This tincture is sometimes recommended in preference to laudanum, as less liable to produce those nervous symptoms, which often follow the use of opium. As shown in the table, it is stronger than laudanum, but much weaker than black drop.

Wine of Opium.—This officinal substitute for Sydenham's laudanum, may be made by a precisely similar process to the foregoing. It is made with a much larger proportion of opium to the quantity of menstruum employed, than laudanum, and yet the dose directed in the books is the same; this must be owing to the supposed inferior solubility of the active principles in wine, than in diluted alcohol. A great many extemporaneous prescriptions for collyria contain this ingredient.

Vinegar of Opium, or Black Drop.—The strongest of the preparations of opium is made by a series of processes, not quite so simple as those last detailed. The opium, either in coarse powder or worked into a paste as before described, is mixed with saffron and grated nutmeg, and digested with a given quantity of diluted acetic acid, for 48 hours. This may be conveniently accomplished in an ordinary beaker glass, or, if the heat is carefully regulated, in a wide-mouth packing bottle or bowl, placed on top of a stove in a bed of sand, care being taken to avoid a heat which would boil the preparation; after straining off this first portion of the liquid, the residue is again digested, with a fresh portion of the menstruum, for 24 hours, and this drained off. In order to displace the portion of menstruum which would otherwise remain in the mass, to insure the more thorough extraction of its soluble principles, and to obtain the liquid clear, the mass is now transferred to a displacement funnel, and the whole of the liquid passed through it, returning the first portion till it passes clear, and continuing the process by the addition toward the last of fresh portions of the same menstruum, till exactly the required measure is obtained. The clear solution is now transferred to the vessel first employed, the sugar added to it and dissolved, and finally, should it not make exactly the required quantity of the preparation, it is further evaporated to the right point.

Black drop is deservedly esteemed as a most valuable preparation. The morphia it contains is in the condition of acetate; which is considered by many to be more agreeable in its mode of action, than the native meconate existing in the drug. One grain of opium being represented by $6\frac{1}{2}$ minims, the dose will be only from 5 to 10 drops, because, although in the case of laudanum, two drops are

frequently required to make a minim, in this case, sugar being used instead of alcohol, the drops are larger, and frequently reach a minim in bulk.

The popularity of black drop with persons who use opium habitually, is one of the strongest evidences of its superiority over laudanum. I was informed by one lady, who is a victim to this vice, and who procures her black drop by the gallon, that in comparing her own condition with that of others within the range of her acquaintance, who have used laudanum to no greater excess than she uses black drop, that while they soon exhibited in their persons the evidences of its poisonous effects, she was enabled to preserve to a great extent the natural freshness and fulness of her features; this she attributed to the form in which she took the drug. Her statement cannot of course be received as evidence of the difference referred to, though it accords with the testimony of others, and also corresponds with the observation of some physicians of large experience.

Solution of sulphate of morphia (U. S.), though its strength is usually estimated as stated in the syllabus, is weaker in proportion to the other preparations than is there stated. The dose is frequently f℥ij. Magendie's solution, much used in New York and Boston, is made in the proportion of 16 grains to the fluidounce. Care should be taken in prescribing and vending this, to distinguish between it and the officinal solution.

Unofficinal Solutions.

Elixirs of Opium.—There are several preparations vended under this name, of which the most popular is McMunn's Elixir. This is a weaker preparation than laudanum, the common dose being varied from 20 to 40 or even 60 drops; being an aqueous solution, with probably the smallest proportion of a spirituous ingredient that is sufficient to preserve it, the drops are large and the quantity named approaches f℥j. McMunn's Elixir borders on the confines of quackery, though much used by regular practitioners. Its composition is concealed, although the fact of its being a nearly pure aqueous solution of opium seems generally understood. Several pharmaceutists have from time to time called attention to the superiority of water as a menstruum for opium. The late Augustine Duhamel was in the habit of making laudanum by digesting the opium with water alone, and adding the alcohol after filtering, believing that in this way he avoided the extraction of the resinous ingredient supposed to occasion the unpleasant after-effects. The separation of the narcotine from opium by digestion with ether previous to making laudanum from it, was at one time recommended, but has long since been abandoned.

Eugene Dupuy, pharmaceutist of New York, published in 1851

the following recipe for a substitute for McMunn's Elixir, which he stated had been used for some six years with satisfaction, being found to possess the sedative property peculiar to it without any of the unpleasant effects attributed to laudanum. The proportion of opium is the same as in the officinal tinctura opii.

Take of	Opium	ʒx.
	Water	q. s.
	Alcohol (95 per ct.)	fʒiv.

The opium is to be made into a thin pulp with water; the mixture allowed to stand in a cool place 48 hours, then transferred into an elongated glass funnel, containing filtering paper. A superstratum of water, equivalent to the bulk of the whole mass, is added. When the filtered liquid reached fʒxij, the alcohol is added to the filtered liquid, making Oj—about two thirds of the substance of the opium is contained in the solution; the resin, narcotina, &c., being chiefly contained in the residue. The dose by minims would be the same as that of laudanum.

Professor Procter's recipe for a similar preparation is as follows. It is more difficult of execution and more expensive, but makes a fine preparation, and one which has been found to answer a very good purpose:—

Take of	Opium, in powder	ʒx.
	Ether,	
	Alcohol, of each	fʒiv.
	Aqua	q. s.

Macerate the opium in half a pint of water for two days, and express; subject the dregs to two successive maccrations, using six fluidounces of water each time, with expression; mix and strain the liquors, evaporate them to two fluidounces, and agitate the liquid with the ether several times during half an hour. Then separate the ether by means of a funnel, evaporate the solution of opium to dryness, dissolve the extract in half a pint of cold water, pour the solution on a filter, and after it has passed, wash the filter with sufficient water to make the filtrate measure 12 fluidounces, to which add the alcohol and mix, making a pint.

This has the same strength as laudanum.

By the ether in this process, the odorous principle and resin dissolved to a certain extent by the water are extracted and dissipated; any portions of thebaina, meconin, codeia and meconate of narcotine, contained in the aqueous solution, are also removed; the evaporation to dryness and re-solution in water, remove the ethereal odor, and separate a portion of acid resin and extractive.

Incompatibles.—All the preparations of opium are pharmaceutically incompatible with the alkalies, and their mono-carbonates generally, on account of their precipitating the morphia in an inso-

luble condition from its meconate. With acetate of lead, they give a precipitate, chiefly of meconate of lead, the morphia remaining in solution as acetate. Astringent infusions and tinctures generally throw down tannates or gallates of morphia, which are quite insoluble. Some of the metallic salts may be considered as incompatible, but in practice there is no difficulty in mixing small quantities of laudanum with diluted solutions of these. In fact, the chief point to be observed, in the mixing of these preparations in prescription, is to add them after the full degree of dilution is obtained; in this manner they may be mixed without disturbance, in the great majority of instances, especially where, as is mostly the case, the quantity added is small.

Treatment of Poisoning by Opium.—When opium is taken in quantities sufficient to produce death, the first and invariable remedy is to evacuate the stomach, by administering an active emetic dose, as, for instance, five grains of tartar emetic or sulphate of zinc, or, as is frequently more convenient and equally efficacious, large doses of mustard suspended in warm water. The patient should also be kept in motion, if possible, the face and head being splashed with cold water, when a disposition to sleep seems to be gaining the mastery; in this way, patients may very frequently be restored, even after taking large doses of laudanum. Instances of the kind have been of frequent occurrence within the last few years in this city.

Two cases have come under my own notice, in which the galvanic battery has been employed as a last resort, with the effect of restoring one patient permanently, and the other temporarily, the reaction not being sufficient in the latter instance to establish convalescence, though life was prolonged for several weeks. Artificial respiration has occasionally been resorted to, when the prostrating influence of the poison had arrested the natural process, life being prolonged by this means, until the impression of the narcotic had passed off: recovery has been effected in this way.

The Abuse of Opium.—The habitual use of the preparations of opium as a means of intoxication, is an evil, the extent of which is scarcely appreciated by the profession, or by the community at large. There are shops in the outskirts of our large cities in which the sale of laudanum forms one of the principal items of business. These peddle it out to every poor victim, who can produce a few pennies to purchase a temporary relief from imaginary pains. So common is this article of trade, that even little children are furnished with it, on application, as if it were the most harmless drug. It is sold in these shops at half the price maintained by respectable establishments, and there can be no doubt that its intoxicating effects are sought by many, who use it as a substitute for alcoholic drinks. Individuals who would shrink from the habitual use of spirituous liquors, employ this *medicine*, under a false persuasion

that it is useful or necessary to allay some symptom of a chronic disease, until they become victims to one of the worst of habits. There is scarcely an apothecary in our large cities who cannot relate instances of opium intoxication that have come under his own notice, and been served at his own counter. Females afflicted with chronic disease; widows bereft of their earthly support; inebriates who have abandoned the bottle; lovers disappointed in their hopes; flee to this powerful drug, either in its crude form, in the form of tincture, or some of its salts, to relieve their pain of body or mind, or to take the place of another repudiated stimulant. Such, too, is the morbid taste of these, that they think they require the soporific influence of opium to fill up the measure of their life enjoyment, just as the drunkard is wedded to his cups, or the tobacco-user to the weed.

The prevalence of this kind of indulgence is liable to increase in proportion as legal restrictions are placed upon the sale of alcoholic stimulants. By the so called liquor laws, the sale of spirituous liquors is also thrown into the hands of the druggist and apothecary; with him rests in great measure the necessary discrimination as to the sale of these powerful agents; he must endeavor to draw the line between the purchaser who seeks them for an undue indulgence in their intoxicating effects, and one who will apply them to legitimate uses in disease. That this is a difficult duty cannot be denied, and its observance implies the exercise of great care and tact, as well as of moral courage.

Who would sell an ounce of laudanum to an applicant whose intention to commit suicide was apparent? And yet how often is it sold to individuals, who are only protracting their suicide by the demoralizing and dissipating habit of taking it in smaller and gradually increasing quantities?

The responsibility for many cases of habitual intoxication, both with alcohol and opium, rests with the physician. Almost every apothecary of large experience has met with instances in which the parties attribute their habit to the use of these agents, for the first time, under the advice of a physician, by whose direction it has been persisted in, in some chronic case, till it has become almost impossible to desist from the indulgence.

A habit among laudanum-takers, which evinces the care with which the practice is concealed from the apothecary, has fallen under my notice. A small well-washed vial is presented at the counter, and laudanum demanded; it is furnished, and labelled by the seller. The buyer consumes it all in a few hours, or days at most; he removes the label, cleanses the vial again, and presents it at another store, with the same request; and after it is used, he goes to a third, and so on perhaps to a dozen stores, till he comes to the first, again, in a few weeks after his original presentation; he may not be recognized at either place till months, or even years have rolled away, and his shrivelling skin, lemon-colored complexion, contracted pupil, and tremulous limbs mark him as a con-

firmed victim of this dangerous habit. The apothecary having found out his customer, remonstrates, but conscious of the fact that he will buy somewhere, and that acute pain and misery will be the consequence of abstinence, feels perhaps that it is justifiable, under the circumstances, to sell; and thus the days and weeks go on, till the habit and its victim alike disappear.

The quantity of laudanum that may be taken varies with different individuals. Those habituated to it consume from a few teaspoonfuls to an ounce or more per day. A medical friend informed me that a child less than two years old came under his observation, to whom was administered a dessertspoonful of laudanum per diem, to keep it quiet, while the mother was engaged at her daily toil; this, of course, was the result of previous habit, originating in a small beginning.

Persons who have been addicted to the use of ardent spirits, are, perhaps, more apt to use laudanum in preference to the crude drug, or any of the salts of morphia. The cheapness of the tincture over the salts is a strong reason with others. We know of a lady whose bill for sulphate of morphia during a single year, was ninety dollars, which, if we estimate it at the usual price, and take the daily average of the quantity consumed, would exhibit the enormous consumption of over 20 grains a day. And yet the victim of this slavery is able to attend, in some measure, to her daily pursuits, and has already attained middle age, without any evidence of organic disease.

Another lady, suffering from a uterine complaint, who had been for years in the habit of using opium, at first by the advice of a physician, and subsequently from an impression of its value to her, continued it in gradually increasing doses, till the daily consumption of the gum and the tincture, taken alternately, amounted to many grains of the former, and half an ounce of the latter. In this case the patient was bedridden, and suffered a great deal of pain when the system was not directly influenced by the medicine.

A degree of restlessness and nervous irritability, amounting almost to spasm, when not under the effects of the drug, are characteristic in almost every aggravated case.

One colored woman, advanced in life, who had been advised, many years before, by her physician, to employ laudanum for the relief of the painful symptoms of a chronic disease, was known for several years to take invariably f℥iss of laudanum, which was purchased daily as required. A lady of my acquaintance, who I believe since recovered entirely from the habit, took for years a half grain powder of sulphate of morphia daily, sometimes perhaps twice a day. On one occasion, a man proposed to purchase at the counter a fluidounce vial of laudanum, and when the price of it was demanded, immediately swallowed the whole, as was supposed for the purpose of suicide. He was afterwards seen in the streets apparently in his usual health.

Dr. Garrod relates a case of a young man who took one drachm

Smyrna opium night and morning, and frequently from an ounce to an ounce and a half of laudanum in addition.

We are informed of an instance of a lady advanced to her threescore years and ten, who, from fear of the pains of death, from day to day kept herself under the influence of this narcotic. Such was the morbid mental influence which kept her unhappy in the anticipation of a result which has not yet occurred.

The moral responsibility connected with the question of prescribing and dispensing opium, may be greater than has been hitherto acknowledged; and the few remarks here presented are designed to awaken an interest among those who by position and pursuits are best qualified to exercise a wholesome influence upon its abuse.

CHAPTER VIII.

THE GENERATION OF HEAT FOR PHARMACEUTICAL PURPOSES.

Many of the processes directed in the *Pharmacopœia* may be conducted in an ordinary cannon stove—as making infusions and decoctions, syrups, some of the extracts, all of the ointments and cerates, and some of the plasters. The various kinds of cooking stoves are still better adapted to these purposes, each having its particular advantages, and nearly all offering facilities not only for performing the processes requiring the naked fire, but also being conveniently fitted with sand and water baths, and having ovens attached which answer the purposes of the drying chambers in regular pharmaceutical furnaces or stoves.

Permanent furnaces, fitted to the proper performance of every pharmaceutical process, are fully described in the work of Mohr, Redwood, and Procter, and in that of Prof. Morfit; a detailed account of these does not fall within the scope of the present work. A few notices of cheap and convenient forms of apparatus for generating heat, especially of a portable character, may be given.

The common clay furnace is much used in open chimney-places, or in the open air, charcoal being the fuel; a common bellows is employed when necessary to increase the intensity of the fire.

Similar furnaces are made of cast iron, but they possess no advantages for use with charcoal.

The small French hand furnace, Fig. 120, is light and portable, and preferable to the ordinary clay furnaces for table operations.

Many of the operations of the pharmaceutical laboratory are conveniently performed with lamps, alcohol being the fuel. A neat and elegant alcohol lamp is that shown in Fig. 118; it has a

ground glass cap to prevent the waste of alcohol by evaporation. In the absence of such a lamp, a common glass bottle, with rather

Fig. 118.

Glass spirit lamp.

Fig. 119.

Extemporaneous glass lamp.

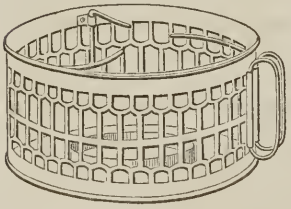
Fig. 120.

French hand furnace.

wide mouth, may be used; a perforated cork with a small glass tube about an inch long is inserted in the neck of the bottle, as shown in Fig. 119, and the wick is made to pass through this into the alcohol contained in the bottle.

A small tin alcohol lamp answers about as well as any for common purposes, with the exception of having no cap to prevent evaporation from the wick; such a one is here figured, Figs. 121 and 122, with a convenient stand in which to place it under a capsule or other vessel to be heated.

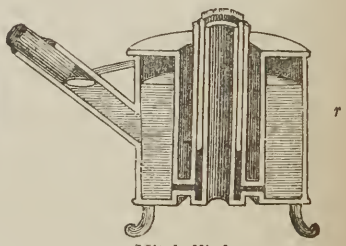
Fig. 121.



Tin alcohol lamp and stand.

Fig. 122.

Fig. 123.



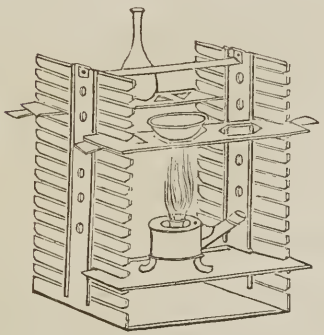
Mitchell's lamp.

Another kind of alcohol lamp, familiar to all chemical students, is Mitchell's argand lamp, shown in section in Fig. 123. In this, which is usually made of tin, an argand burner is placed in the centre of a cylindrical reservoir, *r*, with which it communicates at bottom by small lateral tubes; the reservoir is furnished with a tube near the top at *a*, for the introduction of the fluid; this is stopped with a cork having a slight perforation, so as to admit the air as the alcohol is consumed. The cylindrical wick, *b*, which is inserted in the burner, is kept saturated with alcohol, owing to its communicating with the reservoir. When lighted at its upper edge, it burns freely, having a draft of air within as well as without the cylindrical column of flame, and generates a large amount of heat.

When no longer wanted for use, the lamp should be covered by a cap over the burner, or emptied of alcohol, otherwise a great waste will occur by continued evaporation from the wick.

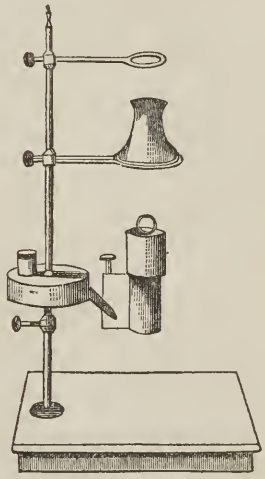
Fig. 124 represents the argand burner on Mitchell's retort stand, in use; a great advantage is attained by the use of a chimney to surround and concentrate the flame; this may be set into the outer opening for draught between the reservoir *r* and the burner *b* (Fig. 123), so as to rest upon the little lateral tubes at the bottom; it should be long enough to project three inches above the top of the lamp.

Fig. 124.



Mitchell's retort stand and lamp.

Fig. 125.



Berzelius's lamp.

Fig. 125 represents Berzelius's lamp; this is adapted to alcohol or oil; it is attached to a permanent stand, upon the upright rod of which it moves, being secured by a screw, which presses against the rod; the reservoir is here separated from the burner with which it communicates by a single tube. Another pattern has the burner in the middle of the reservoir, as in the case of Mitchell's lamp. A little screw is arranged alongside the burner to raise or depress the wick.

Fig. 126.

Lamp chimney.

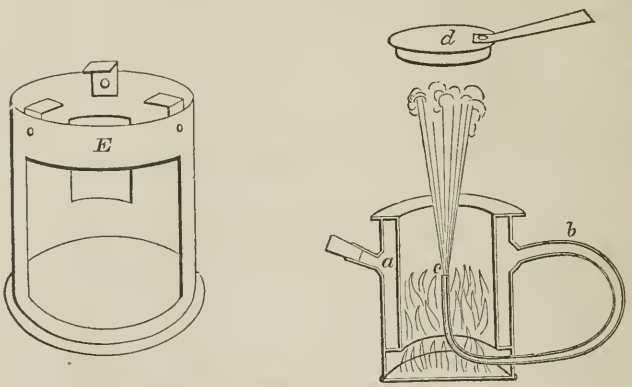
Fig. 126 is a chimney, which is adapted to confine the flame within narrow limits, and to increase the draught, thus diminishing the tendency to smoke, and increasing the intensity of the heat. It may be applied either to Berzelius's or Mitchell's lamp.

One of the best contrivances for generating an intense heat for those few processes in pharmacy to which it is essential, and for fusing insoluble silicates in analytical processes, and for glass blowing, and

bending operations, and numerous other uses in chemical laboratories, is the lamp here figured, which is called the Russian lamp, or the alcohol blast lamp.

This is shown in Fig. 127. It consists of a double copper cylinder *a*, inclosed at top and bottom, and surrounding an interior chamber, which extends somewhat below the bottom of the

Fig. 127.



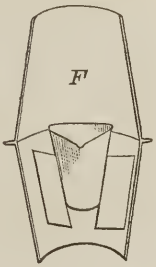
Russian or alcohol blast lamp and stove.

cylinder to a permanent copper bottom, as shown in the section. Near the top of the cylinder, an open tube of the same material is soldered on at *a*, for the purpose of filling it; and nearly opposite, on the other side, a tube *b*, also of copper, is inserted; this is bent as seen in the drawing, and gradually tapering down to a small diameter, enters the internal chamber between the lower terminus of the cylinder and the bottom; it is now curved upward, and terminates with a small orifice at *c*; a movable top *d*, is fitted with a handle, and so constructed as to fit tightly over the open top of the chamber. *E* represents a sheet iron stove or furnace in which the lamp may be placed when used, and which serves as a support for crucibles, dishes, &c. The mode of using this lamp is to fill the cylinder with alcohol by means of the tube *a*, till it commences to run out of the jet *c*, then cork up the open end of the tube *a*, observing not to secure the cork too tightly, for fear of explosions. About two fluidounces of alcohol are now poured into the central chamber, or sufficient to cover the bottom and rise to within an inch or two of the orifice at *c*. This spirit being now ignited by a match, quickly heats that contained in the surrounding cylinder, and as this boils the vapor formed is forced through the tube *b* in a powerful jet, which, as it escapes at *c*, is ignited by the flame playing upon the surface of that in the chamber, and thus forms a jet of flame possessing an intense heating power; should any obstruction occur in the tube *b*, or at the orifice *c*, the apparatus might explode, but that the cork at *a* would be likely to be thrown

out. When it is desired to stop the flame, and whenever the apparatus is to be put out of use, the cover *d* is placed on the top.

For accomplishing fluxions with carbonated alkali, where a very intense heat is required, I have found this lamp an admirable arrangement, doing away with the necessity of a counter blowpipe. In order to apply this jet to the greatest advantage for the purpose named, a crucible jacket, *F*, Fig. 128, may be placed upon the projections on the top of the stove *E*, Fig. 127, immediately over the flame of the lamp. This is a sort of chimney made of sheet iron, and serving the double purpose of keeping the crucible from all currents of air but those highly heated by the flame, and of returning the flame back, somewhat as in a reverberatory furnace.

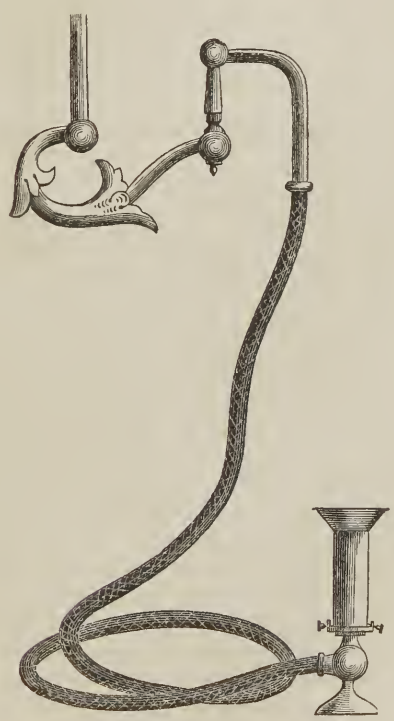
Fig. 128.



Crucible jacket.

The best fuel for pharmaceutical purposes is the coal gas now so freely and cheaply supplied in almost every considerable town.

Fig. 129.

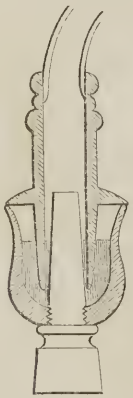


The gas may be conducted by pipes into the counter or table, and terminated at any convenient point just above its surface by a

suitable burner; or, preferably, it may have soldered on to the iron pipe at its terminus, a leaden one, which, being flexible, may be moved at pleasure to any desired part of the table. A very good portable apparatus, capable of being used in any part of the room, or in any room in the house, is shown in Fig. 129; it consists of a flexible tube of gum elastic material, which is terminated at one end by a cap to fit on to the burner of a common chandelier, pendant, or side light, such as are suspended from the ceilings or walls of apartments for the purposes of illumination. To the other end of this tube is a little stand of metal surmounted by a burner to be adapted to some of the various kinds of gas furnaces to be described in the sequel.

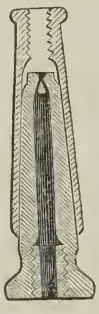
Figs. 130 and 131, are sectional drawings, to illustrate the different modes of connecting the flexible tube as above with the per-

Fig. 130.



Gas burner with mercury cup and cap.

Fig. 131.



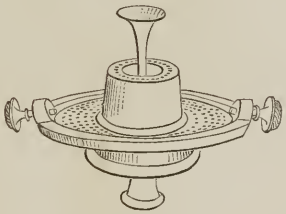
Ground gas burner and cap.

manent pipe. Fig. 130 is the mercury cup arrangement; a small cup is screwed on to the burner at its base, into which is introduced a few ounces of mercury, and into this the cap of the conducting tube dips so as to form an air-tight joint, which is very readily shipped and unshipped; in this figure the cap is represented as having a flange covering the mercury cup, which, while it is in its place, protects the mercury from evaporation or from spilling out. When unshipped, however, the bath of mercury is unprotected, and becomes wasted, frequently requiring to be renewed, and leading to inconvenience. Fig. 131 is a ground burner and cap, such as is shown also in Fig. 129. The burner and cap are fitted and ground to each other, so as to make a direct air-tight connection when adjusted, and yet are removable at pleasure. The screws by which the burner is attached to the pipe, and the cap to the flexible tube above, and also the internal construction of the fish-tail burner, are shown in this section.

Fig. 132 represents the argand burner with rim; these were formerly much used with glass chimneys and shades, for illumination, but have been almost discarded on account of the great consumption of gas attendant on their use. The jet of gas is here through the small holes at the top of the hollow cylinder, the funnel-shaped appendage above being designed to spread the flame when used for illumination; the disk of brass screwed on below is used to support the chimney, and is perforated with holes so as to allow a draft of air around the flame, while the hollow cylindrical shape of the burner favors the draft through its centre. The argand burner is shown in Fig. 129, as covered by a gas furnace, to be described a few pages hence.

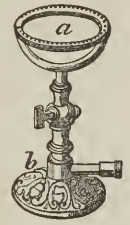
Fig. 133 is a kind of burner not much used in this country, but well adapted to applying a low gas flame to an extended surface, as in evaporation; *a*, is a cylinder of from 4 to 8 inches diameter,

Fig. 132.



Argand burner.

Fig. 133.



Gas burner for small jets.

or more, with very fine orifices near each other, through which the gas is allowed to escape and inflame, the jet being controlled so as to avoid a deposit of soot, while a considerable amount of diffused heat is generated, owing to the extended surface inflamed.

Fig. 134 represents a cylindrical screen used to cover over either of the foregoing burners, the object being to confine the heat, to prevent the flame being affected by draughts, and to afford a support for the vessel being heated. The door is convenient, when the top is covered, to light the flame, and to see its elevation and depression during the process.

Fig. 135 represents a cylinder of sheet copper, iron, or tin (this may vary in length from 5 to 8 inches, and in diameter from $2\frac{1}{4}$ to 4 inches), with a ring of the same material about an inch wide, and just large enough to slide over the cylinder. A piece of copper or brass wire gauze, of not less than 700 apertures to the square inch, and a little larger than the diameter of the cylinder, is stretched over the top, and secured by passing the ring over it, while the bottom is left open, and either supported upon feet or stood directly upon the table, the lower margin being as in this case scalloped, so as to allow the free passage of air into it. This gas stove, as it is called, is to be set immediately over a gas pipe, which may either be permanent or flexible, as in Fig. 129, or it may be open at the end, or

terminated by an ordinary bat-wing or fish-tail, or argand burner; preferably by the latter.

Fig. 134.

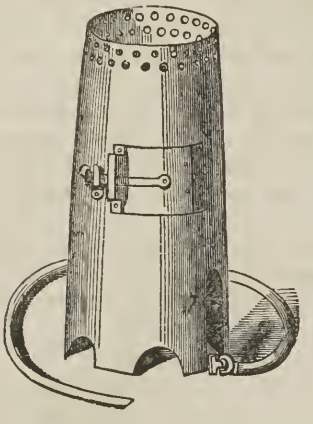
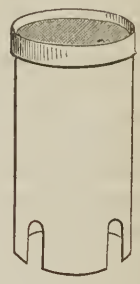


Fig. 135.



Gas stove.

Fig. 136 represents a gas furnace of small diameter set upon an argand burner; *b* represents the wire gauze surface, and *a* the cylin-

Fig. 136.

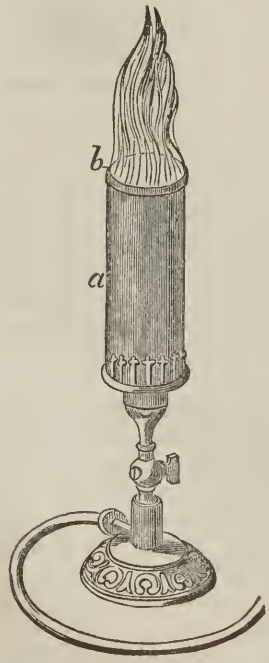
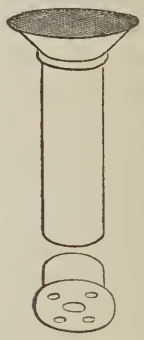


Fig. 137.



Small gas stove.

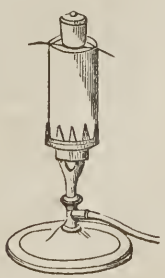
der, which may be of brass, and perforated at the bottom so as to facilitate the admission of air, which also enters through the perfo-

rated rim of the argand burner. If the gas is admitted so freely as to produce a high flame like that shown in the figure, it will undoubtedly smoke for want of a sufficient admixture of air.

Fig. 137 is another form of gas furnace, of tin; the bottom being removed, it will fit the rim of the argand burner, and is shown in Fig. 129, so arranged; the object of the little cap at bottom is to adapt it to an ordinary fish-tail or bat-wing burner. These are extensively introduced in Boston for family use; price 50 cents each. A great many restaurants, in the various cities, are also supplied with these, and their construction is often varied, so as to give support to the vessel to be heated. An iron tripod should accompany the gas furnace, when permanently fixed and used for a single object, but with a retort-stand it may be adapted to a greater variety of operations when not in use.

The mode of using the stove is to place it over the burner, and to allow the gas to escape into it, and thus to become mixed with air, then to apply a light above the surface of the wire gauze. The gas which, under ordinary circumstances, burns with a bright-yellow flame, indicating the presence of carbon in a state of incandescence, and depositing, in consequence, a large amount of soot upon any cold body brought in contact with it, may now be so completely diluted with air, by regulating the jet, as to burn with a light blue flame, containing no carbon. The combustion being much more complete, and spread over the whole surface of the gauze, gives an increased amount of heat, and so diffuses it over the bottom of the vessel as to diminish the liability to fracture. This kind of heating apparatus, when the fuel is accessible, is recommended by its cleanliness, as it is as free from any residue or sooty deposit as alcohol itself. Gas is far cheaper than alcohol, even in towns where the price reaches $4 00 per thousand feet. In Philadelphia it is but $2 00. It may be applied for an indefinite period without renewing, which in long evaporations is particularly desirable. It may, also, be regulated with perfect facility, and left burning during the absence of the operator, without the fear of a material increase or diminution of the flame, thus superseding, in many instances, the necessity for a sand and a water bath, to be described in a subsequent chapter.

Fig. 138.



In those instances where a gentle heat is required, and especially when the vessel to be heated is small, the stove may be dispensed with, and an argand burner being used, a small chimney of metal or glass is set on its rim, as shown in Fig. 138, and the jet of gas being small, and the object removed some distance above the flame, a steady and continuous heat is attained without a deposit of soot.

In some gas furnaces, the rim used to secure the wire gauze over the top is made to project for a half

inch or more above the gauze, and the inclosure is filled with pieces of pumice-stone, or of brick, about the size of a chestnut; the advantages of this are, that the flame is not so liable to be blown out by a draught of air, the rim acting as a shield to it; the incombustible material becoming hot, radiates heat beside the direct heating effect of the flame. It also protects the wire gauze from corrosion by liquids accidentally spilled, and diminishes the liability to its becoming so perforated as that the flame may be communicated to the mixed gas in the interior of the stove, thus causing a slight explosion, similar to those which occur on a larger scale, on introducing a light into close apartments accidentally filled with a mixture, in large proportion, of gas and atmospheric air. If the cylinder rests on the table, and is short, so that the fire is brought near the top of the table, the heat will scorch, and may inflame it. To avoid this, elevate the top of the cylinder at least eight inches, or place it and the burner both on a plaster tile. The fashion of putting a wire-gauze diaphragm between the gas-burner and the top of the stove, with a view of mixing the gas and air more completely, though recommended in some of the books, is rarely followed.

Fig. 139.

It is well to have two or three gas stoves of different sizes; the smaller will be useful in heating small capsules, and crucibles, in analysis, &c., while the larger will always be preferred for evaporating dishes, and other vessels of considerable diameter, used in manufacturing operations.

Thermometer.

The measurement of temperature, which is of practical importance in some heat operations, and in ascertaining the specific gravity of liquids, is effected by the use of a thermometer. These, as made for the measurement of ordinary changes in the temperature of the atmosphere, are of various cheap patterns, generally having a small range from a few degrees below zero of Fahrenheit, to about 120° above it. Fig. 139 represents a thermometer such as is convenient in a chemical or pharmaceutical laboratory. It is graduated from — 20° to + 640°.

In the United States and Great Britain, Fahrenheit's scale is universally used, but as the student is liable to see in works written in continental Europe, Centigrade and Reaumur's scales referred to, I append a description of these, with the mode of converting them into Fahrenheit's. The Centigrade scale is the best adapted to the wants of the scientific, by its decimal arrangement; in it the freezing point is zero, and the boiling point of water 100°, each degree being equal to 1.8 Fahrenheit's.

Reaumur's scale has the boiling point of water at 80°, the zero being at freezing; it has been superseded, where it was formerly used, by Centigrade.

Fahrenheit's has the zero 32° below the freezing point, and 180° between freezing and boiling, so that the latter point makes 212°.

To reduce Centigrade to Fahrenheit's, multiply by 9, divide by 5, and add 32.

To reduce Reaumur's to Fahrenheit's, multiply by 9, divide by 4, and add 32.

The following diagram illustrates the relation of these three scales to each other:—

Fig. 140.

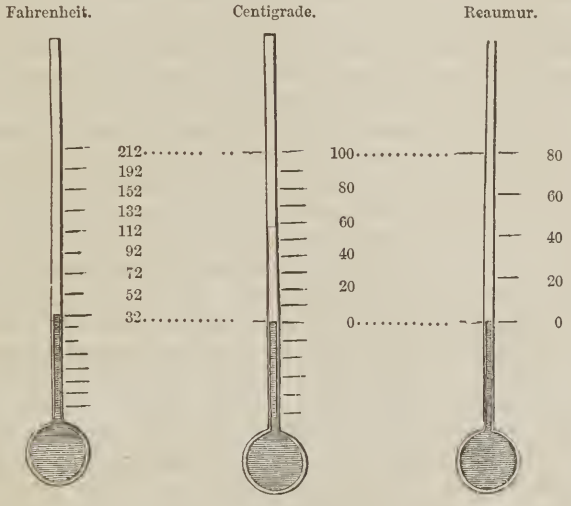


Diagram of different thermometers.

CHAPTER IX.

ON THE MODES OF APPLYING HEAT FOR PHARMACEUTICAL PURPOSES, AND ON THE DECOCTIONS.

In most of the operations of the pharmaceutical shop and laboratory, the intervention of some conducting medium, between the fire and the vessel in which the operation is performed, is useful, either

to prevent its too sudden elevation and depression of temperature, or to regulate the degree of heat applied. For these purposes sand, water and steam baths are invented. As the scope of the present work is not such as to embrace a full description of these, as used in manufacturing establishments, the reader is referred to Prof. Procter's edition of *Mohr & Redwood's Pharmacy*, to *Morfit's Chemical and Pharmaceutical Manipulations*, and to the standard works on Technology, for full descriptions and illustrations of this kind of apparatus. My purpose is, merely to describe such simple means of regulating temperature as are compatible with the arrangements of a dispensing shop and country practitioner's office.

The Sand Bath.—This is used to prevent the sudden elevation and depression of temperature, and where arrangements for burning gas, such as are described in the last chapter are at command, may be dispensed with in nearly all cases. A convenient sand bath, at all times ready during the winter season, is furnished by the top of an ordinary sheet-iron stove, such as is used with anthracite coal for warming apartments; a rim of sheet iron stretched around the top and projecting from three to four inches above it, makes a good receptacle for the sand, which becomes more or less heated according as the fire is increased or not, and may be used to digest infusions, to dry precipitates, and to evaporate any solutions, the vapors of which would not contaminate the atmosphere injuriously. For use with a common charcoal furnace, the best vessel to contain the sand, is a shallow cast-iron pot, fitting, though not too closely, the top of the furnace; this is to be filled only so full of sand, as is necessary completely to cover the bottom of the vessel to be set in it; as a general rule, the greater the amount of sand, the greater will be the waste of heat. In introducing a vessel to be heated, it may be plunged into the sand, so as to cover the bottom and sides more or less, according to the degree of heat required; and when the diameter of the sand bath is greater than that of the fire below, there is a similar choice between placing it immediately over the source of heat or in a less heated position near the edge of the bath.

The Water Bath.—A good extemporaneous water bath is prepared by procuring a rather shallow tin or copper cup, and an evaporating dish of just such size as will completely cover it, projecting slightly over its edge. Those glass evaporating dishes which have a projecting edge turned over and downwards, will fit more securely over the metallic vessel, without being pushed out of place by the force used in stirring. They are also convenient from not allowing the ready escape of steam round the edges: this being condensed, either passes back into the cup, or drops from the edge.

The outer vessel is to be nearly filled with water, and the substance to be heated placed in the evaporating dish, which being

adjusted to its place, the whole is put over the fire, as shown in Fig. 141. In 142, the heat is applied directly by radiation.

Fig. 141.

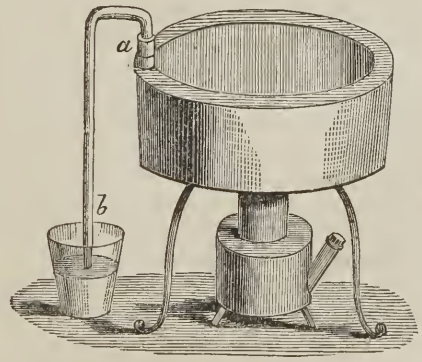
Fig. 142.

Now, the temperature of boiling water under ordinary circumstances of pressure being 212°, it is obvious that the contents of the evaporating dish cannot reach a higher point; it is found practically, that at least two or three degrees of heat are lost, in passing from the boiling water through the dish, so that when the water below is boiling, the temperature of the contents of the dish will not exceed 210°. Aqueous liquids will not boil in a water bath, but most of the solutions used for the preparation of extracts being alcoholic, undergo active ebullition at this temperature.

A disadvantage attending upon an extemporaneous arrangement, such as is shown above, arises from the rapid escape of steam from the lower vessel on all sides of the capsule: now the quantity of vapor which will be suspended in a given space in the atmosphere is constant at any given temperature, so that in proportion as such space is saturated with moisture, further evaporation becomes difficult.

A convenient water bath, less liable to the above objection, is

Fig. 143.



here figured; it is constructed of tinned iron, or preferably of copper, and consists of an outer vessel or jacket soldered on to a shal-

low dish coated with tin, designed to contain the evaporating solution. The jacket is fed with water by the tube *a*, which may be fitted more or less tightly with a cork. It is tightly corked when the vessel is to be tilted in pouring off the contents of the upper part of the vessel, but loosely during the application of heat. In drying substances, and in all cases where it is desirable to prevent the escape of steam from the water in the jacket into the surrounding air, the cork may be perforated and fitted with a steam pipe of glass conducted into a vessel of cold water, *b*, into the flue of a chimney, or through a window. When put out of use, the water bath should be carefully dried by wiping out the upper or evaporating vessel, and placing it in such a position that the jacket will be completely drained of its moisture.

By adapting to the cork, as above, a tube of glass, and passing it into a vessel of mercury, steam may be obtained under pressure so as to raise the temperature of the bath somewhat above 212°, and this arrangement may be resorted to with advantage when a more rapid evaporation is desirable than that afforded by the ordinary water bath. Steam with regulated pressure is applied on a large scale in a variety of manufacturing processes. (See page 154.)

Fig. 144 shows a porcelain water bath sold by the importers of Berlin ware, which is too small except for experimental purposes, or for the preparation of very small quantities of extracts or chemical products; it is, however, very convenient in these cases, and not liable to corrosion. Figs. 145, 146, and 147 represent the so-called Hecker's farina boiler, which is useful for the preparation of farinaceous articles of food, particularly where milk is employed; it obviates the danger of scorching, which is constantly experienced in heating milk by exposure to the naked fire. Fig. 145 is an outside tin vessel with a spout for the ready introduction of water. Fig. 146 is the inner vessel fitting into the above for containing the farinaceous substance, and Fig. 147 shows the two as fitted together.

Fig. 144.

Porcelain water bath.

Fig. 145.

Fig. 146.

Fig. 147.

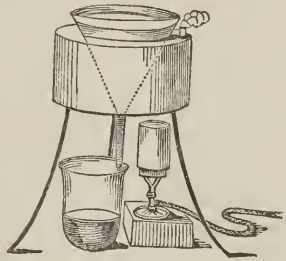
Fig. 148 represents a little apparatus for applying the principle of the water bath to drying precipitates or filters; it consists of a kettle of water surmounted by a steam jacket surrounding a funnel, which is closed at bottom, so that a substance laid into it is heated to about 212° when the water reaches the boiling point.

Fig. 149 illustrates the application of the water bath to filtering liquids while hot—Physick's jelly strainer, Fig. 81, operates on the same principle.

Fig. 148.

Water bath for drying filters.

Fig. 149.



Apparatus for hot filtration.

Processes requiring Heat.

Decoction and the Officinal Decoctions.

In considering the processes of desiccation (Chap. I.), and of maceration and digestion (Chap. IV.), allusion has been made to the employment of artificial heat, and in the present and preceding chapters, the generation and application of heat in pharmacy have been specially treated of as far as deemed necessary to prepare the student for the consideration of the remaining processes of decoction, evaporation, distillation, &c., and of the Galenical preparations in preparing which they are necessary.

Decoction, or boiling, is a process to be applied with care to vegetable substances in contact with water; although boiling water, from its being permeated by steam, and from its being of less specific gravity, is more penetrating than cold; it is, nevertheless, liable to disadvantages as a menstruum for the preparation of Galenical solutions.

There appears to be a difference between the apparent temperature of a boiling solution, and the actual heating or scorching influence to which it is subjected by contact with the bottom and sides of the containing vessel. The steam generated at the point of contact being under heavy pressure in deep vessels, and temperature rising in proportion to pressure, it may be supposed at the moment of its formation to be much hotter than 212°, and if the portion of liquid immediately in contact with the heated vessel contains substances in solution liable to be burnt, it is reasonable to suppose that such a result may occur during the moment consumed in converting any portion into steam. In this way we may account for the well known injurious effect of boiling upon vegetable infusions.

Starch is a proximate principle, present in a large number of

vegetables; being inert and soluble in water at a boiling temperature, it adds to the viscidity of the solution, and renders it disagreeable to the patient, and yet has generally no connection with their medicinal activity.

The extractive matter upon which depends the activity of some medicines, is more freely soluble in hot than in cold water, but the boiling temperature applied under ordinary circumstances produces the decomposition of this and other vegetable principles, or so modifies them as to impair their efficiency. The access of air seems to promote this result, and hence boiling in a covered vessel is preferable, except where the quantity of the solution is to be reduced by the process. In this case, by conducting the operation in a *still*, the surface of the liquid may be kept covered with the vapor, almost to the exclusion of the air.

A substance called *apotheme*, or by some *oxidized extractive*, is also apt to be deposited by vegetable solutions on long continued boiling with access of air; this may carry with it a portion of the active principles, and should not be rejected from the preparation.

If the plant under treatment contains a volatile oil which it is desirable to retain in the solution, long boiling is inadmissible, especially in an open vessel.

Vegetable decoctions, if strained while hot, generally deposit a portion of insoluble matter on cooling, which may or may not contain active ingredients; but it is generally advisable to retain the precipitate and diffuse it through the liquid, stirring or shaking it up before taking each dose.

The proximate principle called vegetable albumen, which is soluble in cold water and alcohol, is coagulable at a boiling temperature, and hence is removed from decoctions on straining them.

The existence of starch and tannic acid together, in a vegetable substance, forbids the long-continued application of a boiling temperature, especially during exposure to the air, as a tannate of starch is formed which is insoluble, and probably nearly inert.

The officinal directions for making decoctions vary according to the nature of the drug. They are all made by the direct application of heat, unless where a sand bath is more convenient, or where a steam apparatus is kept ready for use. Some are directed to be made by boiling the drug in the water for ten minutes, and straining. Others, by boiling from a pint and a half down to a pint; one, by boiling from twenty fluidounces down to a pint. The direction in each case is given in the subjoined table, together with the proportions employed, and the medical properties of the drug. The usual dose of decoctions is the same as infusions, f℥ij, repeated several times a day. Some are given *ad libitum*.

Group 1.—℥j to Oj.

Decoctum chimaphilæ	℥j to Oiss; boil to Oj	Oj per diem	Alt. diaph.
" uvæ ursi	℥j to f℥xx do.	f℥ij	Ast. diuretic.
" dulcamaræ	℥j to Oiss do.	"	Alt. narcotic.
" hæmatoxyli	℥j to Oij do.	"	Astringent.
" quercus alb.	℥j to Oiss do.	"	od.
" cinch. flav.	℥j to Oj, boil ten minutes	"	Tonic.
" " rub.	do. do.	"	do.
" cornus floridæ	do. do.	"	do.
" senegæ	℥j to Oiss, boil to Oj	"	Stim. expec't.
" hordei	℥ij to Oivss, boil to Oij	Ad libitum	Demulcent.

Group 2.—Exceptions to the usual proportions.

Decoctum cetrariæ	℥ss to Oiss, boil to Oj	Oj per diem	Tonic demulc.
" taraxaci	℥ij to Oij do.	f℥ij	Diuretic.
" sarsap. comp.	Sarsap. ℥vj Sassafras, Guaiac, Liquorice, āā ℥j Mezereon, ʒiij to Oiv, boil 15 min.	f℥iv	Alterative. Diaphoretic.

Decoctum hordei, called barley-water, is peculiar in its mode of preparation, the directions requiring that the decorticated seeds, called pearl barley, should be washed with cold water to separate extraneous matters, then boiled for a short time in a small portion of water, which is to be thrown away: upon the seeds, which, by this process, are completely freed from any unpleasant taste, and are much swollen, the remainder of the water is poured boiling hot; it is now to be boiled down to two pints and strained. Various adjuvants are used to improve the taste of this, such as raisins, figs, liquorice-root, &c., which are sometimes contraindicated. Its use is as a demulcent and nutritive drink in inflammatory and febrile diseases affecting the alimentary canal and the urinary organs.

CHAPTER X.

ON EVAPORATION AND THE EXTRACTS.

This process, which is employed in the preparation of most of the extracts, fluid extracts, and syrups, and in the concentration of solutions generally, differs from that of decoction in the degree of heat employed, and in the precautions necessary to success.

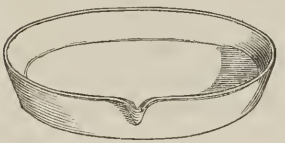
When the liquid under treatment is brought to a temperature

above its boiling point, so that the formation of vapor is upon the inner surface of the containing vessel, and it escapes by its elasticity through the body of the liquid in the form of bubbles, the process is termed decoction; but when the liquid does not reach its boiling point, and the temperature and other circumstances are such that it is liberated without disturbance, in the form of vapor, directly from the surface exposed to the air, it is termed evaporation. When this change to vapor is spontaneous, without the application of artificial heat, it is called vaporization, though this term, as generally applied, is synonymous with evaporation.

In decoction, the rapidity of the conversion of the liquid into vapor is in proportion to the extent of surface of the containing vessel exposed to the *fire*, while in evaporation it depends upon the extent of surface of the liquid exposed to the *air*. Viewed as processes for dissipating the volatile liquid ingredients from a solution, these differ chiefly in regard to the degree of heat employed, and the consequent rapidity with which the object is attained. For reasons hinted at in the last chapter, evaporation at a moderate temperature is generally preferred, and is indicated in the *Pharmacopœia*, for the preparation of most extracts. Many vegetable solutions, which would be greatly deteriorated by the long boiling necessary to reduce them to the condition of extracts, may be exposed to a temperature below their boiling point in a wide and shallow vessel until completely inspissated, with but little danger of losing their solubility, or their medicinal activity.

Extracts are, therefore, always evaporated in shallow vessels, which should be of porcelain, or well tinned iron or copper. Fig. 150 represents an evaporating dish of Berlin ware, which is the best material. The preparation of extracts is rendered tedious by the low temperature employed, the rapidity of evaporation being in proportion to the temperature, thus: at 180°, the rate of evaporation is only one-half what it is at 212°; and at 150°, it is only one-half what it is at 180°. The long exposure of a vegetable solution to a moderate heat, besides being so tedious, is liable to objections of exposing the proximate constituents present for a long period to the oxidizing influence of the air, sometimes even producing the acetous fermentation.

Fig. 150.



Berlin evaporating dish.

The liquid to be evaporated should be divided into comparatively small portions, and each reduced separately till it is highly concentrated; then the whole may be mixed. By this means, no one portion is kept a very long time under the unfavorable circumstances of an elevated temperature and exposure to the air.

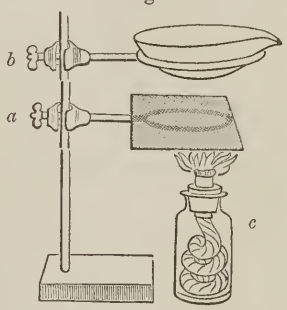
A draught greatly facilitates evaporation by carrying off the air as fast as it becomes charged with moisture, and constantly furnishing

a dry atmosphere to become saturated in turn with the escaping vapor. Constant stirring, by continually exposing a large surface of the heated liquid to the air, also increases the rapidity of evaporation.

The different modes of applying heat for the purposes of evaporation, are: 1st. Directly by exposing the containing vessel to the source of heat. 2d. By a sand bath. 3d. By a water bath. 4th. By a steam bath.

Whenever a vegetable solution is evaporated by a direct application of heat, it should be at such an elevation from the furnace or lamp, as not to be touched by the flame, so that the heat should be communicated by radiation. When the heat is under perfect control, as in a gas furnace, this plan is not objectionable, and may be substituted for the use of a water bath with the advantage of being raised to the boiling point, or depressed below it at pleasure.

Fig. 151.



Application of radiated heat.

Fig. 151 shows an arrangement for the direct application of radiated heat in evaporation; *a* is a diaphragm of wire gauze placed between the evaporating dish *b* and the source of heat *c*, which spreads the flame and prevents its contact with the dish, though brought closely together; the diaphragm *a* may be omitted in using a gas furnace, as the flame is then under control by regulating the jet.

As several retort stands have already been shown in the last chapter, and in that on displacement, and as the instrument as commonly constructed is sufficiently familiar, I shall here confine myself to describing an improvement in their construction which is worthy of notice. In the ordinary kind, it is necessary in adjusting apparatus, or when it is desirable to disconnect or alter the position of the rings for any purpose, to slide them up the whole length of the rod, and remove all above them, which is sometimes a very great inconvenience. In Wiegand's improvement, the casting that clasps the rod is open on one side to the diameter of the rod, so that by loosening the screw it may be slipped off laterally, and yet, when the screw is tightened so as to press firmly against

Fig. 152.

the rod, it is sufficiently secure to bear any weight appropriate to such an apparatus. Fig. 152 gives a view of one of these sepa-

rated from the rod, and in Fig. 151 the whole retort stand is shown in use, giving a front view of the improved clasp.

The sand bath is very little employed in the preparation of extracts, possessing no advantages over the carefully regulated direct application of radiated heat. The water bath is directed in all the officinal processes, for the preparation of extracts; its advantages are detailed on p. 147. Whatever means may be resorted to for effecting the concentration of vegetable solutions, with a view to the preparation of extracts, they should be finally evaporated to the proper consistence, either on a water bath or spontaneously; and this remark applies to all cases of evaporation below the boiling point of the liquid, when accomplished by unskilful and inexperienced persons.

The steam bath is by far the most eligible means of applying heat for the purposes under discussion, although being out of the reach of a majority of pharmaceutists and medical practitioners, it is confined, for the most part, to the comparatively few who manufacture pharmaceutical preparations as a business. The difference between a steam bath and a water bath, consists in the application of pressure to the steam boiler in the one case and not in the other. The temperature of steam bears a remarkable relation to the pressure under which it is maintained; steam under pressure of five pounds to the square inch is at a temperature of 226°, which is about as high as can be safely employed in making extracts; as the liquid will boil at this temperature, of course the evaporation is more rapid than ordinary surface evaporation, and yet the containing vessel is not so hot as to deteriorate the vegetable principles present.

By the regulation of the pressure, the temperature may be increased or diminished at pleasure, and its application may be suddenly stopped if required.

A steam boiler, by arranging pipes communicating with suitable forms of apparatus, and by adapting the fittings and safety valve so as to regulate the pressure, may be made to supply the heat necessary for boiling, evaporating, digesting, distilling, drying, and even heating an apartment.

In the preparation of extracts by steam apparatus, the pressure is so regulated that, as the solution becomes inspissated, the degree of heat shall be diminished. Near the conclusion of the process, the extract is sometimes withdrawn, and poured in thin layers on plates of glass, which are placed in a drying room or closet till sufficiently hard.

The most perfect form of apparatus for the preparation of extracts, is a combination of the steam bath with a vacuum pan. A suitable air-tight boiler is connected with an air pump worked by machinery, which, by removing the pressure of the atmosphere from the liquid placed in it, lowers the boiling point, and greatly increases the rapidity of evaporation, even at a temperature much

below 212°. The air being excluded, the principal objection to the long continued evaporation of vegetable solutions is also removed.

In all first-rate establishments for the manufacture of extracts, apparatus constructed upon this principle is employed, and the superiority of their products over those made by evaporation, under ordinary circumstances of pressure and exposure to the air, furnishes a clear proof of the advantage obtained by the steam and vacuum apparatus.

As the preparation of extracts is generally confined to those pharmaceutists who make it their chief business, a few words in relation to their physical characters, and the mode of distinguishing those of good quality, will be more useful to the student than a description of the processes and precautions to be observed in making them.

Extracts are classified in this work primarily, according to the menstruum employed in their preparation; and secondarily, according to their therapeutical properties, and both these ideas are kept in view in the syllabus presented below.

Extracta, *U. S. P.*

Class I.

Narcotic inspissated juices, prepared by bruising or mashing the fresh plant into a pulp, and expressing the juice from this latter; then raising to the boiling point, to coagulate the vegetable albumen and green coloring matter, and separating these by straining; after which evaporate the clear liquid to its proper consistence.

Officinal Name.	Med. Dose.	Remarks.
Extractum Aconiti	1 to 2 grs.	See Class I., Group 1, Tinctures.
" Belladonnæ	do.	and Class II., Group 1, Extracts.
" Stramonii foliorum	do.	See Class II., Ext. Stramonii seminis.
" Conii	2 to 3 grs.	In practice, usually a smaller dose often repeated.
" Hyoscyami	do.	Much used as a substitute for opium.

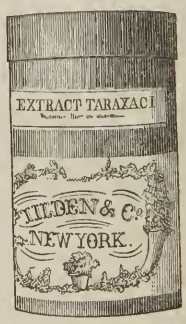
Good extracts of this class have been, until recently, obtained almost exclusively from the English manufacturers, although some nearly worthless were imported from Germany, and some produced by the Shakers. We now obtain the very best from Tilden & Co., of New Lebanon, N. Y., to whose enterprise in this department of pharmacy a great improvement in the quality of medicinal extracts generally is due; they were the first manufacturers in this country who introduced the complete steam bath and vacuum pan in the evaporation of extracts. While by the abundant cultivation of the

herbs required, and the extensive arrangements of their factory, they are enabled to produce large quantities of these invaluable remedies at prices lower than the English can be imported. The enterprise of this firm has induced a spirited competition on the part of their old rivals, the United Brethren, or Shakers, who have improved the quality of their production within a few years.

The five extracts classed above form a remarkably natural group, therapeutically, pharmaceutically, and physically; as commonly prepared and imported, they have a more or less decidedly green color, and this feature was formerly regarded as a test of their having been prepared without scorching from the employment of too high heat; but inasmuch as the green coloring principle (chlorophylle) is associated with the inert and insoluble vegetable albumen, which the *Pharmacopœia* directs shall be first coagulated and separated, all strictly officinal extracts prepared by inspissating the juice of the green herbs are destitute of this, have a light brown color, and are soluble in water. Under the name of clarified extracts, Tildens offer an article answering this description put up in bottles of half a pound, four ounces, and one ounce each. Figs. 153 and 154 exhibit one of these, with the box in which it is kept.

Fig. 153.

Fig. 154.



The odor of these extracts is one of the surest indications of the quality; it should, as nearly as possible, resemble that of the undried plant.

Extracts which are thus deprived of a portion of their inert constituents (clarified) are, of course, other things being equal, stronger than the kind formerly in use; and, hence, the doses stated in the books are generally rather above those usually prescribed. I have known of one instance of great inconvenience resulting from a physician ordering too large a dose of extract of belladonna, under a wrong impression as to the strength of the best commercial article. This impression was founded in part on his own experience with the inferior article, which was formerly kept exclusively in the shops, and which he had met with in country practice.

Extract of belladonna is much used in the treatment of diseases of the eye, and especially for the dilatation of the pupil before operation for cataract; for this purpose the extract is softened with water to the consistence of a thick liquid, and applied directly to the eyeball, and painted on to the upper and lower lids a few hours before the operation.

Extract of conium is readily tested by the following interesting experiment: Take a small pellet of the extract, soften it into a thin paste with water, and add a drop of solution of potassa, or of carbonate of potassa; immediately a strong characteristic odor will be observed, resembling, when faint, the odor of mice. This is from the liberation in a gaseous form of *conia*, the active principle of the herb; at the same time ammonia will be set free, as shown by holding near it a rod moistened with muriatic acid, when a cloud of muriate of ammonia will be produced.

If the extract is very inferior, the experiment will not succeed, or will be only partially successful.

These extracts are to be ordered in prescription by the names given them above, and must be carefully distinguished from those to be now introduced.

Class II.

Hydro-Alcoholic and Alcoholic Extracts.—By the preparation of tinctures with diluted alcohol, or with alcohol and water used separately, or alcohol alone, and subsequent evaporation to the proper consistence.

Group 1.—*Narcotics, &c.*

Officinal Name.	Med. Dose.	Remarks.
Extractum Aconiti alcoholicum	½ gr. to 1 gr.	See Class I. of Extracts, and
" Belladonnæ "	do.	Class I., Group 1, Tinctures.
" Stramonii seminis	do.	
" Conii alcoholicum	1 to 2 grs.	
" Hyoscyami "	do.	
" Nucis vomicæ	(Made with alcohol, 385°.)	Nervous stimulant.

These correspond so nearly with the first class as to be conveniently studied in comparison with them. By the use of diluted alcohol with the dried leaves, a large amount of the extractive and albuminous matters are left behind, and, on evaporation, the active principles of the plant are obtained in a more concentrated form than when the thick expressed juice, containing also a portion of the cellular structure, is evaporated as in the first class.

These extracts have a brownish aspect; they should possess the odor of the plant, and be soluble in diluted alcohol.

As will be observed, their dose is about half that of the corresponding extracts of the first class.

They are seldom met with in commerce, but are designed to be pre-

pared by the physician and apothecary, in the absence of reliable extracts of the first class. They may be obtained by the careful evaporation of the corresponding tinctures. They are seldom prepared, owing to the expense of obtaining the dried leaves in a state of perfect preservation, and the waste of alcohol. Extract of stramonium seed is an unexceptionable preparation, and might often be substituted for the extract of the herb with advantage.

Extract of nux vomica, though not properly a narcotic extract, is classed with the others for convenience; it may be prepared by the evaporation of the officinal tincture, and is an exceedingly powerful and efficient nervous stimulant much used in certain forms of dyspepsia connected with obstinate constipation.

GROUP 2.

Officinal Name.	Dose.	Med. Prop.
Extractum Hellebori	10 to 15 grs.	Cathartic.
" Jalapæ	do.	do.
" Rhei	do.	do.
" Podophylli (May apple)	5 to 10 grs.	do.
" Cinchonæ flav.	10 to 15 grs.	Tonic.
" " rub.	do.	do.
" Sarsaparillæ	do.	Alterative.
" Colocynthidis comp.	(Colocynth made into tincture and evaporated, aloes, scammony, soap, and cardamom added.)	Cathartic.

Of the above cathartics, each has its peculiar properties, adapting it to some particular use. Extract of hellebore is used as an emmenagogue cathartic. In combination with aloes, myrrh, sulphate of iron, &c., it constitutes the celebrated Hooper's Female Pills. Extract of jalap, and compound extract of colocynth, are combined with calomel and gamboge in the compound cathartic pill. Extract of podophyllum is less used than it deserves, being equal to extract of jalap in its cathartic effect in half the dose. Extract of rhubarb is rarely employed. Extracts of cinchona and sarsaparilla are seldom used in practice in this country, although the latter is in good repute in England. These extracts of cinchona must not be confounded with the article called Wetherill's Extract, nor with extractum calisayicum, which are superior preparations.

CLASS III.

Extracts made by Displacement with Cold Water and Evaporation.

Officinal Name.	Med. Dose.	Remarks.
Extractum Gentianæ	10 to 20 grs.	Tonic.
" Quassiæ	3 to 6 grs.	do.
" Dulcamaræ (Bittersweet)	do.	Alterative narcotic.
" Krameriæ (Rhatany)	10 to 20 grs.	Astringent.
" Juglandis (Butternut)	do.	Cathartic.
" Opii	1 grain.	Narcotic.

The great advantage of extract of quassia over extract of gentian in making pills, will be seen by comparing the dose. Extract of rhatany when well prepared, so as to be soluble in water, is a valuable substitute for kino and catechu, which it resembles in physical as well as medical properties. Extract of opium is added to eye-washes and astringent injections.

Extracts not included in either Class.

By Decoction in Water, Straining and Evaporating.

Extractum Hæmatoxyli (logwood). Dose, 10 to 20 grains. Astringent.

This is highly esteemed as a very mild astringent, and is much used in the arts as a pigment.

By Expressing the Milky Juice from the Root and Evaporating.

Extractum Taraxaci (dandelion). Dose, ℈i to ʒi. Diuretic, &c.

No extract out of the narcotic series is so popular as this; it is much used in the treatment of liver complaint, habitual constipation, and as a diuretic in dropsy. Being soluble in water, it may be conveniently given in liquid form.

By Preparing a Medicated Vinegar and Evaporating.

Extractum Colchici aceticum (meadow saffron). Dose, 1 to 3 grains. Diuretic.

This most valuable preparation has been recently introduced; it is well adapted to combining with other ingredients in pilular form, and, with extract of digitalis, enters into the celebrated Lartique's Gout pills. I have obtained 5 ounces of this extract from 10,000 grains of the root, or about 25 per cent.

Unofficinal and Pseudo Extracts.

Under this head will be brought into view a number of preparations, among which are the following:—

Evaporated Tinctures.

Extract of Digitalis alc.	Dose, ½ grain	Sedative diuretic.
" of Ignatia amara	" ¾ grain	Tonic, excit. motor.
" of Lupulin	" 3 to 5 grains	Narcotic.
" of Cimicifuga	" 3 to 10 grains	Sedative tonic.
" of Valerian	" 3 to 10 grains	Antispasmodic.

Extract of Digitalis, Alcoholic.

The dried and powdered leaves of digitalis are more used in practice than the extract, but the latter, if skilfully prepared, is, I think, more reliable, besides being capable of being combined in liquid form.

Extractum Ignatiæ Amaræ Alcoholicum.

This preparation has been proposed as a "remedy" for dyspepsia, attended with nervous depression, and extensively advertised as such by a clergyman of Brooklyn, N. Y., who, having been cured by it, makes it known to others for the benefit of humanity. The recipe, as here given, is an improvement upon his, and is offered for the benefit of apothecaries, who may be called upon to make it.

The beans of St. Ignatius, like nux vomica, have a very horny and tough kernel (due to bassorin and fixed oil), which renders it difficult to powder them so as to extract their soluble matter. Professor Procter recommends the following process for their extraction. The beans are bruised in an iron or brass mortar, until reduced to small fragments or very coarse powder; they are then moistened with water in a covered vessel, and heated until the tissue of the pieces has become soft, and can be bruised into a pulpy mass. This is then mixed with twice its bulk of alcohol, sp. gr. .835, and allowed to macerate in a close vessel in a warm place for 24 hours, and then treated by displacement until 8 or 10 times the weight of the drug is obtained. The alcohol is then distilled off and the residue heated in a water bath until reduced to the consistence of a soft extract. By this process, about 10 per cent. of a brown colored, intensely bitter extract may be obtained. This extract is much stronger than extract of nux vomica, and is directed to be made into a mass with gum Arabic, in the proportion of 30 grains of the extract to 10 of gum, and divided into 40 pills ($\frac{3}{4}$ grain in a pill), one of which is to be taken three times a day.

It is scarcely necessary to remark that the free use of a medicine of such power, containing one of the most poisonous of alkaloids, as a popular remedy, to be given without the advice and care of a physician, is most dangerous and unjustifiable.

Extract of Lupulin.

(W. W. D. Livermore.)

Take of	Lupulin	℥iv.
"	Alcohol	f℥viii.

Mix in a percolator and allow it to stand an hour, then displace with

Alcohol	q. s.

until two pints are obtained; pour this into a shallow dish, and allow it to evaporate spontaneously. ℥i of lupulin yields about ℈ii of the extract, which is proposed as a substitute when prescribed in the pilular form. The dose being somewhat less than that of lupulin, is an advantage, besides its utility as a convenient and adhesive excipient with other substances.

Extractum Cimicifugæ. (*Am. Journ. Pharm.*, vol. xxvi. p. 106.)

This extract is made by evaporating separately a tincture prepared with 1 part of ether and 2 of alcohol, and one made with diluted alcohol, until they reach a syrupy consistence, then mixing these and finishing the evaporation over a water bath, with constant stirring. Eight grains of this represent 3i of the root.

Extractum Valerianæ—Made as follows: Macerate the root in coarse powder, with twice its weight of strong alcohol, then displace with diluted alcohol, until exhausted. The first portion of the tincture is to be evaporated spontaneously, and reserved for addition to the extract formed by evaporating the diluted alcohol tincture. The addition of a portion of ether to the first portion of alcohol would facilitate the solution of the oil, and, also, the spontaneous evaporation of the menstruum.

The following unofficinal extracts are made with different menstrua from the foregoing:—

Extractum Calisayicum	Dose 2 to 5 grs.		Tonic antiperiodic.
" Ergotæ (aqueous)	"		Excito-motor.
" Pareiræ "	"	10 to 30 grs.	Tonic diuretic.
" Uvæ ursi "	"	"	"
" Lobeliæ aceticum	"	2 to 3 grs.	Narcotic sedative.

Calisaya Extract (Ellis).—First recommended by Charles Ellis, of this city, in an article published in the *Amer. Journ. Pharm.*, vol. xx. p. 15, is made by boiling coarsely-powdered Calisaya bark in successive portions of water, acidulated with muriatic acid, precipitating the decoction with hydrate of lime, digesting the precipitate in hot alcohol till all taste is exhausted, and then evaporating the alcohol so as to leave an extract. The old-fashioned precipitated extract of bark was nearly identical with this, which is only objectionable on the score of expense.

It contains all the quinia and cinchonia contained in the bark, besides the amorphous quinia, or chinoidine, and is an admirable substitute for the celebrated Wetherill's extract, formerly much in vogue. Its dose is from 2 to 5 grs.

Ergotine.—Under this name an aqueous extract of ergot is sold in the shops, for which the following is the formula of M. Bonjean: Exhaust powdered ergot by displacement with cold water, heat the solution in a water bath and filter; evaporate to the consistence of syrup, and add rectified spirit to throw down the gummy matter; when settled, decant the clear liquid, and evaporate by water bath. One ounce of ergot yields about 70 grains. It is said to possess the hæmostatic without the toxic effects of ergot.

Extractum pareiræ is prepared from sliced pareira brava, by decoction with water, straining and evaporating. A decoction is more frequently prescribed.

Extractum Uvæ Ursi.—The London College directs the preparation of this, also, by maceration and decoction with water. Its dose is the same as the foregoing, and they are both used as tonics and diuretics in chronic urinary disorders.

Extractum Lobeliæ Aceticum. (*Am. Journ. Pharm.*, vol. xiv. p. 108.)

To prepare this, the powdered seed of lobelia are macerated, and then displaced with diluted alcohol, to the first portion of which has been added a small portion of acetic acid. This liquid is then to be evaporated to the consistence of an extract, which will be about one-eighth the quantity of the seed employed. Dose 2 to 3 grains. The object of the use of the acetic acid, is to form a soluble acetate of lobelina, less readily decomposable by heat than the native salt.

The *extracts of lettuce, poppyheads, and hops* are very weak narcotic extracts, occasionally prescribed, but less esteemed than lactucarium, opium, and lupuline, which are the more efficient products of their respective plants.

Chinoidine is the name given to an insoluble residuary extractive principle obtained in the manufacture of quinia, which will be adverted to under the head of alkaloids.

The following impure forms of extract are officinal in *the list* of the *Pharmacopœia :—*

Extractum Cannabis, a powerful exhilarant and narcotic.
" Glycyrrhizæ, an inspissated saccharine juice.

Extractum Cannabis.—The alcoholic extract of cannabis sativa, variety Indica, is imported from the East Indies, and directed by the Dublin College to be purified by solution in alcohol, filtration, and evaporation. The dose of the purified extract, which is occasionally met with in our market, is from 1 grain upwards, till its effects are produced. It must not be confounded with an extract of apocynum cannabinum, occasionally met with.

Extractum glycyrrhizæ is the name given in the list of the *Pharmacopœia*, to the common drug known as liquorice, imported from Italy and Spain. Until recently this was the only extract of liquorice used; our manufacturers now make a true and proper extract, which is made in either of two ways, as follows :—

1*st Process.*—Take of liquorice root, bruised, any convenient quantity, macerate in water, with the application of heat, until exhausted; strain, and evaporate to the consistence of an extract.

2*d Process.*—Take of liquorice (impure extract) any convenient quantity, lay the pieces of liquorice in a large displacer, or a barrel, in layers alternating with straw; macerate, and then percolate the mass with cold water, and evaporate the clear liquid that runs off. The pieces of liquorice will be found to have lost their saccharine extractive matter, although retaining their shape as before.

The extract has a yellow color, becoming brown by age, and the taste of the root, and is deliquescent, so as to require to be kept in jars. Tilden's extract of liquorice is made into sticks of a yellowish-brown color by admixture with gum Arabic; in taste it resembles the root more decidedly than that of black liquorice.

"Concentrated" or Resinoid Extracts.

Jalapin is the name given to the resin of jalap, which may be separated pure enough for medicinal use by preparing a concentrated tincture with strong alcohol, and throwing it into a considerable quantity of water, when the resin will be precipitated, and may be collected and dried. It is given in doses of three to eight grains, triturated with sugar.

Podophyllin, which is made in the same way from May-apple root, is a powerful cathartic in doses of from one to three grains, and is a useful preparation, especially when combined with milder and less drastic medicines.

Macrotin is a name given by "eclectics" to the impure resin of cimicifuga racemosa; it is used in doses of from one to six grains in the course of a day, in the treatment of chorea and other diseases, in which the root is commonly used. (See Chapter on *Resins*, also a paper, by the author, on *Eclectic Pharmacy*, in the *American Journ. of Pharm.*, vol. xxiii. p. 329.)

Stillingin.—Under this name the "American Chemical Institute," "eclectic" pharmaceutists, prepare a sort of pulverulent extractive principle from the root of stillingia sylvatica, or queen's delight, an indigenous plant which has had a reputation for many years, chiefly as a domestic remedy, in scrofulous and venereal diseases. The dose stated for this preparation is two to four grains; it is a crude preparation, having no just claim to be considered the active principle of the plant.

Leptandrin.—The "eclectic" active principle obtained from the root of leptandra Virginica, an indigenous herb formerly officinal in the *U. S. Pharmacopœia*, is an impure resinoid, very much used by practitioners of that school "to stimulate the hepatic secretion where it is desirable not to produce debility by drastic alvine evacuations;" they also recommend it in small doses in dysentery, diarrhœa, and cholera infantum. Dose, two to four grains.

Hydrastin, as prepared from the root of hydrastis Canadensis, golden seal, is advertised as an alkaloid; it is a beautiful yellow powder with a bitter taste, and is recommended as a tonic with a special influence upon the mucous membrane of the stomach and bowels. The root of hydrastis, which is one of the ranunculaceæ, was analyzed by Alfred A. B. Durand, and a supposed alkaloid crystalline principle was obtained, though not purified, as also an acrid resin and extractive; how far the "eclectic" preparation is entitled to be considered as the alkaloid principle of the drug, ex-

periment only can determine. Another preparation of the same root is sold by the same makers as *hydrastin;* it is described as the resinoid principle, and as possessed of similar though less active properties. The dose of the former is stated at from one to two grains, of the latter as two to three grains.

Sanguinarin is offered as the active principle of bloodroot, but whether the *alkaloid* or *resinoid* principle is not stated; if prepared by the only published process I have seen, that of Merrill, it would probably contain but little of the former, which is the most active of its constituents.

As a class, these preparations, which are very numerous, cannot with truth be called the active principles of the several plants from which derived, unless where these are purely resinoid, as in the case of podophyllum and jalap. In regard to their efficiency as medicines, we have too little testimony from disinterested and well educated practitioners to form an intelligent judgment. In justice to the so-called "eclectic practitioners," it must be admitted that they have been instrumental in introducing to notice some obscure medical plants which possess valuable properties, too much overlooked; it is to be regretted that their narrow and unscientific system of practice, and their disposition to run into pharmaceutical empiricism, should have so long limited their usefulness and excluded them from the pale of the regular profession.

The *physical properties of extracts* vary, according to their composition, age, and the circumstances in which they are kept.

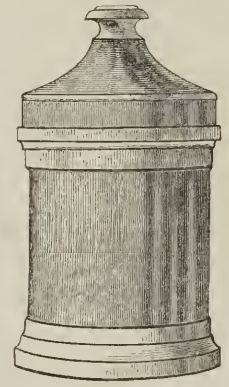
The narcotic extracts of the first class, as vended by the manufacturers, are apt to be too soft for convenient use in the form of pills, and are disposed to deliquesce. This want of a firm consistence, which results from a disposition to preserve the more volatile ingredients from loss in the final concentration, causes no inconvenience when the extract is used with a considerable proportion of dry or hard ingredients. Sometimes it is obviated by combining with them powdered liquorice, lycopodium, or tragacanth, when the additional bulk is no objection. The hydro-alcoholic extracts are seldom liable to this objection. They harden on exposure to the air, and when old are sometimes inconveniently dry and brittle. The extracts of jalap and podophyllum are apt to become tough and unmanageable, so as to resist the action of the pestle either by trituration or contusion. Extract of jalap is ordered, in compound cathartic pills, in the form of powder, and this is in every respect its best form for use; it is conveniently kept in bottles, as other powders are, is readily weighed and incorporated with other substances, and becomes plastic by the addition of moisture. Few manufacturers push the evaporation so far as to produce the extract dry enough for powdering; but there is no difficulty in accomplishing it where steam is employed, and as a demand grows up for the article it will be more generally met with in the stores, although at

a somewhat advanced price on the soft extract. Compound extract of colocynth is frequently brittle enough to powder, and is sometimes met with in this form. The addition of soap to its other ingredients prevents a liability to toughness, besides increasing its solubility.

Extract of rhatany is always pulverulent, and when properly made is nearly soluble in water.

The *mode of preserving extracts* next requires attention. The kind of jars usually employed for preserving extracts are here figured. Those with covers or tops are most eligible. In furnishing a shop where a good many are needed, it is well to reserve the canopy-top jars exclusively for ointments, the flat tops for extracts, for the sake of distinction. Extracts should never be put in gallipots or tie-overs, except for temporary purposes. Besides the cover, which fits loosely on the jars, there should be a piece of bladder, oiled paper, or preferably tinfoil, stretched over the open top before fitting on the lid.

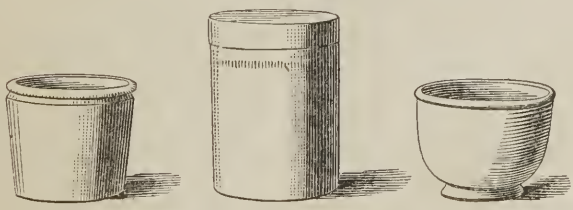
Fig. 155.



Canopy-top jar.

In the case of soft extracts, which have a tendency to mould, the occasional addition of a few drops of alcohol is found advantageous. Extracts put up in glass, wide mouth bottles, either with ground stoppers or corks, are preferable to jars in affording a more complete exclusion of the air, but the smaller sized bottles, having too narrow mouths to admit a spatula of ordinary width, are inconvenient.

Fig. 156. Fig. 157. Fig. 158.



Tie-over jar. Flat-top covered jar. Gallipot.

The Uses of Extracts.—This class of preparations may be used either in the form of pills, solution, or mixture. They are chiefly prescribed in the pilular form, combined with other substances, and to this they are peculiarly adapted. One of the chief points in making pills is to increase or modify the effect in the highest degree, without a corresponding increase of bulk. Hence the utility

of adding extracts to substances possessing no adhesiveness, choosing among them such as will most promote the therapeutic effect, while a plastic mass will be the result. Thus, in tonic pills, as of subcarbonate of iron or sulphate of quinia, extract of quassia or of gentian would be preferable to an inert substance like conserve of rose or mucilage.

In dilute aqueous solutions, extracts are not generally preferable to the corresponding tinctures, but where the dose of the tincture would be large, the physician often avails himself of the extract in preference, as not containing alcoholic stimulus. Extracts are generally combined in *mixtures* containing sweet or viscid substances more than in *solutions* proper, although in cases where the quantity of the extract desired is large, and it is soluble in water, it may be employed to impart viscidity to a mixture, and to suspend insoluble substances without the necessity of using either gum or sugar.

In triturating an extract, particularly a hard one, with viscid liquids, as syrup or mucilage, or with lard in making ointments, considerable difficulty is experienced in dissolving or diffusing it equally throughout the mixture; to obviate this, it should be first softened with a few drops of water if aqueous, or alcohol if alcoholic, until it has about the consistence of thick honey or treacle, and then incorporated with the other ingredients. Frequently this will require the application of heat and a long and tedious trituration, but it is the only way to accomplish the object thoroughly and effectually.

CHAPTER XI.

FLUID EXTRACTS.

The class extracta fluida is found for the first time in the *Pharmacopœia* in the edition of 1850. Most of its members had been used and were esteemed standard remedies for several years previous to that date, though two of them (the oleo resins) have not yet attained any great popularity. They are all made by displacement and evaporation. It is to be regretted that preparations so unlike should be arranged under one generic name and placed together in the *Pharmacopœia;* for, as their number increases, it will probably be found necessary, in order to prevent confusion, to separate them into different classes.

Extracta Fluida, *U. S. P.*

These naturally divide themselves as follows :—

1*st Class.* Concentrated syrups. 2*d Class.* Concentrated preparations containing alcohol as their antiseptic ingredient. 3*d Class.* Oleo-resins.

1st Class.—These all represent an equal quantity, or half an equal quantity, of the drug from which they are made.

Officinal Name.	Dose.	Med. Prop.	Adjuvants.
Extractum Sennæ fluidum	f℥ss	Cathartic	Oil of fennel and comp. spt. ether.
" Rhei fluidum	f℥j	"	Oils of anise and fennel, and tinct. of ginger.
" Spigeliæ et sennæ fluidum	f℥j	Anthelmintic	Carb. potass., oils of caraway and anise.
" Sarsaparillæ fluidum	f℥j	Diaph. alterative	(Compound.)

The preparation of either of the above is accomplished as follows: A tincture is first prepared by displacement with a mixture of one part alcohol and two of water, or of diluted alcohol; after the strength is thoroughly extracted from the drug in this way, it is transferred to a capsule (preferably to a water bath), and evaporated to such a point as that, on the addition of sugar, it will make the quantity required. The proportion of sugar is made somewhat less than in the case of ordinary syrups, so as to prevent the preparation being too thick for convenience; and, to make up for this deficiency of sugar, various antiseptics are added, as above indicated, under the head of adjuvants.

These preparations are the most eligible of their respective drugs. Their dose is comparatively very small; they are freely miscible with aqueous liquids, though fluid extract of rhubarb forms a cloudy and somewhat grumous solution when diluted. By dilution with simple syrup, the appropriate fluid extracts yield preparations nearly resembling the officinal syrup of rhubarb, syrup of senna, and compound syrup of sarsaparilla, and, by dilution with water, the corresponding infusions. The proportion may be readily calculated by a comparison of the officinal formulæ, or by reference to the table given on page 169.

2d Class.—There is but one officinal alcoholic fluid extract.

	Dose.	Med. Prop.
Extractum Valerianæ fluidum	f℥j	Antispasmodic (made with ether).

This elegant and efficient preparation is made by first treating the coarsely powdered root with a mixture of alcohol and ether by displacement, and allowing the ethereal tincture thus obtained to

evaporate spontaneously, until the dissolved oleo-resin and valerianic acid are left in solution in a small portion of the alcohol. While this evaporation is going on, the valerian in the displacement tube is further treated with diluted alcohol, till a definite quantity of tincture has passed; to this the evaporated ethereal tincture first prepared is now added, and the mixture allowed to stand, with occasional agitation, for a few hours, or till an insoluble blackish precipitate has ceased to be deposited. It is then filtered and diluted, if necessary, to exactly a pint for every eight ounces of valerian employed (two parts to one of the drug). In the dose above given, this fluid extract is a powerful preparation, far more efficient than the tincture in double the dose, or the powder in a thirty grain dose. It makes a milky solution in aqueous liquids, but may be mixed with syrups or mucilaginous preparations, or with tincture, without inconvenience from this cause. The Shaker fluid extract of valerian, called Brown's, appears to be a very strong tincture made from the fresh root, and, judging from its sensible properties and general popularity, it is scarcely inferior to the officinal fluid extract as produced from the dried imported root.

3d Class.—The oleo-resins. There are only two officinal fluid extracts.

Extractum Cubebæ fluidum.	Stimulant.	Dose, 5 to 30 drops.
" Piperis "	"	" 1 to 5 "

These preparations are made by passing ether through the powdered drug in a covered displacement apparatus, and allowing this ethereal tincture to evaporate spontaneously. The resulting liquid is in each case of a more or less syrupy consistence; of a very dark color—brown, with a tinge of green; extremely pungent, and reminding one of the drug. It consists of the essential oil holding in solution a portion of the wax and of the peculiar resinoid principle (in the one case cubebin, and in the other piperin). These are apt to be deposited in part, upon standing, a circumstance which modifies somewhat the properties of different specimens. In the instance of fluid extract of pepper, the piperin is directed to be separated, and the oil of black pepper of commerce, which is similar to the fluid extract, is a residuary product of the manufacture of piperin. Cubebs yield from 12 to 28 per cent. of oleo-resin; black pepper about one-sixteenth of its weight.

The chief mode of using these preparations is to suspend them in saccharine and mucilaginous solutions, or to add them to other ingredients in pill mass. Fluid extract of pepper is much used in connection with sulphate of quinia in the form of pill. Fluid extract of cubebs has been inclosed in gelatin capsules, similar to those of copaiba, so much used.

Table showing the Proportion of each ingredient in the Officinal Fluid Extracts.[1]

f℥i of Fluid extract represents of	FLUID EXTRACT OF																		
			RHUBARB.				SENNA.			SARSAPARILLA.				FINK ROOT AND SENNA.					
	Cubebs.	Black Pepper.	Rhubarb.	Tinct. Ginger.	Oil Aniseed.	Oil Fennel.	Senna.	Oil of Fennel.	Hoffman's Anodyne. (Sugar.)	Sarsaparilla.	Liquorice Root.	Sassafras.	Mezereon.	Pink Root.	Senna.	Carb. Potassa.	Oil Aniseed.	Oil Caraway.	Valerian.
℔ or grs.	480	960	60	4	1/16	1/16	60	3ss	3ss	60	7½	7½	2¾	30	15	1⅞	1/6	1/6	30

Table showing the Fluid Extracts as compared with the other Preparations of the same Drugs.

f℥i Fluid Extract equal to	CUBEBS	RHUBARB.						SARSAPARILLA.				SENNA.			VALERIAN.		
	Tincture.	Infusion.	Syrup.	Aromat. Syrup.	Tincture.	Tinct. Rh. and Aloes.	Tinct. Rh. and Gentian.	Extract.	Infusion.	Comp. Syrup.	Comp. Decoction.	Extract.	Infusion.	Syrup.	Tinct. Sen. and Jalap.	Infusion.	Tincture.	Ammon. Tinct.
	f℥viii	Oss	℥iss	5¾ oz	1⅓ oz.	3 oz.	℥ii	℥ss	℥ii	⅔ oz.	℥i	8 gr.	℥ii	℥i	℥ii	℥ii	℥ss	℥ss

Unofficinal Fluid Extracts.

So numerous and important are the medicines of this class recently brought into notice that it seems necessary to devote considerable space to describing, classifying and arranging those not recognized in the *Pharmacopœia*, in order to supply a want often felt and expressed by physicians and apothecaries who have not access to a full copy of the *American Journal of Pharmacy*, the

[1] See paper on "Fluid Extracts," by Jos. Laidley, in the *Stethoscope*, published in Richmond, Va.

work in which nearly all the formulæ have been published from time to time.

The following table embraces these Unofficinal Fluid Extracts.

1st Class.—*Concentrated Syrups.*

				Dose.	
Ext. Cinchona, fluid	Jones	f ℥j = ℥ss	f ℥j	Transparent.
" " "	Taylor	" "	"	Turbid.
" Buchu "	Procter	" "	"	See 2d class.
" " comp'd.	Parrish	" "	"	Cont's stim. oils.
" Hydrangea "	Butler	Oj = ℥xij	f ℥ss	With honey.
" " "	Parrish	f ℥j = ℥ss	"	"
" Rhubarb and senna, fluid	Procter	f ℥j = { senna ℥vj, rhub. ℥ij }	"	Bicarb. potassa.
" Ergot "	Baker	f ℥ss = ℥ss	f ℥j	By eth., alc., water.
" Serpentaria "	Savery	f ℥j = ℥ss	f ℥ss	See 2d class.

2d Class.—*Alcoholic Fluid Extracts.*

			Dose.	
Ext. buchu, fluid	Procter	f ℥j = ℥ss	f ℥j	See 1st Class.
" " "	Weaver	f ℥j = ℥ss	f ℥j	Made with ether.
" Serpentaria "	Taylor	f ℥j = ℥j	♏ xx	Strongest.
" Taraxacum " 1st.	Procter	f ℥ss = ℥j fresh	f ℥j	Suc. tarax. parat.
" " " 2d.	"	f ℥vj = ℥j "	"	From fresh root.
" " " 3d.	. . .	f ℥j = ℥j dried	"	" dried "
" " " 4th.	. . .	f ℥ij = ℥j extract	"	Extemporaneous
" Gentian "	Procter	f ℥j = ℥j	"	Contains brandy
" Galls "	Parrish	f ℥j = ℥ss	. . . .	In dentistry.
" Lobelia "	Procter	f ℥j = ℥ss	♏ v to xx	With acet. acid.
" Cimicifuga "	"	f ℥j = ℥j	♏ xxx	With ether.

3d Class.—*Oleo-Resins—prepared with Ether.*

Piperoid of ginger.	Used in confectionery.
Oleo-resin capsicum.	" "
Oil of male fern.	" for tape-worm.
" of Canada snakeroot.	" in perfumery.
" of Cardamom.	" "
" of ergot. Dose ♏ xx.	" in parturition.
" of parsley.	" as a diuretic.

1st Group.—*Concentrated Syrups.*

Fluid Extract of Cinchona.

Three formulæ have been contrived for making this preparation, the results of which vary in their physical and medical properties.

The first is that of M. Donovan, given in vol. xvii. p. 49, *Amer. Journ. Pharm.*, and is chiefly objectionable as being complicated, and difficult of preparation; besides, the liquid is made from the bark by repeated maceration in diluted alcohol, and by decoction with water, subsequently concentrated by evaporation. A rare salt, the dinoxalate of quinia, is added, in large proportion, to in-

crease the strength of the preparation, and the whole is then formed into a very thick fluid extract, called, by Donovan, "Syrup of Bark."

As far as I am aware, this has not been prepared in this country; but the prevailing idea, that quinia and cinchona are not the only proximate principles of the cinchona barks that give them their antiperiodic properties, and that the natural state of combination, in which the various principles exist, is to be preferred in certain cases, has led some of our own pharmaceutists to propose formulæ for fluid extracts of bark.

Isaac C. Jones, a graduate of the Philadelphia College of Pharmacy, in his inaugural thesis, proposed a preparation to be made as follows:—

Take 8 ounces of calisaya bark; exhaust it completely, by displacement with water, acidulated with muriatic acid, in quantity not exceeding half a fluidounce. The infusion is now to be evaporated to 9 fluidounces; and, while yet hot, 14 ounces of sugar dissolved in it, which will bring it to measure a pint. Each fluidrachm of this fluid extract represents half a drachm of the bark, or about 1 grain of quinia. It becomes turbid on cooling, by the deposition of cinchonic red, which may be separated by straining or decanting it. The preparation will then be clear; but it will be observed, it contains the quinia in the form of *muriate*, thus disturbing the natural state of combination existing in bark.

Some pharmaceutists prepare this, and furnish it when fluid extract of bark is prescribed.

Alfred B. Taylor has since communicated a formula, which was published in the *American Journal of Pharmacy*, vol. xxiii. p. 218, which presents the constituents of bark in an unaltered condition, although turbid, and less elegant in appearance than the foregoing. It is as follows:—

Take 8 ounces (Troy) of calisaya bark, exhaust it completely by displacement with diluted alcohol; evaporate to 9 fluidounces, then add 14 ounces (Troy), of sugar; continue the heat until it is dissolved, and strain while hot, if necessary. This makes a pint, each fluidrachm of which represents half a drachm of bark, or 1 grain of quinia.

In the process of evaporating the tincture, as first prepared, in the last formula, a very copious precipitate, consisting of the cinchono-tannates, and cinchonic red, is thrown down, coating the bottom and sides of the dish or water bath. It is designed to suspend this, by the aid of the sugar, subsequently added. I have found an advantage in varying the process, by pouring off the concentrated liquid into another vessel, and dissolving this precipitate in 4 fluidounces of alcohol. The sugar is now added, and becomes saturated with this alcoholic solution; the 9 ounces of concentrated liquid, previously poured off, being now returned, and

heat applied. The alcohol is nearly dissipated, while the sugar is dissolved. The result is a very complete suspension of the insoluble portion.

Fluid extract of cinchona is applicable to the cases in which the bark itself would be indicated; its dose, as a tonic, is usually about a fluidrachm. It is well adapted to admixture with other tonics, in the liquid form.

Fluid Extracts of Buchu.

Preparations of buchu have been used to some extent for many years. More than twenty years ago, Geo. W. Carpenter, of this city, advertised in his "essays" "addressed to physicians," a compound fluid extract of buchu, prepared by a secret formula, and recommended for diseases of the urinary organs, especially "gonorrhœa or clap, and gleets of long standing." Of latter time, since this valuable drug has come to be more generally known and appreciated, our *Pharmacopœia* has recognized an officinal infusion, and that of Dublin, a tincture. The fluid extract may be made so as to class it with those now under consideration; or may contain alcohol and thus be classed with those which follow. I shall proceed to give processes for both kinds, as also that for a compound fluid extract, which I have prepared for several years, and which has found favor with some. For the two next following recipes we are indebted to Prof. Procter.

The Syrupy Fluid Extract.

Take of Buchu leaves	. . .	8 ounces.
Alcohol	. . . .	16 fluidounces.
Water	. . . .	a sufficient quantity.

Reduce the leaves to coarse powder, moisten them in a covered vessel with twelve fluidounces of the alcohol, macerate for six hours and introduce the whole into a suitable displacer. When the clear liquid has ceased to drop, add the remaining alcohol mixed with four fluidounces of water, gradually, until the displaced alcoholic liquid amounts to twelve fluidounces, which is evaporated with moderate heat to four fluidounces. The residue in the displacer is then treated with a pint of cold water by maceration for twelve hours, and subjected to pressure, until a pint of aqueous liquid is obtained. (Displacement is ineligible, on account of the mucilaginous character of the marc.) This is evaporated to eight fluidounces and mixed with the four fluidounces of evaporated tincture previously obtained, and eight ounces of sugar are dissolved in it by agitation. A pint of fluid extract is thus obtained from eight ounces of buchu, and a fluid drachm, the usual dose, represents half a drachm of the powdered leaves.

The Hydro-Alcoholic Fluid Extract of Buchu.

Take of Buchu leaves	8 ounces.
Alcohol	16 fluidounces.
Water	a sufficient quantity.

Reduce the leaves to coarse powder; moisten them with twelve fluidounces of the alcohol; macerate them for six hours, and introduce the whole into a suitable displacer; when the clear fluid has ceased to pass, add the remaining alcohol, mixed with four fluidounces of water, gradually, until the displaced alcoholic liquid amounts to twelve fluidounces, which is set aside until reduced to six fluidounces by spontaneous evaporation. The residue in the displacer is treated with water by maceration for twelve hours, and subjected to pressure until a pint of aqueous liquid is obtained. This is evaporated to ten fluidounces, mixed with the six fluidounces of evaporated tincture, and after occasional agitation for several days, may be filtered or strained, to remove the undissolved resinous and gummy matter. This is of the same strength as the preceding, and given in the same dose. It contains a little more alcohol, and no sugar.

The following recipe, by Thomas Weaver, is an improvement on the foregoing, producing an elegant and very strong though less mucilaginous preparation. It is here published for the first time:—

Take of Buchu (finely powdered)	8 ounces.
Ether	4 fluidounces.
Alcohol	12 fluidounces.
Diluted alcohol	sufficient.

Mix the ether and alcohol, and having packed the powdered buchu in a tall displacer, pass the mixture through it, then add sufficient diluted alcohol to obtain a pint of the tincture. Put the ethereal liquid, thus obtained, in a porcelain capsule, and allow it to evaporate to five fluidounces. Upon the mass in the percolator, pour, gradually, diluted alcohol until ten fluidounces of tincture have passed; mix this with the five fluidounces before obtained, and dissolve in a fluidounce of alcohol the oleo-resinous matter left in the dish and add it to the rest, after standing in a closed bottle for several hours, and occasionally shaking up: filter.

This is a dark-colored hydro-alcoholic liquid, with a tendency to the formation of globules of essential oil on the surface, and possessed in a very high degree of the characteristic odor and taste of the drug.

The Compound Fluid Extract of Buchu.

Take of Buchu in coarse powder	12 ounces.
Alcohol	3 pints.
Water	6 pints, or sufficient.

Treat the leaves by maceration and displacement, first with a portion of the alcohol, and then with the remainder mixed with the water; evaporate the resulting liquid by a gentle heat to 3 pints, and to this add

Sugar	2½ pounds.

Continue the heat till it is dissolved, and, after removing from the fire, add—

Oil of cubebs,	
Oil of juniper, of each .	one fluidrachm.
Spirit of nitric ether . .	twelve fluidounces.

Previously mixed; stir the whole together.

It will be perceived that this preparation, although it contains a portion of sugar sufficient to impart sweetness to the taste, does not owe its permanence to that ingredient. The oils of cubebs and juniper, and the spirit of nitric ether, are not only useful as therapeutic agents in the majority of cases in which cubebs would be used, but act as antiseptics, and would render the preparation permanent without the presence of alcohol or sugar.

It has been found a useful preparation, and is well adapted by its composition, to chronic maladies of the urino-genital organs, appearing to act topically in its passage through them.

Fluid Extract of Hydrangea.

The root of hydrangea arborescens, an indigenous plant found in many parts of the United States, was introduced to the notice of the medical profession by Dr. S. W. Butler, of Burlington, N. J., through the *New Jersey Medical Reporter*. Dr. Butler states that his father, who is connected with the mission to the Cherokees, learned of them the merits of this plant in the treatment of gravel and stone, and has himself, for many years, employed it in the course of an extensive practice among a people peculiarly subject to these complaints; he considers it as a most valuable medicine, and possessed, perhaps, of specific properties claiming for it a trial at the hands of practitioners. Dr. Butler's formula is as follows:—

Take of the Root of hydrangea . . .	2 pounds.
Water	12 pints.

Boil to four pints, strain, and add

Honey	2 pints.

Boil further to two pints.

We have modified it thus:—

Take of Hydrangea . . .	16 ounces
Water	6 pints, or sufficient.

Boil the root in successive portions of water, mix them, and evaporate to half a pint; mix this with

Honey . . . . . 2 pints

and evaporate to 2 pints. In the summer season push the evaporation somewhat farther, and add brandy, half a pint.

The dose is a teaspoonful twice or three times a day.

I have prepared fluid extract of hydrangea for several years, during which time I have dispensed it, under the direction of several practitioners, to numerous patients, and with general satisfactory results, in irritable conditions of the urethra, though its value as a specific remedy requires confirmation.

The plant is abundant on the west banks of Schuylkill, about six to eight miles above Philadelphia.

Fluid Extract of Rhubarb and Senna.

The peculiar fitness of rhubarb and senna to be associated together in one cathartic preparation, so as to modify and assist each other, has led Prof. Procter to propose a fluid extract prepared as follows: (See *Am. Journ. Pharm.*, vol. xxv. p. 23.)

Take of Senna, in coarse powder .	twelve ounces.
Rhubarb	four ounces.
Bicarbonate of potassa .	half ounce.
Sugar	eight ounces.
Tincture of ginger .	a fluidounce.
Oil of cloves . . .	eight minims.
" aniseed . . .	sixteen minims.
Water and alcohol, of each .	a sufficient quantity.

Mix the senna and rhubarb (by grinding them together in a convenient way), pour upon them two pints of diluted alcohol, allow them to macerate 24 hours, and introduce the mixture into a percolator, furnished below with a stopcock or cork, to regulate the flow. A mixture of one part of alcohol and three of water, should now be poured on above, so as to keep a constant, but slow displacement of the absorbed menstruum, until one gallon of tincture has passed. Evaporate this in a water bath to eleven fluidounces; dissolve in it the sugar and bicarbonate of potassa, and after straining, add the tincture of ginger, holding the oils in solution, and mix; when done, the whole should measure a pint. The object in adding the alkaline carbonate in this fluid extract, is to prevent the griping which is apt to result from the use of the senna. The aromatics contribute to the same end. In making this and other fluid extracts, observe precautions under head of evaporation.

Fluid Extract of Ergot.

This preparation was originally described by Jos. Laidley, of Richmond, Va., in a paper published in the *Stethoscope*, Jan. 1852, in which, however, the recipe for its preparation was not given in the usual way. Since that time, the following was published by T. Roberts Baker, of the same place. (See *Am. Journ. Pharm.*, vol. xxvii. p. 302.)

Take of Ergot, freshly powdered . 2 lbs. com.
Ether,
Alcohol (80 per cent.),
Water,
Simple syrup, of each . sufficient.

1st. Displace the ergot with ether until it comes through nearly colorless, and evaporate spontaneously to procure the oil.

2d. Displace with alcohol to exhaustion, and evaporate by water bath (or regulated heat) to a thin syrupy consistence.

3d. Displace with water to exhaustion, and evaporate the resulting liquid as fast as obtained, to guard against chemical changes. Then strain to separate albumen, and mix with the alcoholic extract, continuing the evaporation to a syrupy consistence. Incorporate the evaporated mixture first with the oil as obtained by the ether, and then with sufficient simple syrup to make up the measure of two pints. To each fluidrachm of this add one minim of oil of peppermint. The dose is f℥j = ℈ij of the powder.

Fluid Extract of Serpentaria.

The first published formula which appeared for a concentrated preparation of this valuable indigenous root was by John B. Savery, in his inaugural thesis in the *American Journal of Pharmacy*, vol. xxiii. p. 119. It is as follows:—

Take of Virginia snakeroot,
Sugar, in powder, of each . eight ounces.
Water,
Alcohol, of each . . . a sufficient quantity.

The root is to be finely ground, and after having macerated for a day or two in a pint of alcohol, is to be introduced into a displacer, and diluted alcohol poured on it until four pints shall have passed. The tincture thus obtained, should be evaporated with a gentle heat and constant agitation, until it measures 12 fluidounces; the sugar is then to be dissolved, and the whole to be strained through flannel. This forms a clear, syrupy liquid (any resinous matter separated on mixing the more aqueous with the strong alcoholic tincture is dissolved on the addition of the sugar); it is free from the objection of containing an inconvenient quantity of

alcohol, which pertains to the tincture, while the intense bitterness and powerful camphoraceous taste of the drug, are relieved by the presence of the sugar.

The dose is half a fluidrachm, representing 15 grains of the root.

Alfred B. Taylor's process, vol. xx. p. 207, *Am. Journ. Pharmacy*, yields a preparation double the strength of the above, and belonging to the *second class* of fluid extracts. It is as follows:—

Take of Serpentaria, bruised . . twelve ounces.
Alcohol,
Water, of each . . . a sufficient quantity.

Mix the serpentaria with 12 ounces of alcohol, and allow it to stand for twenty-four hours; then transfer it to a percolator, and pour alcohol gradually upon it, until a pint and a half of filtered liquor is obtained. Place this in an evaporating dish, and allow it to evaporate spontaneously, until reduced to six fluidounces. To the root, exhausted by alcohol, add water and displace till it is exhausted, or until about three pints have passed; evaporate this portion in a water bath to six fluidounces, mix the two parts together and filter. Each fluidounce of this represents one ounce of the root.

Dose, from 15 to 45 drops.

Unofficinal Fluid Extracts of the Second Class.

Those containing alcohol as their antiseptic ingredient.

Several fluid extracts are made indiscriminately, so as to contain sugar or alcohol, or sometimes both, as the antiseptic ingredient. The fluid extracts of buchu and serpentaria, already spoken of, and several to be now introduced, are instances of this kind.

Fluid Extract of Taraxacum. (*Liquor Taraxaci.*)

1*st Process.* (By Prof. Procter, 1848.)

Take of fresh dandelion root, collected in September or October, 32 ounces; slice it transversely, and reduce it to a pulp by bruising; mix this with one-sixth of its bulk of alcohol; macerate for 24 hours; then express strongly; add a pint of water containing a little alcohol, and again express; evaporate the liquid to 12 fluidounces; add 4 fluidounces of alcohol, and filter. A teaspoonful of this fluid extract represents half a drachm of extract of dandelion obtained from the fresh juice, which is several times the strength of that obtained by boiling the roots in water.

If alcohol should be objected to, 8 ounces of sugar may replace it in the above, it being dissolved by agitation.

In this country, every one may obtain fresh roots of dandelion at the proper season, and may make the preparation but once a year; but where this is neglected, the carefully preserved dried root may be substituted, 16 ounces being equal to 32 of the fresh. The dried root is to be powdered coarsely, and treated with alcohol and water by maceration, expressed, evaporated, and finished as directed.

2*d Process.* (By Prof. PROCTER, 1853.)

Take of Fresh dandelion root .	20 pounds (com.).
Alcohol (835°) . . .	4 pints.

Slice the roots transversely, in short sections, and by means of a mill or mortar and pestle, reduce them to a pulpy mass; then add the alcohol, and mix them thoroughly. The mixture thus far prepared at the season when the root is proper for collection, may be set aside in suitable vessels (stoneware jars are appropriate), and extracted as the preparation is needed through the other seasons. After having stood a week, or until a convenient time, the pulpy mass is subjected to powerful pressure, until as much as possible of the fluid is removed. This is then filtered and bottled for use. It is necessary that sufficient time should elapse after the pulp is set aside for the alcohol to penetrate the fibrous particles and commingle with the natural juices, as well as for the woody structure of the root to lose its elasticity, that it may yield the juice more completely on pressure. When the pulp has stood six months in this, it yields the juice with great readiness, and possessed of the sensible properties of the dandelion in a marked degree. When eight pounds, avoirdupois, of the root are thus treated, after standing several months, the practical result is about six pints of fluid with an ordinary screw press. This yield will vary in amount with the condition of the root when collected, and the length of time it is exposed afterwards, as well as the power of press used. Should the alcohol in this preparation be contraindicated, it might be partially removed by exposure in a water bath until the juice was reduced to five-sixths of its bulk; then for every pint of the residue, eight officinal ounces of sugar may be dissolved in it. The name *Succus Taraxaci Paratus* has been applied to this preparation, which resembles the English preserved juice.

3*d Process.*

Macerate four pounds of the recently dried root, in sufficient cold water, for 24 hours, expressing and evaporating to 36 fluidounces, to which liquid 12 fluidounces of alcohol is added; hence each fluidounce of the preparation represents an ounce of the *dried* root.

The evaporation of an aqueous solution of taraxacum is almost sure to have an unfavorable effect on its medical properties; it is

well known that the solid extract, when prepared by the old process of decoction and evaporation in an exposed water bath, is greatly inferior to the best inspissated juice prepared in vacuo.

4th Process.

The only remaining process to be noticed, is that for preparing the fluid from the solid extract, which is only employed where expedition is the desideratum. The following is the formula:—

Take of Extract of dandelion, *U. S. P.* four ounces.
Alcohol . . . . . one fluidounce.
Water . . . . . a sufficient quantity.

Triturate the extract with the water and the alcohol, and apply a gentle heat, till it is dissolved, taking care that the product measures just half a pint.

These processes yield a liquid which is substantially the same in physical and medical properties. The usual dose is a teaspoonful. It is a more convenient preparation for ordinary use than the solid extract, which is not well adapted to the pilular form, on account of the largeness of its dose.

Fluid Extract of Gentian.

The following formula of Prof. Procter produces one of the most elegant of fluid extracts, well adapted to supersede the tincture of gentian, and by combination with aromatics or laxatives, to furnish a substitute for the different tonic tinctures given on p. 113.

Take of Gentian, in coarse powder, sixteen ounces.
Water . . . . a sufficient quantity.
French brandy . . six fluidounces.

Macerate the gentian in two and a half pints of water for twelve hours, and having introduced it into a suitable percolator, allow the infusion to pass slowly, adding water at intervals, until five pints of liquid have passed. Evaporate this to ten fluidounces by means of a water bath, add the brandy, and strain through cotton flannel; this fluid extract may be given in doses of half a teaspoonful to a teaspoonful, which represent half a drachm to a drachm of the root.

"When it is desirable to associate aromatics, they may be added in the form of tincture, in place of a part of the brandy, or the aromatics in substance may be extracted by the brandy, and the tincture thus formed added to the evaporated solution of gentian."

Fluid Extract of Lobelia.

The chemical and pharmaceutical history of lobelia inflata, one of our most interesting and valuable indigenous plants, is connected with the labors of Wm. Procter, Jr., now Professor of Pharmacy in

the Philadelphia College of Pharmacy, and editor of the *American Journal of Pharmacy*. In 1837, he wrote his inaugural thesis for graduation in the institution, with which he is now so honorably connected, on lobelia. In this paper, which was published in the *Journal* (vol. ix. p. 98), he gave a full chemical history of the plant, and proved the existence in it of a peculiar alkaline acrid principle, for which he proposed the name of *lobelina*.

Subsequently, in 1841, he called attention in a paper published in vol. xiii. p. 1, to lobelina and some other principles of the plant, and showed the advantage of fixing this alkaloid by the use of an acid, in making those preparations of lobelia requiring the application of heat.

In 1842, he again appears in the *Journal* in an article on some preparations of this drug, in which the principles already ascertained are applied in practice. The acetous extract, vinegar and syrup, there introduced, have not been made officinal, but the former is introduced under its appropriate heading in this work.

In 1852, the fluid extract of lobelia was proposed by Prof. Procter, and the following formula published in vol. xxiv. p. 207 of the *Journal*:—

Take of Lobelia (the plant), finely bruised .	eight ounces.
Acetic acid	one fluidounce.
Diluted alcohol	three pints.
Alcohol	six fluidounces.

Macerate the lobelia in a pint and a half of the diluted alcohol, previously mixed with the acetic acid, for twenty-four hours; introduce the mixture into an earthen displacer; pour on slowly the remainder of the diluted alcohol, and afterwards water, until three pints of tincture are obtained; evaporate this in a water bath to ten fluidounces; strain; add the alcohol, and, when mixed, filter through paper. Each teaspoonful of this preparation is equal to half a fluidounce of the tincture. The dose would vary from five drops, as a narcotic and expectorant, to twenty or thirty as an emetic.

Fluid Extract of Galls.

The following is for a preparation which has been occasionally used by dentists in Philadelphia; as it may be called for in the course of practice, it is introduced here:—

Take of Galls, in coarse powder .	℥viij.
Alcohol	sufficient to make a pint.

Extract by displacement.

Used as a powerful astringent application.

Fluid Extract of Cimicifuga.

In an article on the pharmacy of cimicifuga, Prof. Procter proposes the following formula, which has been found very satisfactory

both pharmaceutically and medically. (See *Am. Journ. of Pharm.*, vol. xxvi. p. 106.)

Take of Black snakeroot (recently dried)	sixteen ounces.
Ether	half a pint.
Alcohol	one pint.
Diluted alcohol	a sufficient quantity.

Powder the black snakeroot and introduce it into a displacer, suited to volatile liquids; pour upon it the ether mixed with the strong alcohol, closing the lower orifice, so that the liquid shall pass by drops. When the menstruum disappears above, immediately add diluted alcohol until the filtered tincture measures a pint and a half; set this aside in a capsule in a warm place until it is reduced to half a pint, and has lost its ethereal odor; meanwhile continue the percolation with diluted alcohol until two pints more tincture are obtained. Evaporate this in a water bath to eight fluid-ounces, and mix it gradually with the first product so as to avoid as much as possible the precipitation of the resin from the latter. After standing a few hours, the fluid extract should be filtered, and, if it does not measure a pint, add sufficient alcohol to make that measure. If the amount of resin precipitated is considerable, it may be separated by a cloth strainer, redissolved in a little alcohol, and added to the solution, which should then be filtered.

As thus prepared, the fluid extract has a dark, reddish-brown color, like laudanum; is transparent, and possesses the bitter disagreeable taste of the root, in a marked degree. A fluidrachm represents about a drachm of the root. The dose usually given is from thirty to sixty drops.

Unofficinal Fluid Extracts of the Third Class.

Oleo Resins.

Ginger, capsicum, filix mas, asarum Canadense, cardamom, parsley, ergot and mustard, yield more or less fluid oily extracts, on the evaporation of their ethereal tinctures. As these have been but little called for, there has been very little written about them, and I shall proceed to state what I have ascertained by experiment and learned from the limited sources at command.

Oleo Resin, or Piperoid of Ginger.

Treat powdered ginger by displacement, with a mixture of one part of alcohol and four of ether, until nearly exhausted of its taste and odor; expose this ethereal tincture to spontaneous evaporation, until deprived of the odor of ether. The resulting oleo-resin, is a dark brown, transparent, oily liquid, extremely pungent, insoluble in water, but soluble in ether and strong alcohol. Ginger is said

to contain about $1\frac{1}{2}$ p. ct. vol. oil, and $3\frac{8}{10}$ p. ct. soft resin. The proportion yielded by the root, treated as above, varies with the commercial variety of ginger. A commercial pound of African ginger yielded, by this process, one and a half ounces, or 9.3 per cent., while the same quantity of the Jamaica variety yielded only one ounce—6.2 per cent. That from the African was darker in color, thicker, and somewhat less pleasant than the other. One ounce of the piperoid added to twenty pounds of melted sugar, made "ginger drops" of about the usual pungency.

Oleo Resin of Capsicum.—Capsicum is said to owe its intense fiery taste, and its powerful stimulating properties, to a peculiar soft resin, called capsicin, about four per cent. of which is said to exist in the fruit deprived of seeds. The preparation named above, is an impure form of this. It is too powerful for convenient use.

Oil of Male Fern.—Oil of filix mas, usually extracted from the powdered rhizome, is used as a remedy for tape-worm. It is extracted by ether, which is afterwards allowed to evaporate spontaneously, and leaves a dark green colored oily liquid, having the odor of the plant. It is a favorite with the "eclectics."

Oil of asarum Canadense is used chiefly as a perfume; it is also gratefully stimulant in small doses, being not unlike ginger in some of its properties.

Oil of cardamom, prepared with ether, is an impure oily fluid, containing both the fixed and volatile oil of the seeds, and esteemed a powerful carminative stimulant; it is little known to practitioners.

Oil of parsley is a diuretic remedy in esteem among the "eclectics." I have prepared it by the spontaneous evaporation of an ethereal tincture. It is highly charged with the odor of the plant, of which it is probably the chief active constituent.

Oil of Ergot.—Under this name a brown colored, acrid, oily liquid is sold in the shops, which is obtained by treating powdered ergot with ether, or a mixture of ether and alcohol, and evaporating off the menstruum. Its most bulky ingredient is the peculiar bland fixed oil, which, according to the experiments of T. Roberts Baker, is nearly isomeric with castor oil. My friend, Ambrose Smith, informs me that he has found oil of ergot, when made with pure ether, to become inconveniently thick—almost solid; which difficulty is obviated by adding a portion of alcohol to the ether employed. Although the pure fixed oil is destitute of any of the effects of ergot, this preparation, owing to its other ingredients, is more or less active. Its dose, in cases of labor, to promote uterine contractions, is from 20 to 50 drops.

CHAPTER XII.

OF SYRUPS.

This class of pharmaceutical solutions is distinguished by containing sugar as the antiseptic ingredient. The kind of sugar used in the officinal preparations, is that named in the list of the *Pharmacopœia*, saccharum, and called, commonly white, sometimes loaf sugar, or, as more commonly met with now, broken down or crushed sugar. This, as supplied to our markets by several large refineries, is nearly chemically pure cane sugar, and requires no further preparation for pharmaceutical use. It is soluble in less than half its weight of water; to a less extent in alcohol, and insoluble in ether. It crystallizes from its solution in the form of oblique rhombic crystals, containing water, and called, as found in the shops, rock candy.

The advantages of the use of sugar in pharmaceutical preparations are, 1st. Its agreeable taste. 2d. The viscidity and blandness of its solution. 3d. Its conservative properties, when in sufficient proportion. It is chiefly objectionable in cases where, from want of tone in the digestive organs, it is liable to produce acidity of stomach, with its attendant symptoms.

Syrups are most used as expectorants, and in the treatment of the diseases of children, with whom a sweet taste goes far to reconcile otherwise disagreeable properties of a medicine. They are, also, much used with other and more active medicines, as adjuvants and vehicles. The first of this class to be noticed, is

Syrupus. (*Simple Syrup.*)

Take of	Sugar . .	2 pounds and a half.
	Water . .	1 pint.

Dissolve the sugar in the water by the aid of heat.

Syrup is a viscid liquid, constituted of two-thirds sugar, and one-third water, and having a specific gravity, when boiling hot, of 1.261 (30° Baumé); or when cold, 1.319 (35° Baumé). It is of a pure sweet taste, without odor, when freshly prepared. The boiling point is fixed at 221° F.

The proportion of sugar in syrup is a matter of primary importance, as, owing to the presence of minute quantities of nitrogenized principles which are apt to be accidentally present, even in simple

syrup, fermentation will be set up, unless the syrup has the full officinal proportion, which is about two parts, by weight, of sugar, to one of water (14,400 grs. to 7290).

In weighing so large a quantity, precise accuracy is not necessary, and in practice it is found expedient to substitute two pounds commercial, for two and a half of the officinal weight, thus reducing the proportion slightly, but simplifying the formula, which is then, for simple syrup—

Take of Sugar . . 2 lbs. (commercial).
Water . . 1 pint.
Dissolve by the aid of heat.

The 2 pounds of sugar, when dissolved, are about equivalent to 1 pint of the liquid, by measure, so that the syrup resulting from the above quantities, would just about measure 2 pints. It is, then, important to bear in mind the rule, which may be thus abbreviated: *Two parts of sugar are required by one part of water, and make two parts of syrup.*

In the absence of extraneous, and particularly of nitrogenized principles, a syrup will keep well enough in cold weather, without reference to its proportions; but in a majority of instances of medicated syrups, it is absolutely necessary to observe the above well-established rule, which insures a nearly saturated saccharine solution.

If impure or brown sugar is employed, it is necessary to boil the syrup until the proper specific gravity is attained; skimming or straining off the scum which contains the impurities; but when the sugar is pure, this is unnecessary.

If impurities are diffused in the liquid, which will not readily rise as scum, it is well to add a little white of egg, which, by its coagulating at the boiling temperature, forms a clot, inclosing the impurities, and facilitating their removal. A richer and more elegant syrup is produced by the use of Havana sugar, clarified in this way, than from the best refined sugar, and some of our best pharmaceutists use this process for their mineral water syrups, on account of its superior product, though so much more troublesome.

In some of the medicated syrups, a boiling temperature is directed, in order that the vegetable albumen contained in the medicinal ingredient may be coagulated, and thus separated. In others, the presence in the drug, or in the menstruum employed, of antiseptic properties, insures the permanence of the preparation. Syrup of squill is an instance, in which, owing to the presence of the antiseptic element, acetic acid, in the menstruum, we are enabled to reduce the proportion of sugar somewhat below that necessary in other instances. Among the articles not unfrequently added to syrups, to prevent fermentation, the following may be mentioned:—

Essential oils, which, of course, greatly modify the taste and other properties of the preparation, as in compound syrup of sarsaparilla. *Brandy*, which, though not officinally directed, is much used, with aromatics. *Glycerin*, which does not alter the taste or other properties of the preparation. *Hoffman's anodyne*, which is one of the very best antiseptics, though liable to the objection of imparting an ethereal odor and taste. It should, however, be added in small quantity only; 1 part, by measure, to 75 of syrup, which is stated to be proper, seems to me unnecessarily large. One fluidrachm to a pint, has generally answered the purpose.

After these preliminary observations, the medicated syrups, classified with reference to their mode of preparation, may be introduced.

Syrupi, *U. S. P.*

1st Class.—*Infusions or Decoctions rendered permanent by Sugar.*

Officinal name.	Preparation.	Use.	Dose.
Syrupus aurantii corticis	By maceration with b. water	As an adjuvant	
" sennæ (with fennel)	By digestion with hot water	Laxative	f℥j to f℥ij.
" krameriæ	By displacement with	Astringent	f℥ss.
" pruni Virginianæ	cold water	Sedative and tonic expectorant	"
" senegæ	By decoction	Stim. expectorant	f℥j to ℥ij.
" scillæ comp.	"	"	♏20 to f℥j.

We have, in the above class, instances of three processes. In the treatment of orange-peel and senna, heat is applied below the boiling point, so as to form hot infusions. In the case of rhatany and wild cherry, cold infusions, by displacement, are directed, while seneka, and the mixed seneka and squill, are to be boiled in water, and the decoctions, after being strained and evaporated, are, like the others, made into syrup by the requisite addition of sugar.

In *syrup of orange-peel*, the fresh rind of the sweet, or Havana orange, is preferred to the bitter orange-peel, prescribed in the various tonic preparations, this syrup being used for its flavor rather than for any medicinal effect. (See Orange Syrup.)

Syrup of senna is generally superseded by fluid extract of senna, which is preferred, owing to the comparative smallness of its dose.

Syrups of rhatany and of wild cherry leave nothing to be desired for their respective uses. The latter is one of the most popular and really valuable of remedies, being much used in pulmonary affections, connected with an atonic condition of the system.

Syrup of seneka, and compound syrup of squill, are made either by the process of decoction, as above, when haste is an object, or

otherwise, by the use of alcohol, as in the 2d Class, now to be introduced.

CLASS II.—*Extracted with Alcohol and Water, by displacement, concentrated by evaporation, and completed by the addition of Sugar.*

Officinal name.	Proportion.	Use.	Dose.
Syrupus ipecacuanhæ	℥ss in Oi of the syrup	Expectorant	f ʒj to f ℥ss.
" senegæ (2d process)		"	f ʒj to f ʒij.
" scillæ comp.	Squill and seneka, + tart. emetic, gr. j to f ʒj		gtt. xx to f ʒj.
" rhei	ʒj in Oj of the syrup	Laxative	f ℥ss to f ʒiv.
" sarsaparillæ comp.	Sarsaparilla, guaiacum, roses, senna, liquorice root, and oils of sassafras, anise, and partridge berry	Alterative	f ℥ss.

The simplest statement of this process for making syrups, is the following: Of the drug, properly powdered, make a tincture by displacement. Evaporate this in a capsule, to the point named in the *Pharmacopœia;* thus getting rid of the alcohol contained in it. Now add sugar, in the proportion of two parts to one of the liquid, and dissolve it by the aid of heat.

Of this very important class each individual should be carefully studied, and in making them the officinal directions must be accurately observed. The valuable comments of the *Dispensatory* will be found to aid in estimating the comparative value of these, as of most other preparations adverted to in this work, but no study will equal the knowledge gained by actual experience, both in their preparation and use.

Syrup of ipecac, as it is now generally called, although not a strong preparation, is one of the most useful expectorants we have, and in domestic practice is perhaps the most popular in Philadelphia. It is particularly adapted to the treatment of the catarrhs of children. The dose may be so regulated as to produce a gentle relaxing, or, in the case of children, a powerful emetic effect, with the advantage of causing neither stimulating nor depressing after-effects.[1]

Syrup of Seneka is the most stimulating of its class; its use is indicated in chronic catarrh not accompanied by inflammatory

[1] The process for making it may be varied, according to the suggestion of Joseph Laidley, of Richmond, Va., as follows: Make a concentrated tincture of ipecacuanha with strong alcohol, and evaporate it so that two fluidounces shall represent an ounce of the root; add a fluidounce of this to half a pint of simple syrup; evaporate to six fluidounces, and add eight fluidounces of syrup and two of water, which, when mixed, will constitute one pint of syrup of ipecac of the officinal strength, and less liable to ferment from containing no gum nor starch, nor ferment of any kind. I do not recollect to have met with any difficulty in keeping this syrup in midsummer, when prepared by the officinal formula.

action; it is seldom urged so as to produce its emetic effect, except in combination with other remedies.

Coxe's hive syrup (syrupus scillæ compositus) has been for many years a very popular remedy in croup. As originally prepared, it contained honey, which, being by many objected to from its alleged liability to ferment, was changed in the *Pharmacopœia* of 1840 to sugar, and the preparation was thus removed from mellita to syrupi. As now prepared, it is not popular either among physicians or pharmaceutists, the former regarding it as therapeutically, and the latter as pharmaceutically, objectionable. The officinal process for preparing it would be improved by the substitution of diluted alcohol for the weak alcoholic menstruum directed in preparing the tincture in the first part of the process. The precaution should not be neglected in this instance, as also in syrup of senega, of boiling this diluted alcoholic preparation during the evaporation and filtering, before adding the sugar. A copious coagulation of the vegetable albumen takes place at the boiling temperature, the removal of which on the filter obviates, to a great extent, the tendency to fermentation in the resulting syrup. The solution of the tartar emetic in the syrup should be accomplished while it is hot, by trituration in a mortar, as prescribed under the head of Solution.

In cases of croup, it is customary to increase the dose very much above that mentioned in the books, or to repeat it every fifteen or twenty minutes till the patient vomits. The dose for a child one year old may be ten drops, for one of two years fifteen, of three years twenty-five drops, and so on, repeated as above.

Simple syrup of rhubarb is very extensively used as a mild cathartic for children. Its mode of preparation is precisely that indicated for the class; its dose is from f℥j to f℥ss for children; that given in the Syllabus is adapted to adults.

Compound syrup of sarsaparilla is manufactured in very large quantities by regular pharmaceutists, and, after many fluctuations, has an extended reputation among practitioners of medicine, as well as the public at large. Its chief use is in skin diseases, and in syphilitic and scrofulous cases, in which it is used both alone and combined with mercurials, iodides, &c. Its composition is similar, though not identical with the fluid extract; it contains, besides the soluble principles of sarsaparilla, those of guaiacum-wood, red roses, senna, and liquorice-root, extracted by diluted alcohol, evaporated, and made into a syrup, as before indicated for the syrups of this class. For the improvement of its flavor, and as antiseptics, the oils of anise, sassafras, and partridge-berry are directed to be added. The extensive range of diseases to which sarsaparilla is applicable, and the harmless character of the remedy, have made it a great favorite with empirics, so that there are an immense number of quack medicines sailing under its name, and not a few called alteratives and panaceas, which contain it as one of their ingredients. So numerous and so generally popular were these several years

ago, that the period of their greatest popularity, from 1845 to 1850, has been called among druggists the "sarsaparilla era." Many of these, as the notorious Townsend's, the chief merit of which was its great dilution and the large size of the bottles in which it was put up, have gone into disuse, while a few are yet in demand.

It is greatly to be regretted that educated physicians should so frequently lend their influence to the empiric by countenancing, and even recommending these medicines, some of which may no doubt be found useful in their hands, but, besides the disadvantage of our being ignorant of their composition, are generally inferior to the officinal and other published preparations in medicinal virtues.

Class III.—*Syrups containing Acetic Acid.*

Syrupus Allii. By maceration of garlic in dil. acet. acid, sugar being afterwards added. Antispasmodic. Dose, f℥j.

" Scillæ. Vinegar of squill Oj + sugar ℔ij. Expectorant. Dose, f℥j.

Of these, the first is but rarely used; but the second is an extremely common expectorant, used both by itself and in combination with camphorated tincture of opium, tincture of digitalis, syrup of ipecac, and with other medicines. The presence of the acetic element takes from this preparation the cloying character which belongs to the syrups generally.

Class IV.—*Having Simple Syrup as a base.*

Officinal Name.	Preparation.	Use.	Dose.
Syrupus acidi citrici	℥j to Oj + oil of lemon ♏j	Adjuvant & vehicle	
" krameriæ	(Second process) ext. ℥j to Oj	Astringent	f℥ss.
" tolutanus	(*U. S. P.* 1840) tinct. f℥vj to Oj	Adjuvant	
" zingiberis	(*U. S. P.* 1840) " f℥ss to Oj	"	
" rhei aromaticus	(See page 189).	Carminat'e & lax'tive	f℥ij to f℥j.

Citric acid syrup is used as a substitute for lemon syrup, and, when the ingredients are of good quality and well prepared, is a far pleasanter article; it is much used largely diluted with water, in which form it is called lemonade. It is also well adapted to use as an excipient in extemporaneous prescription.[1]

Syrup of rhatany, which has been introduced among the first class, may also be made extemporaneously, as above, from the officinal extract by dissolving it in syrup with the aid of heat.

Ginger and Tolu syrups are made, according to the last edition of the *Pharmacopœia*, by impregnating sugar with the proper proportion of the tincture, stated in the syllabus, and driving off the alcohol by heat, after which the sugar is dissolved in the requisite quantity of water. This process is troublesome, and its only

[1] See Mineral Water Syrups.

advantage is that the syrup thus prepared is somewhat clearer than that by the old process, of adding the tincture directly to hot simple syrup, which plan I find most convenient and satisfactory for common purposes.

These two syrups have been made the subject of comment by several pharmaceutists: first, by the late John D. Finley, in an inaugural thesis; afterwards by Joseph Laidley; and more recently by Professor Procter. They agree in preferring the trituration of a concentrated tincture with carbonate of magnesia and a small portion of sugar, thus making an aromatized water, which is rendered clear by filtration and converted into a syrup by the addition of sugar in the usual way. The same plan is recommended for making syrup of orange-peel.

Spiced syrup of rhubarb (syr. rhei aromat.) is the most familiar remedy for the so-called summer complaint of children, the form of diarrhœa, usually connected with teething, so extremely prevalent and fatal in our large cities during the intense heat of summer. It has the advantage of being a warming tonic or stomachic, as well as a very mild laxative, and is given in doses from a teaspoonful for an infant of a year old to a tablespoonful or more for older children and adults. The formula for its preparation, reduced so as to make one and a half pints of the syrup, and somewhat modified in phraseology, is as follows:—

Take of Rhubarb	five drachms.
Cloves and cinnamon, each .	one drachm
Nutmeg	half a drachm.

Reduce to a uniform coarse powder, pack them into a small percolator, and pour upon them gradually diluted alcohol, frequently repassing the first portion until half a pint of clear tincture is obtained; then evaporate to four fluidounces, and add syrup (while hot) one and a half pints.

An old recipe for this preparation, credited to the late Dr. James, and preferred in practice by my father, the late Dr. Joseph Parrish, and some contemporaneous practitioners, prescribes a considerable portion of French brandy, not to be evaporated, but retained in the syrup when finished. To meet this preference, the rhubarb and aromatics may be displaced with brandy, which may be mixed with a somewhat smaller proportion of syrup, the evaporation being dispensed with altogether.[1]

Unclassified Syrups.[2]

Syrupus	Amygdalis	1 p. bitter almonds, 3 p. sweet almonds	Demulcent.
"	Limonis	Lemon-juice Oj, sugar ℔ij	Adjuvant and vehicle.
"	Acaciæ	Gum ℥j, sugar ℥vij, water f℥iv	Excipient for pills.

[1] See Syrup of Blackberry Root.

[2] See Fruit Syrups.

Almond or orgeat syrup is a most delightful preparation for use as a drink with water, or with carbonic acid water; it is frequently modified by the addition of orange-flower water, vanilla, or other flavoring materials, which, however, do not improve it. It is occasionally prescribed in large doses frequently repeated in gonorrhœa. Its process involves, 1st, the blanching of almonds (depriving them of their skins by maceration in warm water, and then pressing out the kernel from the skin between the fingers); 2d, the beating of these into a paste with a portion of sugar; 3d, the formation of a milky mixture or emulsion by trituration with successive portions of water; and 4th, the solution in this of the required quantity of sugar, which should be done without the aid of heat.

Lemon syrup is more acid than syrup of citric acid; its quality is mainly dependent on the freshness of the lemon-juice.

Syrup of gum Arabic, of the *Pharmacopœia*, must be distinguished from the French *Sirop de Gomme*, which, diluted with water, is a favorite demulcent drink. Our syrup is a saturated solution of gum and sugar designed to be permanent; it is very viscid, so much so as to be only fitted for suspending insoluble substances, and for combining unadhesive materials in pill. The use of well-selected gum Arabic not powdered, insures a clearer and more elegant syrup than can be made from the ordinary powdered gum.

Unofficinal Syrups.

In this division, I shall include an account of the following syrups, grouped according to their resemblance to the foregoing officinal classes:—

Class I.—Syrups of Chamomile, Pipsissewa, Uva Ursi, the Compound Syrups of Blackberry Root and of Carrageen.

Class II.—Syrups of Poppies, Frostwort, Bittersweet, and Gillenia.

Class IV.—Syrup of Sulphate of Morphia.

Unclassified.—Jackson's Pectoral Syrup, Syrups of Manna, Galls, Assafœtida, Williams's Sarsaparilla Syrup, and the Mineral Water and Fruit Syrups.

Syrup of Chamomile. (*Syrupus Anthemidis.*)

The following formula by the author was published in the *American Journal of Pharmacy*, vol. xvi. p. 18, and although not an active medicinal agent, has been acceptable to some of the many admirers of chamomile.

Take of	Chamomile flowers, in coarse powder	one ounce.
	Cold water	twelve fluidounces.
	Refined sugar, in coarse powder	twenty ounces.

Make an infusion by displacement of the chamomile flowers and water, remove the residue from the apparatus, and place the

coarsely powdered sugar in its stead; on this, pour the infusion until it is entirely dissolved.

The dose might be stated at a tablespoonful.

Syrup of Pipsissewa. (*Syrupus Chimaphilæ.*)

Formula by Prof. Procter, published in *Am. Journ. Pharm.*, vol. xv. p. 70.

Take of Pipsissewa (chimaphila, *U. S.*)		four ounces.
Sugar	. . . . .	twelve ounces.
Water	. . . . .	a sufficient quantity.

Macerate the pipsissewa, finely bruised, in eight fluidounces of water for thirty-six hours, and then subject it to displacement, until one pint of fluid is obtained; reduce this by evaporation to eight fluidounces, add the sugar, and form a syrup in the usual manner.

The long preliminary maceration is rendered necessary by the coriaceous character of the leaves, which impedes their easy saturation by the menstruum.

On account of this property, some have preferred boiling them in successive portions of water, mixing the decoctions, evaporating, and after the sugar has been dissolved, adding a small portion of alcohol to obviate the proneness to decomposition, common to most syrups made in this way.

One fluidounce of this syrup represents two drachms of the leaves. Syrup of pipsissewa is an elegant preparation of one of our most valuable and abundant indigenous tonic and alterative medicines. Dose, a tablespoonful.

Pipsissewa is also much used in combination with sarsaparilla, and other alteratives, and enters into numerous private recipes of that description.

Syrup of Uva Ursi. (*Syrupus Uvæ Ursi.*)

Formula by Duhamel and Procter, published in *American Journal of Pharmacy*, vol. xi. p. 196.

Take of Bearberry leaves (Uva Ursi, *U. S.*)		four ounces.
Water	. . . . .	a sufficient quantity.
Sugar	. . . . .	one pound.

To the finely bruised uva ursi, add water till it is thoroughly moistened, then place it in a displacement apparatus, and operate by percolation till it is exhausted of all its soluble active principles; then evaporate to ten fluidounces; add the sugar, and form a syrup, marking 31° Baumé.

The dose of this might be stated at a tablespoonful. Like the foregoing, this syrup is a good preparation of a valuable medicine,

and one much in vogue. The two may often be advantageously associated in diseases of the urinary organs.

Compound Syrup of Carrageen.

The following recipe has been in use for some 15 years in our establishment, and the syrup has been pretty extensively used as a popular cough medicine. It does not keep well in summer, unless in a cool place.

Take of Horehound (Marrubium, *U. S.*) .	1 ounce.
Liverwort (Hepatica, *U. S.*) . .	6 drachms.
Water	4 pints.

Boil for 15 minutes, express, and strain, then add

Carrageen (Chondrus, *U. S.*) . .	6 drachms.

Previously well washed with cold water. Boil again for 15 or 20 minutes, strain through flannel, and add

Sugar, 1 lb. commercial to each pint by measure.

The dose of this agreeable medicine is a tablespoonful occasionally; it is a good demulcent, without sedative effects.

Compound Syrup of Blackberry Root. (*Syrupus Rubi Villosi.*)

This is another hitherto unpublished formula. Its object is to furnish a substitute for the spiced syrup of rhubarb, where that remedy is deficient in astringency. It has been used chiefly as a popular medicine in domestic practice. The astringent virtues of blackberry root are almost universally known, and it is much used in the form of decoction and syrup throughout the country, both as a domestic remedy and in regular medical practice. The experience of some ten years past has proved the eligibility of this old-fashioned formula.

Take of Blackberry root, well bruised[1] .	8 ounces.
Cinnamon,	
Cloves, and	
Nutmegs, of each . . .	3 drachms.
Sugar	4 pounds.
Water	4 pints.

Boil the root and the aromatics in the water for one hour; express and strain; then add the sugar, boil to form a syrup, and again strain; then add

French brandy . . .	6 fluidounces.
Oil of cloves, and	
Oil of cinnamon, of each .	4 drops.

[1] Dewberry root (rubus trivialis), will answer equally well.

Dose, from a teaspoonful for a child of two years old, to a tablespoonful for an adult, repeated till the symptoms abate.

Unofficinal Syrups of the Second Class.

Syrup of Frostwort.

Rock rose, frostwort, and frost weed, are common synonyms of the herb which is officinal in the secondary list of the *Pharmacopœia*, as helianthemum, the herb of helianthemum Canadense; but more familiarly known as cistus Canadensis, the name given to it by some botanists.

Having for some years prepared a syrup of this plant, which was used with much success by my brother, the late Dr. Isaac Parrish, in scrofulous affections of the eyes, and also by several other practitioners in diseases of the scrofulous type, I insert the formula for the information of such as are disposed to make a trial of this valuable indigenous alterative:—

Take of Frostwort (the herb) . .	4 ounces.
Water, and	
Alcohol, of each . . .	a sufficient quantity.
Sugar	16 ounces.

Macerate the bruised herb in eight fluidounces of diluted alcohol, for twenty-four hours; displace with a mixture of one part of alcohol to three of water, till the liquid comes over nearly free from the taste and color of the plant; then evaporate to one pint, add the sugar—boil for a minute or two, and strain.

The dose of this syrup is a fluidrachm three times a day.

Syrup of Poppies. (*Syrupus Papaver.*)

This syrup, which as usually prepared is extremely liable to ferment, and on that account is a very troublesome preparation to apothecaries, who often have calls for it, may be conveniently made by the following process of Professor Procter, so as to be permanent:—

Take of Poppy-heads	16 ounces.
Diluted alcohol	4 pints.
Sugar	30 ounces.

Deprive the poppy-heads of their seeds; bruise them thoroughly, macerate them in twice their weight of diluted alcohol for two days, express powerfully, add the remainder of the diluted alcohol, and after twenty-four hours again express; evaporate the liquid to one pint, strain, and add the sugar, and dissolve by the aid of a gentle heat.

Syrup of Bittersweet. (*Syrupus Dulcamaræ.*)

The following recipe, from the same source as the foregoing, furnishes a syrup which is adapted to use by itself, or in combination with those of sarsaparilla and other alteratives in cutaneous and rheumatic diseases:—

Take of Bittersweet, coarsely powdered	4 ounces.
Water	12 ounces.
Alcohol	4 fluidounces.

Mix the liquids, pour on the powder in a displacer until one pint of tincture is obtained, adding water to displace the mixed alcohol and water; evaporate to half a pint, add fifteen ounces of sugar, and make a syrup. Dose, a tablespoonful.

Syrup of Gillenia.

The enormous price of ipecacuanha, which has been so long sustained, has led to some inquiries, lately, for a good substitute growing on our own soil, and always attainable. "Gillenia trifoliata," Indian physic, is a common indigeneous herb, the root of which has long been known to possess very decided nauseant and emetic properties. It cannot be claimed for it that it very closely resembles ipecacuanha in therapeutical action, although sufficiently allied to it to be used in many cases, particularly of catarrhal affections as a substitute. The following syrup I have contrived with a view to remove one of the chief objections on the part of the physician to the trial of indigenous drugs, namely, the absence of suitable preparations. As far as it has yet been used, it gives promise of answering a good purpose:—

Syrup of Gillenia.

Take of Gillenia	℥ij.
Diluted alcohol	Oj.
Sugar	℔iiss.
Water	sufficient.

Reduce the gillenia to coarse powder, treat it by displacement with diluted alcohol till Oj is obtained. Evaporate to f℥vj, filter, and add sufficient water to make the liquid measure Oj, then add the sugar and dissolve by the aid of heat.

This syrup has twice the proportion of the medicinal ingredients contained in syrup of ipecacuanha; it is less agreeable to the taste. The dose is f℥j.

Unofficinal Syrups of the Fourth Class.

Under this head mention may be made of

Syrup of Sulphate of Morphia.

I believe there is no published recipe for this except one that is given in Griffith's *Formulary*, credited to Cadet, which prescribes one grain of the salt to four fluidounces of syrup. Under the head of syrup of poppies, in the *U. S. Dispensatory*, Dr. Wood suggests the use of a syrup made by dissolving four grains of sulphate of morphia in a pint of syrup (a quarter of a grain to the ounce, the same as Cadet's), as a substitute for syrup of poppies, which, made by the old recipe, is so prone to ferment.

Notwithstanding that we have no officinal or other recognized recipe (that of Cadet being almost unknown in this country), physicians frequently prescribe syrupus morphiæ sulphatis, and generally, as far as I have inquired, under the impression that there is a syrup corresponding in strength with the officinal liquor morphiæ sulphatis, one grain to the ounce, and hence the habit has grown up with apothecaries of making this preparation extemporaneously of that strength.

This is more remarkable, from the fact that the syrups of acetate and muriate of morphia of the *Dublin Pharmacopœia* are in the proportion of one grain to four fluidounces.

This discrepancy in practice cannot, I think, be remedied by the further publication of unauthorized recipes, and physicians should not fail to indicate the preportions designed in prescribing the salt in solution in syrup. Should there not be an officinal preparation with such a distinctive name, and authorized proportions as would remedy so serious a departure from uniformity?

Unclassified Unofficinal Syrups.

Under this head, I shall treat of such of the very numerous syrups not already mentioned, as enjoy sufficient reputation in this city to be kept by our best apothecaries.

Jackson's Pectoral Syrup.

Alfred B. Taylor, in the *American Journal of Pharmacy*, vol. xxiv. p. 34, holds the following language:—

"A prescription of Prof. Samuel Jackson, of Philadelphia, familiarly known as his 'pectoral syrup,' has obtained considerable reputation from its beneficial action in cases of coughs, colds, &c. We believe the prescription was originally given to Mr. E. Durand, but as the syrup has for some time been a standing preparation with many of our druggists, we have thought that a published formula

would be acceptable both for the purpose of giving its benefit to those who may not be familiar with its composition, and of promoting uniformity among those who may already be accustomed to prepare it. Dr. Jackson has furnished us with the following recipe:—

℞.—Sassaf. medullæ	. . . .	℥j.
Acaciæ	. . . . .	℥j.
Sacchari	. . . . .	℔j¾.
Morphiæ muriat.	. . . .	gr. viij.
Aquæ	. . . . .	Oj, or q. s.

"The sassafras pith and gum Arabic are to be put into the water and allowed to stand ten or twelve hours with occasional stirring. The sugar is to be dissolved, cold, in the mucilage, which, after being strained, should be made to measure two pints by the addition of water; lastly, the muriate of morphia is to be dissolved in the syrup."

In the recipe which I have used for a number of years, half a grain of sulphate of morphia is prescribed in place of a quarter of a grain to the ounce as in the above, and to this is added about half a drachm of Hoffmann's anodyne, and a drop of oil of sassafras to each pint.

A recipe used by some pharmaceutists is as follows:—

Take of Syrup of gum Arabic (diluted)	.	one pint.
Muriate of morphia	. . .	four grains.
Oil of sassafras	. . . .	four drops.

Mix.

The adult dose of this syrup is a teaspoonful.

Syrup of Manna. (*Syrupus Mannæ.*)

This is often directed by practitioners, without a very clear idea of what they are prescribing, since neither of the British pharmacopœias, nor our own, contain any mention of it. The following recipe, taken from the *Pharmacopie Universalle*, I have used with satisfactory results:—

Take of Flake manna	. . .	10 ounces.
Water	. . . .	12 ounces.
Make a solution, strain and add		
Sugar	. . . .	1 pound.

Which dissolve by the aid of heat.

This is an elegant laxative, where not contraindicated by debility of the digestive organs, and is chiefly prescribed for children and pregnant women.

When extemporaneously prepared, there seems no necessity of adding the sugar at all, as a simple solution of manna in water is

sufficiently agreeable, besides being stronger than the above. The peculiar sugar of manna is not fermentable.

Syrup of Galls. (*Syrupus Gallæ.*)

This old and esteemed recipe is attributed to several eminent physicians of the last generation. It is used in chronic diarrhœa, and obstinate cases of dysentery.

Take of	Bruised galls	℥ss.
	Brandy	f℥viij.

Introduce into an f℥viij vial, digest in hot water for half an hour, and filter; then pour it into a saucer, and inflame the spirit with a lighted taper; add sugar ℥ij, by melting it in the flame on a fine wire support, and allowing it to drop into the brandy, which must be stirred till it ceases to burn, and a syrup is formed. Then introduce it again into the f℥viij vial, and fill it up with water.

Dose, a tablespoonful. Some recipes direct that cinnamon and nutmeg, of each ℥ij, shall be digested in the brandy.

Williams's Sarsaparilla Syrup.

This preparation has been much prescribed by Dr. J. K. Mitchell, who furnished the following formula:—

Take of	Compound syrup of sarsaparilla .	Oj.
	Corrosive chloride of mercury .	gr. ij.
	Extract of conium	℥j.

Triturate the corrosive chloride with a little alcohol and water, till dissolved, then incorporate it and the extract of conium with the syrup. Dose, a tablespoonful.

Syrup of Assafœtida.

Richard Peltz, while a student of the Philadelphia College of Pharmacy, proposed the following formula, which, with specimens of the syrup prepared by it, were presented to the college, at a pharmaceutical meeting, in the spring of 1852. The object is to furnish a preparation of assafœtida, free from alcoholic stimulus, and yet tolerably permanent. Although an old specimen of this syrup has a more fetid odor than a recent one, yet the change takes place much less rapidly, and to a less extent, than in the case of the milk or mixture of assafœtida, for which it may be substituted by the physician, when it is not convenient to prepare the former:—

Take of	Assafœtida . . .	one ounce.
	Boiling water . . .	one pint.
	Sugar	two pounds.

Rub the assafœtida with part of the boiling water, till a uniform

paste is made; then gradually add the rest of the water, strain, and add the sugar, applying a gentle heat to dissolve it. Dose, a tablespoonful, containing seven grains and a half (15 grains to the ounce) of assafœtida.

By adding one part of tincture of assafœtida to four parts of syrup, and evaporating off the alcohol, a good substitute for the foregoing may be prepared.

Mineral-Water Syrups.

These are used for flavoring mineral water, and in the manufacture of pleasant refrigerant drinks. The remarks which follow are, in part, compiled from an article by Ambrose Smith, in the *American Journal of Pharmacy*, vol. xxii. p. 212, and are, in part, the result of my own experience in regard to their preparation and uses.

As some of the subjects have already been introduced among the officinal syrups, the remarks which follow may be considered as supplementary, and are somewhat more in detail.

Lemon Syrup.

This is now almost universally made from citric or tartaric acid, oil of lemon and water, instead of lemon juice. Some of the confectioners, when they are overstocked with lemons, make them into syrup, but from the use of fruit that has partially spoiled, and from the syrup being made in such large quantities at once as to become more or less altered by keeping, before it is consumed, the article thus made is inferior to that made from acid and oil of lemon.

Citric acid is preferable to tartaric for preparing it. The syrup made with the former acid has a more agreeable flavor, which it retains longer unimpaired. The syrup made with either acid, when long kept, throws down a bulky white granular deposit of grape sugar. Its flavor changes gradually on keeping long, even when made with citric acid. This is probably due to a change in the oil of lemon, by which the syrup acquires a terebinthinate flavor. This turpentine taste is very common in the lemon syrup which is manufactured and sold wholesale, and may frequently be due to the employment of impure oil of lemon. A common adulteration of this oil is the admixture of recently distilled oil of turpentine or camphene, and the adulterated oil may contain a considerable portion of it without its being perceptible by taste or odor while new, but as the camphene becomes resinous, the turpentine flavor is developed. But even pure oil of lemon degenerates in flavor and odor, when long kept, and the alteration is probably more rapid when it is diffused through the syrup, and assisted by the action of the acid; therefore, it is better to prepare the syrup in small quantities, so that it will be consumed before there is any

change in its quality. The following formula furnishes a pleasant mineral-water syrup, which can be made in a few minutes:—

Take of	Oil of lemon	♏xv.
	Citric acid	ʒx.
	Simple syrup	Cong. j.

Rub the oil of lemon first with a little powdered sugar, and afterwards with a portion of syrup, dissolve the citric acid in an ounce or two of water, and mix the whole.

The simple syrup may be made in the proportion of six commercial pounds of sugar, to half a gallon of water. This contains rather more acid than the officinal *syrupus acidi citrici*. Some prefer the use of a little tartaric acid; citric acid ʒj, and tartaric acid ʒij, is a good proportion to the gallon. A few fresh lemon-peels thrown into the hot syrup is a good substitute for the oil of lemon, or, as suggested by Geo. D. Coggeshall, f ʒij of saturated tincture of recent lemon-peel for every 4 minims of oil of lemon.

Lemonade.

Mix	Lemon syrup . . .	Oj.
	Water (iced) . . .	Cong. ij, or q. s.

Stir them well together.

Ginger Syrup.

The formula of the *Pharmacopœia* makes a syrup of about the proper strength for use with mineral water. It is usually made in considerable quantities, and it will be found most convenient to prepare the simple syrup somewhat more dilute than the officinal, and, while it is hot, to pour on the surface the tincture of ginger, allowing the alcohol to evaporate before mixing with the syrup. If the tincture is mixed directly, the syrup will be cloudy. On the other hand, if it is allowed to remain too long on the surface of the hot syrup, before mixing, the resin separates in globules, which cannot afterwards be thoroughly diffused through the syrup. The tincture should be allowed to evaporate from the surface of the syrup until the vapor ceases to ignite on the approach of flame, then mixed immediately. The method of making ginger syrup, prescribed in the *Pharmacopœia*, is to pour the tincture on to the sugar, which is to be exposed to the air until the spirit has evaporated, and then made into syrup. This plan is more operose, however, and does not answer better than the one indicated above. The introduction of the whites of two or three eggs, before boiling and straining, makes the syrup much clearer. Some druggists prefer to boil ginger in water, which extracts a large amount of starchy matter, and makes a richer and more frothy mineral-water syrup. The following is the recipe:—

Take of Ginger, bruised . . . . . 3 ounces.
Water . . . . . 2 pints.

Boil for half an hour in a covered vessel, and strain, then add Sugar . . . . . 4 lbs. com.

Continue the heat till it is dissolved.

Capsicum Syrup.

Take of Simple syrup . . . . . Oij.
Tincture of capsicum . . . . . f℥j.

Proceed as for ginger syrup.

This is a fine stimulant, which is used to advantage in mineral water, in intensely hot and debilitating weather, when the relaxed condition of the digestive organs seems to contraindicate the use of cold drinks.

Sarsaparilla Syrup for Mineral Water.

As this syrup is intended for making a pleasant beverage, it is made much weaker of sarsaparilla than the compound syrup of the *Pharmacopœia*, and the senna, guaiac, &c., which enter into the composition of the latter, are very properly omitted.

The following formula is that of Ambrose Smith :—

Take of Sarsaparilla, finely bruised,
Liquorice root do. each . . 2 lbs. (com.)
Sugar . . . . . 30 lbs. (com.)
Oil of anise, wintergreen, and sassafras, of each . . . . . 40 drops.
Oil of cinnamon . . . . . 5 drops.
Water . . . . . q. s.

Digest the roots 12 hours, with 2 gallons of warm water, then put into a displacer and displace, adding sufficient water until 2 gallons of infusion are obtained. In this dissolve the sugar with the aid of heat, and to the syrup when cooled add the oils, previously rubbed up with a little sugar.

The following formula is employed by some of the druggists of this city:—

Take of Sarsaparilla, liquorice root, each . 1 lb.
Cinnamon, sassafras, each . . 6 oz.
Cloves, anise, coriander, each . 2 oz.
Red saunders, cochineal, each . 1½ oz.
Alcohol . . . . . 2 pints.
Water . . . . . 2 gallons.

Digest the above for 4 days, strain, and make a syrup with 27 lbs. (com.) sugar. It is also frequently made by diluting the

compound syrup with twice its measure of simple syrup, and adding the essential oils. The fluid extract of sarsaparilla, if mezereon enters into its composition, does not answer, as the persistent acrimony of this bark is so perceptible even in the diluted syrup as to make it unpalatable.

The following is our own formula:—

Take of	Simple syrup	Oij.
	Comp. syrup of sarsap. . . .	f℥ij.
	Caramel	f℥vj.
	Oil of gaultheria, and	
	Oil of sassafras, of each . . .	3 drops.

Mix, by shaking up in a bottle.

Orgeat Syrup.

This corresponds with the officinal syrupus amygdalæ (see p. 190), with the addition of some more decided flavoring substance, as orange-flower water, bitter almond oil, or vanilla.

Fruit Syrups.

To make one gallon of strawberry, raspberry, or blackberry syrup:—

Take of	the fresh fruit	4 quarts.
	Water	sufficient.
	Sugar (refined)	8 lbs. com.

Express the juice and strain, then add water till it measures four pints, dissolve the sugar in this by the aid of heat, raise it to the boiling point and strain. If it is to be kept till the following season, it should be poured while hot into dry bottles, filled to the neck, and securely corked.

Fig. 159 represents the straining bag; and Figs. 160 and 161

Fig. 159.

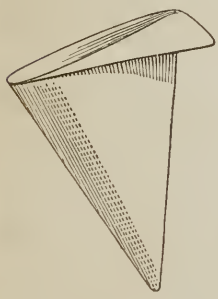


Fig. 160.

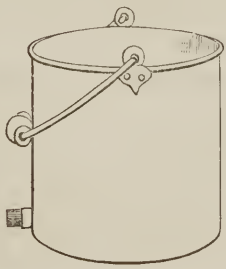
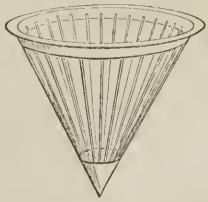


Fig. 161.



the apparatus for straining and expressing, by means of a square piece of flannel or muslin.

Strawberry syrup is made by first inclosing the ripe fruit in a strong bag—coarse linen is well adapted to the purpose—then applying a gradual pressure by means of a screw or lever press, if the quantity operated upon is large; for small quantities it may be pressed sufficiently by hand. The juice is now diluted, if necessary, mixed with sugar, and transferred to a kettle, in which it is heated to the boiling point, and then strained while hot.

Raspberry syrup is made by the same process; the juice is richer in pectin and more liable to glutinize than the foregoing, so that it bears a larger dilution; it improves the flavor of this syrup to use a small proportion of pie-cherries, or currants—say a pound to four quarts of the raspberries.

Blackberry syrup does not differ from the foregoing in its mode of preparation, except in the usual addition of a small proportion of French brandy, say f℥j to Oj of syrup. The proportions for these three syrups are the same, and as they yield variable quantities of juice, the degree of dilution may be so regulated as that every quart of the fruit will yield a quart of syrup.

Blackberry brandy contains a much larger proportion of brandy and less sugar, with some infusion of aromatics, as cinnamon and cloves.

The following recipe was furnished me by Dr. P. B. Goddard.

Aromatic Blackberry Syrup.

Take of	Blackberry juice	Oij.
	Sugar	℔j.
	Nutmegs, grated	No. vj.
	Cinnamon, bruised	℥ss.
	Cloves	℥ij.
	Allspice	℥ij.
	Brandy	Oj.

Mix and make into a syrup.

The astringent properties of blackberry juice adapt it particularly, in combination with carminatives, to the treatment of bowel complaints.

Raspberry Vinegar.

Take of	Raspberry syrup	Oij.
	Acetic acid	f℥ss.

Mix them.

Added to iced water according to taste, this is one of the most delightful of refrigerant drinks.

The following formula, though not recommended as a substitute for the true fruit syrup, will be found a tolerable approximation to it:—

Artificial Syrup of Raspberry.

Take of Orris root (selected)	2 oz.
Cochineal	2 dr.
Tartaric acid	2 dr.
Water	1 quart.

Powder the orris root coarsely together with the cochineal, infuse in the water with the acid for twenty-four hours; strain, and add four pounds of sugar; raise to the boiling point and again strain.

Pineapple Syrup.

Take of the fruit a convenient number, pare them and mash them without slicing in a marble or porcelain mortar, express the juice, and take for each quart—

Water	1 pint.
Sugar	6 lbs. com.

The water and sugar may be placed on the fire and heated to near the boiling point before adding the juice, after which, continue the heat till the syrup boils, then remove from the fire, skim and strain. Preserve this as the foregoing.

Orange Syrup.

Take of oranges, the fresh fruit, a convenient number, grate off the yellow outside peel, cut the oranges and express the juice, to each quart of which add

Water	1 pint.
Sugar	6 lbs. com.

Mix the sugar with the grated peel, add the mixed water and juice, and apply a gentle heat till it is dissolved, then strain.

The following new and elegant process for syrup of orange-peel is extracted from the *Am. Journ. Pharm.*, vol. xxvi. p. 298.

Take of Peel of sweet oranges, recently dried .	2 ounces.
Carbonate of magnesia	$\frac{1}{2}$ ounce.
Sugar, in powder	$2\frac{1}{2}$ pounds.
Deodorized alcohol,	
Water, of each	sufficient.

Reduce the orange-peel to coarse powder, put it in a small glass percolator, and pour deodorized (Atwood's) alcohol slowly on it till six fluidounces of tincture have passed; evaporate this spontaneously to two fluidounces; triturate this with the carbonate of magnesia; an ounce of sugar and half a pint of water gradually added; pour this on a filter, and when it ceases to pass, add water till a pint of filtrate is obtained; to this add the sugar, dissolve with a gentle heat, and strain if necessary.

If a pure and fresh article of oil of orange can be obtained, the syrup may be made by the following formula:—

Take of	Syrup	Oij.
	Oil of orange	♏v.
	Tartaric acid	ʒj. Mix.

One dozen oranges will make one and a half to two gallons of syrup.

Vanilla Syrup.

Take of	Vanilla	6 drachms.
	Boiling water	4½ pints.
	Sugar	8 lbs. com.

Reduce the vanilla to fine powder by trituration with a portion of sugar, boil this with water two hours in a covered vessel; then strain.

Or:

Take of	Fluid ext. of vanilla	℥ss.
	Simple syrup	Oj. Mix.

Nectar syrup consists usually of mixtures having orgeat as their base; sometimes strawberry is added, and not unfrequently a little port wine or brandy.

Wild cherry syrup is a popular and wholesome flavor for mineral water; the officinal article can hardly be improved upon.

Cream syrups are mixtures of the fruit syrups or syrup of vanilla, with fresh cream. They must be made fresh every day, and may contain equal parts of their ingredients, or, preferably, two parts of the syrup to one of cream.

Some pharmaceutists prefer to make a syrup of cream by dissolving sugar in it, and flavoring this by the addition of strong fruit syrups.

CHAPTER XIII.

OF PULPS, CONSERVES, CONFECTIONS, ELECTUARIES, PASTES, LOZENGES, AND CANDIES.

Preparations having pectin, the sugar of fruits, as their basis, or containing medicinal substances suspended in a semi-solid form by the aid of honey and syrup, are variously termed as above. The first class to be taken up, as named in the *Pharmacopœia*, is the following:—

Pulpæ, *U. S. P.*

Pruni pulpa . . . 10 parts = 12 of the fruit; softened by steam and pressed through a sieve.
Tamarindi pulpa . 7 parts = 12 of the fruit; digested with water, strained, and evaporated.
Cassiæ fistulæ pulpa 5 parts = 12 of the fruit; digested with water, strained and evaporated.

In straining these, the chief object is to remove the seeds, skin, and stringy portions, and, in the case of cassia fistula, the fragments of pods, and to obtain a smooth, soft mass, which in small quantities is agreeable, and, in the case of tamarind pulp, is pleasantly acid. These are rarely prepared, except by the manufacturers of confection of senna, who use them in the fabrication of that article.

Confectiones, *U. S. P.*

This class naturally subdivides into two, which are alike in their properties, but quite unlike in their mode of preparation.

1*st. Conserves.*

Confectio Rosæ (by an unofficinal process), 1 part to 3 sugar.
" Aurantii corticis, *U. S.*, 1 part (grated) to 3 sugar.
" Amygdalæ (*Lond. Ph.*), sweet almonds, gum, and sugar.

By beating with powdered sugar a fresh, moist substance, as undried rose petals, or the rind of the fresh orange, or a fruit rich in oil, and naturally moist like the almond (which should be previously blanched), we obtain a true conserve. The trituration should be continued till a smooth and uniform firm paste is produced, which will generally be permanent if kept in a well-covered vessel, except in one instance, that of the almond, which will generally be rendered unfit for use by long keeping, and hence the confection has been omitted in the recent edition of the *Pharmacopœia*.

Confection of rose is more frequently made, according to my observation, by the above process, with the common hundred-leaved and damask rose petals, than by that of the *Pharmacopœia*, in which the powdered red-rose petals are to be made into an electuary; so that Confectio Rosæ, as usually met with, is not decidedly astringent.

Confection of orange-peel is made chiefly from the rind of the common sweet orange, so abundant in our market, and not from bitter orange-peel, as sometimes supposed by physicians.

Confection of almonds is made from the blanched almonds, triturated through a fine sieve, and thoroughly incorporated with the gum and sugar, thus forming the whole into a mass. It furnishes a ready mode of forming almond mixtures.

2d. *Electuaries.*

Confectio Rosæ, *U. S. P.* Powd. rose 2 p., sugar 15 p., honey 3 p., rose water 4 p.
Confectio Aromatica. Arom. powd. 5½, saffron ½, syr. orange-peel 6, honey 2.
Confectio Opii (1 gr. in 36). Opium powd. 4½, aromat. powd. 48, honey 112.
Confectio Sennæ. P. senna and coriander, added to a syrup of liquorice-root and figs, to be triturated with equal parts of pulps of prunes, tamarinds, and purging cassia.

All of this division of confections are made from dried and powdered materials, incorporated mechanically with a saccharine solution into mass.

Confection of rose is used as a vehicle in the preparation of pills, which is almost its only use.

Aromatic confection and *confection of opium* are somewhat used as vehicles; the latter is prescribed in old recipes, and sometimes in prescriptions, as *Theriaca Andronica*. It enters into the composition of a celebrated fever and ague mixture introduced among extemporaneous preparations.

Confection of senna is a fine laxative, and, when properly prepared, is one of the most agreeable remedies of its class. When given in large enough quantities to purge actively, it is liable to disagree with the stomach when there is want of tone in that organ, and to become distasteful to the patient. It constitutes the basis of the next preparation to be noticed.

Unofficinal Confections.

The following recipe has been in use for many years as a remedy for piles, and, from the numerous cases in which it has afforded relief, is believed worthy a place among our unofficinal formulæ:—

Take of Supertartrate of potassa,
Powdered jalap,
Powdered nitrate of potassa, of each half an ounce.
Confection of senna . . . an ounce.
Make an electuary with syrup of ginger.
Dose, a piece the size of a marble three times a day.

Confection of Black Pepper (*Confectio Piperis*).—*Ward's Paste.*

The following is the recipe from the *London Pharmacopœia* for this celebrated preparation, which is not unfrequently prescribed for piles; it is said to require to be used continuously for some months to realize good results:—

		Reduced.
Take of Black pepper,		
Elecampane, each . . .	1 pound .	℥j.
Fennel (seeds) . . .	3 pounds .	℥iij.
Honey,		
Sugar, each	2 pounds .	℥ij.

Rub the dry ingredients together into a very fine powder, and keep them in a covered vessel; but, whenever the confection is to be used, add the powder gradually to the honey, and beat them until thoroughly incorporated. Dose, ʒi to ʒii, three times a day.

Pastes.

Medicines having sugar and gum for their basis, of a firm yet flexible consistence, intermediate between confections and lozenges, are called *Pastes*. These are usually sold in sheets, or in small squares, each of which is of suitable size to be taken at one time into the mouth, and covered with powdered sugar, or, in the case of jujube paste, with oil, to prevent their adhering together.

The object proposed in their preparation is the production of an agreeable demulcent and expectorant form of medicine; as their pleasant qualities are to a great extent lost by age, they should be freshly prepared.

The transparent kinds are allowed to cool and harden spontaneously, while the opaque varieties are stirred and beaten as they cool. A few recipes for pastes are appended:—

Jujube Paste. (*Transparent Gum Paste.*)

Take of Gum Arabic . . . . 6 ounces.
Water . . . . . 8 fluidounces.

Bruise the gum, and make it into a clear mucilage, which may be conveniently done by inclosing it in a bag of coarse gauze suspended near the top of a vessel of cold water; introduce the mucilage into an evaporating dish, and add—

Syrup . . . . . 7 ounces (by weight).

Evaporate to a very thick consistence, adding, towards the last—

Orange-flower water . . . 2 fluidrachms.

Let it cool, remove the crust which will have formed on the surface, and run the paste into shallow tin pans, which lay away in a warm place to dry. In order to turn out the paste, some are in the habit of slightly greasing the cans; but, this oil sometimes becoming rancid and giving unpleasant properties to the paste, it is suggested by Dorvault to make use of tin pans prepared by spreading with a rag a globule of mercury over the whole inside surface, and then wiping it well. The moulds need to be gone over with the mercury only once in eight or ten times. The French Codex directs the addition of a decoction of jujube; but this, which was the original practice, and gave name to the preparation, is now generally abandoned. The use of orange-flower water is generally substituted in this country by oil of lemon or rose, and, where the latter is used, a red color is imparted to the paste for the sake of distinction. Other flavors may be used.

Marshmallow Paste. Opaque Gum Paste. Pate de Guimauve.

Take of Gum Arabic (white),	
Sugar, of each	℔j.
Water	sufficient.
Orange-flower water	f℥iij.
White of eggs	No. x.

Bruise the gum, dissolve it in the water, and strain; put the gummy solution upon the fire in a deep, wide pan, add the sugar, stirring continually until it has the consistence of thick honey, carefully regulating the temperature. Then beat the eggs to a froth, add them and the orange-flower water gradually to the paste, which must be constantly stirred; continue to beat the paste until, in applying it with the spatula upon the back of the hand, it does not adhere to it, then run it out upon a slab, or into pans covered with starch.

Formerly this contained marshmallow; now it is, properly speaking, only an opaque paste of gum.

The *Iceland moss paste*, so extensively advertised of latter years, may be closely imitated by this process, slightly varying the flavor. The asserted presence of *Iceland moss* in it improves it only in name.

Carrageen Paste. (*Mouchon.*)

Take of Carrageen	℥j.
Water	Ovj.

Boil the carrageen (previously soaked) first in four pints, and then in the remainder of the water, and mix the liquids; to this add—

Pure gum Arabic,	
Sugar, of each	8 ounces.

Strain, evaporate to a very thick consistence, cool it, and separate any crust, and run it out into pans or on a slab.

Iceland Moss Paste. (*French Codex.*)

Take of Iceland moss	℥ij.
Gum Arabic	℥x.
Sugar	℥viij.
Water	sufficient.

Wash the Iceland moss in boiling water, and, having rejected this water, boil it in an additional portion of water during an hour. Express and strain, add the gum and sugar, and evaporate till a drop does not adhere to the back of the hand; then cool it on a marble slab.

Lozenges.

The manufacture of lozenges, as of confections, and of some syrups, pertains to the confectioner, in common with the pharmaceutist, and is principally confined to the former; yet the obvious eligibility of this form of preparation, for certain expectorant and other medicines, particularly for children, makes a knowledge of them desirable both to the physician and pharmaceutist.

The process for preparing them is quite simple, and so well adapted to all insoluble, tasteless, and agreeable medicines, that we may with propriety resort to it for ordinary purposes in prescribing.

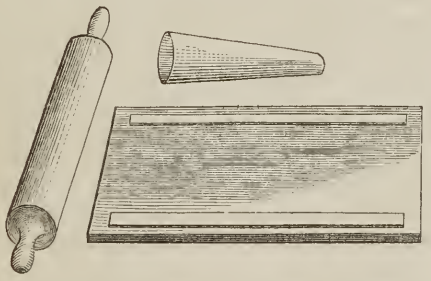
The author has repeatedly made up medicines in this form extemporaneously by physician's prescription, and with considerable advantage, as compared with the usual pharmaceutical forms.

The lozenges to be described are of two classes:—

First Class.—Those which consist of white sugar combined with a medicinal substance, and made up by the addition of mucilage. The dry ingredients are first to be thoroughly reduced to powder and mixed together; then beaten in a suitable mortar, with sufficient mucilage of tragacanth or gum Arabic to form a tenacious and tolerably firm mass; this mass, being dusted with a little powdered sugar (not starch, which is sometimes used), is to be rolled out upon a suitable board, or marble slab, to the required thickness, previously ascertained; and then, with a small punch, either round, oval, stellate, or cordate, to suit the taste of the maker, cut out singly, and laid away to dry on a suitable tray or sieve.

Fig. 162 represents a simple apparatus used for rolling and cutting this description of lozenges; the rolling-board is adjusted as follows: Having a punch of a certain diameter, a small portion of

Fig. 162.



Board, roller, and punch, for making lozenges.

the mass is rolled and cut out, and its weight ascertained; if it be too heavy, the cake is rolled thinner, and so on until adjusted to the required weight; a strip is now tacked on to each side of the board,

within the range of the roller, and corresponding in thickness with the cake, so that the roller, when passed over, will reduce the medicated mass to the right point. A board arranged in this way should be kept for each kind of lozenges, as the weight of different materials varies, and, in adjusting it, a small allowance must be made for the moisture present in the soft mass, which increases its bulk. In dividing a mass extemporaneously, it is convenient to roll the whole out into a square or oblong cake of suitable size, and then, with a spatula, divide it equally into a definite number of square masses.

Some manufacturers have, independently of their cutting punches, a stamp bearing the name of the base of the lozenge, or the card of the manufacturer, which they impress upon each lozenge; for white lozenges, the punch may be dipped in an infusion of cochineal. The cutting punches are sometimes so made as to combine cutting and marking in one operation.

In order to have lozenges nicely cut, it is important to clean the cutting punch frequently by steeping it for a moment in water, then wiping it dry.

In lozenges made of vegetable powders, as, for instance, those of ipecacuanha, the use of thick mucilage is advised to prevent the extractive matter from coloring the product.

The mucilage used is nearly always made of gum tragacanth, but some pharmaceutists prefer that of gum Arabic, as giving them a more translucent appearance; white of egg is recommended for the same purpose.

The quantity of mucilage necessary to thicken substances varies somewhat; it is greater for lozenges which contain dry powders than for those made of extractive substances. It may be remarked that lozenges containing a large proportion of mucilage become very hard by time.

Mucilages are sometimes made with simple water, and sometimes with aromatic waters, or the latter are replaced by essential oils added directly to the mass, or to the dry powders.

M. Garot mentions a German method which confectioners sometimes make use of to aromatize lozenges extemporaneously after their desiccation. It consists in dissolving a volatile oil in ether, and pouring this solution upon the lozenges contained in a bottle with a large mouth, shaking them well, then pouring the lozenges upon a sieve, and instantly placing them in a stove to dispel the ether. This method is very convenient, as it permits the preparation of a large quantity of inodorous lozenges, which may be flavored as they are needed.

The *second class* embraces those which consist of adhesive, saccharine, and mucilaginous materials, softened by water and beaten into a mass with flavoring and medicinal ingredients, and then rolled into lozenges, generally of a different shape from the others.

Although there are an immense number of lozenges in use, the

following syllabus embraces all those recognized in the *Pharmacopœia:—*

Trochisci, *U. S. P.*

Class I.—*Each lozenge weighing* 10 *grains.*

Officinal Name.	Proportion.	Adjuvants.	Med. Prop.
Trochisci cretæ	3½ grs. in each	Pow'd nutmeg	Antacid, astringent.
" magnesiæ	2½ "	"	Antacid, and laxative.
" sodæ bi-car.	" "	"	Antacid.
" ipecac.	¼ gr. "	Arrowroot	Expectorant.
" menthæ pip.	$\frac{1}{10}$ ♏ "	"	Carminative.

Class II.—*Each lozenge weighing* 6 *grains.*

Trochisci glycyrrhizæ et opii	Opium, 1 gr. in 10 lozenges Sugar, liquorice, gum Arabic, and oil of anise	Sedative. Expectorant.

Before describing the preparation of the only officinal lozenge of the second class, it will be proper to introduce to view the following unofficinal lozenges of my own invention, for neither of which has any formula been heretofore printed:—

Iron Lozenges. (*Trochisci Ferri Carbonatis.*)

I have prepared these for several years, and, without the stimulus of newspaper puffing, or the employment of any unprofessional means, they have grown into general favor and enjoy a wide-spread reputation both in and out of the profession, furnishing an answer to those who assert the necessity of illegitimate aids to the successful introduction of a popular remedy. The following is the formula:—

Take of Subcarbonate of iron . .	five ounces,
Vanilla	one drachm,
Sugar	ten ounces,
Mucilage of tragacanth . .	q. s.

Triturate the vanilla with a portion of the sugar into a uniform powder; mix this with the remainder of the sugar in powder, and the carbonate of iron, then beat the whole into a mass with the mucilage, and divide into round lozenges, each weighing fifteen grains.

Each lozenge contains five grains of subcarbonate of iron, the usual dose for a child; an adult might take two or three for a dose three times a day. They have been used with success in the early stages of chorea, in anæmia, and in cases, generally, in which this well-known and popular chalybeate salt would be indicated.

The use of carbonate of iron as an anthelmintic is worthy a more general trial. From experience with these lozenges, I believe they are better adapted to meet the popular demand for worm medicines than any of the numerous pink-root preparations sold in such vast quantities.

Phosphatic Lozenges.

Take of	Phosphate of lime . .	ten ounces.
	Phosphate of iron . .	two ounces.
	Phosphate of soda . .	six drachms.
	Phosphate of potassa . .	two drachms.
	Sugar, in powder . .	seventeen ounces.
	Piperoid of ginger, or Powdered ginger,	
	Syrup of phosphoric acid,	of each a sufficient quantity.

Mix the phosphates of lime and iron, with the sugar and ginger, by passing through a fine sieve; then, by the aid of heat, dissolve the phosphates of soda and potassa in the syrup of phosphoric acid, and make into a mass with the mixed powders. Roll this into a cake of the proper thickness, dusting it with a sifted mixture of one part of phosphate of iron, and eight parts of sugar, and cut out the lozenges, each weighing 15 grains.

The syrup of phosphoric acid is made by dissolving one drachm of the glacial acid in eight fluidounces of syrup. Each lozenge contains five grains of phosphate of lime, one grain of phosphate of iron, and $\frac{1}{2}$ grain of the mixed phosphates of soda and potassa. The very small proportion of the last-named ingredients is made necessary, in order to avoid imparting a decidedly saline taste to the preparation.

The use of the phosphates, particularly phosphate of lime, has recently been highly recommended abroad, and adopted, to some extent, in this country, as supplying elements to the system which are exceedingly apt to be deficient, particularly among children, in large cities. It is asserted that this salt not only aids in the building up of the bony structure, when it is deficient, but assists in maintaining the irritability, without which assimilation and nutrition are always lacking. My friend, Dr. W. E. Brickell, now of Vicksburg, Miss., used these lozenges, with great success, in an asylum for friendless children, in this city, in treating the glandular swellings, sore heads, and other forms of scrofulous disease prevailing among that class. He also reports a case of secondary syphilis, and another of sciatica benefited by their use.

Wistar's Cough Lozenges.

In the second class of the foregoing syllabus, but one officinal preparation is placed, which is that commonly known as Wistar's cough lozenges. These are known and esteemed throughout the

United States, and are almost as familiar to the public at large as to the physician and pharmaceutist. The recipe, which originated with the late Professor Wistar, of the University of Pennsylvania, has been considerably modified by most manufacturers, although retained nearly in its original form in the *Pharmacopœia*. In giving that employed in our own establishment, I may preface it by the remark that most pharmaceutists and physicians prefer buying them to attempting their preparation. The formation of a mass possessing the requisite softness and pliability, and yet firm enough to retain the shape given to it, is a matter of considerable difficulty, even with those who are somewhat accustomed to it, while those who are not, often waste their material, as well as their time, in the manipulation. This remark, however, lessens in force when the quantity manipulated with is small.

Take of	Powdered liquorice,	
	" gum Arabic,	
	" sugar, of each .	five ounces.
	Oil of aniseed . .	thirty drops.
	Sulphate of morphia .	twelve grains.
	Water, and	
	Tincture of Tolu, of each	a sufficient quantity.

Dissolve the sulphate of morphia in one fluidounce of water, and add the oil of aniseed, with sufficient powdered gum Arabic to incorporate it thoroughly. To this add one fluidounce of water, or a sufficient quantity; add this, now, to the powder, and beat thoroughly into a mass of the proper consistence. This is to be divided into lozenges, each weighing six grains, and these, after they are dry, are to be varnished with tincture of Tolu.

The mode of rolling and dividing these, and, consequently, their shape, is different from that indicated for the previous lozenges. After beating the ingredient into a mass, portions of 168 grains each are weighed out, and each of these being rolled between two smooth pieces of board, into a cylindrical stick, 28 inches in length, is laid away upon a smooth drying board, until nearly dry and brittle, and then cut with a sharp knife or scissors, into 24 equal lozenges, each about $1\frac{1}{8}$ inch in length, and weighing 6 to 7 grains.

The dose is one, taken occasionally. About twelve lozenges contain an ordinary adult dose of sulphate of morphia. Made by this recipe, they are less liable to constipate the bowels, and are less bitter to the taste than the officinal.

Spitta's (Coryza) Lozenges.

These are unofficinal but popular lozenges, for cold in the head, particularly for the painful sense of tightness and obstruction in the nasal fossæ. They will frequently cure sore throat and hoarseness, the cubebs they contain adapting them to these complaints by

its local stimulant effect. They are generally made into the same shape as Wistar's, and in very much the same way, but they are larger, each lozenge containing 10 grains, and not so palatable.

Take of	Powdered cubebs	4 ounces.
"	extract of liquorice	16 ounces.
"	gum Arabic	8 ounces.
	Oil of sassafras	40 drops.
	Syrup of Tolu	sufficient.

Beat the ingredients together into a uniform mass, and divide into lozenges of ten grains each.

These may be taken almost *ad libitum*, the lozenge being allowed to dissolve gradually in the mouth.

Dr. Jackson's Pectoral Lozenges.

This formula was first published by A. B. Taylor, who obtained it directly from its distinguished author. It is anglicized as follows:—

Take of	Powdered ipecacuanha	10 grains.
	Precip. sulphuret of antimony	5 grains.
	Muriate of morphia	6 grains.
	Powdered gum Arabic	of each 11 drachms.
"	sugar	
"	ext. of liquorice	
	Tincture of Tolu	4 drachms.
	Oil of sassafras	4 drops.

To be made into a stiff mass, with simple syrup, and divided into 200 lozenges, or into lozenges of ten grains each. Each lozenge contains $\frac{1}{20}$ gr. of ipecac, $\frac{1}{40}$ gr. of the antimonial, $\frac{1}{33}$ gr. of morphia. They are usually rolled into flat cakes, and cut out with a round punch, as described under the head of the officinal lozenges.

Dr. Jackson's Ammonia Lozenges.

Take of	Muriate of ammonia	$1\frac{1}{2}$ drachms.
"	morphia	3 grains.
	Powdered elm bark	6 drachms.
	Powdered gum Arabic	of each 7 drachms.
"	sugar	
"	ext. of liquorice	
	Tincture of Tolu	3 drachms.
	Oil of partridgeberry	4 drops.

To be made with syrup into 180 lozenges, or into lozenges of ten grains each, containing $\frac{1}{2}$ grain muriate of ammonia, and $\frac{1}{60}$ of a grain of the morphia salt.

These are used for somewhat similar affections with the foregoing, and are made into the same shape.

Parrish's Cough Lozenges.

We have been in the habit, for the last seven or eight years, of preparing a pectoral lozenge not unlike that of Dr. Jackson. The recipe, which is as follows, was contrived with the aid of a medical friend, and has proved a useful one, producing a comparatively active preparation:—

Take of Powdered ipecacuanha .	50 grains.
Kermes mineral . . .	100 grains.
Sulphate of morphia . .	16 grains.
Pow'd sugar . . .	of each 3 ounces.
" gum Arabic . .	
" extract of liquorice .	
Oil of anise	40 drops.
Syrup of Tolu . . .	sufficient.

To be made into a mass and divided into 320 lozenges, each containing about $\frac{1}{6}$ grain of ipecacuanha, $\frac{1}{3}$ grain of Kermes, $\frac{1}{20}$ grain of morphia salt.

The dose of these, is one three times a day.

Candy and Drops.

Various kinds of candy are used in medicine for the well-known expectorant or demulcent properties of the sugar alone, or for the effects of such medicines as may be conveniently combined with it. The manufacture of these pertains almost exclusively to the confectioner, who prepares a thick semifluid mass by using with the sugar a small portion of water, and boiling till it is brought to such condition as that a small portion removed from the fire upon a glass rod will solidify into a transparent candy on cooling; it is then poured out upon a marble slab. If the coloring or flavoring ingredient is in powder, as, for instance, tartaric acid used in making lemon drops, it is worked in with the melted candy on the slab; otherwise it must be added before testing its hardness and removing from the fire. The sheet of melted candy being smoothed upon the surface, if designed for secrets, a very common form, is cut partially through into squares, and then, when brittle, broken off; if designed for drops, the candy requires to be run into moulds upon a machine constructed for the purpose; if for sticks, it is rolled and drawn out to the required thickness.

By kneading and working this material while soft, its whiteness is increased. The principal art in making candies is in removing them from the fire at just the right moment before *caramel* begins to be formed, and not until the whole of the uncombined water is driven off; besides the proximate mode, with a glass rod, given above, the elevation of the boiling point to exactly a certain point is an indication that the candy is finished.

The fruit essences, so called, prepared by artificial processes from

fusel oil, have been much used of late to flavor drops. Lemon and ginger drops are also much in vogue; the latter are best prepared from the piperoid, or oleo-resin of ginger (see p. 121), of which one ounce suffices for twenty of candy.

The following recipe is appended, as of utility to the pharmaceutist, who may procure the admixture of the medicinal ingredients, with candy at the confectioner's for a few cents per pound advance on the cost of the sugar.

Medicated Secrets, or Cough Candy.

To ten pounds of melted candy add the following mixture, and divide into secrets:—

Take of Tincture of squill		f℥iv.
Camphorated tincture of opium, Tincture of Tolu	of each	f℥ss.
Wine of ipecacuanha		f℥j.
Oil of gaultheria		♏viij.
" sassafras		♏vj.
" aniseed		♏iij.

Used *ad libitum* in ordinary coughs.

CHAPTER XIV.

ON DISTILLATION AND SPIRITS.

This process, the reverse of evaporation in its applications, is, like it, designed to separate the volatile from the fixed ingredients in a solution. While in evaporation the object is to dissipate and reject what is volatile, preserving and retaining what is comparatively fixed, in distillation the volatile ingredient is to be secured, and the fixed is generally discarded. To distil a solution, it is first converted into vapor by the application of heat, and the vapor is then condensed in a separate part of the apparatus.

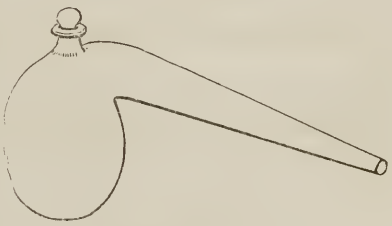
In a work of the design and scope of the present, any elaborate description of the apparatus used in distillation, and the mode of conducting the process on a large scale, would be quite out of place. The uses of the still in the manufacture of spirituous liquors and the spirit of turpentine of commerce, and in the rectification of these into alcohol and camphene, and in various other branches of manufacture, are among the most important subjects connected with chemical technology, and occupy a prominent place

in works on that subject. In the present chapter, I shall have reference chiefly to the use of distillation in Galenical pharmacy, referring to another part of the work an account of its application to some of the small chemical processes falling within the range of the country practitioner and pharmaceutist. The dry distillation of solid substances, which are unaltered by the heat employed, is called *sublimation*. In Galenical pharmacy, this is applied to the separation of benzoic acid; in chemistry, to the manufacture of calomel, corrosive sublimate, &c. When this is accomplished in close vessels by a degree of heat which decomposes the substances acted on, it is called *destructive distillation*, as in the manufacture of acetic acid.

Apparatus for Distillation.

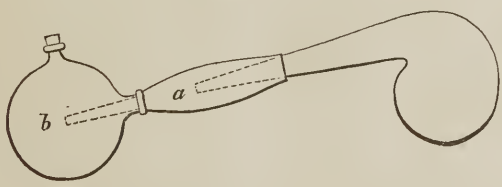
Retorts are usually made of glass; they are adapted to make distillations sometimes without, and sometimes with, condensing arrangements attached. The plain retort, though much used abroad, is almost superseded with us by the tubulated, which is represented in the accompanying figure, Fig. 163. Formerly, the retort was nearly always connected with a *receiver*, which is a glass globe with a wide mouth and neck, into which the beak of the retort is inserted, either loosely or by the aid of a cork, or as in Fig. 164, with the use of an *adapter*. The retort here represented is of the kind called plain;

Fig. 163.



Tubulated retort.

Fig. 164.



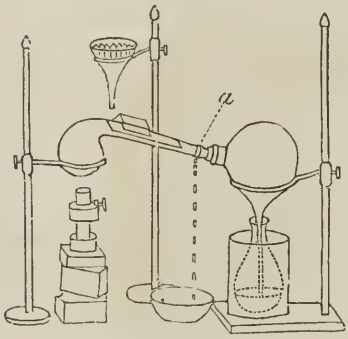
Plain retort, tubulated receiver, and adapter.

the receiver *b* is tubulated; *a* is the adapter. The use of a vial of appropriate size and shape, with the bottom and rim, or lip of the neck, cracked off, furnishes a tolerable substitute for the adapter.

The substance to be distilled being introduced into the retort and heat applied, the vapor given off passes at once into its beak or neck, and, if this is not refrigerated, into the receiver. In some

cases, particularly in treating very volatile liquids, it is found more convenient to apply cold directly to the beak, as in Fig. 165, in which pieces of linen or cotton cloth, folded several thicknesses and laid lengthwise on the beak, are kept constantly wet by the dropping of water from a filter suspended above it. At the point *a*, below the lower edge of the wet cotton, a piece of lampwick or other suitable string is tied tightly round the beak, to conduct off the descending warmed water. The receiver here shown, though not tubulated as in the other plate, is quilled or drawn out into a fine tube, which enters the receiving vessel below; this being fully refrigerated, insures the complete condensation of the liquid.

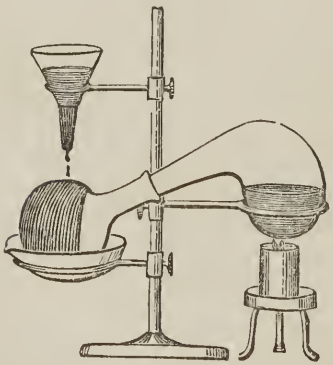
Fig. 165.



Retort with quilled receiver.

When the liquid to be distilled is condensed at a moderate elevation of temperature, the mode of refrigeration last mentioned is conducted without the use of a receiver, the distillate being collected directly from the beak of the retort, from which it drops as fast as it accumulates. Sometimes the receiver is refrigerated, and not the beak of the retort, and this is perhaps the most common arrangement for retort distillation. It is rather roughly shown in Fig. 166, which represents a plain retort, a plain receiver, and a funnel from which the cold water is supplied. Where this arrangement is adopted, care should be taken not to secure the beak of the retort tightly into the neck of the receiver, in which case the expansion of the heated air and vapors, on commencing the operation, would lead to a rupture of some part of the apparatus.

Fig. 166.

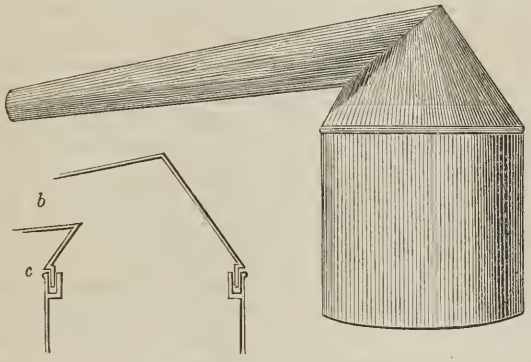


Distillation with plain retort and receiver.

Fig. 167 represents a vessel of tinned iron, which I have contrived as a convenient substitute for a glass retort in all operations in which no corrosive or acid substance enters into the liquid to be distilled. Near the top of a deep tin vessel is soldered on a small gutter, so arranged on its inside as not to reach quite up to the

level of the sides of the vessel. The top, *b*, has a rim projecting downwards, which sets into this gutter, as shown in the section. When about to use this, after charging it with the substance to be distilled, the little gutter is filled with water and the top fitted on. The water joint thus formed prevents the escape of any portion of

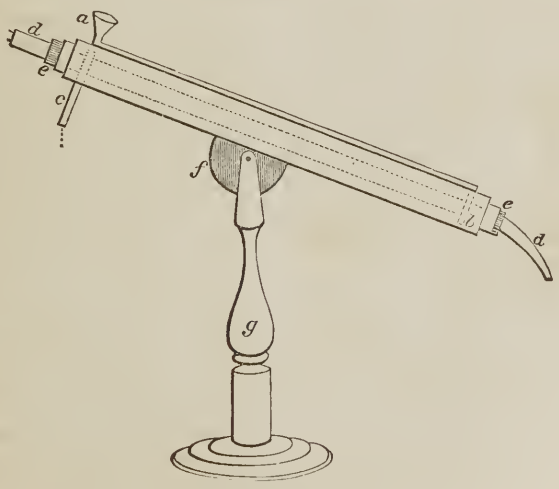
Fig. 167.



Tin retort with water joint.

the vapor, while it is prevented from becoming empty by the moisture condensed on the inside of the conical top dropping into it as it descends.

Fig. 168.



Liebig's condenser.

Fig. 168 represents a well-known form of condensing apparatus which has almost superseded the arrangements before figured.

This is constructed on a variety of patterns, and of different materials. That represented, Fig. 168, is one I have had in use for several years, and prefer on several accounts to the more expensive and complicated kinds. It consists of a tin tube 18 inches long and 2½ inches in diameter, and having the ends reduced to 1¼ inches to suit the largest size of good corks that are readily attainable.

Fig. 169.

Cork borer.

The funnel, *a*, is the upper termination of a very small tin tube, which, passing down the whole length of the apparatus, enters it near the lower extremity, where it is extended by a bent leaden tube, as shown by the dotted lines, to the very bottom, at *b*. A short piece of thin lead pipe, *c*, leads from near the apex of the condenser, and, passing out through a perforation into which it is soldered, terminates about two inches below. *d d* is a glass tube 1 inch in diameter, drawn out and bent at its lower end, which passes through the whole length of the apparatus, being secured by the perforated corks *e e*, at either end. These corks must be perfect, and as soft as can be obtained. A smooth and even perforation may be made by a brass cork borer, Fig. 169, or rat-tail file, Fig. 170, or both, so as to constitute a water-tight joint. *f* is a stout piece of sheet copper soldered on to the main tube, and made to work by a screw upon the wooden upright *g*.

Fig. 170.

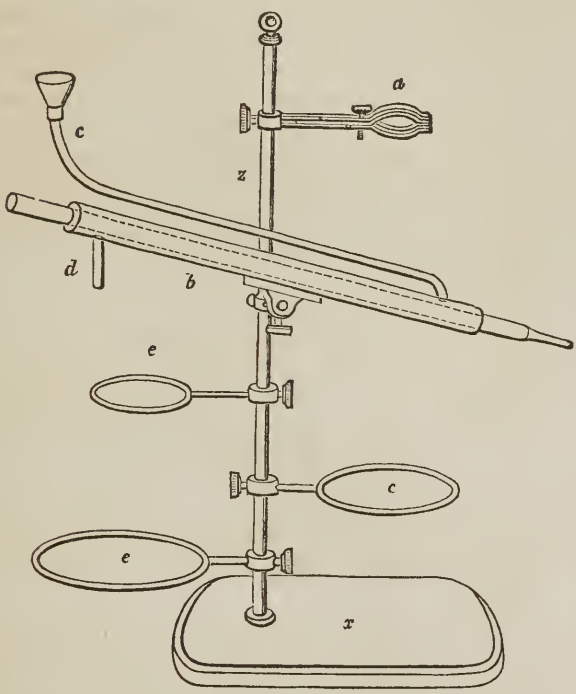
The use of cement or luting to surround the corks is necessary if they are not very perfect and very completely fitted, and as no alcoholic liquids will come in contact with them, dissolved sealing-wax is found to answer an excellent purpose. With an apparatus of this kind, the use of which will be described a few pages further on, most of the processes requiring distillation can be satisfactorily accomplished. The expense of a condenser, such as here described, is from $3 50 to $5. The bottom of the wooden stand should be grooved on the under side and filled in with melted lead, to prevent the ill effects of warping, and to give solidity to the whole.

Fig. 171 represents a condenser supported on a retort stand, having freedom of motion in every direction; *x* is a cast-iron foot, in which is fixed a solid rod of iron *z*. The condenser, as here represented, is designed to be made of brass, with a glass tube fitted into it with corks, as in the other case; the comparative size of the outer tube, as here shown, is much smaller, which requires a much more rapid passage of the cold water through it, especially in distilling very volatile liquids. The Gay Lussac holder *a*, and the rings, are usually made of brass in this arrangement.

Fig. 172 represents a Liebig's condenser and flask attachment, made entirely of glass, and such a one as a pharmaceutical student

might readily fit up for himself; the tube for the ingress of cold water and the egress of the warm, here enters through the same

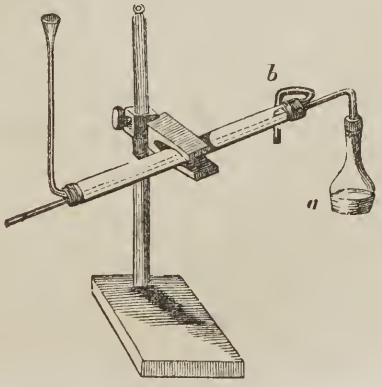
Fig. 171.



Brass Liebig's condenser in retort stand.

corks as are perforated for the tube containing the condensing vapor; this tube is continuous from the neck of the flask to the

Fig. 172.

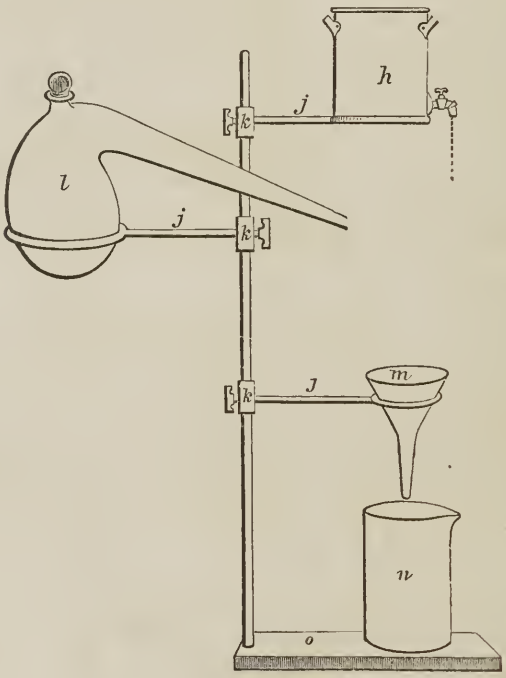


Small glass condenser and flask.

other end of the apparatus. In the absence of a large glass tube suitable for this apparatus, which is not always to be had, a tin tube, as, for instance, an adhesive plaster can, with the ends taken off, may be substituted.

A mechanical support for the retort and for the refrigerating apparatus, is, of course, absolutely necessary in the arrangement of a distillatory apparatus; at least *one retort stand* is quite necessary, even in connection with the Liebig's condenser, as shown in Fig. 171; in which case one of the rings might have a sufficiently long handle, connecting it with the screw that clasps the upright rod, to hold a retort or a flask at a sufficient distance from the condenser, to be adjusted to it for use; but this is not the case with any that I have seen, and would render the whole apparatus unsteady when loaded with the liquid.

Fig. 173.



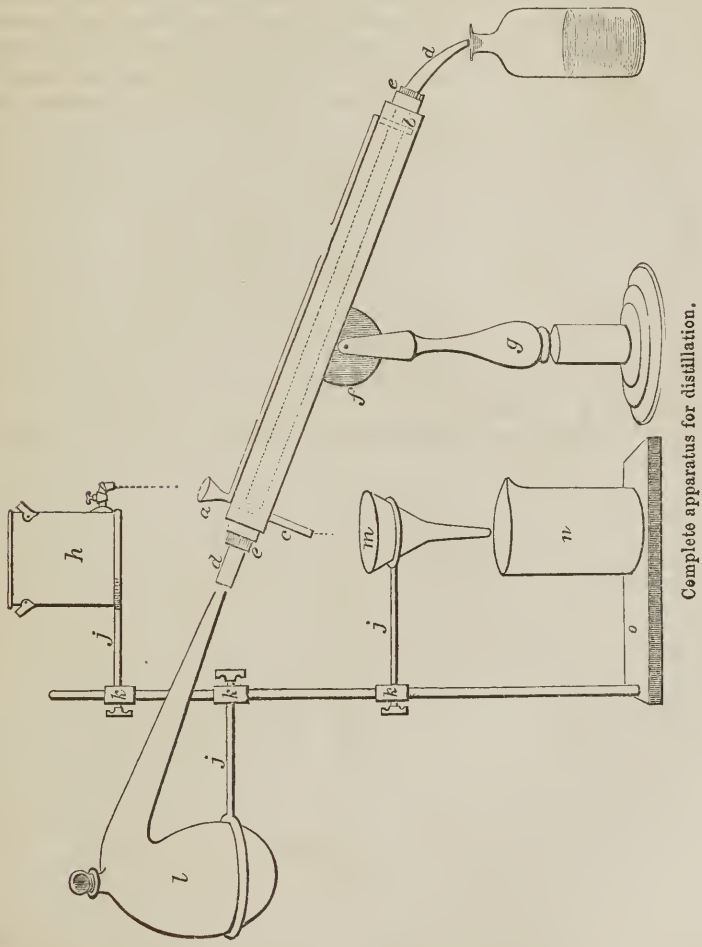
Retort stand for use in distillation.

Fig. 173 will give an idea of the arrangement of the retort and vessel for supplying the condenser with water, and that for catching the waste water upon one retort stand, which, however, must be in due proportion to the size of the condenser.

In Fig. 165, it will be seen that as many as three retort stands are used in a small operation.

When put together, the apparatus for distillation will be complete as arranged in Fig. 174. The tin bucket *h* has a small brass cock, which is so regulated in using the apparatus as to drop the water either slowly or rapidly as the warming of the water in the condenser may require.

Fig. 174.

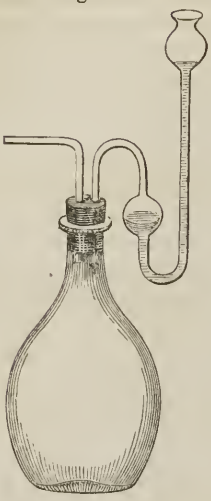


Complete apparatus for distillation.

The only use of the funnel *m*, is to prevent the splashing of the water as it falls from the condenser. By placing the heavy *receiving* vessel *n* on the wooden base of the retort stand, it is rendered solid, and the weight of the retort *l* is counterbalanced.

A flask with perforated cork and glass tube, as shown in Fig. 175, may be substituted for the retorts before described, an arrangement well adapted to distilling very volatile liquids, and those which boil with great violence. This figure also shows a tube for introducing fresh portions of the liquid without removing the cork; the tube, being bent, retains a portion of liquid in the bulb and adjacent curve, which prevents the escape of vapor from the interior. It is designed to extend only a little below the cork. In case of any stoppage in the apparatus by which an accumulation of vapor might take place in the flask or retort, these tubes would serve as a safety valve and the liquid being forced out would allow of the escape of the accumulated steam.

Fig. 175.

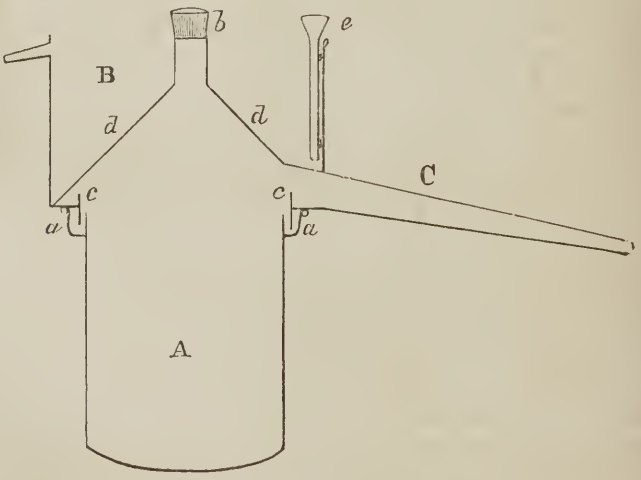


Flask and safety tube.

The pharmaceutical still is the name given to an old-fashioned and cheap form of apparatus, in which the condenser is immediately over the heated liquid, and the distillate is collected by means of a ledge or gutter on its lower surface.

Fig. 176 represents a section of this still, which may be made of

Fig. 176.



Section of pharmaceutical still.

tinned iron, and of any required size. *A* is a deep tin boiler, with a rim soldered round its top at *a a*, forming a gutter for the water

joint, by which it is connected with the dome or head *B*. This is the refrigerator, on the inner surface of which the condensation occurs; *C* is the neck or tube for carrying off the distillate; *c c* is a circular rim soldered on to the base of the head *B* in such a position as that the upper projection forms a gutter for conducting the condensed fluid as it runs down on the under surface of the cone *d d* into the neck *C*, while the lower part projects downward into the gutter *a a* to form the water joint.

The course of the circular rim *c c* is of necessity inclined downwards toward the under edge of the neck *C*, as indistinctly shown in the section, in order to determine its liquid contents in that direction.

b is an opening in the top of the condenser, stopped by a cork, for inspecting the progress of the distillation, and adding to the contents of the boiler; *e* is a funnel tube into which a current of cold water is directed during distillation, while as it becomes warm it ascends and escapes by the tube on the other side. The water joint is to be nearly filled at the commencement of the operation, and effectually prevents the escape of the vapor.

The Process of Distillation.

From the description and illustration of apparatus now given, the reader will have a pretty good idea of the process as conducted on a small scale. A volatile liquid or mixture containing a volatile ingredient being introduced into a retort or flask connected as before described, and heat applied, the volatile ingredient will rise in vapor, and, being cooled by contact with the neck of the retort, the receiver, or the glass tube of the Liebig's condenser, will be condensed, and may be collected in a liquid and generally a pure condition.

One of the chief practical difficulties in distilling arises from the irregularity of the boiling of liquids in glass vessels, occasioning violent bumping, and sometimes the fracture of the vessel. In treating resinous substances in this way, and in numerous chemical processes, especially as in the preparation of hydrocyanic acid, where a large amount of heavy precipitate is present in the liquid, this renders the operation one of great difficulty and annoyance. The best remedy for this is found in the diffusion of the heat over the sides of the retort, and indeed over the whole surface in contact with the liquid, and in the interposition of small angular fragments of insoluble material, such as rock crystal, flint, or broken glass, among the particles of the liquid; advantage is gained by covering the bottom of the glass vessel with wire gauze, which diffuses the heat of the flame, or preferably by coating the retort with metallic silver on its inner surface, which may be done by reducing a solution of ammonio-nitrate of silver, by boiling it in the vessel to be plated with oils of cinnamon and cloves, in solution in alcohol.

Silver forms the most eligible metallic coating, next to platinum. Flasks may be coated on the outside with metallic copper so as to answer an excellent purpose. This is done by the aid of a battery. (*See* Mohr, Redwood, and Procter, p. 457.)

The application of heat must of course be regulated by the volatility and inflammability of the liquid treated. Strong alcoholic or ethereal liquids, being volatilized at low temperatures, may be heated by a water bath or a sand bath, not too hot, which, besides preventing the excessive boiling of the liquid, will diminish the danger from a fracture of the glass vessel used.

In distilling from flowers or herbs for obtaining essential oils or medicated waters, there is great liability to scorching, from the contact of masses of the solid material with the heated surface of the still, thus producing empyreumatic principles which quite destroy the agreeable fragrance of the product. A false bottom or perforated diaphragm, a few inches above the point of contact with the flame, is a preventive of this, adopted in large operations. The application of carefully regulated steam heat is, of course, in this as in most other heat operations on a large scale, a great improvement.

The pharmaceutical still, Fig. 176, is well adapted to recovering the alcohol from tinctures to be made into syrups, fluid extracts, or extracts; the alcohol obtained, even though impure and below standard strength, is suited to preparing the same tincture again; and the saving of alcohol by this means, in a large establishment, will be very considerable. The long-continued application of a pretty high heat, which is necessary in this case, involves an expense which, if gas, or even charcoal fuel is employed, may approach the value of the alcohol recovered, so that in the winter time it is well to avail ourselves of the stove used for heating the apartment by fitting the still to it, and distilling slowly at the moderate heat thus obtained. The advantage gained by the exclusion of the atmosphere in distillation is not to be overlooked when vegetable preparations are being concentrated. The head of the still becoming full of steam excludes the air, for the most part, and the condensation of the steam brings about a partial vacuum which favors evaporation at low temperatures.

The proper refrigeration of the condensing surface, whether of the retort beak, receiver, Liebig's condenser, or pharmaceutical still, requires pretty free use of cold water; and the application of this has direct relation to the degree of heat required to vaporize the liquid being distilled. An indication by which the operator may always judge when the refrigeration is insufficient, is the escape of uncondensed vapor. When this is observed, he should diminish the heat applied, and increase the application of cold to the condensing surface; this precaution is very important when the vapor is inflammable. The methods indicated in the drawings for the continuous application of cold water by a funnel, and by a

small cock, near the bottom of a tin bucket, are well adapted to the several kinds of apparatus figured.

The processes in Galenical pharmacy requiring the use of the still, are chiefly limited to those articles prepared on a large scale, and the apparatus is not commonly in use in retail pharmaceutical establishments, or in those of country practitioners; yet, I have fitted a number from time to time for medical students leaving the school of practical pharmacy, who have found in using them, both for experiment and manufacture, an agreeable and profitable employment during the tedious process of "getting into practice."

Officinal Preparations made by Distillation.

Aqua Destillata. (*Distilled Water.*)

This is directed to be used in a great many preparations in the *Pharmacopœia.* In some, its employment seems called for, while in others the moderately pure river or spring water, so freely supplied in nearly all towns and cities, answers every purpose.

The inorganic impurities imparted to spring waters by the rocks through which they permeate, are in the highest degree important in connection with solutions of delicate chemical substances, and the same may be said of the organic substances which contaminate some of the natural sources of water, and form precipitates with nitrate of silver, tartrate of antimony and potassa, and a few other very delicate chemical agents. It is, however, generally sufficient, that water should be pure enough for safe and wholesome drinking, to be fit for use also in preparing the Galenical and even many of the chemical preparations.

One of the most important uses to the apothecary and physician, of the apparatus for distillation here figured and described, is to enable him to prepare and keep at hand for special occasions, *aqua destillata.*

Olea Destillata, U. S.

The distilled oils are prepared by mixing the bruised herb or other part containing the oil with a small portion of water in a still, when, after macerating for a suitable length of time, and adjusting the apparatus, heat is applied. The oil, though its boiling point is always much above that of water, is readily diffused in the steam; and when this is condensed in the refrigerated part of the apparatus, the oil, if in excess, separates, and if specifically lighter, collects on the surface of the distilled water; or, if heavier, it settles to the bottom, and may be separated; the mode of preparing the officinal *aqua rosæ*, and other common distilled waters, corresponds with this, the proportion of water being so adjusted as that no

excess of the oil beyond what is soluble in the water shall be present.[1]

Spiritus, *U. S.*

Alcoholic solution of essential oils are usually called spirits or essences; they are sometimes prepared by distilling alcohol from the fresh herb, which thus gives up its essential oil, and on its condensation retains it in solution; they are also prepared by dissolving the oil directly in alcohol, as in the tinctura olei menthæ piperitæ, tinctura olei menthæ viridis, called essence of peppermint and spearmint, and tinctura camphoræ, called spirits of camphor. The officinal class *spiritus* consists of some which are made by distillation, and some which are simple solutions or mixtures of essential oils and alcohol. The following syllabus represents the composition and mode of preparation of each of the officinal class:—

Group 1.—Made with diluted alcohol.

Spiritus Myristicæ	Nutmeg ℥ij to dil. alc. 1 gallon	By distillation.
" Juniperi Comp.	Oils of juniper, caraway, and fennel	By solution.
" Pimentæ	Oil of pimenta in diluted alcohol	do.

Group 2.—Made with strong alcohol.

Spiritus Rosmarini	Oil f ℥iv to 1 gallon alcohol		Solution.
" Lavandulæ	Flowers ℔ij to do.		Distillation.
" " Comp. Lavender Compound	Cinnamon, Cloves, Nutmeg, Saunders,	to spt. Lavender and spt. Rosemary	Maceration or displacement.

The only preparation of this series which is much prescribed, is the last named. This is very often directed by practitioners as a flavoring and coloring ingredient in prescription. The choice of saunders as the coloring agent is, however, unfortunate from the resinous deposit which is apt to separate by dilution with water and long standing. Cochineal is a much brighter and handsomer coloring ingredient, and the compound tincture of cardamom is, on that account, to be preferred to the lavender compound.

The simple spirit of lavender prepared by distillation is one of the pleasantest of perfumes. That made by solution from the recipe given on page 230 is dependent on the freshness and fine quality of the oil for its value as a perfume. The cultivated or garden lavender yields a much better oil than the common wild plant; the finest quality oil of garden lavender comes from England, and commands a comparatively high price.

Essences for Perfumery.

Besides the use of fragrant essences for the mere gratification of the sense of smell, they serve a good purpose in headache, and as

[1] See Chapter on Essential Oils, Camphors, and Resins.

grateful refrigerant applications in dry and hot conditions of the skin. I append a few recipes for agreeable and ready spirituous perfumes. The art of perfumery has attained a perfection in France towards which our manufacturers make but a faint approximation. The French recipes call for so many ingredients not readily obtained in this country, and altogether derived from their own gardens and manufactories, that they require considerable modification to make them practicable to us. I shall, therefore, confine myself to inserting a few recipes which constitute a moderate assortment of essences, and which, for the most part, our own experience enables us to recommend.

Cologne Water.

Eau de Cologne, as imported from Cologne, and from Paris, is a highly rectified spirituous perfume obtained by distillation from a variety of fragrant plants. Of the numerous Farina colognes imported, all are highly rectified and apparently distilled from the plants, while, as prepared in this country, Cologne water is almost always made from essential oils dissolved in alcohol. This may be very good, if the oils are fresh and combined with reference to their relative strength and accord.

Cologne Water.

No. 1. Take of Oil of bergamot . . . . fʒij.
" neroli . . . . fʒij.
" jessamine . . . . fʒss.
" garden lavender . . fʒij.
" cinnamon . . . . fʒj.
Benzoated tincture . . . fʒiij.
Tincture of musk . . . fʒss.
Deodorized alcohol . . . Cong. j.
Rose-water . . . . . Oij.

Mix, and allow the preparation to stand a long time before filtering for use.

Cologne Water.

No. 2. Take of Oil of lavender . . . ʒiss.
" rosemary . . . ʒss.
" lemon . . . ʒj.
" cinnamon . . gtt. xx.
Alcohol . . . . Cong. j. Mix.

Much cheaper than the foregoing.

Benzoated Tincture for Colognes, &c.

Take of	Tonqua beans	ʒj.
	Vanilla	ʒij.
	Nutmegs, grated	No. j.
	Mace	ʒij.
	Benzoic acid	gr. x.
	Alcohol	Oj.

Macerate the solid ingredients, in coarse powder, in the alcohol *ad libitum*.

Essence of Millefleurs.

Take of	Peruvian balsam	ʒij.
	Oil of bergamot	fʒss.
	" cloves	fʒij.
	" neroli	fʒss.
	Tincture of musk	fʒij.
	Orange-flower water	fʒij.
	Alcohol (deod.)	Oij.

Mix and filter.

Essence of Patchouly.

Take of	Oil of copaiva	gtt. xx.
	" orange	gtt. iij.
	" valerian	gtt. j.
	" rosemary	gtt. j.
	Tincture of Tolu	gtt. xx.
	" ginger, alcohol, āā	q. s.

Mix.

Verbena Water.

Take of	Oil of balm melisse	fʒiij.
	Deodorized alcohol	Oij.

Make a solution.

This may be made somewhat stronger, though of a less pure verbena flavor, by the addition of a little oil of lemon. Oil of balm melisse is imported; its smell seems identical with our garden lemon trifolia.

Lavender Water.

Take of	English oil of garden lavender	fʒij.
	Deodorized alcohol	Oj.

Make a solution.

A little fresh calamus root macerated in the above improves it.

Aromatic Vinegar.

A pungent and reviving perfume, formerly esteemed a preventive of contagion.

Take of Acetic acid, very strong,
Camphor, in powder,
Oil of cloves, of each a sufficient quantity.

Mix them, and secure in a strong and well stoppered bottle.

Tincture of Musk.

Take of Musk	℥ij.
Water	Oss.

Macerate twenty-four hours and add—

Solution of potassa, *U. S.*	f℥ij.

Macerate twenty-four hours and add—

Alcohol	Oss.

Let it stand, decanting as required.

Perfume for adding to Mouth Washes.

Take of Asarum Canadense	℥ss.
Orris root	℥ss.
Strong alcohol (Atwood's)	f℥viij.

Make a tincture and add—

Tincture of musk	f℥j.
Essence of millefleurs	f℥ss.
" patchouly	gtt. xx.

Superior Mouth Wash.

Take of Old white Castile soap	℥ij.
Alcohol	f℥iij.
Honey	℥j.
Perfume, as above	f℥iv.

Dissolve the soap in the alcohol, and add the honey and perfume.

PART III.

ON THE PHARMACY OF PLANTS, THEIR PRODUCTS, &c.

CHAPTER I.

LIGNIN AND ITS DERIVATIVES.

This work is designed mainly for a class of students little versed in organic chemistry, and whose object is to acquaint themselves with the practical bearings of pharmacy rather than with its theory. Some will study it in connection with a course of manipulations, while others, perhaps, will use it as a guide in the daily routine of a dispensing office or shop. To all such it is adapted by an arrangement, which, without any claim to a scientific basis, is recommended by simplicity, and a gradual advancement from the easy to the more difficult manipulations.

In abandoning for the present this arrangement of subjects, it is designed, in Part III., to present to view some matters which could not be conveniently introduced in the previous portions of the work, and yet are important to the student before approaching the succeeding Chapters on Extemporaneous Pharmacy.

Although a more scientific classification of subjects, than that heretofore observed, is called for in this connection, and some theoretical matters will necessarily be introduced, the effort will be made by simplicity and plainness, to adapt it as far as possible to the class for which it was designed.

The pharmaceutical classification of materia medica is primarily into organic and inorganic medicines. Of these, the organic will be brought into view in Part III.

The study of these in their chemical relations, has, of latter years, become an object of great interest, and has developed the germs of a system of classification of plants founded on their chemical composition.

All plants are composed of a collection of organic proximate principles, which, when further resolved, are found to consist of carbon, oxygen, and hydrogen—the two latter elements frequently

combined in the proportion in which they exist in water; some of these principles consist of carbon and hydrogen only, others contain also nitrogen, and some of these phosphorus and sulphur, the protein compounds.

The predominance of one or other of these proximate principles in any group of animal or of vegetable products, usually adapts its individual members to certain modes of preparation and use in medicine, and constitutes the strongest feature of resemblance among them. This characteristic is still more marked, when associated, as it sometimes is, with similar botanical relations, but even in the absence of these, it is very apparent: thus substances which owe their utility to containing starch, are naturally associated as *farinaceous*, while the *gums* are well and familiarly classed together. So with the *aromatics* containing essential oils and resins; the *narcotics* containing alkaloids, &c.

It may be mentioned that the proximate principles of plants seem capable of ready division into two main classes, which, however, are only approximate; these are: *First.* Those which are nutritious, and are generally diffused throughout the vegetable kingdom, including a few obtained from animals also; this class consists of lignin, starch, gums, sugar, fixed oils and fats, and the nitrogenized or protein compounds. *Second.* Those which are generally not nutritious, but medicinal in their properties, and are less diffused, being in some instances confined to a very few families of plants; these are, the crystallizable and uncrystallizable neutral principles, the vegetable acids and alkalies, the essential oils and resins, &c.

In treating of these vegetable principles, and some of the important drugs in which they are found, the vegetable materia medica will be brought into view, in a somewhat different aspect from that under which it is usually studied.

As it is presumed that every student will avail himself at the same time of more extended and thorough treatises, I shall limit the facts presented mainly to those which are of importance in connection with the subject of practical pharmacy.

Lignin.

Lignin, or cellulose $= C_{24}H_{20}O_{20} = C_{12}H_{10}O_{10}$. It is inert, insoluble, tasteless, and inodorous; the basis of woody fibre, and present in nearly all plants. By long boiling with diluted sulphuric acid, it is changed into dextrin, a soluble form, and then into grape sugar.

Pharmaceutical manipulations are chiefly directed to get rid of lignin by freeing from it, by the aid of various menstrua, those active principles which it incloses among its fibres, excluded from external influences, and safely locked up in their natural reposito-

ries, till needed for the relief of suffering, or the restoration of health.

Lignin is officinal under the name of *gossypium*, cotton, which, in its condition of raw cotton, or carded cotton, is much used in surgery, and forms the basis of the singular and interesting compounds known as gun cotton, pyroxylon, and the other modifications of prepared cotton entering into collodion and blistering collodion.

Another form of lignin, which is of interest to the surgeon, is that of patent lint, prepared from the fibres of the flax plant (linum usitatissimum).

See an article on the preparation of lint, by Jacob Bell, in the *London Pharmaceutical Journal*, and copied in the *American Journal of Pharmacy*, vol. xxiii. pp. 70 and 162.

Collodium, *U. S. P.* Ethereal Solution of Prepared Cotton.

This preparation, originally prepared by Prof. Schonbein, was recommended as an adhesive substance adapted to the wants of the surgeon, in an article in the *Boston Medical and Surgical Journal*, under date of March 22, 1848, by S. L. Bigelow. He then stated that he had accidentally discovered its remarkable adaptation to the rapid union of wounds by the first intention, and had tested its efficacy by a number of experiments, which induced him to make it public. The next number of the same journal, issued one week later, contained an article on the same subject, by Jno. P. Maynard, of Dedham, Mass., in which he claims to have been the first to use the preparation as an adhesive plaster, and proceeds to detail its advantages, as proved by a number of experiments made by himself, and by numerous physicians and surgeons in Boston. In the same number of the *Journal*, appears an editorial notice, which recommends the collodion, as it is there named, in terms of approval, and in relation to its adhesiveness, says: "Nothing known to us will compare with it in this respect." Of its mode of preparation, both these writers left us in the dark, although, as soon as a demand was thus created for the article, perhaps before, Dr. Maynard's formula for preparing it was placed in the hands of Maynard & Noyes, druggists, Boston, who commenced the manufacture of it on a large scale, and measures were taken to introduce it throughout the United States.

On the first introduction of Maynard and Noyes' article in Philadelphia, my lamented friend, W. W. D. Livermore, then an assistant in my store, and myself, jointly pursued a series of experiments in its preparation, the result of which we announced in a paper published in the *American Journal of Pharmacy*, vol. xx. p. 181, stating the best formula that we had tried for the preparation of this solution. It prescribed the mixing of equal portions of nitric and sulphuric acids, and the maceration in it of clean bleached

cotton for twelve hours. The proper strength of the nitric acid was then known to be a matter of importance, the acid of 1.5 sp. gr. furnishing the most satisfactory results.

This cotton, after washing and thorough drying, was to be dissolved in a certain proportion of ether, free, or nearly free, from water.

The recipe was accompanied by such practical suggestions as our experiments led to, which were offered rather to draw attention to this then new and interesting preparation, than to furnish an unexceptionable formula.

Although some of the views advanced in that paper were afterwards abandoned, this recipe, with some modifications, has continued to give us satisfaction to this time.

In the following year, an article appeared in the same journal, extracted from the *London Medical Gazette*, in which the following formula of M. Mialhe was offered as more uniformly satisfactory.

Take of Finely powdered nitrate of potash	40	parts	(by weight).
Sulphuric acid . . .	60	"	"
Carded cotton . . .	2	"	"

Mix the nitre with the sulphuric acid, in a porcelain vessel, then add the cotton, and agitate the mass for three minutes, by the aid of two glass rods; wash the cotton, without first pressing it, in a large quantity of water, and, when all the acidity is removed (indicated by litmus-paper), press it firmly in a cloth; pull it out into a loose mass, and dry it in a stove at a moderate heat.

The compound thus obtained, says M. Malgaigne, is not pure fulminating cotton; it always retains a small quantity of sulphuric acid, is less inflammable than gun-cotton, and it leaves a carbonaceous residue after explosion. It has, however, in a remarkable degree, the property of solubility in ether, especially when mixed with a little alcohol, and it forms therewith a very adhesive solution, to which the name of collodion has been applied.

The proportions of ether and prepared cotton directed for the preparation of collodion in this recipe, were, I think inadvertently wrong.

In the same periodical, shortly after, appeared a notice from the *London Pharmaceutical Journal*, by J. B. Edwards, upon the modes of preparing collodion, in which he quotes M. Salmon, surgeon to Hôtel Dieu, of Chartres, who asserts that collodion may be easily prepared by dissolving gun-cotton, made with the mixed acids, in sulphuric ether, which mode he had always preferred, as less liable to variation from the inconstancy of the product than that of M. Mialhe; in the same paper, M. Soubeiran is quoted as follows:—

"I, like many others, have attempted to operate with a mixture of the monohydrated, nitric, and sulphuric acids. I have employed them sometimes with equal weights, at other times with equal volumes, and immersed the cotton for different periods from three

minutes to an hour, and I have never found it to dissolve in ether. I do not, however, contend that it is impossible to do so, but I must think the other a more certain method, though the employment of the mixed acids has the advantage of convenience over the other."

There can be little doubt that one or both of the acids used in these experiments were deficient in strength, as the experience of some other pharmaceutists is directly the reverse of that of this distinguished French authority. I quote from J. B. Edwards, the author of the paper referred to:—

"My own experience coincides with that of Mr. Salmon. I take equal volumes of strong sulphuric, and strong fuming nitric acids, mix them in a mortar or other convenient vessel, then immerse finely carded cotton in small portions, allowing each to remain about one minute; then plunging it into a large quantity of water, and teasing it out with a glass rod, so as to become as loose as possible, yellow fumes arise from the cotton, and are washed away, and it is then perfectly white. This is then well washed from acid and dried, and it then instantly and perfectly dissolves in commercial sulphuric ether, forming either a semi-solid jelly, or thick liquid, according to the quantity of ether added. This is the constant and uniform result of several experiments I have made. This cotton is also highly explosive, and leaves no carbonaceous residue when fired.

"The sources of fallacy I imagine are either from employing weak acids, too long immersion, or ether of high rectification. The latter should not contain water, but sufficient alcohol to reduce its specific gravity to about 760° or 770°. Its solvent action is then instantaneous."

Although this result is sometimes attained, it perhaps as often happens that the solution of the cotton is not so rapid as is here represented; and it has often happened that, when it seemed at first quite deficient, it has, upon standing, become sufficiently thick.

In continuation of his comments, the same writer observes:—

"I consider this process to be superior on many accounts to that of Mialhe. It is more readily prepared, and requires less washing than when entangled with sulphate of potash. It is explosive, and therefore answers both purposes. I have dissolved some with equal readiness, that has been thus prepared more than a month, so that it may be convenient to keep the cotton prepared, and dissolve small quantities as frequently as required, and thus obviate the loss by vaporization, which ensues on keeping a stock of the solution prepared."

In the fourth number of the *Journal*, for 1849, I published the result of further experiments, upon the new adhesive solution, from which I copy the following modified formula, which is recommended over that of Mialhe, as allowing the preparation of a much

larger quantity at one time, and with far less trouble; as avoiding the exposure of the operator to corrosive acid fumes, while stirring the cotton with the semi-fluid mass, which, in the other case, makes it necessary to work either in a well-ventilated apartment, or in the open air; and as facilitating the washing of the product, which comes out from the mixed acids with no solid crystalline ingredient contaminating it, and may be purified with the utmost facility; for distinction, this may be marked—

Recipe No. 1.

Take of Fuming nitric acid, sp. gr. 1.48,	
Sulphuric acid, of each . .	four fluidounces.
Cleansed and bleached cotton .	half an ounce.
Ether	four pints.

Thoroughly saturate the cotton with the acids, previously mixed, and allowed to become cool; macerate for twelve hours; wash the nitrated cotton in a large quantity of water, dry it thoroughly by artificial heat, and dissolve it in ether.

The present officinal process, which is a modification of that of Mialhe, is here introduced—

Recipe No. 2. (*Officinal.*)

Take of Cotton, freed from impurities, and finely carded	half an ounce.
Nitrate of potassa, thoroughly dried, and reduced to fine powder . .	ten ounces.
Sulphuric acid	eight fluidounces and a half.
Ether	two pints and a half.
Alcohol	a fluidounce.

Add the sulphuric acid to the nitrate of potassa in a wedgewood mortar, and triturate them until uniformly mixed; then add the cotton, and by means of the pestle and glass rod, imbue it thoroughly with the mixture for four minutes; transfer the cotton to a vessel containing water, and wash it in successive portions by agitation and pressure until the washings cease to have an acid taste, or to be precipitated on the addition of chloride of barium. Having separated the fibres by picking, dry the cotton with a gentle heat, dissolve it by agitation in the ether previously mixed with the alcohol, and strain.

Both these processes will yield collodion of excellent quality by observing the following precautions:—

1. The sulphuric acid employed in both formulæ must have been well preserved, or, if it has been long exposed to the air, should be boiled to free it from absorbed water. I have found a neglect of this precaution a fruitful source of failure. The officinal acid 1.84, is fully as strong as necessary.

2. The nitric acid employed in No. 1, must be free from muriatic, a common impurity; it must be of the specific gravity named, or not less than 1.45. The fuming variety is to be preferred. So also the nitrate of potassa, in No. 2, must be nearly free from chloride, which is commonly present in large proportion. Dupont's best granulated will answer well.

3. The materials and vessels employed in either case must be dry; the ether must not be hydrated. The presence of a small portion of alcohol in it facilitates the solution. The ether of the shops has about the requisite proportion.

4. In drying the prepared cotton, a diffused heat should be applied, and to thin layers only; otherwise, the part in contact with the heating surface will become dry before the rest; and if it reaches the requisite elevation of temperature, will endanger the whole. A complete mode of avoiding the common accident of explosion from drying is mentioned below.

5. Although the action of the mixed concentrated acids upon the lignin is immediate, as asserted in the quotation made on page 237, yet an advantage is gained by a long maceration in case of any deficiency in their strength, which is the reason for twelve hours being named in the recipe. If this delay is inconvenient, however, it would be well from time to time to remove a little of the macerating cotton into a test tube, and make trial of its solubility. I am not aware that any injury accrues to the prepared cotton from continued maceration in the acids, especially after they have spent themselves by the previous maceration.

It now remains to notice, in connection with the process of preparing soluble gun cotton, *the best mode of washing and drying it.* The cotton should be removed, when the reaction is complete, into a funnel or other suitable support, and the stream from a hydrant turned upon it; or, if this is not convenient, let it be thrown into a vessel of water, and teased out with two sticks or glass rods, so as to be thoroughly permeated by the water, then collected into a compact form, and the acidulated water decanted, to be renewed once or twice, or as often as necessary to purify the prepared cotton. This is now found to be white, tasteless, inodorous, and, if dried, harsh and almost crystalline in its texture. The object of drying is to free it from the water absorbed by it in washing; and here I have the satisfaction of noticing an elegant expedient suggested to me by the late W. W. D. Livermore, which is simply to drain off the water by pressure, and then to macerate the cotton a few minutes in alcohol, which, by its affinity for the water, rapidly extracts it, and then may be sufficiently separated by expression, as it is not incompatible with the ethereal solution, which, in fact, it improves.

Charles S. Rand published, in the *Journal of Pharmacy*, vol. xxi. p. 209, a paper in which the property noticed in collodion of contracting powerfully during evaporation, is referred to as unfitting it for certain important uses. On this he remarks:—

"At the request of those who had experienced these difficulties, I undertook a series of experiments with the view of producing a collodion possessing all the adhesiveness and transparency of the ordinary preparation, but deprived of the contractility. It would be needless to mention in detail all the experiments. The terebinthinates gave the most satisfactory results; a few trials sufficed to show that but a small quantity of resin or turpentine, dissolved in recently prepared collodion, would totally prevent contraction, and increase the adhesiveness of the preparation."

Rand's recipe is as follows:—

Take of Prepared cotton	℥ij.
Venice turpentine	℥ij.
Sulphuric ether	℥v.

Dissolve, first, the cotton in the ether; add the turpentine, and, by slight agitation, complete the solution. I have preferred Venice turpentine as the form least frequently contaminated by mechanical impurities.

The resulting collodion is thus described by C. S. Rand:—

"When applied to the skin, this preparation forms a perfectly smooth transparent pellicle, more difficult to remove than that of ordinary collodion. Being more pliable, it yields to the motion of the skin, and will not crack even after several days' application. It might be supposed that the turpentine would render it more irritating, but this is not the case, owing to the absence of that mechanical stimulus so powerfully displayed in the former solutions. The addition of two drachms of mastic to the above may be at times advisable, if the pellicle be required of great toughness and strength; but it dries more slowly, and remains opalescent longer than that containing Venice turpentine alone. This preparation is much more suitable for the purpose of a varnish than as an application to the skin. The label of a small vial was coated with it, and exposed thirty-six hours to the action of cold water, which was afterwards raised to the boiling point without any effect except a temporary destruction of transparency. Cold and boiling alcohol were alike powerless."

Properties.—Collodion is a clear, colorless liquid, of a syrupy consistence, and strong odor of ether, which, when applied to a dry surface, evaporates spontaneously, yielding a transparent pellicle without whiteness, possessed of remarkable adhesiveness and contractility, and quite impervious to moisture or to the action of any solvents, ether excepted.[1]

M. Malgaigne states, in his article already quoted, that "a piece of linen or cotton cloth covered with it, and made to adhere by evaporation to the palm of the hand, will support, after a few minutes, without giving way, a weight of from 20 to 30 lbs. Its adhesive power is so great that the cloth will commonly be torn

[1] Evaporated collodion, according to Löwig, is "extremely electric."

before it gives way." Collodion can rarely be regarded as a perfect solution of cotton; it often contains, suspended and floating in it, a quantity of vegetable fibre which has escaped the solvent action of the ether. The liquid portion may be separated from these fibres by decantation or straining, but it is doubtful whether this is an advantage. In the evaporation of the liquid, these undissolved fibres, by felting with each other, appear to give a greater degree of tenacity and resistance to the dried mass, without destroying its transparency.

Straining and expressing collodion are often necessary when it contains a large amount of undissolved fibre, which is generally the case with the last portions, in a bottle from which the clear liquid has been from time to time decanted; a slight precaution may save the operator a great deal of trouble and mortification from his hands becoming coated with it beyond remedy. When about to squeeze the strainer, or to thrust the hands into the liquid for any purpose, be careful to have a towel at hand, and instantly, on removing them, wipe them thoroughly dry before time is allowed for evaporation and the consequent deposit of the pellicle. This plan will be found effectual.

Mode of Preservation.—Collodion is one of those liquids which, owing to extreme volatility, it is objectionable to use from a large bottle, not only from the waste by evaporation every time the stopper is drawn, and the consequent inspissation of the liquid; but, also, from the explosive nature of the vapor of ether when it comes in contact with flame; it should, therefore, be put up in small vials, from which it may be used with economy and safety.

Formerly the apothecaries usually put it in ground stoppered vials, of one or two ounce capacity; but a great improvement has been made in the substitution for these of common cork-stoppered, one ounce vials.

Cork, by its elasticity, can be made to fit the neck of a vial more tightly than the best glass stopper, and is, therefore, less liable to be thrown out on an elevation of temperature of the contained volatile liquid.

Collodion is generally applied by the aid of a camel's-hair brush, but if one of these is allowed to dry, after being immersed in the liquid, it is apt to be too stiff to use again. To obviate this disadvantage, a contrivance, such as is shown in the accompanying figure, is resorted to; it consists of a long f℥j vial, with a cork stopper, which is perforated with the smallest cylinder of the cork borer, or with the rat-tail file (see Figs. 169 and 170, p. 220), and into this perforation a thin piece of wood with a turned cap about the diameter of the cork is tightly inserted; this plug of wood has the diameter of the quill of a camel's-hair brush of medium size, and it is long enough to project below the cork so that the quill will fit on to it

Fig. 177.

Collodion vial.

and be secure. The bottle being now nearly filled and the cork inserted, the brush will dip into the collodion, and, by constant immersion, will keep moist and always ready for use. For further particulars in regard to the application of this principle to the administration of medicines, the reader is referred to the chapter on Dispensing.

I have observed that where, from exposure, a part of the ether has evaporated, the addition of more ether will serve to redissolve the gelatinous residue, unless it has dried beyond a certain point, at which it becomes quite insoluble.

Uses of Collodion.—The principal application of this adhesive liquid is to ordinary superficial sores, as cuts and abrasions of the skin, and also to some skin diseases, where the indication is to protect the part from external irritating influences, and where violent itching is one of the most troublesome symptoms. Prof. Simpson, of Edinburgh, recommends it for sore nipples, which it completely protects without interfering with the sucking of the infant; for this purpose, it would seem that Rand's preparation would be best suited. It was first principally recommended for the application of bandages, and is used very much in France as a substitute for dextrin in permanent splints, which, by its use, may be applied over a less extended surface without diminishing the strength and permanence of the dressing.

In cases of burns, where the cuticle has been removed and the symptoms of acute pain allayed by suitable applications, collodion is capable of one of its most useful applications, though its contractility, besides the pain and sense of constriction which it induces, is also objectionable from occasioning a cracking of the pellicle and the irritation of the surface thus exposed.

By combining collodion with the ethereal tincture of chloride of iron, a compound is produced which is said to furnish a much more resisting and pliable, though a thinner pellicle, and one adapted to the treatment of erysipelas.

One of the uses of collodion in the arts should not be overlooked in this connection. In photography, it is used to form the delicate pellicle upon which images are reflected in the camera, for transference to the engraver's block. By this process many of the drawings throughout this work have been produced, accurately representing the originals.

The composition of collodion has excited much discussion, and some ingenious hypotheses. It is still very much in the dark. The discovery by Prof. Leidy, of this city, of a beautiful crystalline deposit in inspissated collodion, and a similar and independent observation in London, are among the most remarkable facts bearing upon the composition and chemical relations of the group of principles to which lignin belongs.

The announcement has been recently made that M. Reschamp, Pro-

fessor of the School of Pharmacy at Strasburg, has succeeded in reproducing cotton from pyroxyline, by heating it at the temperature of 212° with a concentrated solution of proto-chloride of iron. The chloride deepens in color, and very soon there is a disengagement of pure nitric oxide. When this has ceased, and the cotton has been washed with hydrochloric acid, to remove the peroxide of iron impregnating it, the cotton is found to have lost the properties of pyroxyline. In the same way, amidon has been produced from xyloidin.

By the distillation of the purer kinds of wood in close vessels, a variety of interesting compounds are produced, which are useful in the arts and in medicine. Of these, charcoal (carbo ligni, *U. S.*), acetic acid (acidum aceticum, *U. S.*), and pyroacetic, and pyroxilic spirit, and creasote (creasotum, *U. S.*), may be mentioned as of special interest to the physician, and a short notice of each is appended.

Carbo Ligni and Carbo Animalis, *U. S.*

The former of these two kinds of charcoal is used in medicine, while the latter is most employed in chemical processes as a decolorizing agent.

Willow charcoal, the variety most used in medicine, is chiefly obtained from the manufacturers of gunpowder, who devote much attention to the production of a pure and fine powdered article. I recently met with a beautiful specimen of wood charcoal, in the unpowdered form, at the Philadelphia Gas Works, where it was collected as a residuary product from the manufacture of illuminating gas from wood.

Charcoal is wholly insoluble, tasteless, and inodorous; it contains a small portion of the incombustible saline materials of the wood, from which it may be freed by digestion in diluted muriatic acid, although this precaution is never necessary as a preparation for medicinal use.

The dose of powdered charcoal as an absorbent antiseptic, is about a teaspoonful or less; as an aperient, a tablespoonful, or somewhat less, mixed with magnesia.

Animal charcoal, or *bone-black*, is made from bones by calcination, and, besides carbon, contains phosphate and carbonate of lime in abundance; these important constituents have much to do with the peculiar porosity which gives to this substance the power of absorbing coloring matter and gases, and adapts it for the various uses in the arts and in pharmaceutical chemistry to which it is applied. It is not very convenient to use in fine powder, and is hence generally prepared in a granular condition.

Carbo animalis purificatus, U. S., is among the preparations designed to be made by the apothecary. It is prepared by digesting a pound of animal charcoal with a pound each of muriatic acid and

water, for two days at a moderate heat, pouring off the liquid and washing the charcoal thoroughly with water.

This is adapted to many uses to which the unpurified powder would be unsuited, owing to its saline ingredients.

In the preparation of the alkaloids, gallic acid and numerous other chemical substances, animal charcoal is used to absorb the associated coloring matters; but it should not be forgotten that the same property which adapts it to take up the coloring matter also occasions, to some extent, the absorption of the alkaloid or other principle, so that the loss by the decolorizing process is considerable, unless means are resorted to for the subsequent extraction of the absorbed portions.

To this absorbent property animal charcoal owes its utility as an antidote to the powerful vegetable poisons, which, as proved by Dr. B. H. Rand, may be rendered innoxious in their effects by a large admixture of this inert but porous powder.

Acidum Aceticum, *U. S.*

The acid liquid distilled over when charcoal is prepared from wood, in close cylinders without access of air, contains this valuable acid in a very impure state. By subjecting this to further distillation, the liquid is collected which is known as wood vinegar, or pyroligneous acid. By saturating this acid with lime, acetate of lime is produced, which, by decomposition with sulphate of soda, furnishes sulphate of lime and acetate of soda; the latter salt being crystallized in a state of purity, yields, by distillation with sulphuric acid, pure hydrated acetic acid in solution in water.

This is directed in the *Pharmacopœia* to have a specific gravity of 1.041, which, however, is a less satisfactory assurance of its strength than its saturating power, which, as before stated under *Aceta*, is such that 100 grains saturate 60 of crystallized bicarbonate of potassa, and contain 36 grains of monohydrated acid.

Acetic acid is also produced by the oxidation of alcoholic liquids, especially cider and wine, and in this impure and diluted form is called vinegar; in chemical works it is generally classed among the derivatives of alcohol.

Much of the vinegar of commerce is largely adulterated or sophisticated, although, according to the experiments of W. W. D. Livermore, the use of sulphuric acid is less common than has been supposed. Of sixteen specimens of commercial vinegar obtained from different sources, none were adulterated with sulphuric acid. Tested for malic acid, gum, and extractive matter, believed to be always present in cider vinegar, all but two gave evidence of containing one or more of these products by throwing down a precipitate with subacetate of lead, soluble in nitric acid.

The strength of the different specimens was ascertained by him

as follows. The numbers represent the number of grains of bicarbonate of potassa saturating 100 grains of vinegar:—

No.	1	9 grains.
"	2	4 "
"	3	8 "
"	4	$4\frac{4}{10}$ "
"	5	6 "
"	7	8 "
"	8	$8\frac{7}{10}$ "
"	9	6 "
"	10	4 "
"	11	$5\frac{6}{10}$ "
"	12	8 "
"	13	$8\frac{4}{10}$ "
"	14	$5\frac{6}{10}$ "
"	15	$8\frac{8}{10}$ "
"	16	$7\frac{8}{10}$ "

The normal saturating power is about $7\frac{1}{2}$ grains of the bicarbonate to 100 grains of vinegar.

Acetone, or Pyroacetic Spirit, C_3H_3O, and Pyroxylic Spirit, or Wood Naphtha, $C_2H_4O_2$.

These are products of the distillation of wood, which are separated from the acid liquors, after they are saturated with lime, by simple distillation and rectification.

They are both colorless, or slightly yellow, inflammable, volatile, pungent liquids, closely resembling each other in sensible and medical properties, and generally confounded with each other in commerce; they may be known apart by their reactions with chloride of calcium.

While pyroacetic spirit does not dissolve or mix with a saturated solution of the chloride, pyroxylic spirit instantly mixes when dropped into it.

The normal specific gravity of each is about the same, .792 to .798; but, as found in commerce, they oftener reach .820 to .846.

These remedial agents are sometimes prescribed, though not so much as formerly, in connection with cough medicines. Dose, about 10 to 40 drops.

Creasotum, *U. S.*, $C_{14}H_8O_2$. (?)

This is a secondary empyreumatic product of the destructive distillation of wood, which is obtained by the distillation of tar.

Pure creasote is colorless and transparent, having a high refractive power and oleaginous consistence. Its odor, when diffused, is smoky, its taste burning and caustic; its specific gravity is from 1.037 to 1.06. It is freely soluble in alcohol, ether, acetic acid, caustic potash, and in water to the extent of six or ten drops to the ounce.

Its most important property is that of coagulating albumen,

which renders it powerfully antiseptic and caustic. Placed in contact with a suppurating surface, it whitens the cuticle and destroys it like nitrate of silver.

Its principal use internally is in the form of creasote water, to check nausea. For this purpose, about two drops may be dissolved in an ounce of water, and a little gum and sugar added; dose, a tablespoonful (equal to one drop), and frequently repeated.

Dropped upon a fragment of cotton, after dilution with alcohol, ether, or chloroform, and inserted into the cavity of a tooth, it relieves toothache when the pain is occasioned by the exposure of the nerve, and is popularly regarded as the most certain remedy.

From very frequent experiment and practice, I believe that any of the highly pungent essential oils, as of cloves and cinnamon, are equally efficient, while tannic acid and chloroform, which are much less offensive, are nearly always successful. Very painful and distressing accidents are liable to occur from attempting to drop any of these liquids into the cavity of a tooth from a vial.

As an external caustic, creasote may be applied, undiluted, with a camel's-hair pencil; but for other purposes it is usually prepared in the form of ointment (unguentum creasoti, *U. S.*), or in solution in water. In hemorrhages, it acts as a most efficient styptic, and is successfully applied in solution, in the proportion of about six drops to the ounce of water.

Creasote is one of the remedies which the apothecary is most frequently called upon to prescribe and apply. Large quantities are also consumed by dentists.

The article now generally sold as creasote is quite different from what was formerly met with under that name. It is imported from Germany, and is much cheaper than the old kind, which came from England, and was obtained from wood tar as above. The present article, which is remarkable for readily assuming a brown color on exposure to the light and air, is chemically a hydrated oxide of phenyle, or carbolic acid, $C_{12}H_5O$, and is prepared from coal tar. It has a specific gravity of 1.062, and boils at 386°. A slip of pine wood dipped first into this and then into hydrochloric acid becomes blue, which is not the case with the true wood-tar creasote. In an article on this subject, in the *New York Journal of Pharmacy*, Oct., 1853, Professor Edward N. Kent has given a method of manufacture and purification which has proved successful in his hands, and expresses the opinion that carbolic acid is creasote in a purer form than that obtained from wood tar. It is certainly less disagreeable for use.

CHAPTER II.

ON FARINACEOUS, MUCILAGINOUS, AND SACCHARINE PRINCIPLES.

STARCH, $C_{24}H_{20}O_{20}$, having the same composition as lignin, differs from it widely in physical properties; it exists in various parts of plants, especially in seeds, tubers, and bulbous roots, in minute cells, which may be distinguished by a microscope of moderate power. The size and shape of these have been made special subjects of investigation by pharmacologists, and their study has been found to aid in the recognition of the different varieties of fecula. The envelop of these starch granules is insoluble in cold water, but is ruptured by the application of heat, so that the contents are exposed and become dissolved. Hence, starch is said to be insoluble in *cold*, but soluble in *hot* water. By heat, starch is converted into dextrin, a soluble form having the same composition. This object is also attained, as in the case of lignin, by the action of dilute acids, which also ultimately convert it into *grape sugar*. One of the most striking characteristics of starch is its reaction in cold solution with iodine, with which it forms a rich blue colored iodide, which loses its color by heat. These two substances thus become tests for each other. With bromine it produces an orange-colored precipitate.

Fig. 178.

Starch granules as seen under a microscope.

Lichenin from cetraria, *carrageenin* from chondrus, *inulin* from inula helena, and other sources, are closely allied to starch, but are distinguished from it and from each other by physical peculiarities, and by the fact that while lichenin turns blue with iodine, inulin becomes yellow or brownish with that test, and carrageenin is not affected by it, though differing from gum in solubility and in certain chemical relations.

Gums differ from starch chiefly in the absence of the granular condition, and in their consequent partial or complete solubility in cold water. They are obtained from certain plants in amorphous masses, mostly exuding spontaneously or upon a puncture of the bark. A solution of gum is not affected by iodine, but the most common varieties are precipitated in a very insoluble form by subacetate of lead, 2PbO,Ac. A solution of gum is also precipitated by alcohol.

The different varieties of gum are as follows:—

Arabin, $C_{24}H_{22}O_{22}$, derived largely from the acacias; it is extremely soluble in water, forming a clear and colorless though viscid solution, almost free from taste. It may be considered the type of the class, and exists nearly free from impurities in the finer qualities of gum Arabic.

Bassorin, $C_{24}H_{20}O_{20}$, is an insoluble variety, swelling with water and dissolving in alkalies. This predominates in gum tragacanth.

Pectin, $C_{64}H_{43}O_{64}$, the jelly of fruits, is somewhat analogous to bassorin; it is tasteless, dries into a transparent mass, soluble in water. It exists in the currant and various berries and fruits, and largely in the roots of carrots. The gelatinous consistence of currant and other vegetable jellies is due to this principle.

Cerasin, or cherry-tree gum, much resembles the last.

Mucilage, which exists in the mallows, in flaxseed, and in salep, is soluble, but forms a less clear solution than Arabin; it is distinguished chemically by being precipitated by neutral acetate of lead, PbO,Ac.

Mezquite is a name proposed for a gum, to which attention has been called by Dr. Geo. Shumard, produced abundantly in Texas and New Mexico—parts of our own country as yet but little explored; it is extremely soluble, and differs from Arabin principally in not being precipitated by 2PbOAc.

Sugar is of several kinds, which are closely allied to each other and to the foregoing ternary principles in composition. They are distinguished by a sweet taste, and a more or less distinctly crystalline form. They are mostly soluble in water and somewhat soluble in alcohol.

The following table exhibits the composition, sources, and properties of the different varieties:—

Cane Sugar	Crystallized, $C_{24}H_{22}O_{22}$ Combined, $C_{24}H_{18}O_{18}$	Derived from sugar cane, the beet, and sugar maple. In crystals, it is rock candy.
Caramel, $C_{24}H_{18}O_{18}$, deep brown coloring matter produced by heating cane sugar.		
Grape Sugar, or Glucose	Crystallized, $C_{24}H_{23}O_{28}$ Combined, $C_{24}H_{21}O_{21}$	Exists in fruits, less sweet, and less soluble, in warty masses, precipitates CuO from solution in KO.
Milk Sugar, or Lactin	Crystallized, $C_{24}H_{24}O_{24}$ Combined, $C_{24}H_{19}O_{19}$	By evaporating whey; rather insoluble; very hard; not very sweet; not easily fermentable.
Glycyrrhizin, from liquorice; not fermentable; not crystallizable.		
Mannite, $C_6H_7O_6$, from manna; not fermentable; soluble; very sweet; not cathartic.		
Sugar from ergot, $C_{24}H_{26}O_{26}$; not practically important.		

Grape sugar is a variety produced in grapes and in different fruits; it is readily obtainable from old and inferior raisins, on which it is collected as a white powder. It is also deposited by honey, from which it may be obtained in considerable quantities by straining off the uncrystallizable sugar. It abounds in apples,

pears, currants, gooseberries, &c. It constitutes also the sugar of diabetes. The most economical method of obtaining it is by acting on starch or lignin with sulphuric acid.

Sugar of milk is not manufactured in this country, but is said to be chiefly imported from Switzerland, where it is made on a large scale from whey; it is crystallized upon sticks or strings in masses not unlike stalactites in appearance. The greatest consumption of this is by the homœopathists, who use it as a vehicle for almost all their medicines in the form of powders and pillets. It is said by them to have the least action upon the system of any substance they have experimented with; and hence its employment as a diluent for the infinitesimal doses, which, according to their theory, are increasingly powerful in proportion to their dilution. Its physical condition of hardness or resistance to mechanical action adapts it to develop the latent efficiency of those medicines which they assert are only rendered active by long attrition. Recently, powdered sugar of milk has come into use in regular practice, as a food for infants in teething, less apt to produce acidity than cane sugar.

As already stated, by the action of diluted acids upon lignin and starch, they are converted into a soluble form called dextrin, and ultimately pass into grape sugar; this change may be produced by long boiling alone; it is also produced in starch by nitrogenized ferments, especially by that peculiar substance known as diastase. By the same means, cane sugar is spontaneously converted into grape sugar, and this into alcohol, and ultimately into acetic acid; and, in fact, the alcoholic and acetic liquors of commerce are produced in this way from the various starchy and saccharine vegetable products used in their manufacture.

List of the Principal Farinaceous, Mucilaginous, and Saccharine Medicines.

Fecula in its Various Forms.

Amylum, *U. S.*, starch. Fecula of the seeds of triticum vulgare.
Canna, tous les mois. Fecula of the root of an undetermined species.
Maranta, *U. S.*, arrowroot. Fecula of the rhizoma of M. arundinacea.
Sago, *U. S.* The prepared fecula of the pith of sagus rumphii.
Florida arrowroot. Fecula of Zamia integrifolia.
Tapioca, *U. S.* The fecula of the root of the janipha manihot.

Gums in their Various Forms.

Acacia, *U. S.* Concrete juice of A. vera and other species.
Mezquite gum. Concrete juice of prosopis dulcis. (?)
Salep. Root of several species of orchis.
Tragacantha, *U. S.* Concrete juice of astragalus verus.

Sugars in their Various Forms.

Saccharum, *U. S.* Refined sugar of saccharum officinarum.
Saccharum candium, rock candy. Crystallized sugar.
Lactin, sugar of milk. Obtained from whey.
Treacle, molasses. Impure uncrystallizable sugar in liquid form.

Mel, *U. S.*, honey. A liquid prepared by apis mellifica.
Manna, *U. S.* Concrete juice of ornus Europæa.
Extractum glycyrrhizæ, *U. S.* Impure extract of glycyrrhiza glabra.

Other Drugs grouped as Starchy, Mucilaginous, and Saccharine.

Althææ radix, marshmallow root. Contains starch, mucilage, asparagin.
" flores, " " flowers. " " " "
Avenæ farina, *U. S.*, oatmeal. Meal of avena sativa. Contains the hulls.
Buchu, *U. S.*, leaves of barosma crenata, &c. Contain mucilage and ess. oil.
Carota, *U. S.* The fruit is officinal, but it is the root that contains pectin.
Cetraria, *U. S.*, Iceland moss. Contains lichenin and a bitter principle.
Chondrus, *U. S.*, carrageen, chondrus crispus. Contains carrageenin, pectin.
Cydonium, *U. S.*, quince seeds. Seeds of cydonia vulgaris; mucilaginous.
Ficus, *U. S.*, the fig. Dried fruit of ficus carica. Sugar; laxative.
Glycyrrhiza, *U. S.*, root of glycyrrhiza glabra. Peculiar sugar, glycyrrhizin.
Hordeum, *U. S.*, barley. Decorticated seeds of H. distichon; farinaceous.
Inula, *U. S.*, elecampane. Root of inula helena; inulin.
Iris florentina, *U. S.*, orrisroot. Starchy rhizome.
Lappa, *U. S.*, burdock. Root of lappa minor. Contains inulin.
Linum, *U. S.*, flaxseed. Seeds of linum usitatissimum; mucilage, with fixed oil.
Oryza sativa, rice. The seed deprived of hulls; farinaceous.
Papaver, *U. S.*, poppyheads. Ripe capsules of papaver somniferum; mucilaginous.
Prunum, *U. S.*, prunes. Dried fruit of prunus domestica; laxative principle.
Sassafras medulla, *U. S.* Pith of sassafras officinale; rich in mucilage.
Sesami folia, *U. S.*, benne. Leaves of sesamum indicum and orientale; mucilaginous.
Symphytum officinale, comfrey. Root rich in mucilage.
Ulmus, *U. S.*, elm bark. The interior bark of ulmus fulva; highly mucilaginous.
Uva passa, *U. S.*, raisins. Dried fruit of vitis vinifera; contain grape sugar.

The *starch group* contains, besides the starches, all the cereal grains, which owe their immense utility as articles of food to the presence of starch mingled with a due proportion of a nitrogenized principle, gluten. In many drugs, starch exists to an extent which interferes with their convenient preparation for use in medicine, while it is an important element in certain demulcent and nutritious articles used in medicine, as food for infants, &c.

Amylum, or *wheat starch*, is not adapted to internal use.

Arrowroot and *canna root* are the best forms of pure starch for infants; the latter has lately almost ceased to be brought into our market.

The commercial varieties of arrowroot used in this country, are Bermuda, which commands the highest price, Jamaica, Liberia, Florida, and Georgia arrowroot; these all appear to possess the same wholesome and nutritive properties, provided they are well prepared and well preserved. There are few articles more liable to deteriorate by improper modes of preservation than this; a musty taste is imparted to it by exposure to moisture, and it readily acquires the odor of drugs with which it is placed in contact. It should be kept in glass bottles or tin cans.

Arrowroot is an important diet for young children. When fresh and pure, it forms one of the most wholesome and nutritious arti-

cles of food in the dietetic category. Great care is necessary in its preparation, and the reader is referred for instructions upon the subject to the article on diet for the sick.

Corn fecula has lately been introduced, and largely manufactured in this country. It is made from maize, and is an admirable substitute for arrowroot for table use (though not as food for infants), being much cheaper, and equally free from unpleasant odor and taste.

Sago and *tapioca*, owing to their mode of preparation, are more soluble, having properties somewhat resembling those of tragacanth. Their physical condition seems to diminish the tendency to become musty, which is so common a difficulty with arrowroot, while their preparations are better adapted to the taste of adults generally, than the more fluid arrowroot pap.

Of the materials used as food, which owe their utility to containing starch, I need only refer to such as are commonly prescribed in the sick-room, and only such are mentioned in the syllabus.

Reference has been already made to *barley*, and the mode of its preparation, as given in the *Pharmacopœia*, is mentioned under the class Decocta. *Barley flour* is a fine preparation of this.

Rice is a very bland and nutritious farinaceous seed, which, like barley, comes into commerce decorticated, ready to be prepared by boiling. Several of its preparations are mentioned with the recipes inserted under the head of diet for the sick; these are nutritive, demulcent, and somewhat astringent in their effect upon the bowels. Rice, by long boiling in water, becomes nearly dissolved, forming a jelly, which is one of its most useful forms of administration in disease.

Oatmeal is distinguished from either of the above in powder by containing the husk ground with the seed. Unlike the foregoing, it is adapted to relieve constipation. It is easily digested, and exceedingly nutritive. Oatmeal is given to infants when there is no tendency to diarrhœa, and very generally to females after parturition.

Orrisroot, in powder, is much used by ladies as an infant and toilet powder, for which it is adapted by its whiteness and delicate though persistent odor. Its use in dentifrice powders is well known.

The Mucilaginous or Gummy Group.—Gum is associated in some plants with resin; and gum resins, a remarkably natural class of drugs, will be hereafter referred to in treating of resins.

Variously associated with other proximate principles, gum is present in a great variety of vegetables; like starch, it plays an important part in the physiology of the plant, and enters as an element into a great number of articles, both of food and medicine. In its important relations to the art of prescribing and compounding medicines, we shall have occasion to refer to it frequently

throughout the subsequent parts of the work, and now introduce it only for the purpose of calling attention to a few medicines, into which it enters in some of its modified forms.

Salep and *tragacanth* are modified gums which seem adapted to nutritious combinations, and enter into Castillon's powders, introduced among articles of diet. Tragacanth is much used for making paste for common adhesive purposes.

The chief use of *carrageen* in medicine has been adverted to under the head of compound syrup of carrageen, but it remains to refer to it as furnishing a most agreeable article of diet, known as *blanc mange*, for which a recipe is given under the appropriate head. The only difficulty in making agreeable preparations of carragcen arises from its salt-water taste, which may be removed by long soaking in water previous to subjecting it to preparation.

Iceland moss contains a bitter principle, adapting it to use as a tonic demulcent.

Elecampane, *burdock*, and *comfrey*, and the root and flowers of *marshmallow*, enter into a variety of domestic expectorant remedies.

Flaxseed contains, with its mucilaginous ingredient, a large amount of fixed oil; under the head of Infusions, the well-known demulcent drink called flaxseed tea is introduced. Infusion of *sassafras pith* is mentioned in the same syllabus; its chief use is as a bland application to inflamed eyes. Coarsely-powdered *elm bark* and flaxseed are much used as poultices or cataplasms. *Poppyheads*, beaten into a mass, are adapted to the same uses.

The well-known fact that flaxseed meal, particularly that abounding in oil, becomes very acid by age, is well accounted for by M. Pelouze, who finds that whenever a seed containing an oil is crushed so as to break up the cells, and to bring the oil in contact with the associated ferments, acidification almost immediately commences, and goes on till frequently the whole of the oil is decomposed with the liberation of its appropriate oil acid.

The kind of powder called cake meal, which is made from the flaxseed cake after the expression of the oil, and so much used for feeding cattle, is preferred to ordinary flaxseed meal for making poultices in the Pennsylvania Hospital, where great quantities are consumed for that purpose. The cake meal forms a firmer poultice, and one less liable to adhere to the skin than the more oily material which is usually sold in the shops and preferred by many practitioners as more emollient. Dr. R. P. Thomas informs me that he finds the use of one-third bran with the latter kind is an improvement.

In *buchu* and *carrot*, mucilage is associated with an essential oil which adapts these drugs to use as diuretics.

Quince seeds are much used for making bandoline for the hair, a preparation which is made extensively by the perfumers. The consistence of its mucilage, and its property of continuing moist for a long time, adapt it to this use.

The *sesamum*, or *benne plant*, grows readily in gardens in our climate, and might be generally introduced with advantage. The seed yields a bland fixed oil.

Benne leaves have been quite popular for several years as an excellent demulcent and nutritive article for infants, prostrated by the so-called summer complaint, which is so fatal to this class in our large cities; the mucilaginous principle they contain is readily dissolved out by macerating a leaf in a glass of water for a few minutes. The dried leaf furnishes a much less agreeable mucilage than the fresh.

The Saccharine Group.—Of the forms of sugar mentioned in the syllabus, each has its appropriate uses. The abundance and cheapness of pure white cane sugar is one of the greatest blessings secured to the race by the well-directed scientific efforts of the last half century. Its chief physical characteristics, which are sufficiently familiar, have been brought into view in the chapter on Syrups.

Cane sugar is much used in pharmacy as a preservative of vegetable preparations, and to prevent some delicate metallic salts from oxidation. It is highly nutritious, and enters largely into most natural and prepared articles of vegetable food.

Preparation.—The juice of the cane is extracted by pressure between iron rollers, after which it is collected and boiled with quicklime, strained, and reduced by evaporation to a thick syrup, when the whole is cooled and granulated in shallow vessels; it is now raw sugar of commerce. By purification or refining, which is accomplished by the aid of animal charcoal, it is obtained as loaf, or more commonly as broken-down or crushed sugar—the condition in which it is mostly preferred for use in pharmacy.

In the granulation of raw sugar, the uncrystallizable portion which remains is drawn off and constitutes molasses of commerce. Molasses, by careful manipulation, is made to yield a further portion of sugar, and thus constitutes sugar-house molasses, or, as it is called abroad, treacle.

Rock candy is a very pure and pleasant form of cane sugar, prepared by crystallizing it slowly upon a string from a strong solution; it is preferred for coughs from the slowness with which it dissolves in the mouth, and is very generally used to sweeten mucilaginous and acid drinks used in catarrhs.

The peculiar brown coloring matter called *caramel*, which is identical in composition with cane sugar when in combination, is produced by heating that substance to a temperature at which it loses four equivalents of the elements of water, and becomes quite altered in its properties; it is freely soluble in water, and has a bitter and not disagreeable empyreumatic taste. It is much used to color liquors, as in the fabrication of brandy, and is a useful addition to soups; as this substance is not without practical importance, and is

little known to pharmaceutists, I append a formula which I have found to answer very well for its preparation—

Take of Sugar	1 pound.
Tartaric acid	1 drachm.

Mix them in a porcelain capsule, and apply a gradually increasing heat till the sugar melts and burns a little, and the whole assumes a dark brown color, then add water.

Honey is a mixture of uncrystallizable and grape sugar; by long standing, the latter constituent is apt to be deposited in a granular form; it also generally contains a volatile odorous principle and wax. Honey is a favorite remedy in sore throat, which it will often cure when used singly; it is very commonly associated with astringents in gargles. Many persons find honey to produce flatulence and diarrhœa to an extent that forbids its use as an article of diet, while others thrive upon it. As a domestic remedy, it is used for irritable conditions of the mucous surfaces. It may not be generally known that the honey so extensively sold in the cities in tin cans holding a quart or more, and in bottles of somewhat less capacity, by the druggists and grocers, is a factitious article made on a large scale from Havana sugar; this fact, which has only recently come to light, will surprise many who have been favorably impressed with the article as remarkably pure and agreeable honey.

Genuine honey is quite apt to be very impure, and to require clarifying. This is accomplished by heating it in a suitable vessel to a very moderate degree, and maintaining the temperature till it ceases to separate a scum, which is to be skimmed off as it rises to the surface.

Manna is an impure form of sugar, which is universally known as a mild cathartic, or rather laxative, adapted particularly to infants, and much associated with senna in a popular form of cathartic infusion. The peculiar sugar it contains when separated in a pure form is remarkable for not being liable to ferment.

Liquorice root, and the extract prepared from it, and known in commerce as liquorice ball, or Spanish juice, are drugs used exclusively for their saccharine principles; the latter is so impure as to be well substituted by an extract for which two formulas are given under the head of Extracts.

Raisins are used almost exclusively for their sugar, while *prunes* and *figs*, although the former contains a vegetable acid, and both, perhaps, purgative principles, seem well associated with the saccharine group.

CHAPTER III.

THE PROTEIN AND SIMILAR PRINCIPLES.

Albumen, *fibrin*, and *legumin*, or *casein*, are, like the fixed oils and fats, common to vegetable and animal bodies. They contain nitrogen, and, according to some, consist of a hypothetical radical, protein, $C_{40}H_{31}N_5O_{12}$, with varying proportions of sulphur and phosphorus. Whether this view, which has been disputed, be true or not, it affords a convenient grouping under which to arrange them, and the present chapter will be devoted to presenting these, with *gelatin*, which is naturally associated with them, in some of their medical and pharmaceutical relations.

Albumen, in its natural condition, is soluble in cold water, but coagulable at a temperature of about 160° F.; it is abundant in many vegetable juices, as those of the fleshy narcotic plants. It is seen separating as a flocculent precipitate from the cold infusions or tinctures of senega, ipecac, and other medicinal roots, on submitting them to the action of heat. In the animal organism, it is a large constituent; like the other quaternary organic substances, it is prone to putrefy and to produce fermentation in starchy and saccharine preparations, and, on that account, its removal is provided for in a number of the formula for permanent preparations given throughout this work. There seems a close connection between the green coloring matter of plants, chlorophylle, and this coagulable principle, so that the green color is readily separated from vegetable juices by heating and straining them. Albumen is coagulated by corrosive sublimate, creasote, alcohol, and most acids. Analogous to albumen, are the principles named emulsin and myrocyn, existing respectively in bitter almonds and in black mustard-seed, and which, by their reaction with amygdalin, a neutral crystallizable principle in almonds, and a peculiar sulphuretted principle in black mustard, form important and interesting essential oils.

Fibrin exists in vegetable juices, and is apt to separate as a slight coagulum by standing. It is a large constituent of gluten, the nutricious principle associated with starch in wheat flour. It is insoluble in water, and is the chief constituent of lean meat.

Casein, or legumin, is found most abundantly in peas, beans, &c. It is not coagulable by heat, which, however, causes a scum on the surface of solutions containing it. It is coagulable by acids, even very dilute. Casein exists largely in milk, and separates as a curd on the formation of lactic acid by the fermentation of its associated saccharine principles.

These compounds are of great interest in a physiological point of view, as existing, according to some, in all really nutritious food, whether animal or vegetable; as they are found much more largely in animal than in vegetable organisms, they are most conveniently considered in their practical relations in connection with some of the more familiar articles of animal food.

Ovum, U. S. *The Egg of Phasianus Gallus.* (*Common Dunghill Fowl.*)

Eggs are well known to consist of three parts: ovi albumen, the white; ovi vitellus, the yolk or yelk; and ovi testa, the shell.

The *white of egg* consists of nearly pure albumen and water; it comprises about 60 per cent. of the whole. It is very coagulable, forming a firm, rather tough mass upon long boiling. The completely coagulated albumen of eggs is considered rather indigestible. Three minutes immersion of the egg in boiling water is sufficient to bring it to a proper condition intermediate between its natural glairy consistence and a tough coagulum.

The *yelk* contains a yellow oil suspended in water by the aid of albumen; it is inclosed in a sac, and comprises about 29 per cent. of the whole egg. By heat, it is coagulated and dried into a granular solid, from which the fixed oil may be obtained by expression.

The *shell*, or *testa*, consists of carbonate of lime so intimately mingled with animal matter that the inorganic particles are thoroughly isolated. Powdered and levigated, they are more acceptable to delicate stomachs than other forms of the carbonate.

Eggs, owing to their universal diffusion as common articles of food, are available for emergencies in which albumen is needed in medicine, or especially as an antidote for poisons. The white of egg is the antidote usually prescribed for corrosive sublimate and sulphate of copper, with which it combines, and it is useful in all cases of poisoning by corrosive or acrid poisons. The yelk is adapted to a similar use by its demulcent and sheathing properties. In suspending oily matters, both parts are used, the yelk being perhaps the best, although the white is recommended, by absence of color; for most purposes, there is no objection to mixing them. The use of white of eggs to clarify syrups has been spoken of under that head. Some modes of preparing eggs for use in convalescence are introduced among the articles of diet.

[Eggs are often desired by the sick and convalescent, and are sometimes allowable. There are one or two forms of acute disease in which they may sometimes be used with advantage. In cholera infantum, the stomach being irritable and the digestive process exceedingly imperfect, the yelk of an egg that has been boiled till it is dry (say fifteen minutes or more), and reduced to a fine powder, may be readily appropriated by the infant without aggravating the intestinal irritation, care being taken to administer it in divided portions. In those cases of dysentery of a low type, which fre-

quently occur in malarial districts, where the patient is visited with fearful prostration, and the demand for support is imperative, and the stomach rejects the ordinary nutriment, the cessation of vomiting and nausea may be brought about by the administration of the yelk of an uncooked egg, taken in an unbroken state from the shell and dipped in a wineglass containing a little iced water or brandy and water.—J. P.]

No article of the Materia Medica could be classed as *fibrinous*. Fibrin is, however, especially interesting to the physician from its existence in a liquid form in the blood, while it forms also a solid element of muscular fibre. By long-continued boiling, fibrin becomes partly dissolved, and is hence present in most soups. As a constituent of the various cereal grains and of animal flesh, it enters largely into the food of the human race. Farinaceous materials containing gluten serve a good purpose as antidotes to acrid poisons.

Lac. Lac Vaccinum. (*Cow's Milk.*)

This contains casein, which, in common language, is known as curd; an oily ingredient, butter; lactin, or sugar of milk, of which mention has already been made, and which is, in solution in water, called the serum of milk; and alkaline and earthy salts.

Milk is a very complex body. By examination under the microscope, the oily ingredient, in exceedingly minute globules, is seen floating in the serous-looking white fluid; being lighter than the liquor in which they are suspended, these rise to the surface by standing, carrying with them some casein and whey, and forming *cream*. The quantity of cream varies from 5 to 23 per cent. by measure; the milk from which cream is separated is called skimmed milk. The *lactometer* is an apparatus for telling the specific gravity of milk, which, although it varies considerably, should reach about 1.030. Skimmed milk is, however, a little heavier, say 1.0348, so that it will bear dilution with a little water to bring it to the normal specific gravity. The absence of the cream is, however, so easily detected by the blue tinge of color, and want of the characteristic rich taste, that this variation in the instrument is of little account. The specific gravity is not given on the instrument, but the degree of dilution, which, of course, is only approximative. The microscope forms the best test for the purity and richness of milk, showing the proportion of the oil globules.

Solidified milk having recently been extensively introduced to public notice, the following account of its mode of preparation and uses is extracted from the *American Medical Monthly*, by whose editor it was written, after a visit to the extensive manufactory and pasture lands attached, in the State of New York, where it is made:—

"To 112 lbs. of milk, 28 lbs. of Stuart's white sugar were added, and a trivial proportion of bicarbonate of soda, a teaspoonful, merely enough to insure the neutralizing of any acidity, which in the sum-

mer season is exhibited even a few minutes after milking, although inappreciable to the organs of taste. The sweet milk was poured into evaporating pans of enamelled iron, imbedded in warm water heated by steam. A thermometer was immersed in each of these water baths that, by frequent inspection, the temperature might not rise above the point which years of experience have shown advisable.

"To facilitate the evaporation, by means of blowers and other ingenious apparatus, a current of air is established between the covers of the pans and the solidifying milk. Connected with the steam engine is an arrangement of stirrers, for agitating the milk slightly whilst evaporating, and so gently as not to *churn* it. In about three hours the milk and sugar assumed a pasty consistency, and delighted the palates of all present; by constant manipulation and warming, it was reduced to a rich, creamy-looking powder, then exposed to the air to cool, weighed into parcels of a pound each, and by a press, with the force of a ton or two, made to assume the compact form of a tablet (the size of a small brick), in which shape, covered with tin foil, it is presented to the public.

"Some of the solidified milk which had been grated and dissolved in water the evening previous, was found covered with a rich cream; this, skimmed off, was soon converted into excellent butter. Another solution was speedily converted into wine whey, by a treatment precisely similar to that employed in using ordinary milk. It fully equalled the expectations of all; so that solidified milk will hereafter rank among the necessary appendages of the sick-room. In fine, this article makes paps, custards, puddings, and cakes equal to the best milk, and one may be sure it is an unadulterated article, obtained from well-pastured cattle, and not the produce of distillery slops—neither can it be *watered*."

Oil of butter is the name given to a good emollient, perhaps slightly astringent preparation, well adapted to treating the summer complaints of children. It furnishes a good vehicle for the small doses of calomel or mercury with chalk, and opium, so much prescribed in that complaint.

It is made by warming butter floating on water, and when it is fluid skimming it off for use.

As an antidote, *milk* has the same applications as the albumen of eggs, and the gluten of flour. As a demulcent, it is a valuable substance in irritation of the pulmonary and digestive organs. It is also used on account of its demulcent properties in the preparation of the bread and milk poultice.

Wine whey (serum lactis vinosum) is described elsewhere; when taken warm and combined with sudorific regimen, it acts powerfully on the skin, and is valuable in febrile disorders. Cold, it is used as a gentle stimulant and nutritive diet.

Fel bovinum, ox-gall, though not officinal, is occasionally prescribed in dyspeptic affections connected with habitual costiveness.

It is prepared for use by being heated and strained, and then evaporated in a water bath, or by well managed radiated heat, to a pilular consistence. The dose, when thus inspissated, is from five to ten grains.

Ox-gall is also much used as a detergent, and in a refined or clarified condition is adapted to the use of landscape painters as a delicate green pigment.

GELATIN is obtained from bones, animal membranes, &c.; although it has no existence in the vegetable kingdom, and does not belong to the protein group, it is conveniently considered in its practical bearings in connection with the foregoing; it is officinal in *ichthyocolla* (*isinglass*), which is found in commerce, prepared from the swimming bladder of the sturgeon and other fish. It is the basis of a variety of artificial preparations used as food; it is soluble in water, and forms jellies, which are characteristic. Gelatin is precipitated in an insoluble form by tannic acid, for which it is a test. Leather is tannate of gelatin.

Ichthyocolla. (*Isinglass.*)

A variety of articles are met with in our markets under the name of isinglass. One of the cheapest is that called *fish glue*, used almost exclusively for clearing coffee, as a substitute for white of egg; this, I believe, is identical with the New York isinglass described as being prepared from the air-bladder of the common hake (gadus merluccius), which being macerated in water a little while, is then taken out and passed between two iron rollers, by which it is pressed into thin ribbons of several feet long, from an inch and a half to three inches in width. It is a very inferior variety, and is quite unfit for internal use.

Russian isinglass is met with principally in the form of sheets, or folded into compact and twisted forms, called staples. Sometimes it is in fine shreds. In sheets and shreds it is esteemed the best, but is very expensive, and on that account mostly superseded by the articles next to be described.

Gelatin exists largely in bones and in the skins of animals, from which it is prepared for use in making the various popular forms of jelly. In this country, the principal kinds of gelatin are: "Cooper's refined American isinglass," and the transparent French gelatin. The former comes in sheets 9 inches long, and $3\frac{1}{2}$ wide, and about $\frac{1}{8}$ inch thick, in a very light opaque form, nearly white color, and marked with the nets on which they have been dried; sometimes these are cut up into small pieces.

The *French* is in cakes which are rather smaller, very thin, and quite transparent, similarly marked by the drying nets; sometimes it is imported in shreds, put up in boxes with directions for use. My experience is in favor of the French, over Cooper's. It is more readily clarified, and makes an equally good jelly. Sometimes the French is colored red.

The principal cause of failure in the preparation of jellies from these is using a deficient quantity, which fault is due to the indefinite character of the printed circulars accompanying the commercial articles, also to a deficient soaking of the gelatin previous to making the jelly; this is made necessary by the slight taste it acquires at the surface or point of contact with the air and moisture. It should be soaked at least an hour in cold water, which should then be thrown away, and the gelatin, after draining a little, is fit for use. Calves' feet are still in request by some of the old school, who believe gelatin, as manufactured, to be altogether inferior; but these are apt to be deceived by the confectioners, and it is impossible to detect the substitution by the properties or the effects of the jelly produced.

Isinglass plaster is now made by several manufacturers in this country. The mode of preparing it is generally kept a secret. From some experiments with the article now in the market, I am convinced it is made from the common fish glue. It is a very popular and good article, despite the tendency to decompose which has been charged against it; when this takes place, which is perhaps seldom, it produces inflammation of the exposed surface to which it is applied. *Court-plaster* is made by a similar process; the old recipes direct calves' feet for its preparation; but on a large scale, it is probable some other form of gelatin is applied. The chief difference between it and the isinglass plaster in sheets 7 inches wide, rolled and inclosed in boxes, is in the shape in which it is put up for sale.

The original Liston's isinglass plaster or gum-cloth, was made by spreading several coats of strong solution of isinglass in very diluted alcohol over the surface of oiled silk, or, still better, over animal membrane, previously prepared for the purpose from the peritoneal membrane of the cæcum of the ox.

To make Court-Plaster or Isinglass-Plaster.

Take of Isinglass	℥j.
Water	f℥viij.
Dissolve with heat—	
Benzoin	ʒij.
Alcohol	f℥ij.

Dissolve and strain. Mix the two solutions together, and, with a brush, apply several coats of this mixture, while it is kept fluid by a gentle heat to silk stretched on a frame; each successive coat being allowed to dry before applying the next. Then paint a layer of the following solution on the other side of the silk:—

Venice turpentine	℥j.
Tincture of benzoin	f℥ij.

Mix.

Black and flesh-colored silk are both used for court-plaster.

Os, U.S. (*Bone.*)

Bones are officinal for their uses in the preparation of bone phosphate of lime, and the phosphates of soda and ammonia; they are also used in preparing animal charcoal. Bones consist of gelatinous tissue, into which earthy and saline matters have been deposited until they have acquired solidity and firmness. By soaking in muriatic acid, the phosphates and carbonates are dissolved, and the gelatin is left as a tough, flexible, nearly transparent mass, having nearly the same form as the bone.

CHAPTER IV.

FERMENTATION, ALCOHOL, AND THE ETHERS.

Fermentation is the process, whether spontaneous or artificially induced, by which the ternary compounds considered in Chapter II. are decomposed, and resolved into more stable and unorganized forms. It has been stated, in describing these, that under the influence of diastase, a peculiar principle found in germinating seeds and buds, the insoluble principle, starch, becomes converted into the more soluble dextrin and grape sugar; also that, under the influence of chemical agents, a similar change may be made to take place in lignin.

Cane sugar, under the influence of any causes predisposing to fermentation, undergoes a change into the same proximate principle, which, in its relations to fermentation, is the most interesting and important of its class.

Associated with these ternary principles, we find constantly in plants, nitrogenized or quaternary principles, treated of in the last chapter, which, by inducing these changes, are continually tending to the production of grape sugar and to its further metamorphose into alcohol and carbonic acid.

The circumstances necessary to produce fermentation, are, a solution containing starch or sugar, at a moderate elevation of temperature, say from 70° to 90° F., which, however, rises as the process proceeds; and a ferment, or nitrogenized principle itself in a state of decomposition or growth. The juice of the apple furnishes one of the most familiar illustrations of the presence of these conditions. We have in that liquid the ternary compounds associated with vegetable albumen, a nitrogenized material capable of playing the

part of a ferment, and at the season of the year when the juice is extracted, the requisite elevation of temperature. As a consequence, fermentation takes place. The vegetable albumen absorbs oxygen from the air, runs into decomposition, sets the whole of the starchy and saccharine constituents of the juice to fermenting, and they are converted first into grape sugar, and then into alcohol, which is present in the resulting cider, and carbonic acid which is given off, producing the well-known frothing of the liquid.

In the production of wine, we have another instance of spontaneous fermentation—the expressed juice of the grape is simply set aside in large casks, where it undergoes spontaneously the necessary change; if the sugar is in excess and the azotized matter deficient, a sweet wine is produced; if these proportions are reversed, and the whole of the sugar is changed into alcohol, a dry wine results. If the wine is bottled before the alcohol has been produced in sufficient proportion to coagulate the albumen, the process goes on after it has been corked up, the carbonic acid is confined, and a sparkling wine results.

The composition of alcohol is expressed by the formula $C_4H_6O_2$, and its production by the decomposition of grape sugar is thus explained; one equivalent of grape sugar = $C_{24}H_{28}O_{28}$, is broken up into 4 of alcohol, $C_4H_6O_2+8$ of carbonic acid, CO_2+4 of water, HO, thus

$$\begin{array}{lcl} 4,\ C_4\ H_6\ O_2 & = & C_{16}\ H_{24}\ O_8 \\ 8,\ C\ O_2 & = & C_8\ \ \ O_{16} \\ 4,\ H\ O & = & \ \ \ H_4\ O_4 \\ & & \overline{24\ 28\ 28} \end{array}$$

Or, adopting the view of Mitscherlich and Soubeiran, that fermentable sugar has the composition when perfectly dried, represented by $C_{12}H_{12}O_{12}$, it may break up into 2, $C_4H_6O_2$ and 4, CO_2, without the production of water.

In this change, the ferment appears to communicate the molecular change taking place among its particles to the starch and sugar in solution, which are here seen to suffer no increase nor diminution of the number of atoms they contain by the contact or its results.

The *acetic* fermentation consists in the oxidation of alcohol by long exposure to the air in a very divided condition, or in contact with ferments, as when cider is allowed to remain in open casks until it passes into vinegar. Under the head of *aceta* the preparation of vinegar for use as a menstruum in pharmacy is spoken of, as also its substitution by diluted acetic acid.

The *lactic* and *butyric* fermentations are produced in milk by the action of the nitrogenized principle, casein, upon sugar present in the whey.

The *viscous* fermentation takes places in certain complex saccha-

rine and mucilaginous mixtures by the action of fermentation; its results are carbonic acid, hydrogen, alcohol, lactic acid, and mannite.

Fermentation is artificially produced in the process of manufacturing most of the spirituous liquors and beer; the insoluble yellowish viscid matter deposited from the infusion of malt in the process of making beer, called yeast, *fermentum cerevisiæ*, is the best substance for producing the catalytic change in starchy and saccharine solutions. Added to an infusion of rye and Indian corn, it produces, by fermentation, rye whiskey; to potatoes ground to pulp and mixed with hot water, potato spirits; to molasses, rum; &c. In each case a portion of malt is used to facilitate the process by furnishing diastase.

Malt is barley which has been steeped in water till much swollen and softened, and then piled in heaps, to undergo a species of fermentation, or rather germination, during which a portion of its starch has passed into sugar and become soluble, and the peculiar ferment before mentioned as diastase is produced; it is then kiln-dried, to destroy its vitality.

Holland gin is manufactured from malted barley, rye meal, and hops, and distilled from juniper berries, to which it owes its flavor. The Scheidam Schnapps, now so extensively advertised, is understood to be Holland gin, of good quality. Common gin is rectified from turpentine. Arrack is the spirit from the fermentation of rice; it is not met with in our commerce.

Malt liquors are obtained by subjecting malt to infusion with water, mixing this with a due proportion of hops, which give the taste and tonic properties, and subjecting to the requisite fermentation. Under the head of *Medicated Wines*, a recipe was given for wine of tar, or Jew's beer, a medicated, fermented liquor.

The following recipe furnishes a very good and wholesome summer beverage, which, without intoxicating, furnishes an agreeable stimulus in the debilitating summer weather of our climate.

Ginger Beer.

To make five gallons:—

Take of Race ginger (bruised)	. . .	4 ounces.
Bitartrate of potassa	. . .	3 "

Mix them.

Directions.—Add to these ingredients, five pounds of loaf sugar, two lemons (sliced), and five gallons of boiling water. Let it stand twelve hours; then add a teacupful of yeast to the mixture, and bottle immediately and securely. In a day or two it will be ready for use.

Pipsissewa Beer.

The virtues of this excellent alterative diuretic are obtained in an agreeable form, by the following process:—

Take of Pipsissewa (chimaphila, *U. S.*)	6 ounces.
Water	1 gallon.

Boil, strain, and add—

Brown sugar	1 pound.
Powdered ginger	½ ounce.
Yeast	a sufficient quantity.

Set it aside till fermentation has commenced; then bottle it for use. Dose, a small tumblerful three or four times a day.

In the same way, sarsaparilla, sassafras, uva ursi, and other medicinal substances, may be made into *Cerevisiæ*, or beers.

Table of the Proportion, by measure, of Alcohol, sp. gr. .825, contained in 100 Parts of the Liquids named.

Wines.		Wines.	
Port (strongest)	25.83	Cincinnati	9.00
" (weakest)	19.00	Currant wine	20.55(?)
Madeira (strongest)	24.42	Gooseberry "	11.84
" (weakest)	19.24	Orange "	11.26
Sherry (strongest)	19.81	Elder "	8.79
" (weakest)	18.00	Cider (strong)	9.88
Teneriffe	19.79	" (weak)	5.21
Lisbon	18.94	Burton ale	8.88
Malaga	17.26	Edinburgh ale	6.20
Claret (strongest)	17.11	Brown stout	6.80
" (weakest)	12.91	London porter	4.20
Malmsey	16.40	Small beer	1.28
Sauterne	14.22	Brandy	55.39
Burgundy	14.57	Whiskey (Irish)	52.20
Hock	12.08	Rum	53.68
Champagne	12.61	Gin	51.78

These figures, which are compiled from the tables of Brande and others, are of course only approximative. They are believed, by pretty good authority, to be generally too high.

Alcohol.

This is obtained from spirituous liquors by distillation, which process has for its object the separation of the alcohol from the less volatile impurities associated with it in these liquids. These are chiefly coloring matters, water, and, in the case of whiskey, fusel oil. The rectification of alcohol has of latter years become a very extensive branch of business, and has undergone great improvements; so that the product is both cheap and good as compared with the foreign article. Whiskey, as procured from the farmers, is generally the product of the distillation of fermented infusion of Indian corn, mixed with rye; the smallest proportion of the latter ingredient that answers well is one part to two of the corn. A few distillers

of alcohol make their own whiskey, but those in the large cities usually buy it. I am told that, in the western States, much of the whiskey is produced by the fermentation and distillation of the refuse from flour or grist mills. The whiskey is inspected by an officer appointed by the State government, whose business it is to condemn all which does not reach the standard strength—50 per cent. of alcohol. The alcohol distillers have appropriate apparatus, consisting chiefly of large *stills*, some capable of taking a charge of 60 gallons. These are chiefly made of copper, and consist of the body and head, which are connected with a furnace, and the worm, which is inclosed in an appropriate refrigerating tub. The whiskey being turned into the body, and the apparatus closed, heat is applied, the vapor formed, passing into the cooler, is condensed, and runs out at the lower end. The first and last portions that come over are collected separately from the rest as of inferior quality, and the main body of the distillate is transferred to barrels which have been charred on the inside, and constitutes commercial alcohol.

This is the most common variety in this country. It is called druggists' alcohol. It varies with the care used in its preparation, and especially with the heat employed. Sometimes, by urging the process too rapidly with a hot fire, the alcohol has too strong an odor of fusel oil, and is too weak; the former may be detected by its odor, which reminds of whiskey, and the latter, by its sp. gr., which exceeds the standard, .835. Sometimes it is discolored from deficient charring of the cask.

Besides this quality, the common or old sort of deodorized alcohol is made. For preparing this, the whiskey is submitted to extensive filtration through long tubes containing charcoal, and is then distilled from a fresh portion of charcoal, which is placed with it into the body of the still; the charcoal is suited by its property, noticed in a previous chapter, of absorbing odor and coloring matters, for abstracting the fusel oil, and hence rendering the whiskey free from that impurity, while, by careful distillation, it is highly rectified and adapted to the purposes of the perfumer. Another quality is the *absolute alcohol*. The peculiarity in the preparation of this is the very moderate heat employed, and the consequent very slow distillation. It usually has about 95 per cent. of alcohol, and is very useful as a solvent of some articles which resist the ordinary commercial article. Castor oil is one of these; when the alcohol is in small proportion, a perfect solution will not result, unless the so-called absolute alcohol is used.

Atwood's patent, which is now used by several manufacturers, is a fine improvement in the preparation of alcohol. It requires the rectification of druggists' alcohol, by distilling it again from manganate of potassa, which effectually purifies it, and renders it unexceptionable.

For some of the pharmaceutical facts in regard to alcohol, the reader is referred to the chapter on Tinctures. Chemically, alcohol is regarded as hydrated oxide of ethyl, as explained in the sequel.

Ætherea, *U. S.* Ethers.

This class of organic derivatives is produced by the action of various chemical agencies on alcohol. Ethers are usually considered as exclusively artificial products, but numerous analogies lead to the idea that similar influences at work in the organic world give, especially in the ripening of fruit, birth to some of the delightful flavors so familiar in the vegetable kingdom. There is a familiar instance of the spontaneous production of a peculiar ether in the ripening of wines, under the influence of the slow and gradual fermentation which takes place, especially after the production of a considerable proportion of alcohol in the fermenting juice; in this case, the presence of an excess of tartaric acid may be concerned. The peculiar ether here formed, called œnanthic ether, or bouquet of wine ($C_{18}H_{18}O_3$), has been isolated and examined by Liebig and Pelouze.

The artificial essences of banana, jargonelle pear, pineapple, &c., are instances of the attempted imitation of natural volatile principles by artificially prepared ethers.

The type of the class of ethers was called in our *Pharmacopœia* of 1840, *æther sulphuricus*, but is now, for the sake of brevity and simplicity, named as follows:—

Æther, U. S.

This is prepared by mixing alcohol and sulphuric acid in a glass retort or flask adapted to a suitable condenser, and applying a gentle heat; the very volatile ether, contaminated with a little alcohol, is driven over at a low temperature, and collected in the receiver. This is the case as long as the requisite proportions are maintained; but when the acid is largely in excess, which soon comes to be the case unless a continuous supply of alcohol is kept up, the boiling point rises, and other products are produced, among which is ethereal oil, to be referred to again as one of the constituents of Hoffmann's anodyne.

The highly volatile and inflammable nature of ether makes its preparation very dangerous, except in establishments where every convenience and safeguard is provided. The direct application of flame to the retort or flask is attended with great danger, and in the event of a fracture or leakage occurring either in the retort or receiver, the proximity of fire might entail the most disastrous consequences. The ether of commerce is made exclusively by manufacturing chemists, who produce it on a large scale. It is generally pure enough for most of the uses to which it is applied, though not for inhalation. Where alcohol is an impurity, it may be readily separated by shaking up the ether with water, which unites with the water, allowing the mixed water and alcohol to subside,

and pouring off the ether, it will now be what is called in commerce *washed ether*, or hydrated ether. This contains about ten per cent. of water, and is the kind adapted for making tannic acid from galls. It is also pure enough for inhalation, as the presence in its vapor of the small proportion of vapor of water is no disadvantage to it. Hydrated ether is, however, not suited to dissolving gun cotton, nor to most of the uses of ether, as a solvent.

To separate the water from it requires its redistillation from a solution of lime or potassa, which is also adapted to neutralizing any free acid which may have come over with it, or may have formed in it by the oxidizing action of the air.

The sensible properties of ether are familiar to most; it is colorless, very volatile, limpid, with a high refracting power, pungent taste, and a peculiar rather fragrant odor. Its proper specific gravity, when of standard purity, is .750; it may be reduced as low as .713. It is remarkable for the comparatively great specific gravity of its vapor, which is 2.586.

It causes intense cold by its evaporation; the greatest reduction of temperature yet produced is from its admixture with solid carbonic acid. When ignited with air or oxygen, it explodes violently. The great volatility of ether, the highly inflammable nature and high specific gravity of its vapor combine to make it a most dangerous substance to handle or even to decant, in the vicinity of flame. It should be kept in large quantities only in cold situations, as cellars where fire is never kindled, and should always be decanted by daylight. Many disastrous accidents have happened from neglecting this precaution.

Besides its property of dissolving ten per cent. of water, it is said to be dissolved by water to the same extent. Whether this is the case with pure ether, I think admits of a doubt. It dissolves most of the volatile oils and resins, and the fixed oils and fats, also iodine, bromine, phosphorus, corrosive sublimate, sesquichloride of iron, and some of the alkaloids, which it separates from their aqueous solutions; it dissolves also caoutchouc to a limited extent, and xyloidin and etheroxylin to an indefinite extent.

The composition of ether is C_4H_5O. Much uncertainty has rested upon the manner in which these elements are grouped. This seems settled by the recent discovery by Dr. Frankland, of a compound radical ethyle, which has the composition C_4H_5, of which ether is undoubtedly the oxide, while alcohol is the hydrated oxide. The result of the action of sulphuric acid upon alcohol is then the separation, from each equivalent of alcohol, of one equivalent of the elements of water.

$$\begin{aligned} \text{Alcohol} &= C_4\,H_5\,O,\,HO, \\ \text{Ether} &= C_4\,H_5\,O, \\ \text{Ethyle} &= C_4\,H_5. \end{aligned}$$

The complex reactions which take place during the passage of

alcohol into ether under the influence of sulphuric acid, will be found fully described in chemical works; they do not fall within the scope of this.

Oleum Ætherеum, U. S. (*Heavy Oil of Wine.*)

This officinal product of the decomposition of alcohol is rarely met with in commerce. It is a volatile liquid, resembling an essential oil in consistence, having a yellow tint, a penetrating aromatic odor, bitter taste. It is insoluble in water, but dissolves readily in alcohol and ether; its mode of preparation has already been alluded to. It is supposed to have anodyne effects similar to those of ether, and is officinal in the *Pharmacopœia* only with reference to the preparation of Hoffmann's anodyne. Some specimens I have met with were evident sophistications.

Spiritus Ætheris Compositus, U. S. (*Hoffmann's Anodyne.*)

Take of Ether	. . . .	half a pint.
Alcohol	. . . .	one pint.
Ethereal oil	. . .	three fluidrachms.

Mix them.

To the best of my knowledge, Hoffmann's anodyne is never made by this formula. This important preparation is made by a process which, in its very nature, is certain to give varying results. In the distillation of ether, as already stated, the resulting liquid is liable to vary according to the proportions of the ingredients in the retort. If the alcohol be in due proportion, and the boiling point consequently low, a tolerably pure ether will pass over; but when the acid ingredient comes to be in large excess, sulphurous acid, water, and ethereal oil will come over. Now it is usual with the manufacturers to push the process as far as possible in the first instance, getting a product which contains ether, alcohol, and water, contaminated with a very small portion of ethereal oil. This is rectified by a second distillation, the first portion (as long as it comes over at or below 54° Baumé), being reserved as rectified ether. The less volatile products are now driven over, and are found to consist of ether, alcohol, and water, impregnated with ethereal oil. This is now made into Hoffmann's anodyne by mixing it with ether, alcohol, or water, as may be required to give it nearly the sensible properties of a standard specimen kept on hand. These properties, however, furnish a very poor criterion of quality to the manufacturer or to the consumer; the milkiness occasioned by dilution with water is varied by the relative proportions of alcohol and ether. If too much alcohol is present, this milkiness is deficient. If too much ether, the opalescence is not

diffused, the oil globules having a tendency to run together, and thus varying the appearance. Professor Procter analyzed five specimens of Hoffmann's anodyne, four from leading chemical manufacturers, and one made by the officinal recipe. These he found to differ in sensible properties, in specific gravity, and in composition.

While the *U. S. P.* specimen marked .8151, one of the others had a sp. gr. .8925, the others being intermediate; one of the manufactured specimens contained very little ether, being chiefly alcohol and water; another contained less alcohol, but more ether; a third had less water than the others, but more alcohol than one, and more ether than the other; while the fourth approached nearer the officinal proportions, though neither of them contained the full proportion of ether. The proportion of heavy oil of wine was not ascertained, as there is no known practicable method of estimating this. It was proved, however, that all the specimens but that by the officinal recipe were deficient in this ingredient.

Notwithstanding these deficiencies in the commercial article, this medicine has a great and wide-spread reputation, and indeed there is no medicine of its class so much used; it is prescribed for internal use almost to the exclusion of ether, being adapted to admixture with aqueous solutions.

Some of its favorite combinations will be found under the head of extemporaneous pharmacy. Its dose is from 20 drops to f℥j.

Spiritus Ætheris Nitrici, U.S. (*Sweet Spirit of Nitre.*)

This is made by the action of nitric acid, evolved spontaneously from nitrate of potassa by sulphuric acid, on alcohol. It is collected by distillation, and purified by redistilling from an alkaline carbonate; although found among the pharmaceutical preparations along with the other ethers in the *Pharmacopœia*, like them, it is invariably made by the manufacturing chemist, and requires mention here mainly with reference to its composition, properties, and uses.

Sweet spirit of nitre is a solution of nitrous ether (hyponitrite of oxide of ethyl, C_4H_5O,NO_3) in alcohol. It is a colorless, volatile liquid, of a fragrant fruity odor, sp. gr. .834, mixing in all proportions with water, alcohol, and ether. By being kept a long time it becomes acid, and may have a crystal of bicarbonate of potassa kept in the bottle. Aldehyde is an impurity which gives it a tendency to turn brown with strong solution of potassa. Much of the sweet spirit of nitre is of very deficient strength as regards its ethereal ingredient, being mixed with water and alcohol to suit the price charged. It is said that the term spirit. nitri dulc. is applied by some of the wholesale dealers to the weak article, and spirit. æther. nit. to the strong. If skilfully adulterated, its specific gravity would be preserved at about the normal standard, but to

an experienced observer it would be deficient in the proper odor, and the sweet and rather pleasant taste. In view of its use as a very mild diaphoretic and sedative, especially for children, its admixture with alcohol is highly injurious as it is criminal.

Uses.—Spirit of nitric ether is very extensively used as a mild refrigerant and diaphoretic; in febrile complaints, it is much combined for this purpose with antimonial wine, citrate of potassa, &c.; as a diuretic it is much used in connection with the preparations of digitalis and squill.

Its dose is from ten drops for a child to two fluidrachms for an adult.

Chloroformum, *U. S.*

This compound, the vapor of which is so largely employed for anæsthetic purposes in surgical and obstetric practice, while in the liquid form it is one of the most useful of chemical solvents, is peculiarly an American remedy; it was first prepared in 1831, by Samuel Guthrie, of Sackett's Harbor, New York, and was first introduced prominently as an anæsthetic agent by Dr. Simpson, of Edinburgh; it is prepared according to the *Pharmacopœia* by distilling alcohol from chlorinated lime, but is made exclusively by manufacturing chemists, and probably by processes very much modified from that given in the books.

It is a heavy colorless liquid, very clear and bright, sp. gr. 1.49, sp. gr. of its vapor 4.2. Its odor is fragrant, fruity; its taste very sweet and pungent. It is very soluble in alcohol and ether, but not in water. It is a powerful solvent of camphor, caoutchouc, gutta percha, wax, resins, iodine, and of the vegetable alkaloids and neutral crystalline principles generally. Its property of dissolving camphor in so large proportion, is one of its most remarkable peculiarities, and adapts it as a vehicle for that medicine. A solution of gutta percha in chloroform in the proportion of one drachm to the fluidounce forms a very mild and pleasant application to abraded surfaces and cuts, which is less adhesive than collodion, and does not contract in drying. Chemically, chloroform is the terchloride of formyle, having the composition C_2H,Cl_3.

Under the very incorrect name of chloric ether, a mixture of chloroform in ether, in the proportion of one part of the former to three of the latter, by measure, is much used as an anæsthetic agent, being considered by some surgeons less stimulating than ether, while its depressing effects are less marked than those of chloroform.

The chief use of chloroform and ether in medicine, is for the purpose of producing an anæsthetic or benumbing effect during surgical operations and parturition. This effect is produced by the inhalation of their vapors, which appear to be absorbed by the

blood, and, by acting on the nervous centres, suspend their functions. The quantity necessary to be inhaled varies in different individuals, though perhaps the most usual dose by the lungs is of chloroform f℥j to f℥iij, and of ether, f℥ss to f℥ij. Both these liquids are also given by the stomach, and used externally in anodyne liniments.

The dose of chloroform by the stomach is from 20 to 60 drops.

CHAPTER V.

FIXED OILS AND FATS.

The fixed oils and fats form so natural a group that they may be conveniently classed together, though both of vegetable and animal production.

They resemble the preceding groups of ternary organic principles in being nutritious in the sense in which that term applies to non-nitrogenized principles. The very large proportion of carbon they contain peculiarly adapts them to maintain by combustion in the lungs and capillaries, the heat required in the various processes of the economy. In medicine, they are used for this in connection with certain demulcent, alterative, and cathartic properties, pertaining to the particular individuals of the group. They constitute the chief vehicles for medicines to be applied externally, whether in ointments in which the oil is usually not decomposed, or in liniments and plasters, in some of which a decomposition of the oil is effected, as will appear in the sequel. The fixed oils enter largely into the food of animals, and of the human race; they are accumulated particularly in the fruit and seeds of plants, and they exist in the straw and stalks as well as the seed of the cereal grasses, where they are associated with other nutritive materials. The following proportions of fixed oils have been ascertained to exist in the several substances named: in Indian corn, 8.8 per cent.; oats, 6.9; fine wheat flour, 1.4; bran from wheat, 4.6; rice, 0.25; hay and straw, from 3 to 5; olive seeds, 54; flaxseed, 22; almonds, 46; walnuts, 50; cocoa-nut, 47; yelk of eggs, 28; cow's milk, 3.13 per cent.

Chemical History.—The fixed oils and fats differ from the foregoing ternary principles in being separable into several proximate principles, which have been pretty well studied. These are *olein*, *stearin*, and *margarin*. When a fixed oil is heated with a caustic

alkali, it is decomposed into glycerin with an organic acid which unites with the alkali and forms a soap. Thus olein is resolved into oleic acid and glycerin; stearin into stearic acid and glycerin, and margarin into margaric acid and glycerin.

M. Fremy has also shown that the oils, and neutral fatty bodies in general, are converted into fatty acids by concentrated sulphuric acid.

Olein, olcate of glycerin, forms the fluid portion of fats and oils, and exists in nearly all of them. It remains liquid at a low temperature. Oleic acid, $C_{44}H_{39}O_4$, is obtained by saponifying olein, and afterwards decomposing the soap by an acid, when it is set free as an oily, almost colorless liquid, lighter than water, with an acid reaction; it unites with bases, forming salts; those with alkalies are soluble in water, those with other metallic oxides and with the earths are insoluble; oleate of lead is the basis of lead plaster.

Stearin, stearate of glycerin, forms the solid part of mutton suet and beef fat; and *stearic acid*, $2HO+C_{68}H_{66}O_5$, forms salts similar to those of oleic acid.

Margarin, margarate of glycerin, enters into human fat, and into that of the carnivora; it is also present in most vegetable fixed oils. *Margaric acid* is prepared from margarin, or by the action of nitric acid on stearic acid; it is represented by the formula $2HO$, $C_{68}H_{66}O_6$, containing one equivalent more of oxygen than stearic, which it resembles in most of its properties. Margarate of lead is also present in lead plaster.

Besides these principles, found in the most common oils and fats, there are others which may be mentioned, though of little practical utility to the physician or pharmaceutist. In palm oil, palmitic acid, $C_{32}H_{31}O_3$; in cocoa-nut oil, coco-stearic acid, $2HO,C_{27}H_{26}O_3$; in the butter of nutmegs or oil of mace, myristic acid, $HO,C_{28}H_{27}O_3$, are all found combined with glycerin.

Wax and spermaceti are complex products of the animal kingdom, somewhat resembling solid oils or fats, but destitute of glycerin.

This subject brings into view the preparation of lead plaster, which is highly important to the pharmaceutist as the basis of most of the class of plasters which are for convenience introduced in this work among the extemporaneous preparations.

Emplastrum Plumbi, U.S. *Lead Plaster.* (*Oleo Margarate of Lead.*)

This is made usually on a large scale by manufacturing pharmaceutists, some of whom make it, with its kindred preparations, their leading or exclusive articles of manufacture.

The process for the preparation of lead plaster requires that olive oil (lard oil does not produce a nice product) should be boiled with finely powdered semivitrified oxide of lead (litharge), and water

(the proportions are given in the *Pharmacopœia*) for a long time, until they unite into a mass of a soft solid consistence, which is tenacious, and readily rolled upon a wet marble slab into rolls of suitable size, which are allowed to harden by maceration in a trough of cold water and subsequent exposure for a long time to the air; one gallon of oil yields about twelve pounds of plaster. The process is a tedious one, and requires to be pursued with strict reference to many precautions suggested by experience, which seem scarcely appropriate to a work of the scope and design of the present.

Lead plaster is usually found in commerce, in rolls of various sizes, from half an ounce to half a pound in weight, called diachylon, simple diachylon, or lead plaster; sometimes, though rarely, it is spread upon cotton cloth by machinery, and sold by the yard like adhesive plaster cloth. It is milder and less irritating in its action upon highly inflamed surfaces, though less adhesive than that well-known and useful application. Postponing to another chapter the practical details in regard to these, and the numerous compounds into which they enter, I need only refer here to the utility of glycerin as a constituent of emollient plasters, and to the fact that much of the lead plaster now made is deprived of this ingredient by long washing and kneading with water, and is hence peculiarly apt to become dry and crisp by age.

Glycerin, $C_6H_7O_5+HO$, is a colorless, odorless, sweet liquid, resembling syrup, having a sp. gr. of 1.26, converted by nitric acid into oxalic acid; it is generally stated to be a hydrate of the oxide of a hypothetical radical glyceryl, C_6H_7. Glycerin is separated from oils in the process of their saponification, and is readily obtained by evaporation from the water in which lead plaster has been made, care being taken to precipitate any lead held in solution, by sulphuretted hydrogen; it is, of recent time, much employed as a substitute for oils, having the remarkable property of mixing in all proportions with water and alcohol, though not with ether. A few of its medicinal applications may be mentioned in this place; it is a most useful application in the dry and parched condition of the mouth so often present in disease, to which it may be applied either by painting it over the dry surface with a brush, or by swallowing it diluted with water.

For a certain form of deafness resulting from dryness of the tympanic membrane it is one of the best of remedies. It is used in certain scaly skin diseases, as lepra. It is a useful application to sore nipples, also to burns and excoriated surfaces, and is added to poultices to keep them moist. Its substitution for almond and olive oil, in the preparation of delicate ointments, is productive of no advantage.

The idea has occurred to me of using it as a vehicle for subacetate of lead, which, on admixture with common oils in Goulard's cerate, is always converted into a compound of the oil-acid with

oxide of lead; and, on admixture with water, as lead water, immediately commences to be decomposed, and to deposit carbonate of lead so that the solution in a short time becomes inert. By experiment, I find glycerin miscible in all proportions with liquor plumbi subacetatis, and have inserted, under the name of *linimentum plumbi subacetatis*, a formula which I think an improvement on any of the old preparations of lead.

There are two qualities of glycerin in our markets, that called English glycerin which is the cheapest, and is supposed to be made from the waters from which soap has been separated, and the other American glycerin, which is invariably collected as a residuary product from the plaster manufacture. The latter is the best, and commands nearly double the price of the former. English glycerin has a more or less disagreeable smell, which it seems impossible to separate from it. Some specimens have a saline taste, evincing important impurities in view of the uses to which it is applied. The following recipe for the preparation of glycerin is given by Dorvault in *L'Officine*, and is translated for the use of any who are disposed to experiment upon the production of this useful article, premising that the proportion of glycerin is so small that one gallon of oil only yields half a pound of this product:—

Take of a fixed oil or fat . . . sufficient.
Saponify it by milk of lime.

Separate the liquid from the insoluble lime soap; add to the liquid sufficient diluted sulphuric acid to precipitate as sulphate the excess of lime held in solution. Evaporate by a water bath, and treat the residue with strong alcohol, which, on evaporation, will leave the glycerin.

The lime soap which is here a residuary product, is, as far as I know, quite useless, and unless this can be made available for some purpose as yet unknown, this recipe will be deficient in the element of economy.

List of the Fixed Oils and Fats used in Medicine.

Adeps, *U. S.*, lard. Prepared fat of sus scrofa, or hog.
Oleum Adipis, Stearin. } Prepared from lard by expression.
Sevum, *U. S.*, mutton suet. The prepared suet of ovis aries.
Oleum Amygdalæ, *U. S.* Fixed oil from kernels of fruit of A. Communis.
Oleum Macidis, solid oil. From the arillus of the fruit of myristica moschata.
Oleum Cacao, butter of cocoa. From the roasted seeds of theobroma cacao.
Oleum Olivæ, *U. S.*, sweet oil. Oil of the fruit of olea Europea.
Oleum Papaveris, poppy oil. From the seeds of papaver somniferum.
Oleum Sesami, benne oil. From the seeds of sesamum indicum and orientale.
Oleum Lini, *U. S.*, flaxseed oil. From the seeds of linum usitatissimum.
Oleum Bubulum, *U. S.*, neat's-foot oil. From the bones of bos domesticus.
Oleum Morrhuæ, *U. S.*, cod-liver oil. From livers of gadus morrhua.
Oleum Cetacei. From cavity in the upper jaw of physeter macrocephalus.
Oleum Ricini, *U. S.*, castor oil. From seeds of ricinus communis.
Oleum Tiglii, *U. S.*, croton oil. From seeds of croton tiglium.
Oleum Palmæ, a solid oil obtained from the fruit of elais guineensis.

Of the foregoing list several are quite bland, agreeable, and destitute of active properties; of these, oleum olivæ, oleum amygdalæ, oleum sesami, oleum papaveris, may be substituted for each other for internal use.

Olive oil, of the finest quality met with in commerce, has a pale yellow or greenish color, and a very faint and agreeable odor; its taste is bland and pleasant, though sometimes a little acrid; its specific gravity, at 77°, is stated at .9109. It is soluble in one and a half times its weight of ether, but almost insoluble in alcohol; it generally contains a solid deposit of oleo-margarin in cold weather, which is readily fused by a slight elevation of temperature. The best always comes in bottles which hold from f℥xij to f℥xxiv, or in small flasks covered by wicker work, which, after they are emptied, come in play for small chemical operations. The common unbottled oil is generally very impure, acid, and disagreeable, and often abounds in green coloring matter.

Pelouze has lately investigated the subject of the acidification of fixed oils, and confirms the fact already known, that foreign substances with which fatty bodies are contaminated exert the same action upon them that a ferment does upon saccharine fluids, setting free the fatty acids. He has also found that when oleaginous seeds are crushed so as to break up their cells and bring their contents into close contact; the neutral fatty bodies contained in them are spontaneously converted into fatty acids and glycerin. This phenomenon is analogous to what takes place in the grape, the apple, and other fruits, the sugar contained in which is converted into alcohol and carbonic acid as soon as the cells which separate it from the ferment are destroyed. When extracted immediately, these oils are perfectly free from any traces of acid. The difference in quality between good and bad olive oil is thus explained, the former being extracted before the lapse of time has allowed of this peculiar fermentative action.

Almond oil is not always readily obtainable here; it has about the specific gravity of olive oil, and is without its green tinge of color, so that it generally makes a whiter ointment. It is generally imported in jugs. In selling and prescribing it care should be taken that it be not confounded with the essential oil of bitter almond.

Oil of Benne Seed.—Sesamum orientale has been produced in this country, and is recommended as a desirable production to add to our agricultural resources. The plant grows well, particularly in the South, and has been estimated to yield twenty bushels of the seed to the acre; the yield of oil approaches two and a half gallons to the bushel. The seeds should be planted as soon as the frost is out of the ground in drills three feet apart, and six inches distance along the drills.

Poppy seed oil is not common in our markets except, perhaps, as an adulteration of the foregoing.

Oleum adipis, oleum lini, oleum bubulum, oleum cetacei, and oleum palmæ, are not used for any internal form of administration, but in common with olive and almond oil have their special adaptations and uses in the arts, and for topical application in medicine.

Lard oil, which is a very pure form of olein, when freshly and skilfully prepared, is seldom met with in commerce free from a very disagreeable rancid odor; on this account it is rarely employed in medicine. It is said to be largely exported for admixture with olive oil of inferior quality.

Linseed or flaxseed oil is chiefly used to mix with the carbonates of lead and zinc in the manufacture of the pigments known as white lead and white zinc; it is sometimes substituted for this use by a variety of inferior oils, which possess the same drying or oxidizing property. Boiled linseed oil, particularly if litharge or acetate of lead is mixed with it in boiling, is remarkable for the rapidity with which it dries into a hard varnish-like material.

A fine oil is now extensively made by expressing ground nuts between hot plates in the same way that linseed oil is prepared. Its chief use, as far as I can learn, is to mix with linseed and olive oils. It should be thrown into commerce under its own proper name, and would no doubt answer many purposes both in the arts and in medicine.

Neat's-foot oil, as usually met with, is so offensive that it is only used in one officinal preparation, in which it is often substituted by lard or lard oil—unguentum hydrargyri nitratis.

Spermaceti oil is the clearest and thinnest of the whale oils; it is remarkably adapted for greasing heavy machinery, for which purpose it is in great demand; it is also a fine oil for burning, but is never used in medicine or pharmacy, except by those few practitioners who believe it fully equal to cod-liver oil.

Palm oil is consumed exclusively in the manufacture of soap, to which it imparts its peculiar odor and yellow color, of which, however, it is deprived by exposure to air and light.

Oleum ricini, oleum tiglii, oleum morrhuæ, oleum macidis, and oleum cacao, are used as internal remedies.

Castor oil is a viscid, transparent, light yellow-colored oil, specific gravity .9575, at 77°. Its taste and smell, when of fine quality, are very slight, though its extreme viscidity renders it disagreeable. It is peculiar in being miscible with alcohol, though not in all proportions, as asserted by some. The two principal kinds are, the American oil, which is produced principally in our Western States and comes in casks, and the East India oil, which is imported in tin cans from Bombay and Calcutta. The latter article is, I think, the best,

either from the constant agitation to which it is subjected in the hold of the vessel during a long voyage, a great part of the time in the tropics, producing a separation of its albuminous ingredient and thus clarifying it, or from some peculiarity in its preparation. A can of this oil is generally found cloudy near the bottom, while the upper portion may be racked off remarkably clear and free from odor and taste. It is put up by one of our most skilful pharmaceutists, labelled Tasteless Castor Oil.

The *Palma Christi*, which produces the valuable seed yielding this oil, is a beautiful annual plant, readily cultivated in our climate from the seed. It grows to the height of from six to ten feet with us, and is one of the most ornamental of annuals for garden or lawn.

The seeds are powerfully acrid and cathartic. The activity of these and the oil depends upon a principle, said to be resinoid, which is invariably present in it, and is modified by its bland demulcent properties.

Great quantities of castor oil are consumed in the preparation of applications for the hair, it being now generally preferred to bear's oil, which was formerly much in vogue for this purpose. For greasing the hair, it should have a small admixture of alcohol to diminish its viscid properties, while for hair restoratives, such as are called katharion, tricopherous, &c., the alcohol is in larger proportion, the oil being added to diminish the drying and crisping properties of the spirits used. Two good recipes for these preparations are given below—

Perfumed Hair Oil.

Take of Castor oil . . . . . f℥x.
Very strong alcohol . . . . . f℥ij.
Oil of jessamine . . . . . f℥ij.
Mix.

Any other essential oil may be substituted for oil of jessamine, and we usually label the vials according to their perfume, and color the rose oil red.

Hair Restorative.

Take of Castor oil . . . . . f℥vj.
Alcohol . . . . . f℥xxvj.
Dissolve, then add—
Tinct. of cantharides (made with strong alcohol) . . . . . f℥j.
Oil of jessamine (or other perfume) . f℥iss.
Mix.

This preparation has the property of rendering the hair soft and glossy, at the same time that, by its tonic and stimulant properties,

it tends to arrest its premature decay. To accomplish this it should be rubbed thoroughly into the roots at least once a day.

Croton oil, like the foregoing, is the product of the seeds of one of the family euphorbiaceæ. It is imported in bottles holding about twenty ounces. Its powerful irritant and drastic cathartic properties are well known. In applying it as a local irritant for producing a pustular eruption, it is usually diluted with twice the quantity of olive oil; it should then be carefully and conspicuously marked for *external use*. The use of croton oil mixed with castor oil, in the so-called castor oil capsules, is frequently the cause of violent purging, when a mild and pleasant effect was anticipated. The substitution in this way of a powerful for a mild and wholesome remedy in a popular form of medicine should be corrected by the interference of the physician and pharmaceutist.

Cod-liver oil is largely prepared upon our New England coast and that of Newfoundland, in connection with the cod-fisheries. Three different commercial varieties are produced, which vary in quality according to the skill and care expended in their preparation. *Pale* cod-liver oil is prepared in New England by cutting up the fresh livers and throwing them into water in a large tank arranged for the application of heat. A fire being kindled, the oil rises to the surface and is skimmed off; by standing, even after being barrelled, a deposit separates which allows of the clear oil being racked off. It is abundant in our markets within a few years, being used exclusively in medicine, and commanding a price, by the gallon, of from $2 50 to $3 00.

The other most common variety is the *dark brown* oil. The livers being thrown into a heap exposed to the sun, are thus allowed to become decomposed, and the oil is collected as it flows out from the corrupting mass. The dark brown oil is rancid, having a disagreeable empyreumatic odor, and a taste which is bitter, beside being acrid, as in the other case. It is used extensively by curriers. Its price is usually about $1 per gallon.

The *pale brown cod-liver oil* is intermediate in its properties between the foregoing; it is by some preferred to either, and by several consumers with whom I have met is said to disagree less with the stomach. This variety is not so common in commerce. Many dealers do not procure it at all. I have obtained it by the gallon at from $1 25 to $1 75 per gallon. There are all grades of quality between the finest and commonest oils.

The following description of the *Newfoundland* manufacture, it will be seen, differs from that of New England, though the three varieties produced are here differently named; it is compiled from an article by Dr. Edward H. Robinson, *Am. Journ. Pharm.*, vol. xxvi. p. 1.

On the Banks of Newfoundland, the fish are obtained within from one to five miles from shore, and if the day be favorable,

the fisherman fills his boat (which is small) at least twice during the day. As soon as the boat is filled, they are taken on shore and handed over to women and children, who split the fish for drying, carefully putting the livers into a clean tub or some other article used for the purpose. All the fish being thus prepared, and spread on sheds to dry, the livers are carried to a cool place where they are kept until evening, by which time another boat load of fish has generally been obtained. Treating this second lot as the first, the livers are now all put together in a large shallow vessel of iron, usually about five feet square, and three in depth; which vessel is again inserted into another and larger, which is set into masonry and partly filled with water. A fire is then kindled under the outer vessel and kept burning until the greater part of the oil has been separated from the livers. The fire is then extinguished, and, when cool, the oil is dipped out and introduced into new or clean casks. What oil remains in the livers is now pressed out, but not being of as good quality as that made without pressure, it is put into a separate cask, constituting an inferior quality. The casks containing the oil are now put in a cool place, and undisturbed for five or six days, at the end of which time a considerable sediment has fallen, leaving a pure oil on top, which is carefully drawn off and put into other casks; the oil is now fit to be sent into the market. This constitutes the best quality of cod-liver oil. The color of this variety is a pale-yellow, having a specific gravity, at 63° F., of .9240; has a slight fishy taste, though not very disagreeable to most persons, leaving an impression of acridity on the fauces. In some parts, where the fisherman is too poor to purchase the water bath, the fresh livers are put into a common iron pot used for domestic purposes; moderate heat is then applied. As soon as the livers are somewhat broken down and softened, they are taken from the pot and introduced into a coarse canvas bag, and, by pressure, the greater part of the oil is forced out. This variety is not of quite as fine quality as that made with the steam bath; the color is rather darker, has a slight empyreumatic taste, and is apt to leave a peculiar burning sensation in the fauces when swallowed, which is perceptible some time after. Another variety, of an inferior quality, is made in larger vessels which remain at sea for weeks together without going to the shore. The method of obtaining this variety is as follows: As fast as the fish are caught and dressed, the livers are thrown into barrels placed on deck, the tops of which remain uncovered. The livers are exposed to the action of the sun's rays, decomposition soon ensues, and the oily matter separates. That part which first rises to the top is skimmed off and put into a separate cask. The color of this variety is yellow approaching to a brown. It is commonly known as *straits* oil. The commonest variety of all is made from the remnants of the casks from which the straits oil has been drawn. In this variety

complete putrefaction has taken place. It is of a very dark color, has an extremely offensive smell, and is more disagreeable than the other varieties. This is known as *banks oil*.

The *London Pharmaceutical Journal*, October, 1853, announced that a patent has been recently obtained by Sir James Murray for a process by which cod-liver oil may be completely deodorized. This is accomplished by agitating it in high pressure cylinders with carbonic acid gas. None of the deodorized oil having yet found its way to this country, it is probable that some practical difficulty has prevented the success of the process.

The composition of cod-liver oil, as inferred from the analysis of Dr. De Jongh, is similar to that of other fatty oils, with the exception of a peculiar organic substance, called by him *gaduin*, and also some of the constituents of bile, with traces of iodine, bromine, &c.

More recently, Dr. F. L. Winckler has investigated its chemical nature, and regards this oil as an organic whole of a peculiar chemical composition, differing from that of all other fatty oils hitherto employed as medicines. According to this eminent chemist, it contains no glycerin, but by saponification yields oleic and margaric acids, and the hydrated oxide of a peculiar organic radical, *propyle* (C_6H_7); existing also in ergot and in the liquor of pickled herring. From this, Dr. Winckler infers that cod-liver oil cannot be substituted by any other officinal oil. Propylamine ($NH_2C_6H_7$), a product of the reaction of ammonia on cod-liver oil, is also found by Winckler in normal urine and sweat; and, viewing its formation as probable by the reaction in the system by which cod-liver oil is assimilated and burnt up in the lungs, he founds upon this his theory of the utility of cod-liver oil in medicine.

CHAPTER VI.

ON VOLATILE OILS, CAMPHORS, AND RESINS.

VOLATILE OR ESSENTIAL OILS.

This highly important and interesting class of proximate principles contains an immense number of individuals which are distinguished from each other by striking sensible, as well as chemical and physical peculiarities. By far the largest number are derived from plants, in which they exist ready formed, although some are the products of a sort of spontaneous fermentative action set up

among principles contained in the plants in the presence of water; others, of which creasote and oil of tobacco are instances, are products of the destructive distillation of organic substances. The natural volatile oils, to which attention is now turned, are mostly prepared by mixing plants or parts of plants containing them with water, and, after maceration for a certain length of time, subjecting the mixture to distillation. The distillate is usually milky, and on standing separates, the oil rising to the top, or, in a few instances, subsiding; an unpleasant empyreumatic odor, at first perceived, passes off by time. Although the boiling point of these oils is much above that of water, many of them are readily volatilized in contact with steam at 212°, and are hence conveniently prepared in the way above described.

Some highly odoriferous plants which yield by this process very sparse and unsatisfactory results, are found to impart their volatile oils better by digesting with fixed fatty bodies, which, when treated with strong alcohol, yield the volatile oils to that solvent, forming essences. Numerous oils or essences used in perfumery are prepared in this way. Others are prepared by direct expression from the vessels containing them, as the oils obtained from the rind of the lemon and bergamot fruits; while others are obtained associated with their resins and camphors by the use of ether.

The volatile oils are mostly soluble in water to a very limited extent, though sufficiently so to give to it their characteristic flavors. They are mostly soluble to an unlimited extent in alcohol, ether, and the fixed oils.

The perfume of most plants is due to the gradual elimination (and oxidation ?), in very minute quantities, of their volatile oils, which is said to take place only in the presence of moisture. According to Liebig, the perfume of essential oils is strong in proportion to their tendency to oxidize in the air. Certain oils containing no oxygen may be temporarily deprived of their characteristic odors by distillation from freshly burnt lime in an apparatus exhausted of air or filled with carbonic acid gas. The odor of essential oils is apt to be less delicate or grateful after they have been isolated than when spontaneously exhaled by the plant, and it is well known that by time and exposure many of them not only lose their delicacy of flavor, but become less limpid, assuming a darker color and more resinoid consistence, and hence should be purchased in small quantities and preserved in well-stopped bottles. In the process of drying certain plants at a moderate heat, the oil seems to improve in flavor, while very little of it is dissipated, so that the aromatic seeds, as of fennel and caraway, the unexpanded flowers of clove, &c., as found in commerce, yield full proportions of essential oils, and of finer quality than the imported, as obtained from them when fresh.

The adulteration of essential oils is not unusual, the high price

which they generally command furnishing the incentive to mix them with fixed oils, with alcohol, and with other and cheaper essential oils. The mode of detecting these adulterations is as follows:—

With Fixed Oils.—Oils thus adulterated leave upon paper a greasy spot, which remains even after long-continued heating over the flame of a lamp. When the mixture is distilled with water, the volatile oil passes over while the fixed oil remains, and may be saponified with alkali. On dissolving the volatile oil in three times its measure of strong alcohol, the greater part of the fixed oil remains undissolved.

With Alcohol.—When the proportion of alcohol is considerable, the greater part of it may be extracted by water, the liquid becoming turbid. The quantity of alcohol is shown *approximately* by shaking the adulterated oil with an equal bulk of water in a minim measure or test tube graduated for the purpose, and observing the diminution of its volume. Into a graduated tube two-thirds filled with the oil some pieces of chloride of calcium may be introduced, and a gentle heat applied for a few minutes with agitation. If no alcohol is present, the lumps of chloride of calcium appear unaltered on cooling. If it contains alcohol, they will show a disposition to coalesce, and if it is in considerable proportion, a fluid layer will separate at bottom, on which the oil will float. This is especially applicable to oil of lemon, of which 480 grains mixed with 15 of alcohol liquefies 3 grains of chloride of calcium. Another test is furnished by the fact that a pure volatile oil mixes perfectly with olive oil, whereas, if alcohol be present, a turbid mixture is produced.

With other Essential Oils.—The chief reliance in detecting this common adulteration is in observing the odor produced by triturating a small quantity on the hand and noticing the odor after it is dried, or in setting fire to a small portion and blowing it out again, when the foreign odor may generally be perceived. If, on agitating the suspected oil with its own bulk of strong alcohol, it is not completely dissolved, probably oil of turpentine, or some other rather insoluble oil, is present.

Most volatile oils are compound, consisting of two isomeric oils, or of a light hydro-carbon and a heavier oil (sometimes a camphor), containing oxygen. The lighter and heavier oils are distinguished by their different volatility. When distilled, the boiling point is at first low, but rises as the quantity of the more volatile oil diminishes, till at length it no longer rises, but remains constant.

The solid crystalline, camphor or stearoptin, is usually a compound of the carbo-hydrogen oil with the elements of water, and exists in solution in the more fluid oil, which deposits it on being refrigerated. In some instances, as oil of aniseed and the pure attar of rose, it is conspicuous at ordinary temperatures. The vola-

tile oils which are free from oxygen are specifically the lightest; their specific gravity varies from .758 to .993.

The oxygenated volatile oils containing the camphors or stearoptines, vary in density from .810 to 1.170. In the solid state, as produced by intense cold, they have a tendency to the crystalline form; in the fluid condition, they are very thin, mobile, and, with a few exceptions, as oils of chamomile, buchu, and cajeput, which seem to be associated with a volatile coloring matter, are nearly colorless.

The brownish color old oils sometimes exhibit is due to resin contained in them, and is frequently produced by exposure to the air; this may be separated by redistilling the oil with water.

Of the volatile oils of commerce, a large number are too crude and imperfectly prepared to be regarded as definite chemical compounds, and as such studied in their physical and chemical relations; the results of the analysis of these, as given by chemists, are various and even conflicting. In describing them, therefore, reference must be had to their most characteristic principle, which is usually the heavier oxygenated oil, while the lighter hydrocarbon is destitute of decided and constant physical peculiarities.

Although the tendency of most essential oils, on the absorption of oxygen, is to pass into resins, there are some which produce well characterized acids. These are both of the class which exist ready formed in plants, and of those which are produced by a species of catalysis or fermentation set up under certain circumstances among principles contained in them. The oils of bitter almonds, of gaultheria, of valerian, of cinnamon, and of cloves, are acidifiable oils. In works on organic chemistry, these will be found noticed in detail in connection with their mode of formation, chemical relations, and theoretical composition. In a limited essay of this kind, it will be quite sufficient to give, by way of illustration, three series of this kind of compounds, with a tabular view of their composition.

Highly rectified oil of turpentine has the composition $C_{20}H_{16}$ (or $C_{10}H_8$), which is a radical, forming, in combination with hydrochloric acid, a peculiar solid substance called artificial camphor, while camphor, and camphoric acid, which is formed by the oxidizing action of nitric acid on camphor, are traceable to a common base.

Camphene, rectified oil of turpentine . .	$C_{20}H_{16}$.
Camphor, solid product of camphora officinarum	$C_{20}H_{16}O_2$.[1]
Camphoric acid, oxidation of camphene . .	$C_{20}H_{16}O_3$.

The oils of cinnamon and bitter almonds, as shown in the following tables, are closely allied to the vegetable acids found in rue, the balsam of tolu, &c.:—

[1] Borneo camphor has the composition $C_{20}H_{18}O_2$.

Benzyle, Bz, (isolated)	$C_{14}H_5O_2$.
Hydruret of Bz, oil of bit. almonds . . .	$C_{14}H_5O_2+H$.
Oxide of Bz, Anhydrous benzoic acid . .	$C_{14}H_5O_2+O$.
" crystallized " . . .	$C_{14}H_5O_2+O+HO$.
Cinnamyle, Ci, (hypothetical)	$C_{18}H_7O_2$.
Hydruret of Ci, oil of cinnamon . . .	$C_{18}H_7O_2+H$.
Oxide of Ci, cinnamic acid	$C_{18}H_7O_2+O$.

Carbo-Hydrogen Essential Oils.

The most simple group of essential oils is that which consists of carbon and hydrogen alone. Some of these have been already referred to as frequently associated with the oxygenated essential oils. There are a number produced by plants and obtained by distillation. The coniferæ, aurantiaciæ, and piperaceæ yield nearly all that are known. Although these are so similar in composition, they are, as usually obtained, as dissimilar in many of their properties as they are unlike the members of the oxygenated group. As already stated, when absolutely pure and exposed to no oxidizing influences, they are quite inodorous, and it is impossible in this state to distinguish oil of lemon from oil of turpentine, or oil of juniper from oil of neroli. As soon as they are exposed to ordinary external influences, however, they develop their characteristic odors and become less limpid and colorless. As a class, they are the least soluble in alcohol and in water. Several of them are among the most useful of vegetable stimulants. The composition of the carbo-hydrogen essential oils is $C_{20}H_{16}$, or $C_{10}H_8$, or some multiple of C_5H_4.

List of Carbo-Hydrogen Essential Oils (Isomeric).

	Sp. gr.[1]	Remarks.
Oil of turpentine	.86	See camphene series, p. 283.
" savine	.915	From juniperus sabinæ.
" juniper	.911	From juniperus communis.
" cardamoms	.943	Yield 4.5 per cent. (?)
" lemon	.847	From fruit of citrus limonum.
" cedrat		From flowers of citrus medica.
" neroli		From flowers of citrus bigaradia.
" bergamot	.885	From fruit of citrus bergamia.
" orange		Expressed from the rind; very oxidizable.
" cubebs ($C_{15}H_{12}$)	.929	See cubebin.
" copaiva	.878	Associated with an acid resin.
" pepper	.993	See piperin.
" ginger (?)	.893	Associated with acrid resin.
" amber	.758	By oxidation, succinic acid.
" cloves (light)	.918	See oxygenated oils.
" valerian (light)		See oxygenated oils.

[1] Mostly at 72° Fahrenheit.

Oxygenated Oils.

A very large number of oxygenated oils are known to exist, although, according to the views of some, many of this class consist of members of the former class combined with peculiar camphors. Others have regarded members of this series as oxides of oils of the carbo-hydrogen series; but, as their actual composition is not well established, it will be sufficient, in most instances, to present their ascertained empirical formulæ. Many important members of this class are obtained from the natural families Umbelliferæ, Labiatæ, Lauraceæ, and Compositæ, but they are very widely diffused in other divisions of the vegetable kingdom.

The oxygenated oils, like the foregoing, are mostly local and general stimulants: some of them are of the kind called carminatives, used to expel wind in colic; others are stomachics, promoters of digestion; a few, from their influence upon the brain, rank as antispasmodics. Not a few of both this and the foregoing are chiefly valued as perfumes, whether for the toilet or in pharmacy.

Most of the spices, as nutmeg, mace, pimento, cloves, contain oxygenated oils, which, in connection with peculiar camphoraceous or resinous ingredients, give them their value as condiments or seasoners.

The herbs used in soups and stuffings, and rendering savory many otherwise tasteless dishes, all contain essential oils, and most of them of this series. It will be observed that none of the essential oils rank as narcotics, except in over doses, though those of camphor, valerian, serpentaria, &c., as before stated, are used as cerebro-spinal stimulants and antispasmodics.

As a class of essential oils, the oxygenated are the most soluble in water, and enter into the *Aquæ Medicatæ* introduced among the Galenical preparations.

In attempting to embody the leading facts in regard to the oxygenated essential oils in a table, I have not sought to make a complete list of this immense class, but have omitted many which are unimportant, and of which little is known, while a few are introduced that modify greatly the properties of the drugs containing them, though rarely met with in commerce. The composition and specific gravity, when given, must be taken as approximations only, since great discrepancies exist in the published statements. The latest editions of Pereira, and Wood and Bache, and the more recent and theoretical treatises of Gmelin and Löwig, as well as Dr. Garrod's late work on materia medica, have been used in compiling them, and such botanical and therapeutical facts as are capable of being presented in this way, are introduced.

List of Oxygenated Essential Oils.

	Yield from the drug.	Sp. gr.	Composition and remarks.
Oil of anise (seed)	2 per ct.	.976	$C_{10}H_6O$. (?) Solid at 35° to 50°; melts at 62° F. Umbelliferæ.
" absinthium		.972	$C_{20}H_{16}O_2$. Isomeric with camphor.
" almonds (bitter)	1.35 per ct.	1.052	See p. 284. Contains Prussic acid C_2NH. Narcotic poison.
" asarum Canadense			Light colored; fragrant.
" asarum Europæum	.63 per ct.		C_8H_4O. Camphor, $C_8H_5O_2$.
" achillea millefolium		light	Oil of yarrow; color blue.
" buchu	.66 per ct.	light	Yellowish brown. Diuretic.
" cajeput	small	.927	$C_{20}H_{18}O_2$. Green. Stim., antispas.
" canella	small	heavy	With resin and bitter extractive.
" caraway	4.7 per ct.	.931	Umbelliferæ. Much used in pharm.
" catnep	small		The active carminative principle.
" cascarilla	1.2 per ct.	.938	Contains a $C_{10}H_8$ oil. Used for fumigation.
" cloves (heavy)	18 per ct.	1.061	$C_{21}H_{15}O_5$. (?) Caryophyllic acid.
	(crude)	1.079	Boils at 470° F. Acidifiable, forming with alkali crystalline salts.
" chenopodium	2 per ct.	.908	$C_{20}H_{16}O_2$. Anthelmintic.
" carrot (seed)	12 per ct.	.886	Umbelliferæ Diuretic stimulant.
" cassia		1.09	Impure hydruret of cinnamyle.
" cinnamon	.62 per ct.	1.035	$C_{18}H_7O_2+H$. See p. 284.
" chamomile		.908	$C_{20}H_{16}+C_{10}H_6O_2$. Blue. Compositæ.
" coriander		.811	$C_{20}H_{18}O_2$ Umbelliferæ. Used in confectionery.
" cumin			Do. Rubefacient.
" dill	3.5 per ct.	.881	Do. Carminative.
" erigeron Canadense		.845	Compositæ. Antihemorrhagic.
" erigeron Philadelph.	very small		Do.
" filix mas	6.9 per ct.		Crude. Very complex. Anthelmint.
" fennel (seed)	2.5 per ct.	.997	$C_{13}H_8O_2$. Umbelliferæ.
" gaultheria		1.173	Boils at 412°. Solid by KO.[1]
" hedeoma		.948	American pennyroyal. Carminat.
" hops	2 per ct.	.910	$C_{20}H_{16}+C_{20}H_{18}O_2$.[3] See sulph. oils.
" lavender	1.5 per ct.	.898	$C_{15}H_{14}O_2$. Sp. gr. .877 when rect.
" marrubium			Associated with bitter principle.
" matico			Antihemorrhagic. do. do.
" matricaria			German chamomile. Compositæ.
" melissa	very small		Oil of balm melisse. Reddish yellow.
" mint (pepper)	.5 per ct. ?	.920?	$C_{21}H_{20}O_2$. Boils at 365°. Labiatæ.
" mint (spear)	.5 per ct. ?	.975?	$C_{35}H_{28}O$. Boils at 320°. do.
" monarda (horsemint)			Solid at 40° F. Rubefacient. do.
" nutmeg		.95	Associated with fixed oil or fat.
" origanum	0.5 per ct.	.867	$C_{50}H_{40}O$. Boils at 354°. Rubefac't.
" pimenta (allspice)	4 per ct.	1.021	Myrtaceæ. Pungent, stomachic.
" pulegium	1 per ct.	.978	$C_{10}H_8O$. European pennyroyal.
" rose (attar)	very minute	.832[2]	Stearoptin at low temperatures.
" rosmary		.911	$C_{45}H_{58}O_2$. Boils at 365° Rubef.
" rue	very small	.837	$C_{28}H_{28}O_3$. Boils at 446°. Antispasmodic and emmenagogue.
" salvia	very small		$C_{12}H_{10}O+C_{18}H_{15}O_2$.
" sambucus (elder)	very small	1.09	Mild stimulating properties.
" sassafras	2 per ct.		$C_{10}H_5O_2$. Boils at 440°.
" serpentaria		.758	With resin and bitter principle.
" tanacetum			Yellowish green, deposits a camph.
" valerian (heavy)		.934	Valerole $C_{12}H_{10}O_2$. Cam. $C_{20}H_{18}O_2$.[4] By oxidation, val. acid.

[1] Salicylate of methylene (C_2H_3O, $C_{14}H_5O_5$), artificially prepared from pyroxylic spirit.

[2] At 90° Fahrenheit.

[3] This oxygenated oil is isomeric with oil of cajeput (Wagner), and oil of coriander (Kawalier).

[4] This camphor is said to be isomeric with Borneo camphor.

Sulphuretted Oils.

The members of this class have no chemical relations to the foregoing; they are not numerous. The oils of mustard and of horseradish are developed by spontaneous reaction of principles contained in the plants, while the other pre-exists in the plants from which it is obtainable by distillation.

Oil of	Mustard (sinapis nig.) . . .	$C_8H_5NS_2$
"	Horseradish (armoracia) . .	"
"	Garlic or onion (alium) . .	$C_6H_5S_2$.
"	Assafetida	"

These may be represented as compounds of a hypothetical radical, allyle, C_6H_5; of this mustard oil is a sulpho-cyanide, C_6H_5, C_2NS_2, and oil of garlic a sulphide, C_6H_5S. The essential oil of hops, formerly believed to contain sulphur, is found not to belong to this class. These oils possess medical properties adapting them to the treatment of nervous diseases, in which respect they differ from most of those of the other classes.

Camphors.

This class of solid crystalline substances has a close relation to the essential oils. Common camphor, the type of the class, is obtained from an evergreen-tree growing in China and Japan, the roots and twigs of which are cut into chips and placed with water into large iron vessels surmounted by earthen capitals, furnished with a lining of rice straw. A moderate heat being applied, and the camphor volatilized by the steam, it collects upon the straw in a crude and impure condition, and is collected and packed for exportation as crude camphor. It is refined by resublimation, and then constitutes the valuable and characteristic drug so familiar to almost every one. As already stated, camphor is an oxide of the radical $C_{20}H_{16}$, and one of the so-called camphene series.

Some of the essential oils are capable of depositing camphors by exposure to extreme cold, while others can be converted into camphors by solution in water and long exposure. The carbo-hydrogen constituents of these combine with the elements of water to form a sort of hydrates, which appear to be true camphors. These are solid, colorless, crystalline fusible bodies, less volatile than the essential oils, soluble in alcohol and ether, and partially in water.

According to Löwig, ordinary camphor exists in solution in the crude oils of lavender, rosemary, spearmint, and origanum; it is also produced by the action of nitric acid on oil of sage. Its composition is $C_{20}H_{16}O_2$. Löwig describes numerous camphors, of which the following are illustrations: Lemon camphor, a compound of oil of lemon and water, has the composition $C_{20}H_{22}O_6$; but, by

being heated, loses two atoms of water. Juniper-berry water, treated with caustic potassa, yields a camphor=$C_{20}H_{20}O_4$. The crude oil distilled from parsley seed, dissolved in water, after a few days, deposits a camphor=$C_{12}H_7O_4$. If cloves are digested with alcohol, after a little time crystals are deposited, which are soluble in water, fuse at 626° F., and volatilize at 554° F., and dissolve with blood-red color in sulphuric acid.

Some of the substances usually treated of as neutral crystalline principles are classified by the German chemists as camphors; of this number cantharidin, the active principle of Spanish flies, and nicotianin, one of the constituents of tobacco, may be instanced. There is much obscurity now connected with the precise habitudes and relations of the indifferent crystalline principles associated with oils and otherwise distributed in plants.

Resins.

The resins are very extensively diffused in the vegetable kingdom, being generally present in every plant containing an essential oil, as also in many which do not. The idea of a resin is rather vague, but we may, in a general way, describe among this class all substances which are solid at ordinary temperatures, fuse readily by heat, do not volatilize unchanged, become negatively electric by rubbing; are insoluble in water, soluble in alcohol, and partially so in ether and oil of turpentine. They are mostly inodorous, and are readily incorporated with fatty bodies by fusion. They are not, as a class, disposed to crystalline forms, being mostly amorphous.

The origin of resins is mostly in the oxidation of essential oils, which may occur, as in the case of turpentine and copaiva, in the plants producing them, or after their extraction, as stated under the head of essential oils. To this fact may be traced their mixed character. The volatile oils being usually mixtures of two or more oils, the resins are apt to be constituted of several similar though not identical resins. By treatment with alcohol, ether, oil of turpentine, &c., the different constituents can generally be separated. Many of the resins—those containing most oxygen—play the part of acids, and are, in fact, designated as such; these form with alkali compounds, some of which are soluble and others insoluble in alcohol, while some are quite indifferent to the action of alkali. Some so called soft resins possess strong odors; these are usually imperfectly oxidized, and contain portions of essential oil.

Resins generally resemble the corresponding essential oils in their stimulating effects, though there is a group of them which may be termed acrid resins, including the cathartics. A few of the gum resins are adapted, by their control over the nervous system, to use as antispasmodics.

As the object of this chapter is to convey a general view of the

prominent resinous substances entering into the Materia Medica, without any extended details, a tabular statement of some of the leading points in their history may suffice.

I. *Resins Proper.*

	Composition and remarks.
Resina, *U. S.* Colophone, from Terebinthina, *U. S.*	Silvic acid, $C_{40}H_{30}O_4$. Crystalline. Pinic acid, $C_{40}H_{30}O_4$. Amorphous.
Mastich. Exudation from Pistacia lentiscus.	$C_{40}H_{31}O_4$. Very soluble in alcohol. $C_{40}H_{31}O_2$. Not very soluble in alcohol.
Copal. Exudation from different trees.	$C_{40}H_{32}O_5$. Soluble in ether. $C_{40}H_{31}O_3$. Soluble in alcohol.
Elemi. Exudation from tree.	60 per cent. acid resin. Soluble in cold alcohol. $C_{40}H_{33}O$. Indifferent resin. Soluble in hot alcohol. 12.5 volatile oil.
Sandarac. Exudation from Thuya articulata.	$C_{40}H_{31}O_6$. Easily soluble in alcohol. $C_{40}H_{31}O_5$. Not easily soluble in alcohol. $C_{40}H_{30}O_6$. Soluble in boiling alcohol.
Pix Canadensis, *U. S.* Prepared concrete juice of Abies Canadensis.	Small proportion of volatile oil.
Pix Burgundica, *U. S.* Prepared concrete juice of Abies excelsa.	Small proportion of volatile oil.
Guaiaci resina, *U. S.* Concrete juice of Guaiacum officinale.	18.7 per cent. soft resin. Soluble in ether and ammonia. 58.3 per cent. soft resin. Soluble in ether. 11.3 per cent. hard resin. Soluble in ammonia. Trace benzoic acid.
Succinum, *U S.* Fossil resin. Sp. gr. 1.07.	2 resins; volatile oil; succinic acid and bitumen.
Copaivic acid, from Copaiba, *U. S.*	$C_{40}H_{30}O_4$ Associated with indifferent resin and volatile oil.

II. *Oleo-Resins.*

Terebinthina, *U. S.* The juice of Pinus palustris and other species of pinus. (White turpentine.)	17 per cent. volatile oil. Resina, *U. S.*
Terebinthina Canadensis, *U. S.* From Abies balsamea. (Balsam of fir.)	18.6 per cent. volatile oil. 40 per cent. resin, soluble in alcohol. 33.4 per cent. sub-resin, with difficulty soluble in alcohol.
Terebinthina veneta. From Larix Europæa. (Venice turpentine.)	20 per cent. volatile oil. Resin.
Copaiba, *U. S.* (Sp. gr. .916 to 1.) From various species Copaifera.	31 to 80 per ct. volatile oil. 1.6 per ct. soft brown resin. Copaivic acid.

III. *Gum Resins.*

Ammoniacum, *U. S.* Concrete juice of Dorema, A.
- 22 per cent. gum.
- 72 per cent. resin.

→ Stimulant, expectorant.

Assafœtida, *U. S.* Sp. gr. 1.32. Concrete juice Narthex, A.
- 26 per cent. gum.
- 47.2 per cent. resin. Sol. in ether.
- 4.6 per cent. essential oil.

→ Antispasmodic.

Galbanum, *U. S.* Sp. gr. 1.212. From an unknown plant.
- 19.28 per cent. gum.
- 66.86 per cent. resin.
- 6.34 per cent. volatile oil.

→ Stimulant, antispasmodic.

Sagapenum. From an uncertain plant.
- 32 per cent. gum.
- 54 per cent. resin.
- 3.73 per cent. volatile oil.

→ Stimulant like assafœtida.

Gambogia, *U. S.* From an uncertain tree.
- 19.5 per cent. gum.
- 80 per cent. gambogic acid. $C_{60}H_{35}O_{12}$. (?) Sol. in ether.

Scammonium, *U. S.* Concrete juice of Convolvulus, S.
- 5 to 80 per cent. resin. Cathartic.

Olibanum. Frankincense. From an unknown plant.
- 30 per cent. gum.
- 56 per cent. resin.
- 8 per cent. volatile oil.

→ For fumigation.

Myrrha, *U. S.* Sp. gr. 1.31. From Balsamodendron, M.
- 40.81 per cent. gum. (Arabin.)
- 44.76 per cent. resin. (Neutral.)
- 2.18 per cent. volatile oil.

→ Emmenagogue, and astringent.

IV. *Balsams.*

Benzoinum, *U.S.* Sp. gr. 1.063 From Styrax Benzoin.
- Benzoic acid, average 15 per cent.
- *a.* Resin, $C_{70}H_{42}O_{14}$, soluble in ether, not in KO,CO_2.
- *b.* Resin, $C_{30}H_{20}O_5$, soluble in KO,CO_2, not in ether.
- *c.* Resin, $C_{40}H_{22}O_9$, soluble in alcohol, not in ether.

Balsamum Peruvianum, *U. S.* Sp. gr. 1.14 to 1.16.
- Cinnamic acid, 6.94 per cent.
- Oil or cinnameine, 69 per cent.
- 23.1 per cent. resin, $C_{40}H_{28}O_6$.

→ Stimulating expectorant.

Balsamum tolutanum, *U. S.*
- Resin, 88 per cent.
- Cinnamic acid, 12 per cent.
- Volatile oil, 0.2 per cent.

→ Do.

Styrax, *U. S.* Concrete juice of S. officinale.
- Benzoic acid.
- Styracine. Cinnameine. (?)
- 2 resins.

→ Do.

V. *Other Articles of Materia Medica containing Resins or Resinoid Active Principles.*

Calamus, *U. S.;* rhizome of Acorus C. Minute quantity of essential oil, and 2.3 per cent. of soft resin.
Cimicifuga, *U. S.;* root of C. racemosa. See p. 163.
Colocynthis, *U. S.;* fruit of Citrullus C. Colocynthin.
Extractum cannabis, *U. S.;* extract Indian hemp. Cannabin.
Guaiaci lignum, *U. S.;* wood of G. officinale. 26 per cent. resin, ext., &c.
Helleborus, *U. S.;* root of helleborus niger. Helleborin. Soft, acrid resin.
Jalapa, *U. S.;* root of Ipomœa J. 7.8 per cent. jalapin; $C_{42}H_{35}O_{20}$. See p. 163.
Mezereum, *U. S.;* bark of Daphne M., and Daphne gnidium. Acrid resin.
Podophyllum, *U. S.;* root of P. peltatum. See Podophyllin, p. 163.
Pyrethrum, *U. S.;* root of Anacyclus P. Pyrethrin; acrid resin.
Zingiberis, *U. S.;* rhizoma of Z. officinale. Small quantity of essential oil. See p. 284.
Also, drugs, generally, which contain essential oils.

Of the *resins proper*, mastich, copal, and sandarac are used almost exclusively in varnishes; elemi enters into some stimulating external applications; amber is used exclusively for the products of its distillation; Burgundy pitch and the so-called hemlock gum (pix Canadensis) are applied in the form of plasters for their stimulating and counter-irritant effects. Guaiacum, which was formerly classed with the gum-resins, is adapted to the treatment of rheumatic complaints, for which it is much used.

Of the *oleo-resins* three are turpentines. White or common turpentine (terebinthina) yields the valuable oil which has such extensive use in the arts and in medicine, and resin, a scarcely less useful product, which in turn, by distillation, yields several empyreumatic oils employed in the arts. Balsam of fir, T. Canadensis, and Venice turpentine, T. veneta, are chiefly used in the arts, the latter being a useful ingredient in sealing-wax; it is much sophisticated. Copaiva is highly esteemed for its stimulating effect upon the mucous surfaces, particularly those of the urinary organs.

The *gum resins* and balsams are distinguished from each other by the latter containing benzoic or cinnamic acid.

Ammoniac, assafœtida, and the balsams are much used as stimulating expectorants. Assafœtida, galbanum, and sagapenum are most esteemed for antispasmodic effects both internally and externally applied; the latter is rarely met with in this country. Olibanum is almost exclusively used for fumigation. Gamboge and scammony are powerful drastic cathartics, the latter being almost always largely adulterated.

Myrrh is peculiarly fitted for weak and relaxed conditions of the system connected with diseases of the lungs and uterus. It is much combined with salts of iron, as in Griffith's myrrh mixture elsewhere introduced.

Of the *balsams*, benzoin is solid, hard, and brittle; that of Peru, called also myroxylon, is fluid; Tolu is intermediate, being a very soft and readily fusible solid; while storax is met with both in the liquid and a very impure solid granular form.

The group of drugs containing resinous active principles comprises a considerable variety. Calamus, mezereon, and pellitory, with some of the essential oil group, are powerful local stimulants. Colocynth, jalap, podophyllum, and hellebore, are cathartics, the latter possessing emmenagogue properties. Cimicifuga is a sedative tonic in diseased conditions of the nervous system. Extract of cannabis is exhilarant. Ginger is a carminative greatly esteemed. See the chapters on Tinctures, Extracts, and Fluid Extracts.

CHAPTER VII.

ON NEUTRAL ORGANIC PRINCIPLES MOSTLY PECULIAR TO A LIMITED NUMBER OF PLANTS, AND POSSESSED OF MEDICINAL PROPERTIES.

Formerly, the virtues of a great many medical plants were attributed to *extractive* matter, though this, as obtained from various sources and by different analytical processes, was known to vary somewhat in physical and in chemical properties.

Recently, many of these plants have been found to possess certain well-defined proximate principles, sometimes crystalline and sometimes amorphous, to which appropriate names have been given. If *alkaline*, these names terminate in *ia*; if *neutral* or *subacid*, in *in* or *ine*; and, with a view to accuracy, this distinction should be invariably retained.

The chemical properties of many of the *uncrystallizable* principles have not been sufficiently investigated to admit of their being classified, except by the rather inaccurate designation of extractive. Some of them probably contain crystalline principles, which have as yet escaped observation; others are perhaps the result of the oxidation or alteration in some way, by the processes employed, of the peculiar and obscure principle really at the base of the active properties of the drug.

Extractive, then, as at present recognized, is a product of the evaporation of the infusions or tinctures of plants after the separation of their known and indifferent principles.

The *neutral crystalline principles* are conveniently considered under the same head, and will be separately presented with reference to their leading characteristics. Some so designated, though not distinctly crystalline, are pulverulent and white, or of a distinctive color.

Neutral crystalline principles are in some instances active, and in others appear to possess little power of affecting the system. Some of them contain nitrogen, while others consist of merely carbon, hydrogen, and oxygen. To the former class several of the most active belong, and the possession of nitrogen was formerly considered an indication of the power of affecting the nervous system, though digitalin, the most powerful, is not nitrogenized. These principles occasionally unite with acids, forming crystalline compounds, which are, however, acid in their properties; others combine with alkalies, forming crystallizable salts. They are generally precipitated by tannic acid, and many of them by subacetate of lead.

The modes of obtaining the neutral principles are various, and sometimes very complex. The solubility and the chemical peculiarities of each, when known, indicate the process to be pursued in extracting it. Recently, the use of animal charcoal has been found to facilitate their extraction from the solutions containing them.

M. Labourdais, a European chemist, has, within a few years, examined many of these principles and published processes for their extraction, in all of which he avails himself of the absorbent power of charcoal, which is greatly increased by its purification. (See *Carbo-animalis.*) The two following recipes are inserted as examples of his modes of preparation, which are certainly more simple than those previously published.

Digitalin.—Precipitate by the acetate of lead an aqueous solution of alcoholic extract of digitalis, filter and agitate the liquid with purified animal charcoal. Let it rest; pour off gently and wash the *charcoaled* deposit, charged with all the bitter principle, in distilled water. Dry it in a stove, and treat it afterwards with boiling alcohol. This alcohol, evaporated in a water bath, gives a liquid which precipitates, on cooling, the digitalin in a pulverulent form. This can be purified and obtained in crystals by a new alcoholic treatment.

Ilicin.—Make a decoction of holly-leaves; boil with washed animal charcoal; agitate it constantly; take it off the fire; let it rest; pour off gently; treat the dry charcoal with boiling alcohol; filter; evaporate by the stove. The dry and bitter material obtained is ilicine.

Similar modes of preparation may be applied to the isolation of the alkaloids.

It will not be expected that a subject so purely scientific, and having so little direct practical application to the wants of the physician, should claim an extended notice in a work like the present. The appropriation of a chapter to it here results from the effort to generalize, as far as possible, the leading facts in the chemical history of plants, and thus to hold out to the student a study which underlies the whole science of pharmacy.

There is no known scientific mode of classifying these organic principles, and the tables which follow lay no claim to such classification. They are, moreover, liable to the objection of presenting to view some results which require further confirmation, while, from the conflicting character of many of the published analyses, it has been impossible to glean the truth sufficiently to embody it in the compact form selected. It is believed, notwithstanding, that the more important general facts in regard to the neutral peculiar principles are displayed in these tables.

Syllabus of Neutral Organic Peculiar Principles, with the Drugs which yield them.

1st *Group.—Extractive Matters, soluble in Water.*

Aurantiin. Bitter extractive of cortex aurantii and limonis, *U. S.* Associated with volatile oil.

Bitter extractive of anthemis, *U. S.* Associated with volatile oil.
" " canella, *U. S.* Associated with volatile oil.
" " chimaphila, *U. S.* Associated with tannic acid.
" " coptis, *U. S.* Unassociated with volatile oil or tannic acid.
" " cornus Florida, *U. S.* Associated with tannic acid.
" " eupatorium, *U. S.* Associated with tannin, &c.
" " gentiana, *U. S.* Containing unimportant crystalline principles.
" " marrubium, *U. S.* Associated with volatile oil.
" " serpentaria, *U. S.* Associated with volatile oil.
" and acrid extractive of scilla, *U. S.* Said to contain two distinct principles.

Cathartin, in { senna, *U. S.* / cassia Marilandica, *U. S.* / rhamni baccæ. } Probably not the active principle as heretofore obtained.

Ergotin, extractive of ergota, *U. S.* Associated with fixed oil, &c. See p. 161.

Extractive of juglans, *U. S.* Cathartic principle little understood.

Ilicin, in ilex (the holly). Used as a substitute for quinia.

2d *Group.—Neutral Crystalline Principles, with their Composition, Sources, &c.*

Absinthin, $C_{16}H_{10}O_4$, from absinthium, *U. S.* Bitter principle precipitated by 2Pb $\overline{A}e$.

Aloin, $C_{34}H_{18}O_{14}HO$, from aloe, *U S.* The active principle very soluble in hot water and alcohol. Yields by oxidation crysamic acid.

Amygdalin, $C_{40}H_{27}NO_{22}$, from amygdala amara, *U. S.* Forms hydrocyanic acid with emulsin.

Asparagin, 2HO, $C_8H_8N_2O_5$ from { Asparagus officinalis. / Althææ radix. *U. S.* / Glycyrrhiza, *U. S.* / Symphytum officinale, *U. S.* } Represented in some works as a compound of malic acid and amide, malamide, NH_2MaO_3.
Althein, " " "

Apocynin (?), from apocynum cannabinum, *U. S.* Emetic and cathartic.

Asclepione, $C_{40}H_{34}O_6$, from asclepias syriaca, *U. S.* Soluble in ether; narcotic.

Caffein, $C_{16}H_{10}N_4O_4$, from caffea arabica. Coffee. Isomeric with thein.

Cantharidin, $C_{10}H_6O_4$, from cantharis and C. vittata, *U. S.* Soluble in alcohol and water as naturally combined, and very freely in oil of turpentine, fixed oils, ether and chloroform.

Cascarillin, C H O (?), from cascarilla, *U. S.* Bitter principle soluble in alcohol; precipitated by subacetate of lead from solution.

Cetrarin, $C_{34}H_{16}O_{15}$, from cetraria, *U. S.* Bitter principle.

Columbin, $C_{42}H_{22}O_{14}$, from columba, *U. S.* Associated with alkaloid berberine.

Cubebin, $C_{34}H_{34}O_{10}$, from cubeba, *U. S.* Soluble in ether, volatile oils, and hot alcohol.

Cusparin (?), from angustura, *U. S.* Soluble in water, especially hot; precip. by $\overline{T}$.

Daphnin (?), from mezereum, *U. S.* Bitter principle analogous to asparagin, associated with acrid resin.

Digitalin, C H O (?), from digitalis, *U. S.* Soluble in water in its natural combination; a violent poison—dose 1-30th grain.

Elaterin, $C_{20}H_{14}O_5$ (?), from elaterium, *U. S.* Very powerful cathartic; dose 1-10th gr.

Esculin, $C_{16}H_9O_{10}$, from æsculus hippocastanum. Horsechestnut. Antiperiodic. (?)

Hellcborin (?), from helleborus, *U. S.* Associated with acrid resin and oil.

Hesperidin (?), from cortex limonis, &c., *U. S.* Inert; associated with bitter extractive.

Hydrastin (?), from hydrastis Canadensis. See p. 163 and 297.

Limonin, $C_{42}H_{25}O_{13}$, from seeds of lemon and orange.

Liriodendrin (?), from liriodendron, *U. S.*, and magnolia, *U. S.* Soluble in ether and alcohol; bitter and pungent.

Maticin (?), from matico, *U. S.* Bitter principle, associated with an active essential oil.

Meconin, $C_{10}H_5O_4$, Narcein, $C_{23}H_{20}NO_{12}$, Narcotin, $C_{48}H_{24}NO_{15}$, } from opium, *U. S.* Narcotin, tonic and antiperiodic.(?) Therapeutics little understood. (See Alkaloids.)

Phloridzin, $C_{24}H_{16}O_{14}$, from apple, cherry, and plum trees. Bitter and astringent.

Picrotoxin, $C_{10}H_6O_4$ (?), from cocculus indicus. Poisonous.

Piperin, $C_{70}H_{37}N_2O_{10}$, from piper nigrum and longum, *U. S.* Soluble in ether, volatile oils, &c. (See Extractum Piperis Fluidum.)

Quassin, $C_{20}H_{12}O_6$, from quassia, *U. S.*, and simaruba, *U. S.* Said to be = Esculin.

Salicin, $C_{42}H_{29}O_{22}$, from salix, *U. S.*, and other bitter willow and poplar barks. Soluble in water.

Santonin, $C_{30}H_{18}O_6$, from semen santonica. Acid and bitter; soluble in alcohol and ether; anthelmintic; dose 1 to 4 grains.

Saponin, $C_{26}H_{24}O_{16}$ (?), from saponaria officinalis, *U. S.* Frothing in solution.

Sarsaparillin, $C_4H_8O_3$ (?), from sarsaparilla, *U. S.* Soluble in hot water and volatile oils. (?)

Scillitin (?), from scilla, *U. S.* Requires further examination.

Scoparin, $C_{21}H_{11}O_{10}$, from scoparius, *U. S.*, said to be associated with a liquid alkaloid, Spartein, $C_{15}H_{13}N$.

Senegin or polygalic acid, $C_{22}H_{18}O_{11}$, from Senega, *U. S.* Very acrid; soluble in water; resembling saponin.

Taraxacin (?), from taraxacum, *U. S.* Bitter, acrid; soluble in hot water.

Thein, $C_{16}H_{10}N_4O_4$, from the different varieties of thea (tea). Identical with caffein.

Theobromin, $C_{14}H_5N_4O_4$, from theobroma cacao. Contains C_2H_2 less than thein.

Xanthoxylin (?), from xanthoxylum, *U. S.* Properties not investigated.

Of the drugs enumerated in this syllabus, several are distinguished by containing the extractive principle named:—

Cathartin.—This is a yellow uncrystallizable substance, with a bitter, nauseous taste, very soluble both in water and alcohol. It attracts moisture from the air, and is precipitated by infusion of galls and subacetate of lead. It contains no nitrogen. Cathartin, in an impure form, is occasionally prescribed in small doses, although it is by some said not to possess the active properties of the plant. The cathartic principle of *juglans* (white walnut bark) has not been sufficiently studied to allot it a place in any classification.

Under the name of *ergotin*, a preparation, which has been mentioned among the pseudo extracts, is sold in the shops. It is not entitled to rank among pure active principles; but, in the latitude given to the construction of these tables, it is perhaps not inappropriately introduced among the extractive matters.

Saponin is the name given to a pulverulent principle present in the saponaria officinalis. The active principle of senega, which has been called *senegin*, or *polygalic acid*, resembles saponin in some of its properties. It has been obtained as a white powder, soluble in water and alcohol, insoluble in ether, and precipitated by subacetate of lead. It forms no crystallizable salts. It does not contain nitrogen. Sarsaparilla yields a crystalline principle called *smilacin*, or *sarsaparillin*, which resembles senegin and saponin. It is only slightly soluble in cold water, and distinguished by the frothy character it gives to its solution on agitation. Monesia bark and the imported extract of that name are believed to contain saponin.

Angustura bark yields, on the spontaneous evaporation of its

tincture, a crystalline principle slightly soluble in water, more so in alcohol, to which the name *cusparin* has been applied.

Gentian contains a crystallizable principle named *genticin*, but the most prominent character of the root, that of intense bitterness, seems to remain after the separation of this principle, and from this extractive mass no other principle has been isolated; so that we may regard its activity as belonging to bitter *extractive*.

Aloin.—The recent discovery by T. and H. Smith, of Edinburgh, of a neutral crystalline principle existing in aloes, has excited much interest, and their experiments have been repeated by several without success. They obtained it from an aqueous solution, though in sulphur-yellow crystals, which were sparingly soluble, though very readily dissolved by alkali. Aloin is thrown down by subacetate of lead as an intensely yellow precipitate.

Among the most interesting of the nitrogenized neutral principles are *thein* and *caffein*, which have the composition $C_{16}H_{10}N_4O_4$, and *theobromin* $C_{14}H_8N_4O_4$. These possess similar properties, both chemically and therapeutically, and are remarkable for the very large proportion of nitrogen they contain. The almost universal employment as beverages of infusions of tea, coffee, or chocolate, which contain one or other of these principles, taken in connection with their composition, has given rise to important theoretical views concerning their utility, which will be found fully developed in *Liebig's Animal Chemistry*.

Asparagin, or *althein*, $C_8H_8N_2O_5+2HO$, is another highly nitrogenized neutral crystalline principle, which exists in asparagus, liquorice, and althea roots. It seems destitute of any striking therapeutical effects, although like the powerful alkaloids in containing nitrogen.

Amygdalin, $C_{40}H_{27}NO_{22}$, is a remarkable crystalline principle, reacting in the presence of water, with emulsin, a sort of vegetable albumen, to develop the powerfully odorous volatile oil, called oil of bitter almonds, and hydrocyanic acid. These principles are much used in Europe for the artificial preparation of bitter almond water.

In *piperin*, $C_{70}H_{37}N_2O_{10}$, and *cubebin*, $C_{34}H_{34}O_{10}$, we have an illustration of two crystalline products which resemble each other in properties, though differing in regard to a most important peculiarity —the presence of nitrogen. They neither of them play an important part in the activity of the medicines containing them. The former is recently stated to be a compound of an alkaloid, picolin, $C_{12}H_7N$.

In *digitalin*, which is destitute of nitrogen, we have the most potent of vegetable poisons, powerfully affecting the nervous system in doses of one-thirtieth grain.

In *elaterin*, we have a rare instance of an organic crystalline principle, possessed of powerfully acrid cathartic qualities.

Salicin and *phloridzin* are crystalline principles occasionally met with in commerce, but they are rarely prescribed. Salicin has

been used as an adulteration of sulphate of quinia, from which it is conveniently distinguished by its property of turning red on the application of sulphuric acid.

Hydrastin, which was at first considered an alkaloid, is now stated to be a neutral principle. It is believed to be nitrogenized. Edward S. Wayne, of Cincinnati, Ohio, informs me that he is in the habit of extracting large quantities of it to meet an extensive demand in the West. Its brilliant yellow color adapts it to use as a pigment, besides its reputed utility as a medicine.

Santonin possesses more practical interest than most of its class, from its extensive use in medicine as a vermifuge. It is extracted from the European wormseed, and is an article of commerce not only in Europe, where it has been used for some years, but in this country, where its value is just beginning to be appreciated by practitioners. It is in colorless crystals, with little taste, owing to their insolubility, though leaving a slight sense of acrimony in the mouth; its solution is bitter. It is soluble in ether and alcohol, and but slightly in water. Though without acid or alkaline action on test paper, it combines with alkalies, forming soluble compounds. It is best given in powder, diluted with sugar, and is recommended by the absence of an unpleasant taste. The dose is from one to four grains twice a day.

It is one of the numerous principles which have been tried, with occasional success, as a substitute for quinia in intermittents. For mode of extraction, see *Am. Journ. Pharm.*, vol. xv. p. 278.

Coloring Matters.

To the class of neutral crystalline principles belong several important coloring matters.

Indigotin, $C_{16}H_5NO_2$, is the coloring principle of indigo. It is insoluble in water; but, by the action of deoxidizing agents, is converted into *white indigo*, which contains one more atom of hydrogen; this is soluble in water, and, by exposure to the air, becomes converted again into indigotin. By treating indigo with very strong sulphuric acid, a compound is formed called sulph.-indylic acid $C_{16}H_5NO_2+2SO_3$. This is used as a test for chlorine, which deprives it of color.

Litmus.—The article which comes in small cakes, made up of a granular powder, known in commerce as *litmus*, is a factitious substance, prepared chiefly in Holland from certain lichens, species of Rocella, which contain a peculiar acid—*lecanoric acid*. The mass is made by macerating the lichen for some time in a solution of lime and potash, which gives a red-colored liquid containing a peculiar crystallizable compound called *orcine*. This infusion is mixed with urine, which, after a species of fermentation, in which ammonia is evolved, brings out the peculiar blue coloring principle named

orcine. The solution is now made into a mass with earthy impurities, and dried into its characteristic form.

The use of this peculiar substance is familiar to all chemical students. By treating it with successive portions of hot water, an infusion is procured which, by evaporation and painting upon unsized paper, constitutes test paper; reddened by a weak acid, it serves as a test for alkalies which restore the blue color, while acids redden the blue litmus immediately.

Chlorophylle (leaf green), $C_{18}H_9NO_8$, exists in grasses and the leaves of trees, from which it may be obtained by treating a strong alcohol and ether extract with hydrochloric acid; precipitating the chlorophylle from this with water, and drying, we have it as a dark green powder. Leaves contain only a very small quantity of this principle, which, however, possesses powerful coloring properties.

Additional Coloring Substances.

Carthamus, *U. S.* Flowers of C. Tinctoria. $C_{14}H_8O_7$, Red. $C_{24}H_{15}O_{15}$, Yellow.
Coccus, *U. S.* Coccus cacti, the insect. Carmine, $C_{28}H_{14}O_{16}$. Red.
Crocus, *U. S.* Stigmas crocus sativa. Polycroite. Yellow.
Curcuma, *U. S.* Rhizoma, C. Longa. Curcumin. Yellow; brown with alkali.
Hæmatoxylon, *U S.* Wood, H. Campechianum. Hæmatin, $C_{40}H_{17}O_{15}$.
Quercus tinctoria, *U. S.* The bark (quercitron). Quercitrin, HO, $C_{16}H_8O_9$. Yellow.
Santalum, *U. S.* Wood of pterocarpus, S. Santalin, HO, $C_{30}H_{13}O_9$. Resinous.
Rubia tinctoria, *U. S.* Root. Rubian, alizarin, $C_{20}H_6O_6$; purpurin, $C_{18}H_6O_6$.
Anchusa, *U. S.* Root of A. Tinctoria. Anchusin, $C_{35}H_{20}O_8$. Red. Green, $C_{34}H_{22}O_4$.
Rheum, *U. S.* Root of R. Palmatum. Rhabarbaric acid. Yellow; red with alkali.
Sanguinaria, *U. S.* Root of S. Canadensis. Sanguinarina. Red, with acids.
Hydrastis. Root of H. Canadensis. Hydrastin. Yellow.

CHAPTER VIII.

ON VEGETABLE ACIDS.

VEGETABLE ACIDS are distinguished as a class by characteristic properties. They combine with inorganic or organic alkalies, some of them in several different proportions, according to the number of equivalents of water combined with them. Thus, citric is a tribasic acid, containing three equivalents of water; tartaric bibasic, containing only two; and benzoic only one, monobasic. These acids are found in nature both free and combined with organic bases. Some are very commonly diffused throughout the vegetable kingdom, as tannic; others exist exclusively in one family of plants, as meconic acid in the papaveraceæ. Some, although existing naturally, are capable of artificial production from other organic material, as oxalic and valerianic. This whole class, like that of organic alkalies, have a much closer relation to inorganic princi-

ples than the neutral crystalline and uncrystallizable principles before spoken of. They all contain oxygen, and, with the exception of hydrocyanic, which is most conveniently classed with them, are destitute of nitrogen in their composition. The vegetable acids are capable of numerous changes during the vegetative process of the plant, and, in some cases, of conversion into each other, as in the ripening of fruits tannic is converted into malic, and both of these into sugar.

In their relations to food and medicine, some of this class are exceedingly important. The agreeable acids of the lemon and orange, the grape, the apple, and similar fruits, are refrigerants in the highest degree useful, and even indispensable to man. The astringent acids distributed widely in nature, and much associated with bitter principles in plants, are scarcely less important in the functions they subserve in the general processes of digestion, and especially in enfeebled conditions of the organs.

Table of the Principal Vegetable Acids, their Sources, Composition, &c.

1st Group.—Important and widely diffused (Fruit) Acids.

Citric, 3HO, $C_{12}H_5O_{11}$. In lemons, currants, gooseberries, tomatoes, &c.
Tartaric, 2HO, $C_8H_4O_{10}$. In grapes. Obtained from wine deposits.
Malic, 2HO, $C_8H_4O_8$. In apples, &c. Not found in commerce.
Acetic, HO, $C_4H_3O_3$. Occasionally in plants. Product of fermentation, &c.
Oxalic, HO, C_2HO_5. Rhubarb plant, sorrel, &c. Artificially produced.
Pectic, HO, $C_{12}H_{17}O_{11}$. Various vegetable juices. Not found in commerce.

2d Group.—Astringent and Allied Acids.

Tannic, 3HO, $C_{18}H_5O_9$.[1] Most powerful, precipitating gelatin, freely soluble.
Gallic, 2HO, $C_7H_3O_5$. Does not precip. gelatin. Sparingly soluble in cold water.
Ellagic, 2HO, $C_7H_3O_5$. Very insoluble.
Catechu tannic, 3HO, $C_{18}H_5O_5$. (?) In kino, catechu, &c. Milder than tannic.
Cincho-tannic, 2HO, $C_{14}H_6O_7$. In cinchona barks. "
Cephælic, $C_{14}H_8O_6$. In ipecacuanha. Allied to the foregoing.

3d Group.—Having Relation to Essential Oils.

Benzoic, HO, $C_{14}H_5O_3$. By oxidation of oil of bitter almonds.
Cinnamic, HO, $C_{18}H_7O_3$. In balsams, old oil of cinnamon, &c.
Valerianic, HO, $C_{10}H_9O_3$. Generated in valerian spontaneously. Produced artificially from fusel oil.
Hydrocyanic, HC_2N. Generated in bitter almond water, spontaneously. Produced artificially from animal matters.

4th Group.—Combined with Alkaloids in Plants.

Meconic, $C_{14}H_4O_{14}$. With morphia, &c., in opium and the poppy.
Kinic, $C_{14}H_{12}O_{12}$. With quinia, &c., in cinchonas.
Aconitic, HO, C_4HO_3. With aconitia, &c., in aconite; also by heating citric.
Strychnic or igasuric. With strychnia and brucia, in nux vomica, &c.
Veratric, HO, $C_{18}H_9O_7$. With veratria, in cevadilla seed, &c.
Columbic, $C_{42}H_{21}O_{14}$. With bebeerina, in columbo-root.
Cevadic. With colchicia, in colchicum-root and seed.
Coccalinic. With menispermina, in cocculus indicus.

[1] The old formula. According to Mulder, it is isomeric with gallic acid and = HO, $C_{28}H_9O_{17}$.

First Group.—Fruit Acids.

Acidum Citricum, U. S.

This is procured from lime or lemon-juice by neutralizing the acid with chalk, and from the citrate of lime thus formed liberating the citric acid by means of sulphuric acid.

It is in large transparent crystals without color, with a strong, but agreeable acid taste, decomposed by heat, very soluble in water and in weak alcohol, deliquescing in moist weather. Specific gravity 1.6. As usually obtained in crystals, it consists of one equivalent of the tribasic acid + one (sometimes two) equivalent of water of crystallization. It is not sold in the form of powder. I have never met with an adulterated article. According to the *U. S. Pharmacopœia*, 100 grains of crystallized citric acid will saturate 150 grains of bicarb-potassa, which is on the supposition of one equivalent of water of crystallization being present. Its principal consumption is in the preparation of so-called lemon syrup and solution of citrate of magnesia. This latter preparation has increased the quantity of the acid used immensely, so that the price has, within two years, advanced to more than double its former average. The recent reduction to near its former rate has probably arisen from an increased supply. To make artificial lemon-juice, add citric acid ʒixss to water Oj ; fresh oil of lemon ɱj ; and sugar ʒj. This solution is much employed in making effervescing draughts. (*See* Potassæ Citras.) A good *lemonade* may be made by either of the following processes :—

1*st.* Infuse two lemons, sliced, in a pint or a pint and a half of boiling water ; when cool, strain and sweeten to taste.

2*d.* Dissolve twenty grains of citric acid in a pint of water, and sweeten with sugar to which has been added a drop of fresh oil of lemon.

3*d.* From syrup of citric acid, by recipe given under the head of Fruit Syrups.

Fresh lemon-peel is always to be preferred to the oil of the shops.

Acidum Tartaricum, U. S.

This valuable acid is prepared from bitartrate of potassa or cream of tartar, by the addition of carbonate of lime, whereby insoluble tartrate of lime is formed with the excess of acid of the bitartrate and neutral tartrate of potassa left in solution. This is decomposed with chloride of calcium, which forms an additional quantity of tartrate of lime. Lastly, the insoluble tartrate of lime is purified by washing, and decomposed by sulphuric acid, which liberates the tartaric acid. This, on evaporation, crystallizes in colorless crystals, with a tendency to the form of oblique rhombic prisms (citric acid is more in right rhombic prisms). It has a sour taste, resembling, though not identical with, that of citric acid. It

is freely soluble in water, entirely decomposed by heat. Tartaric acid may be recognized by the copious white crystalline precipitate it furnishes on adding to it an excess of any neutral salt of potash. The precipitate formed by both this and citric acid with acetate of lead should be soluble in nitric acid. This is rather a stronger acid than citric, 100 grains saturating 133.5 grains of bicarbonate of potassa. It is most usually sold in powder. Its principal use is in preparing effervescing and refrigerant drinks, and as a substitute for citric acid. Its salts will be treated under their appropriate heads.

Oxalic acid is an instance of an important vegetable acid existing ready formed in plants, and also capable of artificial production. All the oxalic acid of commerce is obtained by the action of nitric acid on sugar or starch, the organic principle being oxidized at the expense of the acid. Nitrous fumes and carbonic acid gas are evolved, and oxalic and saccharic acids are formed; the latter, which is the principal product, is collected and crystallized, and most extensively used as a bleaching agent. It is not officinal.

Acetic acid has been already referred to as produced in the destructive distillation of wood, and also as a product of the spontaneous change which takes place in articles of the saccharine and amylaceous group by the catalytic action of ferments. (See p. 244.)

Malic and *pectic acids* are of little pharmaceutic importance, though of interest as constituents of some of the most useful vegetable productions.

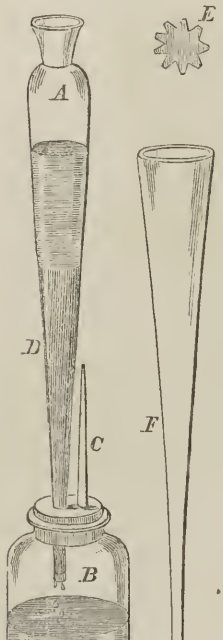
Second Group.—Astringent Acids.

The mode of extracting or preparing tannic and gallic acids being very simple and practicable, may next claim attention.

Acidum tannicum, U. S., is conveniently prepared by treating powdered galls in a narrow covered displacer, with hydrated or washed ether. The ethereal tincture which passes separates, upon standing, into two layers; the lower one is aqueous, thick, and of a light buff or straw color; it contains the tannic acid, which, by the action of the small portion of water in the washed ether, has been dissolved out from the galls. The upper layer or stratum of liquid is limpid and specifically much lighter than the other; it has a greenish color, and contains very little dissolved in the ether, but a small amount of coloring matter from the galls. To obtain the dry product, the light layer is poured off and purified by distillation, and combining with water for another operation, while the thick heavier layer is evaporated in a capsule by a carefully regulated heat till dry. If a white and very porous product is desired, the capsule should be inverted towards the end of the evaporation, so as to expose the thick syrupy liquid to the radiated heat. It is swelled up and whitened as the liquid is disengaged. The whole of the liquid which comes over may be evaporated without the precaution of pouring off the top layer, but the tannin is then apt

to have a greenish tinge. In large manufacturing establishments, apparatus is, of course, constructed for saving all the ether for future use. Figure 179 represents a suitable apparatus for small operations. *A* is an adapter, such as is used for coupling retorts and receivers; *B* is a wide-mouth receiving bottle; *C* is a glass tube passed through the cork, and drawn out to a capillary orifice for the escape of air as the liquid drops in. The adapter is designed to be stopped at bottom with a cork notched, as shown in Fig. *E*; and, as the lower orifice would be too small to allow a free passage of the liquid if the powder were tightly compacted into it, a portion of sand, either alone or mixed with powdered galls, is filled in to the lower part. Fig. *F* represents the broken beak of a retort cut round at its broken end, and adapted to a similar use. I have usually employed for this purpose, in teaching the student the process on a small scale, a Farina Cologne bottle cracked off evenly near the bottom, thus forming a still better shaped tube for the purpose. To prevent undue evaporation of ether, a stout, though loosely-fitting cork, may be introduced into the upper end, or it may be covered with a piece of bladder perforated with a few pinholes. The yield of tannic acid by this process is from 30 to 60 per cent. of the galls employed.

Fig. 179.

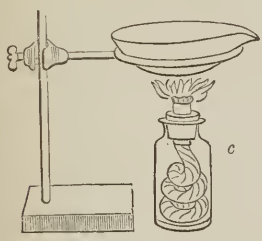


Displacers for making tannic acid.

Acidum gallicum, U. S., is made by subjecting a portion of powdered galls to long-continued action of air and moisture. This may be accomplished in an evaporating capsule loosely covered with paper. The powdered galls is first made into a paste with water, and water repeatedly added to this as it dries, until after the lapse of thirty days (*U. S.*), when the whole of the tannic has passed spontaneously into gallic acid. In extracting this from the moist mass, advantage is taken of the known solubility of gallic acid in hot water, and its ready precipitation on cooling; all that is necessary is to press out from the pasty mass its water, and, rejecting this, to digest the remaining paste in hot water, and filter the solution while hot through animal charcoal to decolorize it, and a nearly white crystalline powder of gallic acid is obtained. Fig. 180 represents the use of the evaporating dish for the hot solution, and Fig. 181 the arrangement usually adopted for filtering the solution while hot. Care must be taken in these processes not to employ vessels of tinned iron, which, by the exposure of a small surface of iron, may blacken the whole product.

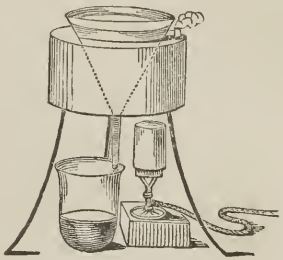
The composition of tannic and gallic acids, according to Liebig, is given in the syllabus of vegetable acids. According to Strecker, whose recent researches upon their chemical history have excited much attention, tannin has the composition $C_{54}H_{22}O_{34}$, and is con-

Fig. 180.



Evaporating dish and lamp.

Fig. 181.



Water-bath funnel.

verted into gallic acid and grape sugar by sulphuric acid, or by a sort of fermentation under the circumstances brought about in the process for preparing gallic acid. The following formula will explain the reaction according to this view ($C_{54}H_{20}O_{32}+8HO_2=3C_{14}H_6O_{10}+C_{12}H_{10}O_{10}$), or one equivalent of tannic acid and eight of water are resolved into three equivalents of gallic acid and one of grape sugar.

The rational formula for gallic acid, according to *Strecker*, is 3HO, $C_{14}H_3O_7$, thus making it a tribasic acid.

Gallic acid is soluble in cold water in about the proportion of four grains to the ounce. In common with tannic, it is usually given in pill, though used externally in ointment and solution.

Ellagic acid is the name given to another principle present in gall-nuts. It is insoluble in water, alcohol, and ether, and appears to be isomeric with gallic acid.

Both tannic and gallic acids are decomposable by heat into *pyrogallic*, $C_6H_3O_3$, and *metagallic*, $C_6H_2O_2$, acid. The former, on account of its great sensitiveness to light, in combination with silver, is considerably employed in photographic processes.

Uses and Varieties.—The relative utility of tannic and gallic acids, which are too apt to be confounded by physicians, depends upon the fact that the former acts directly upon the mucous membranes with which it comes in contact, arresting hemorrhage or other excessive discharge by its direct effect on the gelatin frequent in them. It is hence a direct and powerful styptic, while gallic acid, by entering the circulation, produces an astringent and tonic impression upon the more remote organs which cannot be directly impressed. The dose of tannic acid is from two to ten grains, that of gallic acid from five to twenty, several times a day. The former is much used in ointment as a substitute for powdered galls, in

about one-fourth the quantity, and is also well adapted to astringent injections instead of the less soluble vegetable astringents. Its action is considered somewhat different (harsher) than that of the modified forms of tannic contained in kino, krameria, cinchona, &c.

There are a variety of modifications of tannin, some of which are mentioned under different names in the *Syllabus*. These are distinguished by their behavior with salts of iron, gelatin, &c. The list which follows contains the names of different vegetable astringents owing their activity wholly or in part to tannic or gallic acid, in some of their various modified forms.

List of Vegetable or Tannic Acid Astringents.

Catechu, *U. S.;* extract of wood of acacia catechu. Gum catechu.
Chimaphila, *U. S.;* leaves of C. umbellata. Pipsissewa.
Cinchona, *U. S.;* bark of different species cinchona. Peruvian bark.
Diospyros, *U. S.;* unripe fruit of D. Virginiana. Persimmon.
Galla, *U. S.;* morbid excrescence in quercus infectoria. Galls.
Geranium, *U. S.;* rhizoma of G. maculatum. Cranesbill.
Geum, *U. S.;* root of G. rivale. Water avens.
Granatum fructus cortex, *U. S.;* from punica granatum. Pomegranate.
" radicis cortex, *U. S.* " " "
Hæmatoxylon, *U. S.;* wood of H. Campechianum. Logwood.
Heuchera, *U. S.;* root of H. Americana. Alum root.
Kino, *U. S.;* inspissated juice of various plants. Kino.
Krameria, *U. S.;* root of K. triandra. Rhatany.
Quercus alba, *U. S.;* the bark. White oak bark.
Quercus tinctoria, *U. S.;* the bark. Black oak bark.
Rosa gallica, *U. S.;* the petals. Red roses.
Rubus villosus, *U. S.;* the root. Blackberry-root.
" trivialis, *U. S.;* " Dewberry-root.
Spiræa, *U. S.;* root of spiræa tomentosa. Hardhack.
Statice, *U. S.;* the root of S. Caroliniana. Marsh rosemary.
Tormentilla, *U. S.;* the root of potentilla, T. Tormentil.
Uva ursi, *U. S.;* leaves of arctostaphylos, U. U. Bearberry leaves.

Third or Balsamic Group.

Acidum Benzoicum, U. S.

This was formerly stated to be characteristic of the class of medicines called balsams, although cinnamic acid is more recently asserted to be present in balsams of Tolu and Peru to its exclusion. It is readily obtained from benzoin by sublimation. For this experiment, which is an interesting one to the pharmaceutical student, the following simple directions are to be observed. Select an iron or tinned iron pan or cup—a common pint cup, without a handle, will answer—and, having covered the bottom with some powdered benzoin mixed with sand, stretch over the top of it a piece of porous paper, which may be secured at the edge by a string, but preferably by glue or some firm paste. Now fold a tall conical or straight-sided cap of the diameter of the pan, and tie it, or cement it securely round the upper edge, and set the whole in a sand bath,

or over a slow and well-regulated source of heat, leaving it for several hours. On removing the cap, it will be found to contain brilliant white feathery crystals of benzoic acid. The residue in the cup, by being again powdered, mixed with sand, and heated, will yield another, though a less abundant and less beautiful crop of crystals. As thus obtained, benzoic acid has a faint and agreeable balsamic odor, with very little taste, being nearly insoluble.

The process of Scheele consists in boiling the balsam with hydrate of lime, and treating the benzoate of lime thus formed with muriatic acid. Thus procured, benzoic acid has but little odor, and is ill adapted to the uses to which it is usually applied in medicine and pharmacy. An article is now met with in our markets imported from Germany, and manufactured from urine; its odor betrays its origin, besides that its appearance is different from the sublimed article.

Valerianic Acid.

Valerianic is an important medicinal acid developed spontaneously by the oxidation of volatile oil of valerian, as benzoic acid is by a similar change in the volatile oil of bitter almond. These, together with several other organic acids and odorous principles, are capable of being manufactured practically on an economical scale by artificial means. The substance met with in commerce as fusel oil, which is a residuary product of the rectification of alcohol from whiskey, has the composition $C_{10}H_{12}O_2$, or may be represented by $C_{10}H_{11}O + HO$, that is a hydrate of an oxide of a radical $C_{10}H_{11}$, called amyle. Hence, fusel oil is regarded as amylic alcohol; and as acetic acid is formed from common alcohol by adding two equivalents of oxygen and subtracting two of hydrogen, so valerianic acid is formed from amylic alcohol by a similar change of elements. The production of other comparatively rare vegetable principles from those which are abundant is so greatly to be desired that chemists are earnestly directing their attention to this new and promising field of discovery. Valerianic acid, though not itself used in medicine, enters into several salts used in nervous affections, which are introduced in their appropriate places.

Acidum Hydrocyanicum Dilutum, U. S.

Hydrocyanic or prussic acid, in its interesting connection with amygdalin and emulsin as existing in a certain family of plants, has already been referred to, but its mode of preparation and uses seem appropriate to this place.

The processes of the *U. S. Pharmacopœia* are two in number:—

1st. For the preparation of a considerable quantity, especially with a view to its fixation in the form of cyanuret of silver.

2d. For its extemporaneous preparation by a ready process, and one which shall invariably yield a definite and uniform result.

1*st Process.* Take of ferrocyanuret of potassium (yellow prussiate

of potash) ℥ij, sulphuric acid ℥iss, distilled water q. s. Mix the acid with distilled water f℥iv, and pour the mixture when cool into a glass retort. To this add the ferrocyanuret of potassium previously dissolved in distilled water f℥x. Pour off the distilled water f℥viij into a cooled receiver; and, having attached this to the retort, distil by means of a sand bath, with a moderate heat, f℥vj. Lastly, add to the product distilled water f℥v, or q. s., to render the diluted hydrocyanic acid of such strength that 12.7 grains of nitrate of silver dissolved in distilled water may be accurately saturated by 100 grains of the acid, and give 10 grains of the cyanuret of silver.

The difficulties in this process are twofold: 1st. It is difficult to conduct the distillation in an ordinary uncovered retort by reason of the excessive bumping occasioned by the escape of the acid vapor through the mixed liquid and precipitate; and 2d. It is exceedingly troublesome to adjust the strength of the distillate to the officinal standard. The first of these difficulties may be overcome, but the precision necessary to be observed in regard to the strength of so powerful a medicine as this, and the impossibility of regulating by the proportions employed the amount of the acid generated and absorbed by the water in the receiver, make it necessary to determine its strength by experiment at each operation. This may be accomplished by testing, say 100 grains of the acid distillate with nitrate of silver before diluting it, carefully washing the resulting cyanide of silver, drying and weighing it, then calculating the degree of dilution required by the weight of this precipitate. If of proper strength this would be 10 grains, as above, but in this experiment of course a larger yield would be obtained. The equation would then be as follows: As the known weight of the precipitate from acid of standard strength, is to the weight of cyanide obtained from the distillate, so is the quantity of the acid weighed to the quantity to be obtained by dilution. Suppose the precipitate to have weighed 11.5 grains—then 10 : 11.5 :: 100 : 111.5; or to every 100 grains of the distillate 11.5 grains of water must be added to make the officinal diluted hydrocyanic acid.

The plan that I would recommend to the inexperienced is to saturate the acid which comes over by the officinal process without special reference to the quantity of water in the receiver, with nitrate of silver (the nitrate may be introduced into the receiver before the distillation commences); the result is the formation of cyanuret or cyanide of silver in the form of a very permanent insoluble powder. This, by washing with water and drying, will produce by its decomposition for any given weight, a constant quantity of hydrocyanic acid. It is officinal.

Argenti Cyanuretum, U. S.

The *Pharmacopœia* directs for its preparation nitrate of silver and ferro-cyanuret of potassium, of each, ℥ij, sulphuric acid ℥iss, and directs the distillation of the hydrocyanic acid produced from the

ferrocyanuret and sulphuric acid directly into a solution of the nitrate of silver. Cyanuret or cyanide of silver is a white powder, tasteless, without odor, insoluble in cold nitric acid, but decomposed by that acid at boiling temperature. It is soluble in ammonia and cyanuret of potassium; it consists of 1 eq. of cyanogen 26+, 1 of silver 108=134.

Acidum Hydrocyanicum Dilutum, U. S. (*2d Process.*)

Take of Cyanuret of Silver	. . .	fifty grains and a half.
Muriatic Acid	. . .	forty-one grains.
Distilled Water	. . .	one fluidounce.

Mix the muriatic acid with the distilled water, add the cyanuret of silver, and shake the whole in a well-stoppered vial; when the insoluble matter has subsided, pour off the clear liquid and keep it for use. Diluted hydrocyanic acid should be kept in closely-stoppered vials excluded from the light. In preparing this medicine, a slight excess of muriatic acid is not objectionable, giving it greater stability, and as the commercial acid is nearly always weaker than that of the Pharmacopœia, it should be added as long as any precipitate is produced. It is usually put up in f℥j ground-stoppered vials, the imported kind called Saxony is the best; each vial being inclosed in a tin can. The only apparent objection to this process is its expensiveness; this is, however, less than would at first appear. The reaction between muriatic acid and the cyanide results in the production of hydrocyanic acid and chloride of silver, thus—AgCy+HCl,=H,Cy+AgCl. Now, the chloride of silver is convertible into pure metallic silver by the introduction into it while in the condition of a moist powder, of a strip of zinc which abstracts the chlorine, the chloride of zinc becoming dissolved, and the pure silver remaining as a gray colored spongy mass or powder, which, on being washed and treated with nitric acid, yields the soluble nitrate ready for any further use.

The country practitioner who wishes to be prepared for every emergency in his practice, may with advantage supply himself with a suitable f℥j vial, containing 50½ grs. cyanide of silver, to which the mixed muriatic acid and water may be added when the occasion arises.

The diluted acid prepared as above is a colorless liquid, frequently having, from the presence of iron, a slight blue tint, of a peculiar odor and taste; it is entirely volatilized by heat. It contains two per cent. of anhydrous acid (HCy). Its use in medicine has been very much avoided by practitioners, on account of the violent poisonous character of the anhydrous or concentrated acid; but in the diluted form, in which it is officinal, it is no more dangerous than many other remedies constantly prescribed, and, notwithstanding the alleged variable strength of the commercial article, I believe it will be found as nearly uniform as most other pharmaceutical preparations. The books prescribe for use in medicine no

acid stronger than that of Scheele, which is about two and a half times as strong as the officinal, and may be given in doses of a drop or two. The dose of the officinal acid is ♏ij to ♏v. As a sedative and antispasmodic, it is a favorite with some practitioners, who employ it simply mixed with mucilage, or with the galenical preparations of digitalis, valerian, &c. It should not be prescribed with strong alkaline or ferruginous salts.

Potassii Ferrocyanuretum, U. S.

Yellow prussiate of potash may be, perhaps, appropriately mentioned under this head, being the salt used in the first of the foregoing processes.

This is formed on a large scale by heating to redness in iron pots adapted to suitable stirring arrangements, hoofs, horns, and the rejected parts of dead animals, with potash and iron; after long-continued heating and stirring these together, they are found to have combined into an impure mass in which ferrocyanide is formed by contact with water and crystallized into large yellow crystals, soluble in water, and having a sweetish saline taste. They consist of three equivalents of cyanuret of potassium, one of cyanuret of iron, and three of water, or, if the water be omitted, of ferrocyanogen (Fe_3Cy), with two equivalents of potassium. It is not used in medicine, and is less poisonous than would be supposed from its chemical composition. One of its most important uses is in the preparation of ferrocyanuret of iron or Prussian blue.

Potassii Cyanuretum, U. S.

Cyanide of potassium, prepared by fusing the above in contact with carbonate of potassa, is in white fused masses (the iron being precipitated as sesquioxide), of a powerful caustic taste, and is one of the most intense poisons we possess. Its composition is expressed by the formula KCy, though it is usually contaminated by carbonate and cyanate of potassa. It is given as a substitute for hydrocyanic acid, the dose being $\frac{1}{16}$ grain dissolved in alcohol. It is a useful chemical agent for removing the stains of nitrate of silver, durable ink, and its utility as a solvent for the metallic oxides is well known in electro-metallurgy and photography.

FOURTH GROUP.—ACIDS NATURALLY COMBINED WITH ALKALOIDS.

To the group of acids mentioned in the syllabus as occurring in certain plants combined with alkaloids, it will be unnecessary to refer in detail. They may be passed with the remark that *meconic acid* is interesting from its importance in toxicological investigations. It furnishes a blood-red color with the salts of sesquioxide of iron, and a green precipitate with a weak solution of ammoniated sulphate of copper. These reactions aid in discovering the presence of opium in solution.

CHAPTER IX.

ON THE ALKALOIDS.

The vegetable alkalies or alkaloids, like the neutral principles, are among the triumphs of the nineteenth century, the announcement of the first, morphia, by Sertürner, only dating as far back as 1817. Since that time a great number of them have been discovered, and, although but few have as yet been brought within reach of the practitioner, they have already made a marked change in the pharmacy of the vegetable kingdom.

The alkaloids are the most powerful class of organic principles, displaying their effects especially on the nervous system, which they so forcibly impress as to constitute many of them virulent poisons; a few, however, seem nearly destitute of active properties. They all contain nitrogen, and, by destructive distillation, or by heating with alkali, evolve ammonia; they evince their alkalinity by restoring the color to reddened litmus, and by combining with acids to form neutral salts which are crystalline; they also, like the alkalies proper, form double salts with bichloride of platinum. Those with which we are best acquainted have an intensely bitter taste.

Most of the alkaloids and neutral crystalline principles are sparingly soluble in water, but dissolve freely in alcohol, especially with heat; some dissolve in ether, fixed and essential oils, and almost all in chloroform, which may hence be used for their extraction. They are all precipitated from solution, whether alone or combined as salts, by tannic acid, which is hence, when taken immediately, the best chemical antidote for them; they are precipitated by alkali.

Conia and nicotia are liquid and volatile; the rest exist either in white powders, crystals, or are disposed to amorphous forms, which, however, crystallize when combined with acids.

Unlike the neutral principles, the alkaloids do not exist free in plants, but are generally combined with peculiar vegetable acids. Certain natural families of plants are distinguished by containing the same or similar alkaloids in their several species, while in other instances the same plant contains two or more different alkaloids. Opium contains five, St. Ignatius bean two, sabadilla and veratrum two, while the different species of cinchona are known to contain three.

It is believed that all really poisonous plants contain an alkaloid or neutral crystalline principle, except, perhaps, those few acrid

poisons which owe their activity to resinous principles. It is remarkable that the development of the active principle is frequently only in one organ of the plant, and only at a certain period of its growth.

There is no convenient and scientific classification of alkaloids, and their composition which is known, at least empirically, affords no clue to their properties and relations; indeed, their separation from some of the class of peculiar neutral principles, though sanctioned by a single well-known chemical distinction, seems forced and unnatural when we compare their physical and therapeutic properties, and is constantly lost sight of by writers.

Considering the recent discovery of most of this class, it might be expected that a uniform system of nomenclature would obtain in regard to them. This, however, is only measurably the case; they are most usually named from the generic title of the plants from which first derived, or from some distinguishing property; but by many they are indiscriminately terminated by *in* or *ia*. As elsewhere stated, this practice is contrary to the rule adopted by common consent in this country, appropriating to the neutral principles the former, and to the alkaloids the latter, termination. Even the officinal alkaloids are constantly misnamed from a disregard to this rule. In converting the foreign names into our own Latinized form, some discrepancies arise, as aconitina and aconitia, quinidina and quinidia, applied to the same substances.

The mode of preparation of the alkaloids varies with their habitudes, and particularly according to their solubility and that of their native combinations. When the native salt is soluble, as meconate of morphia, and the alkaloid is itself insoluble, there is no difficulty in its extraction. The simple addition of a strong alkali to the infusion of the vegetable substance neutralizes the organic acid with which the alkaloid was associated, and it is thrown down in a more or less pure form. It more frequently happens that the native alkaloid salt is not so freely soluble in water, and then a diluted acid is employed for its extraction; so that its salt with an inorganic acid is obtained, and, this being decomposed by an alkali, yields the pure precipitated alkaloid. In a large number of cases, however, these simple methods of extraction are quite useless, and complex processes are resorted to. Some of these are founded upon the alkaloid being separated from its associated principles by subacetate of lead. Some processes direct ether or chloroform as the solvent, which separates the alkaloids from the other proximate principles present, and deposits them upon evaporation. The volatile alkaloids are, of course, prepared by appropriate modifications of the process of distillation.

The charcoal processes spoken of in the last chapter as applicable to neutral crystalline principles, are also adapted, by slight variations, to the alkaloids. It is not intended to go into detail on these processes except in a few cases, as those in use are prepared almost exclusively on a large scale by chemical manufacturers.

List of the Principal Medicines known to contain Alkaloids (classified botanically), with the Alkaloids and their Composition.

Ranunculaceæ.

Aconiti folia, *U. S.*; leaves of A. Napellus.
" radix, " root of " } Aconitia, $C_{60}H_{47}NO_{14}$.
Staphisagria; seed of Delphinium S. Delphinia, $C_{27}H_{19}NO_2$. (?)

Menispermaceæ.

Colomba, *U. S.*; root of Cocculus palmatus.
Berberis vulgaris,[1] bark and root. } Berberina, $C_{42}H_{18}NO_9$.
Pareira, *U. S.*; root of Cissampelos. Cissampelina, $C_{36}H_{21}NO_6$.
Cocculus indicus; fruit of Anamirta cocculus. Menispermina, $C_{18}H_{12}NO_2$.

Papaveraceæ.

Papaver, *U. S.*; ripe capsules of P. somniferum.
Opium, " ; concrete juice of unripe " } Morphia, $C_{35}H_{20}NO_6$. Narcotina, $C_{46}H_{23}NO_{14}$. Codeia, $C_{35}H_{20}NO_5$. Thebaia, $C_{25}H_{14}NO_3$. (?) Papaverina, $C_{40}H_{21}NO_3$.
Sanguinaria, *U. S.*; rhizoma of S. Canadensis. Sanguinarina, $C_{37}H_{16}NO_8$. (?)

Umbelliferæ.

Conii folia, *U. S.*; leaves of Conium maculatum.
" semen " seed of " } Conia, $NC_{16}H_{15}$.
Cicuta virosa, and maculata, seed.

Cinchonaceæ.

Cinchona pallida, *U. S.*; " flava, " " rubra, " " (unofficinal) } barks of different species of cinchona. { Quinia, $C_{38}H_{22}N_2O_4$. Cinchonia, $C_{38}H_{22}N_2O_2$. Quinidia, $C_{36}H_{22}N_2O_2$.
Ipecacuanha, *U. S.*; root of Cephealis I. Emetia, $C_{35}H_{25}NO_9$.

Compositeæ.

Arnica, *U. S.*; flowers of A. montana. Arnicina. (?)

Lobeliaceæ.

Lobelia, *U. S.*; herb of L. inflata. Lobelina. (?)

Loganiaceæ.

Nux vomica, *U. S.*; seeds of strychnos, N. vom. } Strychnia, $C_{42}H_{22}N_2O_4$.
Ignatia amara; the bean " } Brucia, $C_{46}H_{26}N_2O_8$.

Solanaceæ.

Dulcamara, *U. S.*; stalks of Solanum D. Solania, $C_{84}H_{68}NO_{23}$. (?)
Belladonna, *U. S.*; leaves of Atropa B. Atropia, $C_{34}H_{23}NO_6$.
Stramonii folia, *U. S.*; " radix, " " semen, " } leaves, root, and seed of Datura stramonium. } Daturia, $C_{34}H_{23}NO_6$.
Hyoscyami folia, *U. S.*; leaves of H. niger. } Hyoscyamia, $C_{34}H_{23}NO_6$.
" semen, " seed "
Tabacum, *U. S.*; leaves of nicotiana T. Nicotia, $NC_{10}H_7$.

Lauraceæ.

Bebeeru (bibiri); bark of Nectandra rodiei. Bebeerina, $C_{38}H_{21}NO_6$.

Melanthaceæ.

Veratrum album, *U. S.*; the rhizoma.
" viride, *U. S.*; " } Veratria, $C_{34}H_{22}NO_6$.
Sabadilla, *U. S.*; the seed of V. sabadilla.
Colchici radix, *U. S.*; the corm of C. autumnale. } Colchicia. (?)
" semen, *U. S.*; the seed "

[1] Nat. ord. Berberideæ, closely allied to Menispermaceæ.

Aconitia, U. S., *and Delphinia.*

This alkaloid is directed to be prepared from the root by extracting with boiling alcohol, evaporating, treating the alcoholic extract with water, and afterwards treating the concentrated aqueous solution with dilute sulphuric acid. The sulphate being decomposed by ammonia, yields a precipitate of aconitia which requires to be purified, and is then in the condition of a white or yellowish powder containing water. It is, when anhydrous, in the form of a brittle mass, usually of a yellowish brown color. It imparts a sensation of numbness to the tongue, which is extremely powerful and characteristic. It is sparingly soluble in water, though forming soluble salts on the addition of acids; it dissolves freely in ether, alcohol, and chloroform. The formula given for it is $C_{60}H_{47}NO_{14}$. Being a very small product of the root, it is extremely expensive and liable to adulteration; probably very little that is sold as such is reasonably pure.

Aconitia is one of the most virulent of poisons, and is not adapted to internal use. Externally applied, it produces on the skin a prickling sensation, followed by numbness and a feeling of constriction. Its principal use is in cases of neuralgia, in ointment made by triturating the alkaloid first with a little alcohol or oil, and then with an unctuous vehicle. From a half to two grains are added to one drachm of the ointment. The galenical preparations of aconite will answer every useful purpose to which aconitia can be applied.

Delphinia is little known; the drug from which it is prepared is rarely found in our commerce.

Berberina, Cissampelina, Menispermina.

These three alkaloids are derived from members of the natural family of plants, Menispermaceæ. They have no practical value as pharmaceutical preparations. Berberina, from colombo-root, of which it is the chief active constituent, would seem to deserve a trial at the hands of practitioners. It must not be confounded with bebeerina, another alkaloid, from bebeeru or bibiri bark, which, in the form of sulphate, is now much in vogue.

The Opium Alkaloids.

These are five in number: Morphia, narcotin or narcotina, codeia, paramorphia, or thebaina, and papaverina, besides meconic acid and several neutral crystalline principles.

Morphia, U. S.

Morphia, which is the only one commonly used in medicine, was the first discovered, and is the most abundant. It is the best and most familiar type of the alkaloids.

There are various processes for its preparation, of which that of the *Pharmacopœia*, already adverted to, is the simplest and best for the student who may be disposed to attempt this, by no means difficult experiment. Reduced in quantity to suit the purpose, it is nearly as follows:—

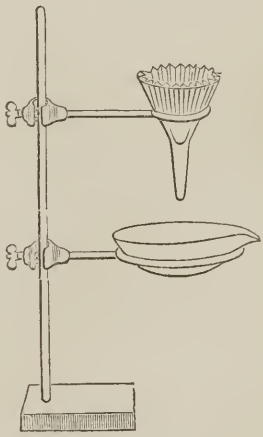
Take of Opium, sliced	℥j.
Solution of ammonia	f ℥ss.
Water,	
Alcohol,	
Animal charcoal, of each . . .	sufficient.

Macerate the opium with f ℥vj of water, working it with the hands or a pestle, as described under the head of *Tincture of Opium*, into a paste (if powdered opium is used, this is unnecessary); then digest it for twenty-four hours, and strain. Macerate or digest the residue in the same way, successively with similar portions of water, and strain; then mix the infusions, evaporate to f ℥viij, and filter. To the concentrated aqueous solution thus obtained add

Fig. 182.

Digestion in a flask.

Fig. 183.



Arrangement for filtration.

first f ℥vj of alcohol, and then f℥ij of solution of ammonia, previously mixed with about f ℥ss of alcohol; cover the vessel and set it aside. After twenty-four hours pour in the remaining f℥ij of solution of ammonia, mixed, as before, with alcohol, and again set aside that the morphia may crystallize out. The only remaining process is to purify the crystals which are formed in the bottom of the vessel. This is done by dissolving them in boiling alcohol, and filtering, while hot, through animal charcoal. A common flask, Fig. 182, will serve for the solution, and, for small opera-

tions, the application of heat to the funnel will be unnecessary. It may be conveniently arranged over an evaporating dish, as shown in Fig. 183. The filtered liquid, as it falls, will be immediately cooled by contact with the dish, and the extended surface will favor the spontaneous evaporation of the alcohol, so that a small crop of crystals (40 to 60 grains) of morphia may be expected.

This is an excellent method of testing the value of specimens of opium, except that, for approximate results, it is not necessary to carry out the last part of the directions, but is as well to take the weight of the crystallized morphia as at first thrown down. The animal charcoal deprives the product of color, but is apt to absorb a portion of the alkaloid also; so that, to get the entire yield, the charcoal should be digested in a further portion of alcohol, which should be added to the filtrate. The motive for using alcohol with the ammonia added to the concentrated liquid in the first instance, is to take up the resinous coloring matters, which would otherwise contaminate the precipitate.

Morphia, as thus obtained, is in small but brilliant prismatic crystals, which are transparent and colorless, intensely bitter when dissolved, but nearly insoluble in water, also insoluble in ether. It dissolves in about thirty parts of boiling alcohol, in fixed alkaline solutions, and with great facility in dilute acids, which it neutralizes, forming salts. Of course, it is entirely dissipated by heat. In powder, it strikes a deep blue color with neutral salts of sesquioxide, or with sesquichloride of iron, decomposes iodic acid with liberation of iodine, and forms, with nitric acid added to it in powder, a red compound passing into yellow. Crystallized, it has the composition $2HO,C_{35},H_{20}NO_6$. In the condition of crystals, owing to the water, it has nearly 6 per cent. more weight than in that of effloresced or dried powder.

Officinal Salts.—These are three in number, as follows: sulphate, muriate, and acetate. They are made by forming solutions of the alkaloids in the appropriate acids and evaporating.

Morphiæ Sulphas, U. S.—This is in white feathery crystals, very soluble in water, of an intensely bitter taste; it liberates morphia as a white precipitate in contact with alkali or alkaline carbonates, with which it is incompatible in solution. It is by far the most common of the morphia salts. Dose one-eighth to one-fourth grain.

Morphiæ Murias, U. S.—This is most used in England, where it is officinal as morphiæ hydrochloras. It is somewhat less soluble in water, though sufficiently so for use in medicine. Dose the same as of the sulphate.

Morphiæ Acetas, U. S. This is a white powder, seldom crystalline in appearance. It is apt to be deficient in the proportion of the acid ingredient, and to be comparatively insoluble, in which case a few drops of acetic acid to the liquid will make a clear solution. This is much used for external application, though adapted also to the form of powder and pill. Dose the same as of the foregoing.

Valerianate of Morphia is an unofficinal salt, made by neutralizing the alkaloids with valerianic acid. Its dose is from one-eighth to one-half grain. (See page 305.)

Narcotina is a brilliant crystalline principle, possessing some properties in common with the neutral principles, but now generally ranked with the alkaloids, from its power of forming salts with acids, which salts, however, are not neutral, but acid. One of its most important chemical differences from morphia is its property of dissolving in ether, which furnishes the means of separating it from the other constituents of opium. Narcotina is not narcotic. It has been given as a tonic and antiperiodic, in doses as high as half a drachm, without the production of narcotic symptoms.

Codeia crystallizes sometimes in octohedral crystals, with two equivalents of water, soluble in alcohol, ether, and in boiling water, but not in alkaline solutions. It does not exhibit the reactions given for morphia. It forms crystalline salts with acids.

Paramorphia or *thebaia* is not soluble in alkalies. Does not react like morphia.

Papaverina is an alkaloid in small acicular crystals, which turn blue with sulphuric acid; with muriatic acid in excess it forms a very insoluble compound.

Sanguinarina.

This alkaloid is derived from the root of one of our most familiar indigenous plants. It is a white, pearly substance, of an acrid taste, very soluble in alcohol, also soluble in ether. With acids it forms soluble salts, which are remarkable for their beautiful red, crimson, and scarlet colors. From this it is inferred that a native salt of this alkaloid is the occasion of the brilliant color of the fresh juice of the plant. (See page 164.)

Conia.

Conia is a volatile yellow, oily fluid, with a very characteristic odor resembling that of the urine of the mouse. It is decidedly alkaline in its reactions. It is soluble in 100 parts of water, floating on its surface when distilled with it. Alcohol dissolves it readily, as also ether, the fixed and volatile oils. It forms salts with acids, which are soluble, and some of them crystallizable.

One of its most characteristic tests is that, when liberated in the form of vapor, it occasions a white cloud, like that of ammonia, when approached by a rod moistened with muriatic acid. This test, when applied to the extract of conium, by adding to it on a tile a few drops of solution of potassa, is much resorted to in connection with the odor, in judging of the quality of that extract.

When exposed to the air, conia undergoes oxidation, being converted into a brown resinous matter, and evolving ammonia. Its composition is stated as $NC_{16}H_{15}$.

The Cinchona Alkaloids.

Quinæ Sulphas, U. S.

This salt is prepared from various species of cinchona bark, which contains it in combination with kinic acid and a peculiar astringent principle called cincho-tannin. These combinations being only partially soluble in water, resort is had to an acid which liberates the alkaloid in a soluble form. The one used in our officinal process is muriatic, which is mixed with water in which the powdered bark is boiled. The very soluble muriate of quinia contained in the decoction is decomposed, giving up its acid to the lime, while the quinia is liberated, and, being insoluble, is precipitated with the excess of lime added, the water retaining the chloride of calcium resulting from the reaction, and most of the impurities, in solution. The precipitated quinia and excess of lime being now digested in alcohol, the former is dissolved, and the impure quinia is obtained by evaporating this alcoholic solution. The remaining part of the process consists in converting this into the officinal sulphate, at the same time rendering it pure. To accomplish this, the amorphous mass is dissolved in diluted sulphuric acid, and filtered through bone black, which contains sufficient carbonate of lime to neutralize the excess of sulphuric acid, and thus facilitate the crystallization of the sulphate as the solution cools. This process requires to be repeated, with the addition of acid, if the charcoal is too alkaline, till a white and pure product is the result.

Quinidiæ Sulphas.

This, as yet unofficinal salt, contains *quinidia*, an alkaloid associated in many cinchona barks, particularly those imported from New Grenada, with variable proportions of quinia and cinchonia. Being somewhat more soluble than sulphate of quinia, sulphate of quinidia is found in the water from which the former salt has been crystallized, and by the appropriate treatment is extracted. When the cheaper barks above referred to are manipulated with, this is an important product, and, as will be again stated, is largely produced and used by some as a substitute for quinia.

Cinchoniæ Sulphas

is another unofficinal alkaloid salt obtained by a similar process, especially from the pale cinchona barks, and now much used. It is more soluble than either of the sulphates of quinia or quinidia, and, if the proper kind of barks have been used, may be crystallized out of the solution which remains, after the separation of one or both of the others.

Quinoidine, *chinoidine*, *precipitated extract of bark*, *amorphous quinia*, are names given to an amorphous mass obtained by evaporating the

liquid which remains after the separation of the crystallizable alkaloids as above described. Its abundance seems to be in proportion to the degree of heat employed in the process, and as it increases the proportion of alkaloid diminishes. The extractum calisayicum referred to on page 161, differs from this in containing the crystallizable alkaloids besides the quinoidine.

The cinchona bark alkaloids are of such importance to the practitioner of medicine, that some details in regard to their properties and relative value, and those of their salts, seem called for in this connection.

Quinia is an insoluble white powder fusible into an amorphous brittle mass. It is freely soluble in alcohol and ether, and may be readily obtained by adding ammonia to the sulphate and washing on a filter. Its *sulphate*, as found in commerce, is in feathery white crystals much interlaced, which effloresce on exposure to the air, and are apt to fall down into a powder very much diminished in bulk. It is soluble in 740 parts cold water and 60 parts of alcohol, but nearly insoluble in ether. It is very readily dissolved on the addition of a little sulphuric acid, which brings it to the condition of an acid and uncrystallizable sulphate. It imparts to its solution a peculiar blue tinge called fluorescence, which may also be observed in the infusum cinchonæ comp. It is now considered to consist of one equivalent of quinia, one of sulphuric acid, and eight of water, four of which may be lost by efflorescence.

Quinidia.—Quinidina may be obtained in shining colorless crystals, which are readily reduced to a white powder; they melt without decomposition, and, on cooling, concrete into a grayish white crystalline mass. When ignited, they burn with the odor of kinole and the volatile oil of bitter almonds; they have a less intensely bitter taste than quinia. This alkaloid is nearly insoluble in water, soluble in 12 parts of alcohol and 143 of ether. It forms crystallizable and generally soluble salts. Its *sulphate* is in long, shining white crystals, as generally found in commerce interlaced and resembling those of sulphate of quinia. It is soluble in 130 parts of cold water, freely soluble in alcohol, and almost insoluble in ether. It contains six equivalents of water of crystallization.

Cinchonia may be obtained in white crystals almost insoluble in water, alcohol, and ether. It is less bitter, because less soluble, than its associated alkaloids. It melts, and is with difficulty sublimed. It forms soluble salts with the strong acids. Its *sulphate*, which, like the foregoing, was formerly considered a disulphate, is in short, oblique, shining prisms, which contain two equivalents of water of crystallization. It is soluble in 54 parts of cold water, and readily in alcohol, but not in ether. On the addition of sulphuric acid, it passes into the very soluble acid sulphate.

Of the three remarkable principles above described as existing in cinchona barks, cinchonia was the first discovered, having been

isolated in an impure state as early as 1803, and fully described as an alkaloid by Pelletier and Caventou in 1820. Quinia was discovered soon after by the same chemists. Not until 1833 was the existence of quinidia announced. In that year, Henry and Delondre announced its discovery, but afterwards abandoned the idea of its being a distinct principle; so that no further attention was bestowed upon it until, about the year 1844, the celebrated German chemist, Winkler, investigated its properties, and conferred upon it the name quinidine, which, to correspond with our nomenclature, is changed to quinidia.

The increasing scarcity and high price of sulphate of quinia, occasioned in part by the restrictions placed upon the trade in genuine Calisaya bark by the Bolivian government, have had the effect to direct the attention of physicians to other and similar remedial agents; but, notwithstanding the frequent announcement of favorable results from the trial of such, there seems a general disposition to withhold confidence from any but the products of that remarkable family of South American trees whose history has been so long connected with the cure of periodical diseases. The introduction into commerce of large quantities of cheap cinchona barks from new sources, has been another result of the long-continued scarcity of the older and officinal kinds. Notwithstanding these have been regarded by many with jealousy, and doubts have been entertained of their therapeutic value, the study of their chemical history has shown that some of them are not less rich in alkaloids than the finest monopoly barks, and experiments in regard to the therapeutic value of their characteristic alkaloids have shown a close resemblance in physiological effects to quinia itself. Some Bogota barks, beside containing the other alkaloids, abound in quinia, which can already be produced at fifty cents an ounce less than quinia, and will probably become much cheaper as the demand increases.

Dr. Pepper and other practitioners connected with the Pennsylvania Hospital have used sulphate of quinidia in the same or less doses than the quinia salt, and with equal success; and the same view is confirmed by the experience of others in private practice.

Sulphate of cinchonia, which had been generally overlooked, has also been much used of latter time as a substitute for the quinia salt; and, although some physicians assert that larger doses of it are required, I am told by Dr. Conrad, the Apothecary of Pennsylvania Hospital, that in that Institution the three cinchona alkaloids are used indiscriminately and in the same doses. Through Dr. R. P. Thomas I am informed that the cinchonia salt has been used with satisfaction as a substitute for that of quinia in the Philadelphia and Northern Dispensaries, and in the Western Clinical Infirmary, and Philadelphia Hospital, Blockley, where many intermittents are daily under treatment. The average prices of the salts are as follows: Sulphate of quinia $3 an ounce, sulphate of quinidia $2 50, sulphate of cinchonia $1 00.

Quinoidine is sold at a still lower price than either of the crystallized products. I am told that the demand for it has not justified manufacturers in preparing all that is produced, for sale. Its usual dose is double that of the crystallized salt. It is freely soluble in diluted sulphuric acid.

Mode of distinguishing the Cinchona Alkaloids from each other, and from Adulterations.

1. *With chlorine water.*—When sulphate of quinia is dissolved in chlorine water, and ammonia added, a green color is produced. If a solution of ferrocyanide of potassium be added to the same solution before the ammonia, it usually strikes a red color. When sulphate of cinchonia is dissolved in chlorine water, and ammonia added, a white precipitate falls. When sulphate of quinidia is treated in the same way, its appearance is not *changed* or its behavior is similar to the last.

2. *With ether.*—Quinia is *soluble* in ether, cinchonia *insoluble*, and quinidia *partially soluble.*

Trommer's test.—Sixty drops of ether, twenty of aqua ammonia, and ten grains of the sulphate, are mixed in a test tube; the quinia being soluble in the ether, will not appear, but any considerable admixture of cinchonia or quinidia will separate as a layer of white powder between the aqueous liquid and the supernatant ether. If quinidia be present, it will be dissolved by a large addition of ether, while cinchonia will not.

3. *Herapath's test.*—Dissolve five grains of sulphate in a fluidrachm of acetic acid, add a few drops of tincture of iodine, and heat to the boiling point, or until a clear solution is formed; as the liquid cools, if the quinia salt were used, a beautiful crystalline iodo-sulphate of quinia will be deposited in thin transparent plates, which reflect the rich iridescent green color of the elytra of Spanish flies. With sulphate of *quinidia*, tufts of chocolate-colored crystals, and of cinchonia, a brick red deposit, are produced. These crystals by polarized light exhibit most curious and characteristic properties.

4. The presence in the sulphates of cinchona alkaloids of common adulterations may be detected as follows:—

The sulphates are entirely soluble in dilute sulphuric acid, and entirely *dissipated* by heat. Sulphate of lime may be detected by its insolubility, and by remaining after ignition on a piece of platina foil. Starch would remain insoluble in dilute acid, and would be recognized by the well-known iodine test. Stearic and margaric acids would float in the solution, and are soluble in ether. Salicine, if more than ten per cent. were present, would show with concentrated sulphuric acid a red color. Phloridzin would be detected as yielding a yellow color with the same reagent. Sugar or mannite would be blackened by concentrated sulphuric acid. Oxalate of ammonia would be detected by giving off ammoniacal vapors with caustic potash.

Emetia, Arnicina, Lobelina.

Emetia, or, as it is sometimes called, *emetina*, is the active principle of ipecacuanha, from which it may be obtained as a white powder, not crystalline, of a bitter taste, soluble in alcohol, sparingly so in water, and precipitated, like the other alkaloids, by tannin; its native salt existing in the root is taken up by water, wine, and diluted alcohol. The commercial *emetia* is very impure, and not preferable for ordinary use to the various Galenical preparations of ipecac, in which the peculiar astringent and acid principles are associated with the alkaloid.

Arnicina.—This alkaloid is not much known. It is stated to be volatile and to resemble lobelina; it is associated in the flowers with a volatile oil, and bitter principle called *cytisin*. Its composition is unknown.

Lobelina was discovered by the late Professor S. Calhoun, of Philadelphia, in 1834, and first isolated in a state of purity by Professor Procter, in 1842. It is a liquid lighter than water, and when dropped into that fluid rises to its surface and spreads out like a drop of oil, then gradually dissolves without agitation, forming a transparent solution. It is very soluble in alcohol and ether, the latter readily removing it from an aqueous solution; it also dissolves in fixed and volatile oils. It forms crystallizable salts, with numerous acids. This is most conveniently obtained by extracting the seed with alcohol acidulated with acetic acid, which forms a fixed salt with the alkaloid, evaporating and treating with magnesia, and then with ether, from which it may be obtained by evaporation.

It is not obtained on an economical scale for use in medicine. Lobelina, as it exists in the plant combined with lobelic acid, is decomposable by a moderate heat, as also by the action of strong acids.

Strychnia, U. S., *and Brucia.*

These principles are associated together and combined with igasuric acid in nux vomica and bean of St. Ignatius. The former only is officinal, though the latter is important from being almost invariably present in the commercial article.

Strychnia, U. S.—The seeds of nux vomica are directed in the *U. S. P.* for the preparation of this alkaloid. After their comminution, which is a work of no little difficulty, they are treated with water acidulated with muriatic acid; after concentration, the muriate thus formed is decomposed by lime, which precipitates the strychnia along with the excess of lime employed, and some impurities. The alkaloid is now dissolved out from the precipitate by boiling alcohol, and deposited, on evaporating and cooling. To purify it still further, it is next converted into a sulphate, boiled with animal charcoal, and precipitated by ammonia. St. Ignatius's

bean contains a large proportion of strychnia and less brucia than nux vomica, but is not so abundant and cheap.

Strychnia, as thus prepared, is a white or grayish white powder, which may be crystallized by the slow evaporation of an alcoholic solution. It is distinguished by extraordinary bitterness. It is soluble in boiling alcohol, but to a limited extent only in water, cold alcohol, and ether. It is soluble in volatile oils. Being generally contaminated with brucia, it strikes a red color with nitric acid; but the following tests are more reliable: Rub a very little of the powder with a few drops of sulphuric acid on a slab, and add a minute quantity of solution of chromate of potassa. A splendid violet color will be produced if it contain strychnia. Or thus: add a little of the powder to a few drops of sulphuric acid containing $\frac{1}{100}$ of nitric; it will form a colorless solution; but, on the addition of a little peroxide of lead, a bright blue color will be developed, which will pass rapidly into violet, then gradually into red, and ultimately to yellow.

Sulphate of strychnia is a crystallized salt, which is only preferred from being soluble.

The medical uses of strychnia are those of a tonic, with a special action upon the nerves of motion. It is much employed in a variety of diseases. Dose one-twelfth to one-sixth of a grain.

In doses of two or three grains, strychnia is one of the most powerful and fatal of poisons. Immense quantities are sold for the purpose of killing animals, particularly dogs, on whom the most certain and rapid fatal effect is produced by its use. In cases of poisoning by strychnia, the most prompt and vigorous efforts are necessary to arrest its effects. The jaws must be prevented from becoming permanently closed, as in tetanus. Emetics should be tried, and will seldom act. Tannic acid or other astringents will precipitate the alkaloid in an insoluble form. Chloroform has been found to arrest the effects of the poison. In one memorable case, I saw the life of an individual saved by the application of the poles of a magnetic battery over the stomach, which aroused that organ, and, by excessive vomiting, produced the relaxation of the spasm.

Brucia is more soluble than strychnia, and is obtained by evaporating the alcoholic solution after the latter salt is crystallized out. It is a less powerful therapeutic agent, being safely employed in doses of from two to four grains. It resembles morphia in turning red with nitric acid, becoming yellow by heat, and violet on the addition, when cool, of proto-chloride of tin. It is, like morphia, insoluble in ether.

Atropia, Daturia or Hyoscyamia, and Solania.

Atropia, as procured both from the root and the herb of belladonna, is in white silky crystals, of a bitter taste, slightly soluble in water, freely in absolute alcohol, also in chloroform and ether. Composi-

tion $C_{34}H_{23}NO_6$. The simplest method of obtaining it is by the use of chloroform, which extracts it from the juice of the plant along with a green resinous matter, from which it may be separated by the use of sulphuric acid, forming a sulphate which readily yields atropia on the addition of an acid. One-tenth of a grain is considered its appropriate dose, though, like aconitia, it is best adapted to external use, and is almost exclusively applied in dilute solution to the eye to dilate the pupil.

Daturia, which, according to the received opinion, is identical with atropia, is derived in exceedingly small quantities from stramonium seeds.

Hyosciamia, by similar processes, is obtained from the seeds containing it.

Solania, which resembles the foregoing in some of its properties, is stated to have a different composition.

Though undoubtedly the active principles of the plants yielding these alkaloids are found in commerce only as rare and curious products, their expensiveness and inconvenient concentration interfere with their use in medicine.

Nicotia, or Nicotina.

Nicotia is a volatile alkaloid, which, like conia, is obtained by distillation from the plant containing it, an acid being placed in the receiver to fix the alkaloid. From this it is afterwards liberated by a strong alkali in the form of an oily, transparent, colorless liquid. Specific gravity 1.048, becoming yellow by keeping, absorbing oxygen from the air, which turns it thick and brown. It volatilizes at 482° F., leaving a carbonaceous residue. The vapor which rises is so powerful in its smell and irritating properties that one drop of it diffused in a room renders the atmosphere insupportable. It is very soluble in water, in alcohol, in ether, and in fat oils. It is separable from an aqueous solution by ether. It thus has a wider range of solubility than any of the alkaloids. Its salts with acids crystallize with difficulty. It is a compound of hydrogen, carbon, and nitrogen, NH_7C_{10}. The volatility of this principle insures its diffusion, along with empyreumatic products, in tobacco smoke, so that it is inhaled to a certain extent by smokers. It exists in the different commercial varieties of tobacco in about the following proportions: Havana 2 per cent., Maryland 2.3, Virginia 6.87, Kentucky 6.09.

Orfila has lately investigated the properties of nicotia, and ascertained with precision its chemical habitudes. These are detailed in a paper copied in the *American Journal of Pharmacy*, vol. xxiv. p. 142, from the *London Pharmaceutical Journal.*

Bebeerina.

Bebeerin (bebeerina), obtained from the bark of a tree growing in Guiana, is an uncrystallizable alkaloid, in the form of a yellow resinous-looking mass, soluble in alcohol, and slightly in ether and in water. The commercial sulphate of bebeerin is impure, but highly esteemed as a tonic and antiperiodic. It is in dark brown glittering slabs, readily soluble by the aid of acids. Dose, three to ten grains; from a scruple to a drachm between the paroxysms in intermittents.

Veratria, U. S., *and Colchicia.*

Veratria is procured from cevadilla seeds by treating them with alcohol, evaporating the tincture to an extract, and treating this with water acidulated with sulphuric acid; this solution containing sulphate of veratria is next decomposed by magnesia, which is added in excess; the precipitated veratria thrown down is now washed and separated from the excess of magnesia by alcohol, from which it is obtained by evaporation, but requires still further purifying with animal charcoal, &c. A pound of the seeds yields about a drachm of veratria.

This product is a white uncrystallizable powder, extremely acrid when diffused in the air, producing excessive irritation of the nostrils. It is freely soluble in alcohol, less so in ether, and almost insoluble in water. Its sulphate and muriate are crystallizable, but are not met with in commerce. It is soluble in diluted acetic acid, from which ammonia and solution of tannin throw down white precipitates. Among its most striking peculiarities are the intense red color it assumes on the addition of sulphuric acid, and the yellow solution it forms with nitric. According to some, veratria, as procured by the officinal process, is a complex body; it is said to contain another alkaloid, *sabadillia*, and a resinoid, *veratrin*.

The medical uses of veratria are confined chiefly to gouty and neuralgic affections, in the treatment of which, it is used internally in doses of $\frac{1}{12}$ to $\frac{1}{6}$ grain, repeated, or externally in ointment, of about ℈j to the ounce.

Colchicia is little known; by some it is supposed to be identical with veratria, although it is stated to be more soluble in water; it has been isolated but rarely, and its composition is not made out.

Tests for Distinguishing the Alkaloids.

The following, taken from Dr. A. T. Thompson, conveys in a compact form the leading facts applicable to distinguishing the alkaloids. Some *general* characteristics are noticed at the beginning of this chapter, and some *particular* ones under the several heads.

Method of Distinguishing the following Vegetable Alkaloids—Atropia, Brucia, Delphia, Emetia, Morphia, Solania, Strychnia, Veratria—when they are in powder.

Treat the powder, first with nitric acid, which is colored red by *brucia*, *delphia*, *morphia*, and the *strychnia* of commerce, but not by pure strychnia. If the reddened acid become of a violet hue on the addition of protochloride of tin, after the nitric solution has cooled, the alkaline powder is *brucia:* if the reddened acid gradually become black and carbonaceous, it is *delphia.* If the powder be soluble without decomposition, and decompose iodic acid, evolving free iodine, it is *morphia:* if it is not fusible, and does not decompose iodic acid, it is *strychnia.* If the powder greens, instead of reddening nitric acid, it is *solania:* if it is insoluble in ether, and does not redden nitric acid, it is *emetia:* if it be soluble in ether, and does not redden nitric acid, but melts when heated and volatilizes, it is *atropia:* if it is thus affected by ether and nitric acid, but is not volatilized, it is *veratria.*

PART IV.

INORGANIC PHARMACEUTICAL PREPARATIONS.

CHAPTER I.

ON MINERAL ACIDS.

In Part IV., I design to present an outline of the subject of pharmaceutical chemistry as pertaining to substances of inorganic origin, presenting in tabular form with short descriptive paragraphs the leading medicines of this class, furnished by the manufacturing chemist; while those which fall within the range of the dispensing office and shop, will be treated of more fully, and in such detail as to render their preparation easy and uniformly successful.

The difference between that part of the *Pharmacopœia* called the List, in which the materia medica is presented, clothed in its appropriate nomenclature, and accompanied by well-ascertained standards whereby the genuineness and purity of many of the individual articles may be known; and that part occupied with formulæ or recipes designed to direct the apothecary and physician in the preparation of the crude articles of the list into eligible forms for use, has been fully presented on page 56 in an extract from the preface to the *Pharmacopœia* there inserted. This arrangement, however, includes among the preparations many articles which in this country are prepared exclusively in large manufacturing establishments; in fact, so generally has the manufacture of chemical preparations been concentrated in the hands of a few leading manufacturers, that even the largest dispensing establishments are in the habit of resorting to these for their supplies of all, except a few of the more readily prepared and extemporaneous articles. Owing to this fact, much of the space heretofore devoted in pharmaceutical works to descriptions and illustrations of apparatus and processes is now destitute of practical value to by far the largest class of students and readers.

In treating of these subjects, therefore, I shall for convenience disregard the division in the *Pharmacopœia*, and present in detail only those preparations which apothecaries are accustomed to make, and which physicians might, if they would, prepare for themselves, with simple and cheap forms of apparatus.

In adopting this course, which is in harmony with the preceding

parts of the work, I would not be understood as underrating the value of practical chemical knowledge to the student or practitioner, whether of medicine or pharmacy. In no pursuit is a knowledge of chemistry unimportant. As the key which unlocks the physical sciences, and opens the most hidden secrets of nature, chemistry is invaluable to every industrial pursuit, and in every relation of life, and to no class is it more so than to the physician, the object of whose study is the highest and most intricate piece of nature's handiwork. The young man who would turn his attention in this direction may avail himself of numerous elementary works, adapted to impart accurate knowledge by means of experiments to be performed with cheap apparatus, and so arranged as to lead by gradual steps to the comprehension of facts which would otherwise be abstruse and difficult.

Of works of this description, it will be sufficient to name Bowman's *Introduction to Practical Chemistry*, Stockhart's *Chemistry*, and Francis's *Chemical Experiments*, while the more advanced student may consult with advantage the works of Fownes, Graham, Gmelin, and the numerous other leading modern chemists.

The object of the present work is not to impart chemical principles, but to improve in its humble sphere the industrial applications of the science to the healing art.

Acida.

All the inorganic acids employed in pharmacy are compounds, rich in oxygen, with the exceptions of muriatic and hydriodic, in which that element is wanting.

Acids are electro-negative compounds; they usually have a sour taste, change the blue color of litmus to red, and affect other vegetable colors similarly; with alkalies, whether vegetable or mineral, they form neutral salts in which the properties of both the ingredients are lost, while new properties are acquired. They also unite with the oxides of the metals proper, forming a great variety of valuable compounds which frequently exhibit slightly acid reactions, and retain the peculiarities of the metal from which they are prepared, modified by the nature of the acid ingredient.

The names of the mineral acids formed from the same element vary in their terminations according to the number of equivalents of oxygen they contain: thus, sulphur*ic* acid, SO_3, sulphur*ous* acid, SO_2, Nitr*ic*, NO_5, Nitr*ous*, NO_4, &c., the degree of acidification being marked by the terminations ic, and ous.

The strong acids act upon cork, and should be kept in ground stoppered bottles; these are made of extra strength, of green glass, called acid bottles. Unless the stopper and neck are very well ground and fitted to each other, they require to be cemented or luted together to prevent the escape of the acid; this may be done by warming the stopper in the flame of a spirit lamp, and inserting it in the neck of the bottle till the two surfaces are dried and

warmed, then coating it with a thin stratum of melted wax, and inserting it securely in its place, and tying it over with kid or bladder. The more common mineral acids are found in commerce of three qualities. The commonest and cheapest used for manufacturing purposes, the medicinally pure, M. P., and the chemically pure, C. P. The use of the latter is chiefly in analysis. The sp. gr. furnishes a ready means of testing the strength of the liquid acids, tables being given in chemical works showing the relation of the sp. gr. to the strength.

The mineral acids generally belong to the class of tonics with refrigerant and astringent properties. Externally, they are caustic, and require to be applied with care, as many know from experience who have used them, nitric acid especially, for warts. Nitric acid is also used as an alterative in syphilitic and other forms of disease.

They are apt to injure the teeth, upon which they also produce a very unpleasant and characteristic sensation. To obviate this in taking them they should be largely diluted, and should be sucked through a small glass tube, which may be made by scratching a piece of the tube sold in the shops with a file; this enables the operator to break it at the point required, and then, by heating the sharp broken edges over an alcohol or gas flame till the glass melts, a rounded edge is left.

One of the most interesting points in connection with the strong mineral acids, is their occasional accidental use in poisonous doses. They are among the most powerful of poisons, owing to their corrosive properties, producing the most painful and dangerous results. The best antidotes are large draughts of alkaline and oily liquids; the alkali to neutralize the acid, and the oil to obtund its action upon the delicate mucous surfaces. The most ready resort in such emergencies is frequently soap, preferably Castile, which should be made into a very strong solution and given *ad libitum*.

The following *vegetable acids* have already been treated of under that head: Acidum aceticum, acidum aceticum dilutum, acidum benzoicum, acidum citricum, acidum tartaricum, acidum hydrocyanicum dilutum, acidum gallicum, acidum tannicum, and acidum valerianicum.

Of the mineral acids, the following are used in medicine, and, except nitrous or nitroso-nitric and phosphoric, which are in Italics, are officinal in the *U. S. Pharmacopœia*:—

	Sp. gr.	Dose.
Acidum Carbonicum, CO_2. (See *Aquæ Medicatæ*.)		
" Muriaticum, gaseous, H,Cl,+water	1.16.	♏iij to v.
" Muriaticum dilutum, 1 part to 3 of water	1.046.	♏xv to xl.
" Nitricum, liquid, HO, NO_5+3HO	1.42.	♏j to iv.
" *Nitroso-nitricum*, " " +NO_4		♏j to iv.
" Nitricum dilutum, 1 part to 6 of water	1.07.	♏xv to xl.
" Nitro muriaticum, 1 part nit. to 2 muriatic acid		♏iij to v.
" Sulphuricum, HO, SO_3,	1.845.	♏j to ij.
" " dilutum, 1 part to 13 water	1.09.	♏xv to xl.
" " aromaticum, alcoholic with aromatics		♏xv to xxx.
" *Phosphoricum*, glacial, HO, PO_5,	solid.	
" " *dilutum*, 1 part to 10 of water	1.064	♏xv to xl.

Acidum Muriaticum, U. S. (*Hydrochloric or Chlorohydric Acid*, HCl.)

Prepared by the action of sulphuric acid and water on chloride of sodium (common salt), sulphate of soda and hydrochloric acid are formed. The latter gas is distilled over, the process being conducted in a retort or flask, connected with a receiver containing water, which absorbs it rapidly in proportion as it is refrigerated. A colorless or slightly yellow transparent liquid, giving off white acrid fumes on exposure to the air. It should not dissolve gold-leaf, as shown by the acid after digesting with it, giving no precipitate with protochloride of tin. The absence of saline impurities is shown by its being entirely volatile, and yielding no precipitate with chloride of barium or ammonia in excess.

Acidum muriaticum dilutum is readily made by diluting the foregoing with water. The officinal recipe for making Oj is as follows:—

Take of Muriatic acid . . . . f℥iv.
Distilled water . . . . f℥xij.
Mix them in a glass vessel.

The specific gravity of this is 1.046. If the strong acid used is below the standard strength, it should be added in rather larger proportion, observing to reach exactly the specific gravity here named, as shown by a good hydrometer for liquids heavier than water, or by a 1,000 gr. bottle.

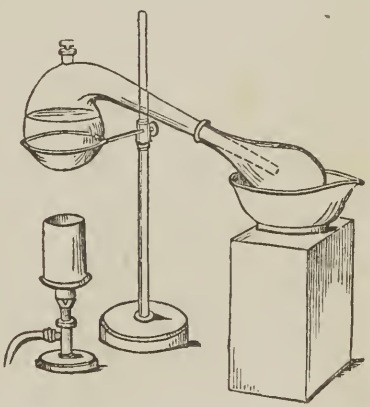
Acidum Nitricum, U. S. (*Aquafortis*, *Nitric Acid*, HO,NO_5+3HO.)

Prepared by the action of sulphuric acid in excess upon nitrate of potassa (saltpetre) in a glass retort, when nitric acid and bisulphate of potassa are formed. The acid, being volatile, is distilled over by the application of heat. It is a colorless transparent liquid, with powerfully acrid odor, and is exceedingly corrosive, staining the skin yellow. The strongest acid, containing one equivalent of water, has the specific gravity 1.521; but, owing to the presence of water in the ingredients used in its preparation, and its mixing readily in all proportions with water, it is usually weaker, and has its specific gravity reduced in proportion to its dilution. In the *Pharmacopœia* of 1840, the officinal strength was 1.5, but it has been changed in the last edition to 1.42, as stated in the *Syllabus*, the object being to adapt it more nearly to the usual strength of the commercial article, and to establish a standard easily attained. The proportion added to water in making the diluted article has been changed to correspond. It fumes in the air like muriatic. The principal impurities are nitrous acid, which is shown by a red color; sulphuric acid, which may be detected by adding to the diluted acid a solution of chloride of barium and chlorine, or muri-

atic acid, which would occasion a white precipitate with nitrate of silver. Nitric acid itself is remarkable for furnishing salts which are invariably soluble.

Nitrous acid (though, correctly speaking, the name is applied to a red-colored gas, having the composition NO_4, formed whenever binoxide of nitrogen, NO_2, escapes into the air) is commonly understood in trade to apply to fuming red-colored nitric acid, such as passes over chiefly at the commencement and close of the process of distilling nitrate of potassa with sulphuric acid as above. This kind of nitric acid contains nitrous acid fumes, which the manufacturers usually separate from the acid of commerce by boiling, thus rendering it colorless. The best and most distinctive name for the article under consideration is *nitroso-nitric acid.* Its chief use is in making Hope's camphor mixture, which is elsewhere spoken of as having peculiar value when made with this form of acid. As the preparation of nitric and nitroso-nitric acid may often be desirable to the physician or apothecary, I insert a view of the necessary apparatus. If the receiver is well refrigerated, there will be no difficulty in collecting the acid. No luting of any kind is used. At the commencement of the process red fumes come over, and, after the nitrate of potassa is nearly exhausted, they commence to come over again, which is the signal to desist. The red fuming acid is now put away for use, or, if the colorless is preferred, is heated or exposed to the air to allow of the escape of the nitrous fumes.

Fig. 184.



The extemporaneous process for the production of nitrous fumes in nitric acid, is to drop into a vial containing it a few chips of some pure kind of wood; on this, part of the NO_5 will act, producing oxidation of the ligneous matter, and liberating NO_4. This process is only suggested where the last is impracticable.

Acidum Nitricum Dilutum.

Take of Nitric acid	. . . .	f ℥j.
Distilled water	. . . .	f ℥vj.

Mix them in a glass vessel.

The specific gravity of this is 1.07, and 100 grains saturate 20 grains of crystallized bicarbonate of potassa.

Acidum Nitromuriaticum, U. S. (*Aqua Regia.*)

Take of Nitric acid	f℥iv.
Muriatic acid	f℥viij.

Mix them in a glass vessel, and, when effervescence has ceased, keep the product in a well-ground glass-stoppered bottle in a cool and dark place. This forms a deep yellow corrosive fuming liquid containing chlorine and nitric oxide in an unknown state of combination. The acid dissolves gold, from the free chlorine present. It should be made in small quantities, as required, care being taken to allow the effervescence to cease before securing the stopper in the bottle.

Acidum Sulphuricum, U. S. (*Oil of Vitriol, Sulphuric Acid,* HO,SO_3.)

Made by burning sulphur and nitrate of potassa together in leaden chambers. Sulphur, when burned, forms sulphurous acid (SO_2), which, in contact in the form of vapor with nitrous acid from the burning nitre and water, becomes more highly oxidized into sulphuric acid, SO_3.

It is an oily-looking, very heavy liquid, without color when pure, having no odor, but an intensely acid caustic taste. It becomes darkened in color by contact with vegetable substances, which it chars by abstracting from them the elements of water. When mixed with water, it readily combines with it, disengaging heat. Its strong affinity for water is one of its useful properties. When largely diluted with water, it is apt to deposit a white precipitate of sulphate of lead derived from the leaden vessels used in concentrating it. Arsenic is an occasional impurity, which may be detected by sulphuretted hydrogen, giving a yellow precipitate when passed through it. It is only prescribed internally, though sometimes prescribed in ointment in one of the officinal diluted forms which follow.

Acidum Sulphuricum Dilutum, U. S.

Take of Sulphuric acid	f℥j.
Distilled water	f℥xiij.

Add the acid gradually to the water in a glass vessel and mix them. The specific gravity of this is 1.09, and 100 grains of it saturate 25 grains of crystallized bicarbonate of potassa. Upon standing, the white precipitate as first formed (sulphate of lead) will be deposited, and the pure diluted acid may be decanted for use.

Acidum Sulphuricum Aromaticum, U. S. (*Elixir of Vitriol.*)

Take of Sulphuric acid . . .	f℥iiiss.
Ginger, in coarse powder . .	℥j.
Cinnamon, do. . .	℥iss.
Alcohol	q. s. (to make two pints.)

Add the acid gradually to Oj alcohol, and allow the liquor to cool. Mix the ginger and cinnamon, and having put them into a percolator, pour alcohol gradually upon them until a pint of filtered liquor is obtained. Lastly, mix the diluted acid and the tincture. Formerly the tincture was made by treating the powdered aromatics directly with the mixed alcohol and acid. The present process is an improvement, giving a clearer and more elegant tincture. Elixir of vitriol is stronger than diluted sulphuric acid, though its dose in drops is usually about the same, the alcoholic liquid giving smaller drops than the aqueous.

This preparation is very extensively used as a refrigerant, tonic, and astringent. It is a popular remedy for night-sweats in phthisis, and for debility generally. In making solutions and pills of quinine, also in the compound infusion of cinchona, it has important pharmaceutical uses.

Acidum Phosphoricum. (*Glacial or Monohydrated Phosphoric Acid.*)

This is prepared from calcined bones, bone phosphate of lime, by decomposing them with sulphuric acid, by which process a superphosphate of lime is produced (the article used as a basis for the manure known by that name). The superphosphate is neutralized by carbonate of ammonia, which generates phosphate of ammonia in solution with precipitation of phosphate of lime. By calcining phosphate of ammonia at a red heat, the volatile ingredient is expelled, and the solid HO,PO_5 remains. It is in transparent glassy looking solid masses, of a very sour taste, and without odor, and freely soluble in water, with which it forms the next preparation.

Acidum Phosphoricum Dilutum.

This may be prepared by dissolving forty-five and a half grains of glacial phosphoric acid in one fluidounce of distilled water, about one part to ten by weight, or by the process of the *London Pharmacopœia*, by the action of nitric acid diluted with water upon phosphorus, by which the phosphorus is oxidized at the expense of the acid, and phosphoric acid results. It is a colorless liquid without odor, of an agreeable acid taste, sp. gr. 1.064. It should not precipitate chloride of barium or nitrate of silver, nor be colored by sulphuretted hydrogen, either before or after a silver coin has been

digested in it, thus showing the absence of sulphuric nitric acids, chlorides, and metallic impurities. It is employed in the preparation of the phosphatic lozenges and of the syrups of phosphate of lime.

CHAPTER II.

THE ALKALIES AND THEIR SALTS.

Alkalies are electro-positive bodies; they may be divided into organic alkalies or alkaloids, which have already been considered, and inorganic alkalies which are oxides of peculiar, light, and very combustible metals. Ammonia forms a connecting link between these, and may be classed with either, though most conveniently with the latter. The three alkalies used in medicine, and to be presented in the present chapter, are, potassa, soda, and ammonia. They possess in common the property of turning vegetable reds to green, and the yellow color of turmeric, and some other vegetable yellows, to brown. They neutralize acids, deprive them more or less of acidity, and form with them salts which are sometimes acid, sometimes alkaline, and sometimes neutral, according to the proportions and relative strengths of the acids employed.

The beautiful laws which govern the formation of salts have been very thoroughly studied, and are fully laid down in works on chemistry; a knowledge of these, in connection with the system of nomenclature founded on them, is in the highest degree important, whether to the practical or theoretical chemist.

The plan of this work embraces only such reference to the laws of combination as the pharmaceutical history of some of the leading chemicals will necessarily bring into view. The officinal names are partly chemical and partly empirical, being, as more fully explained in the chapter on the Pharmacopœia and its Nomenclature, framed with a view to distinctness and adaptation to the purpose, rather than to chemical accuracy or elegance.

In chemical works, the classification of these is in accordance with their chemical relations and affinities. While in treatises on materia medica, they are arranged according to their therapeutical properties. In a pharmaceutical work like the present, it will be well, perhaps, to present yet a different arrangement, and bring them into view with reference to their commercial source and mode of preparation.

Potassa, soda, and ammonia, in their caustic condition (or com-

bined with carbonic acid, which rather modifies than changes their medical properties), are used in medicine chiefly for neutralizing excess of acids existing in the secretions. In the case of ammonia, this use is combined with a powerful arterial stimulant property, adapting it to low forms of disease. The salts formed by these alkalies with the acids vary in their therapeutical properties. Some have a special tendency to the skin, some to the kidneys, some to the bowels, &c. Their physical properties are no less various; although they are mostly crystalline, some assume a pulverulent or amorphous form. The salts of potassa are generally disposed to deliquesce or become damp, while those of soda effloresce, or lose their water of crystallization, falling into powder. Those of ammonia, by decomposition, liberate their volatile and alkaline base, the pungency of which becomes apparent.

The class of salts formed by muriatic acid, with the alkalies and earths, have been found to be compounds of chlorine with the metallic radicals of these, and might be considered with the so-called hydriodates among the halogen compounds, but are usually classed with the oxysalts.

The oxysalts of the alkalies are all soluble with the two exceptions of the bitartrate of potassa and the antimoniate of soda, the formation of which constitutes tests for potassa and soda respectively. The great solubility of the alkalies and their compounds constitutes a prominent distinction between them and the earths, to be presented in another chapter. The alkalies, both organic and inorganic, may be detected by all, forming with bichloride of platinum a yellow crystalline double salt, which is precipitated from a concentrated solution by alcohol.

Potassa Salts.[1]

Group 1.—*Starting with wood-ashes.*

Potash. Lixivium from ashes of forest trees evaporated to a dark moist mass.
Potassæ Carbonas Impurus. Ignited potash. Pearlash.
Salæratus. Dry pearlash subjected to gaseous CO_2. $2(KO),3(CO_2)$?
Potassæ Carbonas, $2(KO,CO_2),3HO$. Solution of pearlash, filtered and granulated.
Liquor Potassæ Carbonatis. ℥xij to f℥xij water. Simple solution.
Potassæ Bicarbonas, $KO,2CO_2,HO$. Passing CO_2 into solution of carbonate, &c.
Potassæ Carbonas Purus, $2(KO,CO_2)3HO$. Calcining bicarbonate and granulating.
Liquor Potassæ. Boiling carbonate with hydrate of lime, sp. gr. 1.056.
Potassa, KO,HO. Evaporating liquor potassæ to dryness, and fusing.
Potassa cum Calc. Equal parts, potassa and lime, triturated together.
Potassæ Acetas, $KO,\overline{Ac}$. Neutralizing acetic acid with carbonate, and crystallizing.
Potassæ Citras, $KO,\overline{Ci}$. Neutralizing citric acid with carbonate, and granulating.
Liquor Potassæ Citratis. A variety of extemporaneous processes.
Potassæ Chloras, KO,Cl,O_5. Passing excess of chlorine through solution of potassa.

Potash and pearlash, though important in their relations to the arts and to domestic economy, are seldom employed in medicine,

[1] Those not officinal in Italics.

except in the preparation of the other forms of caustic and carbonated alkali, and the other salts of potassa enumerated in the table.

Salæratus is a useful and tolerably pure carbonate of potash, which occupies a position intermediate between the carbonate and bicarbonate, besides being distinguished from these by its anhydrous character; it is much used in baking to furnish the carbonic acid which raises the bread, rendering it light and porous. Light cakes made with it are generally considered less objectionable by dyspeptics than those made with yeast. Most of the salæratus of the shops is an imperfectly carbonated bicarbonate *of soda*.

Potassæ Carbonas, U. S.

Made by dissolving pearlash in a small quantity of water, filtering to separate insoluble matters, and evaporating to dryness, stirring actively so as to form a granular powder, which is very deliquescent, and contains water in the proportion of two equivalents to every three of the salt. It is sometimes called *salt of tartar*, a name which is quite inapplicable. Dose, grs. x to ʒss.

Liquor Potassæ Carbonatis, U. S.

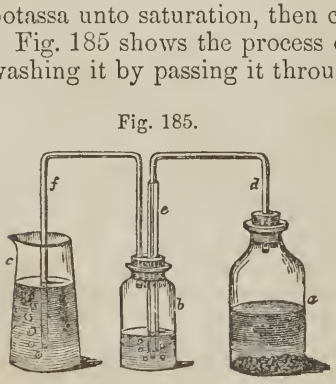
Made by dissolving in a mortar, or by agitation in a bottle, one pound of the carbonate in twelve fluidounces of water. Its uses are as an antilithic and antacid; it should be given in milk, or other bland and viscid vehicle. Dose, ♏x to ʒj.

Potassæ Bicarbonas, U. S.

Made by passing carbonic acid gas (generated by the action of muriatic acid on chalk or marble) into a solution of carbonate of potassa unto saturation, then crystallizing.

Fig. 185 shows the process of generating this gas in the bottle *a*, washing it by passing it through water in the bottle *b*, by means of the pipe *d*, which passes through a pipe *e*, of large bore to the bottom; and, finally, through *f*, conducting it into the solution of carbonate of potassa in *c*. The point of saturation may be judged proximately by the bubbles of gas leaving the pipe *f*, ceasing to diminish in size as they escape through *c*.

Fig. 185.



Bicarbonate of potassa is in large transparent crystals, with a mild alkaline taste, soluble in about four parts of water. The bicarbonates do not precipitate sulphate of magnesia, by which they may be known if fully bicarbonated. By being calcined, this salt loses 30.7 grains of water and carbonic acid, forming the pure carbonate of the *Pharmacopœia*.

This salt is remarkable among the alkaline carbonates for its constancy of composition, being, in a crystalline form, invariably represented by the formula $KO,2CO_2+HO$, and is directed in the *Pharmacopœia* as the test to ascertain the strength of acids, which it neutralizes in the ratio of their strength. The following table exhibits the proportion of bicarbonate of potassa, which neutralizes 100 grains of each of the acids named:—

Acetic acid, 60	Diluted 7.5.
Citric acid, 150.	
Tartaric acid, 133.5.	
Nitric acid	Diluted, 20.
Sulphuric	Diluted, 25.

As a medicine, bicarbonate of potassa acts as a direct and efficient antacid; pleasanter and more efficient than bicarbonate of soda. It readily neutralizes free acid in the stomach, and the excess being absorbed renders the blood and urine decidedly alkaline, and is hence considered alterative in its action. It is used to liberate carbonic acid, and for making the saline preparations of potassa, is confined to carbonate, being pure. Dose ℈j to ʒj.

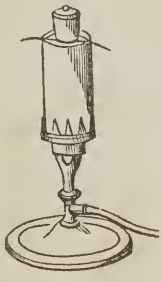
Potassæ Carbonas Purus, U. S.

The ignition of the potash forming pearlash deprives it of organic matter, and brings it more completely into the condition of a carbonate. The solution, filtration, and granulation of this deprives it of some inorganic impurities, but leaves it contaminated with silica. Charging it with a further dose of carbonic acid precipitates this impurity; and, finally, calcination at a red heat will drive off

Fig. 186.

Fig. 187.

Fig. 188.



the additional dose of carbonic acid and the water of crystallization, and leave the pure carbonate. This is directed to be dissolved and granulated. The only use to which it is applied is as a test, and when absolute purity is required. An iron crucible is directed in

the *Pharmacopœia* for this purpose, but a porcelain, Fig. 186, or a platinum crucible, Fig. 187, will do in small operations.

Fig. 188 shows the mode of suspending one of these of small size over a gas lamp chimney by a bent wire; a similar arrangement may be adopted in using the Russian or other alcohol lamps. I have illustrated and described this more fully, because, on a small scale, it is readily practicable, and it is frequently difficult to obtain the chemically pure carbonate. Formerly this was directed to be prepared by igniting bitartrate of potassa, hence the name salt of tartar now frequently applied to both the carbonates.

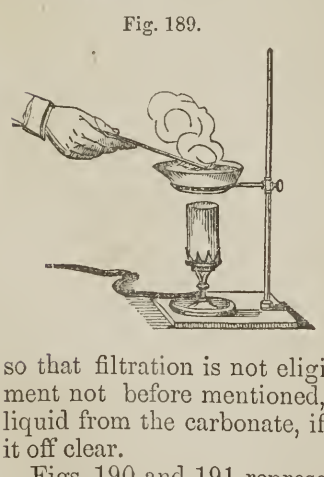
Liquor Potassæ, U. S.

	(Reduced Quantity.)
Take of Carbonate of potassa . .	℔j, or ℥iij, or ʒvj.
Lime	℔ss, or ℥iss, or ʒiij.
Boiling distilled water .	Cong. j, or Oij, or f℥viij.

Dissolve the carbonate in one-half the distilled water. Pour a little of the water on the lime, and when it is slaked add the remainder. Mix the hot liquors and boil for ten minutes, stirring constantly; then set the liquor aside in a covered vessel till it becomes clear; lastly, pour off the supernatant liquor and keep it in well-stoppered bottles of green glass.

This process may be conveniently conducted with an ordinary evaporating dish over a spirit or gas lamp, care being taken that the carbonate of lime does not cake in the bottom of the dish while the heat is being applied; a glass rod should be used for stirring. When the boiling is finished, the whole may be conveniently poured into a precipitating glass, which should be covered by placing the dish over it, or into a salt mouth bottle into which the stopper should be introduced. On standing, the carbonate of lime will subside, and the *liquor potassæ* may be poured off clear. It will act upon filtering paper, so that filtration is not eligible. The use of the siphon, an instrument not before mentioned, will be convenient in drawing off the liquid from the carbonate, if any difficulty should occur in pouring it off clear.

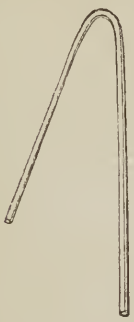
Fig. 189.



Figs. 190 and 191 represent siphons, the latter the most convenient kind; they are bent tubes, having one leg longer than the other. If the tube be filled and the short limb plunged into a vessel filled with some liquid which it is designed to draw off, the liquid will discharge itself from the end of the longer limb, and will continue to flow as long as this end of the tube is below the level of

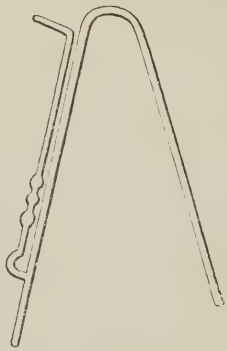
the liquid in which the end of the short limb is immersed. This current is caused by the unequal weight of the columns of liquid

Fig. 190.



Plain siphon.

Fig. 191.



Siphon with suction tube.

in the two limbs of the siphon. The plain siphon, Fig. 190, is constructed by simply bending an ordinary piece of glass tube of the requisite size over a spirit or gas lamp. The inconvenience in its use arises from the difficulty of filling it with the liquid beforehand. It might be filled with water, but that would dilute the preparation. If a small quantity has been already drawn off, the siphon may be filled by inverting it, and pouring into its long end from a graduated measure, then applying the end of the finger to prevent its running out, and inserting the short limb in the liquid to be drawn off. In using the siphon, Fig. 191, the finger is placed at the end of the long limb, and the short limb being inserted in the liquid, the air is drawn out by applying the mouth at the end of the thin sucking tube attached for the purpose, till the apparatus is filled as far as the little bulbs. The current will then be fairly determined toward the receiving vessel, and the last drop of the clear liquid may be drawn off.

Liquor potassæ is a colorless liquid, with an intensely caustic taste, sp. gr. 1.056. It should not effervesce, except very slightly, with acids. It has a very strong affinity for carbonic acid and moisture, which it continually abstracts from the air. It attacks flint-glass, hence the direction to keep it in green glass bottles. Its effect upon the skin is to produce an oily or soapy sensation, due to the destruction of the cuticle; it also destroys or greatly injures vegetable fibre. Its use is chiefly confined to neutralizing free acid in the stomach and in the secretions. It is applied to the treatment of scrofulous and cutaneous affections, and to the arrest of the uric acid deposits in the urine. The dose is from ♏v to f℥ss. When given internally, it should be largely diluted with milk. Dr. E. Wilson, of this city, has used it with success in a case of

extreme obesity for reducing the accumulation of fat; by pushing the dose, diluted as above, to ♏xl three times a day, his patient, a female, lost 48 lbs. weight in a few months, so that from weighing 198 lbs. at the commencement of the treatment, she weighed only 150 lbs. at its close.

Potassa, U. S. (*Vegetable Caustic, Caustic Potassa, Hydrate of Potassa, fused Potash.*)

This preparation is made from the foregoing by evaporating it to dryness, fusing it, and running it into moulds. It is usually found in the shops of two qualities—one in sticks somewhat thicker than a quill, of a bluish gray color and peculiar earthy odor; the other quite white, frequently thinner than the other, more free from organic impurities, though perhaps containing more lime. It is so deliquescent as to become moist on exposure for a few minutes to the air, and should be kept well and tightly closed; sometimes a few coriander seeds are placed with it in the bottle; they keep it dryer, and prevent its contact with the glass, upon which it acts.

It is a very powerful caustic, destroying the part to which it is applied, and producing a deep eschar. Its chief use is in opening abscesses, forming issues, &c. One of its chief disadvantages for these applications arises from its deliquescence, which occasions the spread of its corrosive influence to adjacent parts.

Potassa cum Calc, U. S.

Take of Potassa,
Lime, of each, ℥j.

Rub them together, and keep the mixture in a well-stopped bottle. This powder is designed to be applied in the form of paste, made with a little alcohol, but by a modification of the process, a similar article is produced, which is run into sticks, and is found in the shops in that form, closely resembling common caustic in appearance. It is milder from the dilution with lime, and less deliquescent.

Potassæ Acetas, U. S. (*Sal Diureticus.*)

Made by neutralizing acetic acid with carbonate of potassa, and evaporating by a carefully regulated heat till it fuses and crystallizes. The carbonic acid escapes with effervescence, being substituted by the acetic. This salt is usually found in the shops in foliated satiny masses, unctuous to the touch, and of a pungent saline taste; it is neutral in its reactions, and extremely soluble and deliquescent, so much so, as to be very difficult to manipulate with; its composition is $KO,\overline{A}c+2HO$. Its use is almost confined to dropsical affections. The acid it contains being consumed in pass-

ing through the system, the alkali is found as carbonate in the urine, which is much increased in quantity. The dose of acetate of potassa is from gr. x to ʒij.

A recipe is given among the *Extemporaneous Preparations* for a ready mode of preparing it in a liquid form.

Potassæ Citras, U.S.

	(Reduced.)
Take of Citric acid, ʒx	ʒx.
Bicarbonate of potassa, ʒxiv . .	ʒxiv.
Water, q. s. (Oij)	fʒiv.

Dissolve the citric acid in the water, add the bicarbonate gradually, and when effervescence has ceased, strain and evaporate to dryness, stirring constantly after the pellicle has begun to form till the salt granulates, then rub it in a mortar (wedgewood), pass it through a coarse sieve, put it in a bottle, which should be kept closely stopped. This is a granular powder, slightly acid, very soluble in water, deliquescent, and in its effects refrigerant and diaphoretic. Its dose is from ℈j to ʒss.

Among the diaphoretic solutions, under the head of *Extemporaneous Preparations*, this salt in various liquid forms will be again introduced.

Potassæ Chloras.

Chlorate of potassa is prepared by several modifications of the simple process of passing chlorine gas into a solution of potassa or its carbonate; at first, chloride of potassium and hypochlorite of potassa are formed; with these, a further proportion of chlorine produces changes resulting in the conversion of the hypochloric into chloric acid, which exists in combination with the potassa as chlorate of potassa (KO,ClO_5); this is separated by crystallization from the more soluble chloride of potassium. It is a sparingly soluble salt, unless by the aid of heat, and has a cooling taste and diuretic refrigerant effect, being given in a variety of diseases in doses of gr. x to ʒss. In chemistry it is used to obtain pure oxygen, which it gives off, on the simple application of heat, leaving fused chloride of potassium in the flask or retort.

GROUP 2.—*Alkaline Salts, starting with Common Salt.*

Sodii Chloridum, NaCl. Obtained by evaporation of certain natural spring waters.

Sodæ Sulphas, NaO,SO_3+10HO. By the action of sulphuric acid on common salt.

Sodæ Carbonas, NaO,CO_2+10HO. By calcining sulphate with carbon, &c.

Sodæ Carbonas Exsiccatus, NaO,CO_2. By simple calcination of carbonate and powdering.

Sodæ Bicarbonas, $NaO,2CO_2+HO$. By passing gaseous CO_2 into a box containing crystals of the carbonate.

Sodæ Phosphas, $2NaO,HO,PO_5+24HO$. By neutralizing superphosphate of lime with the carbonate, filtering and evaporating.

Liquor Sodæ Chlorinatæ. By treating carbonate, in solution, with chlorinated lime.

Sodæ Acetas, $NaO,\overline{Ac},+6HO$. An intermediate salt in the preparation of acetic acid.

Sodæ Valerianas, $NaO,\overline{Va}$, an intermediate salt in the preparation of other valerianates.

Sodii Chloridum, U. S. (*Common Salt.*)

In crystals called rock salt, or usually in a granulated or fine dry powder. It is very soluble in water, and contains no water of crystallization; its chief use, that of a condiment and antiseptic, is well known. It is an emetic in large doses. Externally, it is stimulant. Salt baths, with or without friction, are useful appliances of the physician.

Sodæ Sulphas, U. S. (*Glauber's Salts.*)

It is produced as a residuum in making muriatic acid and chlorinated lime, and is one of the most abundant and cheap articles of chemical manufacture. It exists in sea-water and in many spring waters. It is usually in very large white efflorescent crystals. Neutral, very soluble, with a bitter and saline taste; its composition is one equivalent of soda, one of sulphuric acid, and ten of water; the water forming 55 per cent. of its weight. Its dose, as a cathartic, is ℥ss to ℥j, or somewhat less when effloresced, though chiefly used as a purge for horses in much larger quantities. It is the principal ingredient in the so-called Cheltenham salts.

Sodæ Carbonas, U. S. (*Sal Soda. Washing Soda.*)

This is chiefly produced on a very large scale by calcining sulphate of soda with small coal and chalk, which reduces it first into sulphuret, and then from the presence of the chalk into carbonate. This is separated by digestion with hot water, evaporated, further carbonated, redissolved, and crystallized.

The chief use of carbonate of soda is in the arts and in domestic economy as a detergent, and in the preparation of various officinal carbonates and salts of soda. It is extremely soluble in water, and efflorescent, and contains 62 per cent. of water of crystallization, which may be dissipated by heat.

Sodæ Carbonas Exsiccatus, U. S. (*Dried or Calcined Carbonate of Soda.*)

Take of Carbonate of Soda, a convenient quantity.

Expose it to heat in a clean iron (or porcelain) vessel until it is thoroughly dried, stirring constantly with an iron (or porcelain) spatula, then rub it into powder.

This is the form in which carbonate of soda is most conveniently given in powder or pill. It is a milder antacid than the corresponding salt of potassa. The dose of crystallized carbonate of soda is gr. x to ℥ss, though varying with the degree of efflorescence; that of the anhydrous, gr. v to xv.

Sodæ Bicarbonas, U.S. (*Supercarbonate of Soda.*)

The best process for preparing this salt is a modification of that of Dr. Franklin R. Smith, of Bellefonte, Pa. The crystallized carbonate partly effloresced, or a mixture of the crystallized and dried in proper portion, is placed in a wooden perforated box, and carbonic acid gas (generated by the action of dilute sulphuric acid on marble) is passed into it. Owing to the strong affinity of the monocarbonate for a further dose of carbonic acid, the bicarbonate is generated in this simple way. As met with in the shops, it is a dry white powder, slightly alkaline, permanent in the air, soluble in thirteen parts of cold water, decomposed by a boiling temperature. The commercial article I have generally found to contain some sesqui or mono-carbonate. The taste betrays this, as also the fact of its readily precipitating carbonate of magnesia from a cold solution of Epsom salts, which well made bicarbonate will not. This impurity, the result of defective preparation, although not very important, renders this remedy less agreeable, and in view of its employment in effervescing powders, &c., less effective. The proportion of carbonic acid given off from bicarbonate of soda by treating it with acids exceeds 50 per cent., so that it is one of the most productive articles for this purpose. It enters into Soda, Seidlitz, Yeast, and some other powders, in which tartaric acid is employed to decompose it; the proportion being thirty-five parts of the acid to forty of the bicarbonate.

Soda-salæratus is now employed in immense quantities as an adulteration of the proper salæratus, and as a substitute for bicarbonate of soda; it is, generally, an imperfect preparation and poor substitute for the officinal bicarbonate of soda.

Bicarbonate of soda is used in medicine as a mild antacid; it is very cheap, though, I think, inferior to bicarbonate of potassa. Dose, ℈j to ʒj in carbonic acid water, if at hand.

For effervescing powders, see *Extemporaneous Prescriptions*.

Sodæ Phosphas, U.S.

Phosphate of soda is formed by digesting bone ash (phosphate of lime) in sulphuric acid, thus liberating phosphoric acid. The sulphate of lime being separated by adding carbonate of soda to the phosphoric acid till neutralized, and crystallizing, the pure salt is produced in large, transparent, efflorescent, very soluble crystals, resembling common salt in taste.

It is a tribasic salt, consisting of one equivalent of phosphoric acid, two of soda, and one of water, and twenty-four of water of crystallization. ($2NaO,HO,PO_5+24HO$). The enormous proportion of water, 62.3 per cent. of its weight, is a remarkable property of this salt.

It is a mild saline cathartic and diuretic. Dose, from ʒij to ʒj, and is chiefly recommended by its taste.

Liquor Sodæ Chlorinata, U. S. (*Labarraque's Disinfecting Solution.*)

This may be conveniently prepared by the apothecary or physician by observing carefully the directions of the *Pharmacopœia*, as follows:—

		(Reduced.)
Take of Chlorinated lime . .	℔j.	℥j.
Carbonate of soda . .	℔ij.	℥ij.
Water	Cong. iss.	Oj.

Dissolve the carbonate of soda in three pints of the water by the aid of heat. To the remainder of the water add, by small portions at a time, the chlorinated lime previously well triturated, stirring the mixture after each addition; set the mixture by for several hours that the dregs may subside, then decant the clear liquid and mix it with the solution of carbonate of soda. Lastly, decant the clear liquor from the precipitated carbonate of lime, pass it through a linen cloth, and keep it in bottles secluded from the light.

Fig. 192.

Fig. 193.

Wedgewood mortar and pestle.

The necessity for the aid of heat in dissolving the carbonate of soda, may be overcome by the use of the mortar and pestle, Figs. 192, 193, as directed in the chapter on Solutions. In the absence of a precipitating jar, the wide-mouth packing bottles, Figs. 194 and 195, may be substituted, being well adapted to allow the undissolved portion of the first liquid, and the precipitated carbonate of lime of the last to subside.

Labarraque's solution is a colorless alkaline solution, having a faint odor of chlorine, though somewhat modified, and an alkaline taste; it contains an excess of carbonate of soda. It owes its therapeutic and antiseptic value to containing chlorine in a loose state of combination so as to be readily liberated on the addition of even a weak acid, and on exposure to the air, by the absorption of carbonic acid. It is used in malignant fevers as an antiseptic and stimulant, and to correct fetid eructations and evacuations; it is a favorite addition to gargles in ulcerated sore throat. One of its principal uses

is to purify the air in sick-rooms, in which case it acts by decomposing sulphuretted hydrogen, against which gas, when inhaled, it

Fig. 194.

Fig. 195.

Wide-mouth packers suited to precipitation.

is also an antidote. The dose is f℥ss, diluted with water or mucilage. In gargles, f ℥ss or f℥j may be used in Oss.

Sodæ Acetas, U.S.

This is officinal in the list with a view to the preparation of acetic acid by its decomposition, but it is rarely met with in the shops, and is seldom prescribed in this city.

Sodæ Valerianas.

Valerianate of soda is made by saturating caustic soda with valerianic acid, as produced by the distillation of fusel oil from a mixture of sulphuric acid and bichromate of potassa; the fusel oil loses two equivalents of hydrogen and gains two of oxygen, being converted into valerianic acid, which combines with soda. This salt is white, soluble, deliquescent, with the odor of valerian. Its only use is to prepare the other valerianates by double decomposition.

Group 3.—*Alkaline Salts, starting with Crude Tartar.*

Crude Argols, or Tartar. Deposited in the casks during the ripening of wines.
Potassæ Bitartras, $KO,HO,2\overline{T}$. Purified by repeated recrystallizations, &c.
Sodæ et Potassæ Tartras, $KO,NaO,2\overline{T}+8HO$. Boiling carb. soda with bitartrate.
Potassæ Tartras, $2KO,2\overline{T}=KO,\overline{T}$. Boiling carbonate of potassa with bitartrate.

Crude argols are imported from the wine-producing countries of two kinds, the red and the white tartar of commerce. Recently

tartar has been produced, though not in large quantities, in the vicinity of Cincinnati, Ohio. It consists of potassa combined with an excess of tartaric acid, some tartrate of lime, coloring matters, &c., the lees and settlings of the wine which have separated during the conversion of the sugar of the grape juice into alcohol, and collected as a mass on the bottom and sides of the casks.

Potassæ Bitartras, U. S.

Cream of tartar is purified tartar made by treating argols with hot water, mixing with clay, which absorbs the coloring matters, purifying by crystallization, and reducing to powder. It is a white somewhat gritty powder, of an agreeable acid taste, sparingly soluble in the mouth, soluble in 184 parts of cold water, and in 18 parts of boiling water, which deposits it on cooling. It consists of one equivalent of potassa, one of water, and two of tartaric acid; the water contained in it is capable of being replaced by other bases, as in the two salts which follow it, and in the tartrate of iron and potassa, and the tartrate of antimony and potassa, described in subsequent chapters.

Cream of tartar in doses of ℥ss to ℥j, and in smaller quantities, is a very common and well-known hydragogue cathartic, refrigerant, and diuretic. It is usually given diffused in water, being sparingly soluble.

Sodæ et Potassæ Tartras, U. S.

Rochelle salt is prepared by combining one equivalent of carbonate of soda with one of bitartrate of potassa. The soda of the carbonate uniting with the excess of tartaric acid of the bitartrate to form a neutral salt; carbonic acid is evolved. The crystals of this salt are usually large, transparent, slightly efflorescent, of a saline not very unpleasant taste, and very soluble in water. It is commonly sold in powder, and, combined with one-third its weight of bicarbonate of soda constitutes the so-called Seidlitz mixture. It is a mild and pleasant purgative. Dose, from ʒij to ℥j.

Potassæ Tartras, U. S.

Soluble tartar is a salt in which the excess of tartaric acid in bitartrate of potassa is combined with potassa; by boiling one equivalent of the carbonate of that alkali with one equivalent of bitartrate, the carbonic acid escapes; the reaction closely resembles that last described, substituting potassa for soda. Tartrate of potassa is either in white crystals, or a granulated powder slightly deliquescent and freely soluble; it is less agreeable to the palate than the foregoing, which it resembles in medical properties and uses. The dose is from ʒj to ℥j. It is rarely prescribed.

GROUP 4.—*Alkaline Salts—Prepared from Natural Deposits.*

Potassæ Nitras, KO,NO_5. From incrustations on the soil, in India and elsewhere.
Sal-prunelle, $KONO_5$, fused with a little sulphur, and containing a trace of sulphate.
Potassæ Sulphas, $KOSO_3$. From the residuum of the process for nitric acid.
Sodæ Boras, $NaO,2BO_3+10HO$. Found native in Thibet and purified.

Potassæ Nitras, U. S.

Nitre, or saltpetre, is imported from the East Indies, where it is extracted from the soils by mixing them with a little wood-ashes, lixiviating with water, and crystallizing. It is refined in this country by recrystallization, and then exists in large six-sided, nearly colorless prisms, freely soluble, and with a cooling rather sharp taste. Much of the saltpetre of commerce is adulterated with nitrate of soda and chloride of sodium (common salt). In the absence of these, 100 grains of the dry salt, treated with 60 grains of sulphuric acid, and the whole ignited in a crucible till it ceases to lose weight, yield 86 grains of sulphate of potassa. The presence of chlorides may be shown by treating a weak solution with a few drops of solution of nitrate of silver, which would throw down a white insoluble precipitate of chloride of silver. Among the uses of nitrate of potassa in pharmacy, are the preparation of nitric acid, of spirit of nitric ether, and of collodion. Owing to the immense consumption of it in a pure form by the manufacturers of gunpowder, they are resorted to for procuring the best qualities for medicinal use. Dupont, near Wilmington, Delaware, furnishes a fine article both in crystals and in the form of a granular powder. It is one of the most popular of the refrigerant, diuretic, and sedative medicines. Dose, gr. v to ʒj.

Sal Prunelle.

This is fused saltpetre run into round moulds about the size of a filbert, of a white color, and possessing the properties of the nitrate. From the use of sulphur in its fusion, it often contains sulphate of potassa. It is used to dissolve in the mouth in affections of the throat.

Potassæ Sulphas, U.S. (*Vitriolated Tartar.*)

Sulphate of potassa is prepared from the residuum left after treating nitrate of potassa with sulphuric acid, for the distillation of nitric acid; it is also a residuary product in the manufacture of sulphuric and of tartaric acid. A supersulphate is the residuum in the first named case, which requires treatment to reduce it to the proper composition; the salt is then dissolved and crystallized. The crystals are hard, heavy, and usually regular in their shape, being six-sided prisms, terminated by corresponding pyramids. It is used in the preparation of Dover's powder, but is rarely given alone or in any other combination. It is esteemed a cathartic in doses of ʒj to ʒij.

Sodæ Boras, U.S.

Borax is found native in Thibet, and imported in a crude condition from India, also manufactured in Tuscany. In its refined condition it is in large and handsome crystals, semi-transparent, with slight alkaline reaction, and slightly alkaline not disagreeable taste, soluble in water, especially when hot; though a super-salt, it has an alkaline reaction. The proportion of water of crystallizations appears to vary with the process of crystallization. It is a diuretic and antacid, and by some is said to promote contraction of the uterus, to which end it is associated with ergot. It is a very favorite addition to gargles and mouth-washes—being much prescribed for the sore mouth of infants, triturated with sugar, 1 part to 7, and touched to the tongue, or blown in through a quill.

It is remarkable for its whitening effect upon ointments, upon which it seems to act by its sub-alkaline properties, partially saponifying them without materially diminishing their bland and emollient effects.

Group 5.—*Alkaline Salts—Preparations of Ammonia.*

Ammoniæ Murias, $NH_3,H_2Cl=NH_4,Cl$. A neutral, odorless, much used in the arts.
Liquor Ammoniæ. Aqueous solution of caustic ammonia, sp. gr. .960.
" Ammoniæ Fortior. " " " sp. gr. .882.
Spiritus Ammoniæ. Alcoholic solution of " " sp. gr. .831.
" Ammoniæ Aromaticus. Alc. solut. of carb. of ammonia with aromatics.
Ammoniæ Carbonas. Hard, translucent, and pungent, $2NH_3.3CO_2+2HO$.
Ammoniæ Bicarbonas. White, pulverulent, odorless, $NH_3.2\underline{CO}_2$.
Liquor Ammoniæ Acetatis. Neutral and mild solution of, NH_3Ac.

Ammoniæ Murias, U.S.

Muriate of Ammonia, *sal ammoniac*, or *chloride of ammonium*, is in the list of the *Pharmacopœia;* it is prepared on a very large scale in England from the residuary products of the destructive distillation of coal, and from other empyreumatic products containing ammonia. It is in white, translucent, fibrous masses, which are convex on one surface and concave on the other; it has a pungent saline taste, but no odor. It cannot be conveniently powdered by contusion or trituration, and is best reduced by dissolving, evaporating, and granulating. It is a very soluble salt; it is incompatible with strong acids, which liberate muriatic acid, and with alkalies, which disengage ammonia, as in some of the processes which follow. It is frequently prescribed, especially by German practitioners, as a stimulating alterative in catarrhs, combined with other expectorants. Dose, from grs. v to xx.

Liquor Ammoniæ, U.S., *and Liquor Ammoniæ Fortior*, U.S.

Solution of ammonia (spirits of hartshorn), *and stronger solution of ammonia*, are obtained from muriate or any other common ammonia salt, by the action of quicklime, which, combining with the acid, liberates the caustic alkali in the form of gas; this is passed

by suitable contrivances into water, which absorbs it with intensity, especially if refrigerated.

The usual commercial strength is somewhat below that of the officinal *liquor ammonia*, which has the sp. gr. 960. The strongest marks 882, and requires diluting with two parts of water to bring it to the strength of the former; it is not, however, an economical mode of preparing the weaker to dilute the stronger.

Spiritus Ammoniæ, U. S.

The composition of spirit of ammonia is similar to the foregoing, except that alcohol is used as the solvent for the gas; it has nearly the strength of the officinal solution of ammonia, and has the sp. gr. .831.

The three officinal solutions of gaseous ammonia are used almost exclusively for external applications. They are too caustic to be given by the stomach unless largely diluted and modified by emollient or mucilaginous excipients. The dose of the officinal liquor ammoniæ (not fortior), or of spiritus ammonia, is ♏x to xxx. Several liniments introduced under the appropriate head contain one or other of these preparations; the only merit of *spiritus* over *liquor* ammoniæ, is, that it is miscible with certain tinctures, &c., which are decomposed by the aqueous ingredient in the former preparation. Liquor ammoniæ fortior is adapted to raise a blister suddenly.

Spiritus Ammoniæ Aromaticus, U. S. (*Aromatic Spirit of Ammonia.*)

Spt. sal volat. is a very useful and popular stimulant and antacid. Unlike the foregoing caustic preparations, this contains carbonate of the alkali, and is well adapted to internal use. Some processes for preparing it require the solution of the solid carbonate in alcohol by the aid of a mortar and pestle, with the addition of aromatic essential oils, but our *Pharmacopœia* directs a different and somewhat more troublesome manipulation, as follows:—

Take of	Muriate of ammonia . .	five ounces.
	Carbonate of potassa . .	eight ounces.
	Cinnamon, bruised,	
	Cloves, bruised, each . .	two drachms.
	Lemon-peel	four ounces.
	Alcohol,	
	Water, each	five pints.

Mix them, and distil seven pints and a half.

The two first ingredients decompose each other, forming chloride of potassium, which remains in solution in the retort or still used, while carbonate of ammonia in the form of vapor distils over with the alcohol and aromatics, and is collected in the receiver.

This preparation is given, alone or combined with other remedies, to treat a variety of indications in disease. Dose, ♏xx to ʒj.

Ammoniæ Carbonas, U.S.

Carbonate of ammonia (sesquicarbonate) is prepared by treating a mixture of muriate of ammonia and chalk (soft carbonate of lime). By double decomposition, chloride of calcium and carbonate of ammonia are formed; the latter, being volatile, sublimes, and is collected in a colorless almost transparent sublimate, with powerful pungent odor and acrid taste. It is usually in irregular lumps from the breaking of the large dome-shaped mass at first obtained; it is very hard, and on that account liable to fracture a glass bottle in which it is placed.

The stimulant and antacid properties of this salt are very well known; it is given in various modes of combination, some of which will be noticed under the head of *Extemporaneous Preparations*. Its dose is gr. v.

Carbonate of ammonia in smelling bottles is much sought for to relieve headaches, and for this purpose may be most conveniently prepared by mixing

Muriate of ammonia, granulated	. . .	5 parts.
Carbonate of potassa "	. . .	8 parts.

Moistening and flavoring appropriately.

Ammoniæ Bicarbonas.

Bicarbonate of Ammonia.—By long exposure to the air, particularly in small fragments, the sesquicarbonate loses a portion of its pungency, falls into powder, and by absorbing carbonic acid becomes converted chiefly into bicarbonate. The use of this is as a milder and less stimulating diaphoretic and antacid. Dose, gr. x to ʒj.

In using carbonate of ammonia for its direct stimulating effect, care should be taken that it is free from the pulverulent, white bicarbonate; and where it has deteriorated by the formation of this on the surface of the lumps, they should be scraped away, and cracked, till the vitreous looking hard portion is reached. For saturating acids in the formation of neutral salts, the bicarbonate will answer a good purpose.

Liquor Ammoniæ Acetatis, U.S. (*Solution of Acetate of Ammonia. Spirit of Mindererus.*)

This excellent preparation is made very readily and conveniently by the officinal recipe, as follows:—

Take of Diluted acetic acid, . . half a pint.
Carbonate of ammonia, in powder, a sufficient quantity.

Add the carbonate of ammonia gradually to the acid until it is saturated.

Diluted acetic acid, as elsewhere stated, is made by adding one fluidounce of acetic acid to seven fluidounces of water, making eight. It will be found convenient and desirable to consume the bicarbonate or the partially bicarbonated sesquicarbonate, which

falls readily into powder, and is almost useless for other purposes, in making this preparation. By making it in a tincture-bottle in which toward the last the stopper is kept, the solution will be made to absorb a large amount of gas, and to sparkle when decanted. The point of saturation may be determined proximately by the taste, and it is generally not desirable to continue adding the alkali till it is perfectly saturated, as it is far more agreeable to be a little too acid than too alkaline. This solution should be always made in small quantities, and is generally better to be prepared when required. It is very much prescribed as a mild stimulant and diaphoretic. Dose, f℥j to f℥ss. As an antidote to alcoholic liquids given while the patient is intoxicated, from f℥ss to f℥j.

CHAPTER III.

ON THE EARTHS AND THEIR PREPARATIONS.

1st Group.—*Preparations of Lime.*

Marmor (Marble). Native hard carbonate of lime.
Creta (Chalk). Native soft carbonate of lime.
Creta Præparata, CaO,CO_2. Levigated and elutriated, nodules. Dose, gr. x to ʒj.
Testa (Oyster Shells). The shell of ostrea edulis.
Testa Præparata. Levigated and elutriated, small nodules.
Calx, CaO. Lime recently prepared by calcination.
Liquor Calcis. Lime-water, contains 9.7 grs. to Oj. Dose, f℥ij to f℥iv.
Calcii Chloridum, CaCl. Dissolving carbonate in HCl, and evaporating.
Liquor Calcii Chloridi. One part of CaCl in 2.5 of the solution. Dose, ♏xxx to fʒj.
Calcis Carbonas Præcipitatus. From CaCl by adding NaO,CO_2. Very white, fine powder.
Calx Chlorinata, $CaO,ClO+CaCl+CaO+Cl$. Bleaching salt. Disinfectant.
Calcis Phosphas, $3CaO,PO_5$. Calcined bones precipitated from solution in H,Cl.
Syrupus Calcis Phosphatis (Durand), CaCl. By adding $NaO,PO_5,HO.+$Excess of PO_5.
Syrupus Calcis Phosphatis (Wiegand). Contains $3CaO,PO_5$ in solution in H,Cl.
Syrupus Ferri Phosphatis Compositus. Phosphates of iron and lime. Suspended by sugar.

Lime is the oxide of a light metal called calcium, its officinal name is *Calx*, symbol CaO. It exists to a very great extent in the mineral kingdom, being the most familiar type of the so-called alkaline earths. It is obtained from the soil by plants, and becomes incorporated into the structure of animals, entering specially into their bones, shells, and teeth.

Marmor and *Creta* are the names given in the list to two native unorganized forms of carbonate of lime, while *Testa* is applied to the shell of the common oyster. Besides these, there is another form of hard carbonate of lime, called *limestone*, which, though not officinal, is employed for the preparation of lime.

Carbonate of lime for use in medicine requires to be prepared by the mechanical processes adapted to furnishing a pure and fine

article. Chalk and oyster-shell are subjected to the process of elutriation; being powdered and diffused in water to allow of the subsidence of crystalline particles, the turbid liquid is drawn off into other vessels, allowed to settle, and dried by being dropped from a suitable orifice on to a drying slab, thus presenting the carbonate in nodules or small pyramidal amorphous masses, readily falling into a very fine, impalpable, white powder. In this way prepared chalk and prepared oyster-shell are produced. The precipitated carbonate of lime is very differently prepared by means of a chemical process, described, along with the medical properties of the carbonate, on the next page.

Calx, U. S.

Lime, itself, is prepared from the carbonate, mostly from limestone, by calcining along with carbonaceous matters. Sometimes with wood, furnishing wood-burnt lime; and at other times with coal, furnishing a more common article. The action of an intense heat drives off the carbonic acid which escapes, leaving the lime in its caustic state. On the addition of water, lime becomes slaked, a high heat is produced, and it is found to have absorbed water.

Aqua Calcis, U. S.

Take of Lime	. . . . .	four ounces.
Water	. . . . .	one gallon.

Upon the lime, first slaked with a little water, pour the remainder of the water and stir them together, then immediately cover the vessel and set it aside for three hours. The solution should be kept standing upon the undissolved lime in stopped glass bottles, and poured off clear when required for use.

Lime is soluble to a very limited extent, and more so in cold than in hot water. The proportion contained in lime-water is from nine to ten grains to the pint; its dose is from f℥ss to f℥ij. It is particularly useful in small doses to allay irritation of stomach and nausea, and as an astringent antacid is adapted to dyspepsia accompanied with acidity of stomach and diarrhœa. Its taste and caustic properties are best disguised by admixture with milk.

Calcii Chloridum, U. S. (*Chloride of Calcium.*)

Is prepared by dissolving chalk or marble in muriatic acid and evaporating to dryness, after which it may be fused. It is a white amorphous mass or powder, with an acrid, bitter, saline taste, very soluble in water and alcohol, and so deliquescent as to be used for drying gases, and for depriving various liquid substances of water. It is also capable of crystallizing, when it absorbs six equivalents of water.

Liquor Calcii Chloridii, U. S.

Solution of chloride of calcium is directed in the *Pharmacopœia*

to be made by obtaining the chloride as above, and dissolving it in water in about such proportion that 2.5 parts of the solution shall be equal to one part of the salt. It is rarely prepared or prescribed, although considered a deobstruent and alterative remedy adapted to scrofulous diseases and goitre. Dose, ♏xxx to f℥j.

Calcis Carbonas Præcipitatus, U. S.

Is prepared by adding to the solution of chloride of calcium as above, an equivalent proportion of carbonate of soda in solution. By double decomposition, carbonate of lime is formed and precipitated as a white powder, while chloride of sodium remains in solution and is separated by washing. The fineness of this precipitate is dependent upon the degree of concentration and the temperature of the solutions. If dilute and cold, the result would be the formation of a crystalline powder destitute of that softness and miscibility with liquids which adapts it to convenient use. The *Pharmacopœia*, therefore, directs strong solutions and a boiling temperature at the time of mixing them.

When properly made, this is a fine white powder, free from grittiness, insoluble in water, but soluble without residue in diluted muriatic acid, with abundant disengagement of carbonic acid. It is used as an antacid, with astringent properties, adapting it especially to diarrhœa. Dose, from gr. x to ℥j.

As compared with prepared chalk, with which it is identical in composition, this is a far handsomer preparation, and, though less distinctly amorphous, is preferred for almost all prescription purposes. It is well substituted for chalk in dentifrice.

Calx Chlorinata, U. S.

Under the name of chloride of lime, or bleaching powder, this substance is extensively manufactured and used as a bleaching agent. It is made from slaked lime by subjecting it to an atmosphere of chlorine gas till completely saturated. It is a whitish powder, having the odor of chlorine, which it gives off on exposure to the air. It is highly deliquescent, absorbing both moisture and carbonic acid from the air. A very moist consistence argues the presence of a considerable proportion of chloride of calcium, and is an indication of inferiority. Its composition varies, but it is, when of good quality, a mixture of hypochlorite of lime, CaO,ClO; chloride of calcium, CaCl; lime, CaO,HO; and free chlorine, Cl. It is only partially soluble in water.

For the full advantage of the liberation of chlorine the addition of an acid is necessary, though the spontaneous evolution of that gas is usually relied on for common disinfecting purposes. The chief popular use of chlorinated lime is as a disinfectant about cesspools, sewers, and places rendered offensive and unwholesome by the products of decomposition.

It is also used in the manufacture of chloroform and for the pre-

paration of Liquor sodæ chlorinata (see page 342), which is used as a substitute for it for internal and external use in medicine.

Calcis Phosphas, U. S.

This salt, called bone phosphate of lime, is made by calcining bones and dissolving in muriatic acid, precipitating the phosphate by a solution of ammonia, washing, and drying.

It is a white insoluble powder, free from odor and taste; soluble in muriatic, acetic, and phosphoric acids.

This phosphate is used as a remedy for scrofulous diseases, defective nutrition, &c. Dose, from gr. x to ʒss, repeated three times a day.

In a paper in the *American Journal of Pharmacy*, vol. xxv. p. 411, by A. B. Durand, the following recipe for a preparation extensively sold by him was published:—

Syrup of Phosphate of Lime. (Durand.)

Take of	Precipitated phosphate of lime	128 grains.
	Glacial phosphoric acid	240 "
	Sugar, in coarse powder	7½ oz. (offic.)
	Distilled water	4 fluidounces.
	Essence of lemon	12 drops.

Mix the phosphate of lime with the water in a porcelain capsule, over a spirit or gas lamp, or in a sand bath; add gradually the phosphoric acid until the whole of the phosphate of lime is dissolved. To this solution add sufficient water to compensate for the evaporation, then dissolve the sugar by a very gentle heat, and, when perfectly cold, add the essence of lemon. The syrup of phosphate of lime, thus prepared, is colorless, transparent, of an acid taste, and contains two grains of the phosphate of lime and nearly four grains of phosphoric acid to each teaspoonful, and has been found to be more acceptable to the stomach than the solution of phosphate of lime usually prescribed. When diluted by the patient previously to its being taken, it forms a phosphoric lemonade not unpleasant to the taste. Dose, a teaspoonful.

In a paper in the *American Journal of Pharmacy*, noticing the above, T. S. Wiegand remarks upon the acidity of the preparation as an objection to its use in some cases; and, as the use of the phosphates of iron, lime, soda, and potash had proved so satisfactory in the hands of several eminent physicians, proposed the following modified formulæ:—

Syrup of Phosphate of Lime. (Wiegand.)

℞.—Calcis phosphatis præcip.		ʒj.
Acidi chlorohydrici		fʒiv.
Aquæ, q. s. ft.		fʒvij.
Sacchari, q. s. ft.		fʒxiiss.

Dissolve the phosphate of lime, previously mixed with an ounce

of water by means of the acid; filter, then add the remaining water to this; add the sugar until the bulk is increased to twelve fluidounces, and strain.

Syrupus Ferri Phosphatis Compositus. (T. S. Wiegand.)

Take of	Protosulphate of iron	four drachms and two scruples.
	Phosphate of soda (crystallized)	seven drachms and a half.
	Phosphate of lime (recently precipitated)	four drachms.
	Glacial phosphoric acid	one ounce.
	Sugar, in coarse powder	eight ounces (offic.).
	Water	a sufficient quantity.

Dissolve the sulphate of iron, and five and a half drachms of the phosphate of soda, severally, in three fluidounces of the water, and mix the solutions; wash the precipitated phosphate of iron with (cold) boiled water, mix it with the phosphate of lime and half a pint of water in a porcelain capsule, apply heat, gradually add the phosphoric acid, continuing the heat until a clear solution is obtained, and dissolve in it seven ounces of the sugar; then dissolve the phosphate of potash, two drachms of the phosphate of soda, and an ounce of sugar in a fluidounce of water, acidulate the solution with phosphoric acid, and add it to the syrupy solution first obtained. A slight cloudiness is occasioned by mixing the solutions, which may be entirely removed, and the syrup rendered permanently transparent, by adding forty drops of hydrochloric acid.

Each teaspoonful of this syrup contains about one and two-fifths grain of protophosphate of iron, two and a half grains of phosphate of lime, one and one-fifth grain each of the alkaline phosphates, and four and a half grains of free phosphoric acid, which may be considered the dose.

As some of the preparations in use are colored with cochineal and flavored with orange-peel, which render them less disagreeable, this syrup may be so treated by rubbing up six grains of cochineal with a little sugar, and adding ten drops of the oil of orange-peel, and adding the mixture to the syrup, and filtering.

To the foregoing preparations, for which there is as yet a rather limited demand, the following, proposed by Professor Procter, may be added, with the remark that although the space given to the subject is perhaps in undue proportion to its therapeutic importance, yet the phosphates seem to require an extended notice from their recent popularity and the difficulty felt by some in prescribing them.

Take of	Protochloride of iron (in crystals) .	ʒj.
	Chloride of calcium (fused) . . .	ʒiss.
	Phosphate of soda (crystallized) . .	ʒvij.
	Phosphate of potassa	ʒj.
	Glacial phosphoric acid . . .	ʒiij.
	Syrup of lemons,	
	Distilled water, of each . . .	fʒiv.

Triturate the chlorides of iron and calcium, six drachms of the phosphate of soda, and the phosphoric acid, together with a little water, until a homogeneous liquid is obtained, and then add the rest of the water gradually; dissolve the phosphate of potassa and the remainder of the phosphate of soda in the syrup, and add it to the first solution, and mix. The result is a syrupy, acid, saline liquid, holding a portion of gelatinous phosphate of lime in suspension. This may be entirely dissolved by using more phosphoric acid, or by adding a little hydrochloric acid.

The reactions that occur in the above formula are, first, the production of phosphate of lime, phosphate of iron, and chloride of sodium; next, the immediate solution of the first two through the agency of the free phosphoric acid. When the syrup containing the phosphates of soda and potassa is added, a portion of the free acid is attracted by them, and a small part of the phosphate of lime is precipitated in a hydrated form. Sulphate of iron may be substituted for the chloride in the above formula, by first triturating the soda, salt, and chloride of calcium alone with a little water till double decomposition ensues, then adding the *sulphate* of iron, and again triturating, and lastly the phosphoric acid. By observing this order, no sulphate of lime is formed, and the mixed hydrated phosphates of lime and iron at first formed are readily dissolved by the free acid. When sulphate of iron is used, of course both sulphate of soda and chloride of sodium exist in the preparation.

The phosphates of iron and lime of commerce are often so granular and dense that their solution and absorption in passing along the alimentary canal must be much interfered with. This difficulty may be avoided, when the free phosphoric acid is objectionable, by presenting the insoluble phosphates in a hydrated form, thus:—

Take of	Protosulphate of iron (cryst.) . .	ʒij.
	Chloride of calcium (fused) . . .	ʒiss.
	Phosphate of soda (cryst.) . . .	ʒvij.
	Syrup of ginger,	
	Distilled water, of each . . .	fʒiv.

Triturate the chloride of calcium with the phosphate of soda and three fluidounces of the water till the decomposition is complete and a smooth mixture is obtained, then add the syrup, and finally the sulphate of iron, previously dissolved in a fluidounce of the water. The resulting mixture consists of the hydrated phosphates of iron and lime, with about two drachms of sulphate of soda and

a little common salt, the whole rendered palatable by the syrup, which also tends to suspend the insoluble salts, and to prevent the peroxidation of the iron salt.

These formulæ were offered by their author, as conveying some hints as to a manner of preparing the phosphates extemporaneously, for administration in solution or mixture very favorable to their therapeutic action.

(See *Phosphatic Lozenges.*)

2D GROUP.—*Of the Earths, &c. Preparations of Magnesia.*

Magnesiæ Sulphas, MgO,SO_3+7HO, from native carbonate. Dose, ℥j.
" Carbonas, $4MgO,CO_2HO$, $MgO,2HO$, from sulphate, by NaO,CO_2.
Magnesiæ Carbonas Ponderosum, $4MgO,CO_2HO$, $MgO,2HO$? do. do.
" *Bicarbonas* (solution). Fluid magnesia.
Magnesia, MgO. By calcining the carbonate. Dose, ʒj.
Liquor Magnesiæ Citratis, ℥j of the salt in f℥xij bottle.
Magnesiæ Citras, MgO, $\overline{Ci}$, 3HO? By fusing the citrate and adding MgO.
Prepared Citrate of Magnesia. Effervescing powder, mixed citrate, bicarb. potassa, &c.
Moxon's Effervescent Magnesia, contains MgO,SO_3+7HO.

The salts of magnesia, like those of lime, have for their base a metal. It has a brilliant gray color, and a sp. gr. of 2.2. It is rarely met with, except in the cabinet of the chemist.

Magnesiæ Sulphas, U. S.

Epsom salts is made from a magnesian limestone, called by mineralogists, dolomite. By the action of sulphuric acid, the magnesia is converted into the soluble sulphate, which, on filtration and evaporation, yields that salt in crystals. By stirring, as it passes into a solid consistence, it is obtained in acicular crystals, which effloresce by exposure to the air, becoming white and pulverulent. Its sensible properties are familiar to most. In doses of from ℥ss to ℥j, Epsom salts is a brisk saline cathartic; in small doses, a diuretic. It is much combined with senna, senna and manna, &c., in well-known and very disagreable infusions.

Magnesiæ Carbonas, U. S.

The carbonate, called also magnesia alba, is usually made from sulphate by adding carbonate of soda, and boiling the mixed solutions. Sulphate of soda and carbonate of magnesia result from the play of affinities; the former is soluble and is washed out, while the latter is collected, pressed into oblong squares, called bricks, dried at a moderate heat, and wrapped in paper for sale. It is very light, pulverulent, insoluble, tasteless, soft, though somewhat granular. It is a compound of about 1 part of hydrated magnesia and 4 of hydrated carbonate of magnesia.

Heavy Carbonate of Magnesia.

This is the result of a similar process to the foregoing, except that the solutions are much more concentrated and the process somewhat varied in its details. It is heavier than the common carbonate, and is found in a white rather dense powder, preferred from its small bulk.

Carbonate of magnesia is used chiefly as an antacid, in doses of ℈j to ʒj, though liable to the objection of liberating carbonic acid gas in the stomach, producing eructations and distension.

Bicarbonate of Magnesia

Is a crystalline salt, quite soluble in water, but which is not permanent, and is employed only in solution. The so-called fluid-magnesias, of which Murray's, Dinneford's, and Husband's, are the best known, are solutions of this salt. They are conveniently prepared by passing a stream of carbonic acid gas into freshly precipitated hydrated carbonate of magnesia. The quantity contained in these solutions is necessarily small, and they have a tendency to deposit the salt as they lose the free carbonic acid; their usefulness is limited to the case of children, and to the treatment of acidity of stomach in adults. The taste is more alkaline and disagreeable than that of the insoluble carbonate, or of magnesia itself.

Magnesia, U. S.

Usually prepared by calcining the carbonate at a high heat. This preparation is very various in its physical properties, owing to the various modifications of the process for its preparation; it will not be necessary in this work to describe these. The reader is referred, for an account of some interesting experiments made in my laboratory by Thos. H. Barr, of Terre Haute, Ia., to the *American Journal of Pharmacy*, vol. xx. p. 193.

Common calcined magnesia is a very light white powder, almost insoluble and tasteless, but imparting a sensation of grittiness to the tongue, which renders it a disagreeable medicine to most persons. It should be entirely soluble in diluted muriatic acid, without effervescence. The presence of lime would be shown by a white precipitate with bicarbonate of potassa, as the bicarbonate of magnesia is soluble, while that of lime is not.

The four best varieties in commerce are the English ponderous magnesia, sold in bulk, and Henry's, Husband's, and Ellis's, sold in bottles.

The *ponderous* is not much known with us; it has the advantage of smallness of bulk, but lacks the extreme softness of the bottled article. *Henry's* leaves nothing to desire; it is very heavy, soft and smooth, and is highly esteemed among the more wealthy classes; its price, which is enhanced by the payment of duty,

almost puts it out of the reach of the middle and poorer classes. *Husband's* is somewhat cheaper and equally good, though, as would be inferred from the ascertained composition, it requires a little larger dose. *Ellis's* is the most recent make; it maintains the same price in bottles as the last named, and approaches it closely in quality. This is also obtainable by the pound at a somewhat reduced rate.

The following abridgment of Barr's table of the composition of these three kinds will show the relative purity of the specimens examined:—

	Henry's. Sp. gr. 3.404.	Husband's. Sp. gr. 3.326.	Ellis's. Sp. gr. 3.386.
Magnesia	94.40	84.306	94.04
Water	.50	11.400	.80
Sulphates of magnesia and soda, iron, &c.	5.81	3.608	4.41

The dose of magnesia as a cathartic is about ʒj, or, of the common kind, near a tablespoonful, of the heavy kinds, about a teaspoonful: as an antacid, smaller doses are used. Magnesian salts are tested by a solution of phosphate of soda and ammonia, which throws down from a neutral solution the ammonio-magnesian phosphate, an insoluble white salt.

Liquor Magnesiæ Citratis, U. S.

In presenting a formula for this new and very popular cathartic beverage, I shall depart from the usual custom of following the *Pharmacopœia*. It is to be regretted that, from taking the officinal directions, many pharmaceutists are compelled to give up the preparation of the solution, and purchase it of other apothecaries or druggists, so that its manufacture is thrown too much into a few hands. One druggist in Philadelphia has frequently sold a gross of bottles of the citrate per day, on an average, for thirty days in succession. The recipe below is that I have used for some years; it is original with myself, and I believe never fails to furnish a satisfactory article.

	To make one doz.	To make one bottle.
Take of Citric acid	9 ounces (offic.)	ʒvj.
Magnesia	2 ounces and 5 drachms	ʒj + gr. xlv.
Syrup of citric acid	12 fluidounces	fʒj.
Water	1 gallon, or sufficient	fʒxss.

Make an acid solution of citrate of magnesia with the citric acid, magnesia, and 3 pints of the water (fʒiv in making a single bottle); to this add the lemon syrup, and divide the whole among 12 fʒxii bottles (or put into one bottle if the smaller quantity), fill these with the remainder of the water, adjust the corks, and add to each bottle about ʒj of crystallized bicarbonate of potassa.

If the magnesia is rather poorly calcined, and contains some carbonate, it may be best to increase the proportion from 105 to 110, or even 120 grains, though this must be done with great cau-

tion, as the slightest excess may occasion the precipitation of a large amount of the hydrated citrate. If the preparation is not decidedly acid, it will be disagreeable to take, and will possess no advantage over the common saline cathartics, but if too strongly acid, it will be almost equally objectionable. The bicarbonate of potassa has the great advantage of neutralizing a portion of the acid, while it forms a very soluble and agreeable salt. If carbonate of magnesia were used, in the proportion of the *Pharmacopœia* formula, the tendency to deposit would be increased, which is the greatest practical difficulty with this solution.

The size of the bottle is another point to be observed; it must not fall short of f℥xij. The so-called pint-inks are very suitable; porter bottles will do to substitute for them. Bottles are made for the purpose both with and without the label blown in the glass, which are very convenient. Each bottle holds about ℥j of the salt, and is a full cathartic dose; divided portions may be taken for its refrigerant and aperient effects, the cork being always carefully secured, and the bottle inverted in the intervals of taking the doses.

Soluble Citrate of Magnesia.

Citrate of magnesia is insoluble in water in a hydrated condition as that precipitated from a solution, but is more soluble if made by the direct union of its constituents in a dry condition at an elevated temperature. The proportion employed must be varied according to the purity of the magnesia and the condition of the acid. Citric acid is what is called a tribasic acid, having three equivalents of water of combination (see page 298); as found in commerce, it is liable to contain, in addition, either one or two equivalents of water of crystallization, so that its saturating power is not uniform. The basic citrate ($3MgO,\overline{Ci}$) is the neutral and soluble salt aimed at, and the proportion contained in the following recipe will furnish it in a tolerably eligible form with the use of the commercial acid and magnesia.

Take of Citric acid (crystallized) . .	100 grains.
Calcined magnesia . . .	35 grains.
Water	15 drops.

Dissolve the acid in the water, and its water of crystallization by the aid of heat, then stir in the magnesia; a pasty mass will result, which soon hardens, and may be powdered for use. The chief practical difficulty in the process results from the great comparative bulk of the magnesia, and the very small quantity of the fused mass with which it is to be incorporated. A portion of the magnesia is almost unavoidably left uncombined, and the salt is, consequently, not neutral. This uncombined magnesia should be dusted off the mass before powdering it. Care must be taken to avoid too high a temperature which would decompose the citric acid.

The citrate thus prepared is quite soluble when at first made, though not rapidly so; it also becomes less readily soluble by keeping, and is liable to run into masses which are hard and unmanageable. Some mix powdered citric acid with magnesia, and, perhaps, a little carbonate, and sell it as solid citrate; but this dissolves very slowly, and seems a very poor substitute for the effervescing solution.

The *prepared citrate of magnesia*, of Charles Ellis & Co., is made from the salt as prepared by fusion, so combined as to furnish an effervescing draught, which though not clear contains the undissolved portion so nicely suspended as to be taken without inconvenience. The recipe is as follows:—

Take of Powdered citrate of magnesia . . .	℥iv.
Powdered sugar	℥viij.
Powdered citric acid	℥iiss.
Powdered bicarbonate of soda . . .	℥iij.
Oil of limonis	♏x.

Combine the acid and sugar and rub into a fine powder; dry all the water of crystallization from the acid over a water bath. Add the citrate of magnesia and oil of limonis, and mix intimately; then add the bicarbonate of soda and triturate the whole into a fine powder, which must be preserved in bottles properly excluded from the air. The dose for an adult is from one to three tablespoonfuls mixed in a tumbler of water and drank in a state of effervescence.

Moxon's Effervescent Magnesia.

The following recipe for a good effervescing aperient is from Gray's Supplement; though less agreeable than the above, it answers a good purpose, and is popular with some:—

Take of Carbonate of magnesia . . .	℥j.
Sulphate of magnesia	℥ij.
Bicarbonate of soda	℥ij.
Tartrate of potash and soda . .	℥ij.
Tartaric acid	℥ij.

To be perfectly freed from water of crystallization, and mixed and kept in a well-corked bottle.

Dose, from a teaspoonful to a tablespoonful dissolved in water and drank immediately.

3d Group.—*Preparations of Baryta.*

Barytæ Carbonas, BaO,CO_2. Native, witherite. Soluble in strong acids.
Barii Chloridium, $BaCl,2HO$. Poisonous; used only in solution.
Liquor Barii Chloridi, ℥j to f ℥iij water. Dose, five drops.

Barytæ Carbonas, U. S.

Carbonate of baryta, which, like the other earths, has a metallic base, is a rather rare mineral, being chiefly imported from Sweden,

Scotland, and the North of England. It is usually in masses of a light grayish color and fibrous texture. It is soluble in the strong acids with effervescence, forming salts, which, if soluble, furnish in solution the best tests for sulphuric acid, throwing down a white precipitate insoluble in boiling nitric acid.

Barii Chloridum, U. S. (*Muriate of Baryta.*)

When muriatic acid is added to carbonate of baryta, by simple elective affinity, the muriatic acid displaces the carbonic with effervescence, and with the baryta forms chloride of barium and water. By evaporation, the chloride may be obtained in crystals. It is a white, freely soluble, permanent salt, with a bitter acrid taste, and imparts a yellow color to flame. It is poisonous, as are all the other baryta salts; it is only used in medicine in the form of

Liquor Barii Chloridi, U. S.

Take of Chloride of barium	℥j.
Distilled water	f℥iij.

Dissolve the chloride in the water, and filter if necessary.

This solution is almost too strong for convenient use; it is stated to be deobstruent and anthelmintic. The dose is about five drops, but it is very rarely prescribed.

4TH GROUP.—*Preparations containing Alumina.*

Alumen, $KO,SO_3+Al_2O_3,3SO_3+24HO$. Manufactured from alum earths.
Alumen Exsiccatum. Deprived of its water of crystallization by heat.

Aluminum is the name of the metallic radical of the earth *alumina;* is has recently attracted much attention from the announcement in France, of the discovery of an economical process for its extraction. Its extraordinary lightness, beauty of color, and indifference to oxidizing influences, fitting it to displace silver, and even platinum, for many purposes in the arts.

Alumen, U. S. (*Alum.*)

This complex salt is found in commerce in large crystalline masses, very cheap and abundant, being largely produced for use in the arts. Its manufacture, from the peculiar clay formations which yield it, need not be described here.

Alum is slightly efflorescent in dry air from the loss of a portion of its large amount, nearly one-half its weight, of water of crystallization; it is very soluble; mixed with alkalies, it is decomposed, precipitating alumina, which is redissolved by an excess of the alkali. It is, also, incompatible with vegetable astringents.

Alumen Exsiccatum, U. S.

Take of alum, in coarse powder, a convenient quantity. Melt it in a shallow iron or earthen vessel, and maintain it at a moderate heat until ebullition ceases and it becomes dry, then rub it into powder.

Dried or burnt alum differs from the crystallized salt in containing no water; 474.5 grains of the crystals should yield 258 grains of the anhydrous salt, which is consequently nearly double its strength. Care should be taken not to push the heat so far as to drive off a portion of the sulphuric acid. Dried alum is nearly insoluble in water.

Alum is an astringent, and in the dried condition a mild escharotic. In large doses it is a cathartic. It is much used as a gargle for sore throat, as an injection for leucorrhœa, &c. Internally, it is used in hemorrhages, in hooping-cough, &c. Burnt alum is used exclusively as an external application.

Iron alums, *ammonia alums*, *iron and ammonia alums*, &c., are compounds in which the alumina and potassa of this double salt are substituted by other bases. (See works on *Chemistry*.)

CHAPTER IV.

ON THE NON-METALLIC ELEMENTS AND THEIR MEDICINAL PREPARATIONS.

Of the non-metallic elements, chlorine has been referred to under the head of medicated waters. Carbon has been considered as a derivative of lignin, and of the remainder it will only be necessary to consider iodine, bromine, sulphur and phosphorus. The distinction as here made between the closely allied groups and non-metallic elements, and of metals, is one of convenience merely. Arsenic, which is one of the so-called intermediate elements, will be more conveniently considered among the metals.

1st Group.—*Preparations of Iodine.*

Iodinium, I. Solid crystalline scales, sp. gr. 4.95.
Potassii Iodidum, KI. In cubical crystals, dose, gr. ij to gr. v.
Tinctura Iodinii. ʒss to fʒj alcohol, externally used.
" Iodinii Composita, I, gr. xv., KI, ʒss to fʒj. ♏ xv to xxx.
Liquor Iodinii Compositus, I, gr. xxijss. KI, gr. xlv to fʒj. ♏ x to xx.

Iodinium, U. S. (*Iodine.*)

This non-metallic element is procured for use in medicine from the fused and vitrified ashes of sea-weed called kelp, which is prepared in the Western Islands, North of Scotland and Ireland. The kelp being broken and lixiviated, yields about half its weight of soluble soda, potassa, and magnesia salts. The common salt and carbonate, and sulphate of soda, are crystallized out on evaporation. The mother liquors contain iodides of sodium, potassium, and magnesium, to which sulphuric acid is added, liberating carbonic acid, sulphuretted hydrogen and sulphurous acid, by effervescence, and sulphur, which is deposited. The acid lye is next distilled from peroxide of manganese, which liberates the iodine, and it is condensed in cooled glass receivers.

Iodine is in bluish black crystalline scales with a metallic lustre, sp. gr. 4.95. Odor like chlorine, melts when heated, then sublimes in very heavy violet vapors, soluble in ether and alcohol, but very sparingly in water, although by the addition of iodide of potassium or chloride of sodium, it is rendered very soluble. Free iodine precipitates starch in the cold, of a dark blue color, which reaction is its most familiar and delicate test. It dissolves in alkaline solutions, forming iodides and iodates. With the metals and most of the non-metallic elements, it combines with avidity, and several of its combinations are officinal; of these, the iodides of mercury, of lead, zinc, iron, arsenic, and sulphur, are considered under the head of their metallic elements, while several preparations which seem to owe their value exclusively to iodine, are introduced here. Locally applied, iodine is an irritant and vesicant, staining the skin brown or orange color, causing itching, redness, and desquamation. Applied by inunction, it is absorbed; inhaled as vapor, it exercises its alterative effect on the mucous membrane of the respiratory passages. Its influence is chiefly exerted on the glandular and absorbent systems. It is used both internally and topically for an immense number of diseases requiring alterative treatment. The salts of iodine are much used for their several alterative effects; when given internally, it is always in solution or combination.

Potassii Iodidum, U. S. (*Iodide of Potassium.*)

This salt was formerly directed to be made by combining iodine with iron, and decomposing the iodide of iron with carbonate of potassa, precipitating the carbonate of iron, filtering and crystallizing; this process which is in some respects the most convenient to the pharmaceutist, has been superseded in the *Pharmacopœia* by the plan of adding iodine directly to a solution of potash, thus forming the mixed iodide of potassium, and iodate of potash ($6KO+I_6=5KI+KO,IO_5$). This being heated to redness in con-

tact with charcoal, the iodic acid IO_5 parts with its oxygen, and the iodate is reduced to iodide of potassium.

This salt is in white, shining, semi-opaque cubes, without odor, an acrid saline taste, resembling common salt. Soluble in two-thirds weight of cold water, and freely in rectified spirit. Nitric acid decomposes its solution, and if starch be subsequently added, it yields the characteristic blue iodide of amyl.

Tartaric and other acids do not liberate iodine, but a peculiar acid compound hydriodic acid (HI); hence the old name of the salt hydriodate of potassa. With acetate or nitrate of lead, it affords a yellow precipitate of iodide of lead.

Iodide of potassium is liable to adulteration with bicarbonate, or carbonate of potassa; the latter renders it very damp, and they both occasion effervescence with acids; sometimes iodate of potassa is present, which may be detected by tartaric acid liberating iodine, perceptible by the starch test.

This salt contains no water of crystallization. Every 4 grains contains about 3 grains of iodine.

The aqueous solution is capable of taking up a large quantity of iodine, forming a liquid containing the ioduretted iodine, of a deep brown color.

Iodide of potassium is considered to possess the same medicinal virtues as iodine, though preferred by some physicians to obtain the constitutional effects of the alterative. It is used very extensively, both alone and combined with iodine, iodides of mercury, &c. Dose, gr. ij to gr. v.

Tinctura Iodinii, U.S. (*Simple Tincture of Iodine.*)

	To make Oj.	To make f℥j.
Take of Iodine	℥j	℥ss.
Alcohol	Oj	f℥j.

Dissolve the iodine in the alcohol. This is best done by triturating it with successive portions of alcohol in a glass or porcelain mortar. This tincture is not adapted to internal use, as on the addition of water the iodine is precipitated, and exercises its peculiar irritating topical effect on the coats of the stomach. It is applied to the skin as a caustic; a camel-hair brush is convenient in erysipelas, and when the surface to be treated is circumscribed. ♏ xvj contain one grain of iodine.

Tinctura Iodinii Composita, U.S. (*Compound Tincture of Iodine.*)

	To make Oj.	To make f℥j.
Take of Iodine . . .	℥ss.	gr. xv.
Iodide of potassium	℥j.	℥ss.
Alcohol . . .	Oj.	f℥j.

Dissolve the iodine and iodide of potassium in the alcohol.

This is adapted to the same use as the foregoing, and by the presence of the iodide of potassium, the precipitation of iodine on contact with aqueous liquids is prevented. It may also be used internally in doses of ♏ xv to xxx.

These tinctures are included under the general head, *Tincturæ*, U. S., while the following is placed under the head Iodinium:—

Liquor Iodinii Compositus, U.S. (*Lugol's Solution.*)

	To make Oj.	To make f℥j.
Take of Iodine . .	℥vj.	gr. xxijss.
Iodide of potassium	℥iss.	gr. xlv.
Water . .	Oj.	f℥j.

Lugol's solution, as originally proposed, contained twenty grains iodine, and forty iodide of potassium, to f℥j water; the present officinal preparation is adjusted to the proportions convenient for a pint, and as is seen above is somewhat stronger.

In iodine and compound iodine ointments, we have nearly the same proportions as in the foregoing, substituting lard for alcohol and water. (See *Extemporaneous Preparations.*)

2d Group.—*Bromine Preparations.*

Bittern. The mother liquor after the crystallization of salt.
Brominum. Heavy, very volatile liquid, sp. gr. 2.96.
Potassii bromidum, BrI. White cubical crystals. Dose, gr. v to x.
Liquor ferri bromidi. Solution of bromide with excess. " br. ♏v to x.

Brominum, U.S. (*Bromine.*)

Bromine is a liquid, non-metallic element of a red color, stifling odor, and acrid taste; very volatile and fuming, soluble in ether and alcohol, though not in water; it precipitates starch of an orange color. Associated with iodine in sea-water and numerous mineral springs, it is largely extracted from bittern, the liquor left after the crystallization of common salt whether from sea-water or from certain salt springs. At the salt-works, in Western Pennsylvania, this bittern is preserved for the extraction of the bromine, and the American bromine prepared there is fully equal to the imported article. The principal consumption of bromine is in the daguerreotype process, in which large quantities are consumed annually. The mode of its extraction, which is rather complex, is detailed in the books. The vast quantities of bittern thrown away at a single salt manufactory, render it a cause of regret that there is not some use to which it can be profitably applied. Bromine is never used in medicine, except in combination.

Bittern, as obtained from the salt-works, is a heavy liquid, without color, and having a caustic taste and highly stimulating properties. Its chief medical use is to produce redness, and, by continued

rubbing of the part, a pustular eruption. It is a good application in rheumatism and in glandular swellings, being absorbed, and producing the alterative effects of the iodine and bromine salts.

Potassii Bromidum, U. S.

Bromide of potassium is obtained by similar processes to iodide, substituting an equivalent quantity of bromine for the iodine. It closely resembles the iodide in most of its properties, and, like it, is an anhydrous salt. It is believed to possess very similar medical properties to iodide, acting as a powerful alterative, adapted to scrofulous and syphilitic complaints, chronic skin diseases, &c. It is directed in rather larger doses—gr. v to gr. x.

Liquor Ferri Bromidi.

This preparation was introduced to notice by Dr. Gillespie, of Freeport, Armstrong Co., Pa., who, besides being a practitioner of medicine, is engaged in the bromine manufacture, in connection with the salt springs near that place. Dr. G. recommends this solution very highly as a tonic alterative, and it has been successfully used by numerous other practitioners. It is made by macerating iron filings with bromine under water, till they have combined; an excess of bromine being used. The solution, as made by Dr. Gillespie, is given in the dose of ♏ v to x, three times a day, increased to ♏ xxv.

3d Group.—*Sulphur Preparations.*

Sulphur. Sublimed Sulphur, S. Yellow crystalline powder. Dose, gr. x to ʒij;
" lotum. Thoroughly washed with water, " " "
" præcipitatum. A light and very fine powder, " "
Sulphuris iodidum, IS_2. Blackish crystalline masses, used in ointment.

Sulphur, U. S. (*Flowers of Sulphur.*)

Sulphur is a very abundant substance in the mineral kingdom, existing in direct combinations with the metals, as sulphurets; and with their oxides, as sulphates. Virgin sulphur is a native, tolerably pure form, abundant in Naples, Sicily, and the Roman States, from whence it is imported. By fusion, and running into moulds, roll sulphur or rolled brimstone is prepared, while flowers of sulphur is the result of subliming and condensing it in suitable chambers.

Sulphur has a characteristic yellow color, sp. gr. 1.98, is volatilized by heat, and combustible, burning with a characteristic blue color, yielding sulphurous acid gas, which is a powerful disinfectant and bleaching agent.

Flowers of sulphur, or sublimed sulphur, is a crystalline powder, of a harsh and gritty character; wholly insoluble in water, alcohol, and ether; tasteless, and nearly odorless; it is the form of sulphur, much administered as an alterative and laxative remedy in small

doses; being absorbed, it enters the circulation and is given off from the skin as sulphuretted hydrogen. Externally, it is used as a slight stimulant to the skin, and has the power of destroying the acarus scabiei, or itch insect, for which it is popularly known as the remedy.

Dose, as an alterative, gr. x to ʒss; as a laxative, ʒss to ʒij, alone or combined with bitartrate of potassa.

Sulphur Præcipitatum, U. S. (*Milk of Sulphur.*)

Made by boiling sulphur and lime together till they combine, forming sulphuret of calcium, then adding muriatic acid, which abstracts the calcium, forming chloride, while the sulphur is precipitated as a bulky, light powder. This has a soft and very fine consistence, and is adapted to suspending in liquids, though little used internally. Dose, the same as the foregoing. Very considerable quantities have been consumed recently, in the preparation of the following excellent application to the hair, which is also a remedy for skin diseases, blemishes of the complexion, &c.

Twiggs's Hair Dye.

Take of Precipitated sulphur,
Acetate of lead, of each . . . ʒj.
Rose water . . . . . fʒiv.

Triturate together in a mortar. This is not an instantaneous dye, but should be applied twice a day till it gradually restores the color to its natural shade.

Sulphuris Iodidum, U.S.

Take of Iodine . . . . . ʒiv.
Sulphur . . . . . ʒj.

Rub the iodine and sulphur together in a glass, porcelain, or mar-

Fig. 196. Fig. 197. Fig. 198.

Apparatus for making iodide of sulphur.

ble mortar till they are thoroughly mixed. Put the mixture into a matrass, close the orifice loosely, and apply a gentle heat so as

to darken the mass without melting it. When the color has become uniformly dark throughout, increase the heat so as to melt the iodide, then incline the matrass in different directions, in order to return into the mass the portions of iodine which may have condensed on the inner surface; lastly, allow the vessel to cool, break it, and put the iodide into bottles, which are to be well stopped.

A suitable vessel for this operation is a test tube or a common, very cheap bottle, such as are shown in the figure. One should be selected with very thin glass at the bottom. The iodide is in bluish-black crystalline masses, in odor reminding of iodine, staining the skin yellow. Two equivalents of sulphur are combined with one of iodine, so that it is a bisulphuret (IS_2).

Internally, this is rarely or never prescribed, but it is much used in the form of ointment to chronic and obstinate skin diseases.

Phosphorus.

This element is obtainable from bones, by calcining, treating with oil of vitriol, and then subliming the mass with charcoal. The phosphorus is thus collected, and being cast into moulds, is found in commerce colorless, in transparent, or white pipes, having a waxy consistence. It is luminous in the dark, from forming phosphorous acid (PO_3), and is kept under water to prevent gradual oxidation, and to guard against accident from its ready inflammability. It should be handled with care, and not intrusted to children, who frequently procure it for experiment, without due precaution. Its sp. gr. is 1.84. Melting point, 108° F. Soluble in ether, oils, and naphtha, but not in water or alcohol. By combustion it yields phosphoric acid, the acid which is combined with lime in bones, &c. Phosphorus is not often prescribed, although considered to be a stimulant of value in certain low forms of disease; it is a dangerous medicine, except in very small doses, from $\frac{1}{40}$ to $\frac{1}{10}$ grain. It is to be powdered by fusion in a vial or flask of moderately warm water, and shaking up as it cools. It is given in solution in olive oil, or ether, afterwards suitably suspended. *Amorphous or red phosphorus* is a form of the element differing in some of its properties from the ordinary kind. It is much less inflammable, fusible, and luminous, and is in reddish-brown powder. If exposed to the air at common temperatures, it remains unchanged, and, according to recent observations, may be administered in considerable doses without injurious effects. It is prepared in England by exposing common phosphorus to an elevation of temperature (from 419° to 482° F.?) under certain circumstances.

CHAPTER V.

IRON AND MANGANESE.

FERRUM. (IRON.)

Ferri Ramenta (*Iron Filings*). *Ferri Filum* (*Iron Wire*).

THIS metal is too well known to require description. Its purest form is that of wire, or preferably card teeth. The filings (Ramenta), when obtained as a residuum from the manufactories, are apt to be contaminated with other metals. They are also liable to rust, which is objectionable in some cases.

The salts of iron used in medicine are very numerous, including salts of the protoxide, of the sesquioxide, and of the black or magnetic oxide, and also halogen salts.

Those only which are readily prepared by the apothecary need be mentioned in detail.

In the following table, the officinal and unofficinal preparations are presented in the order in which they are treated of in this chapter. The unofficinal in *Italics*.

Name.	Comp.	Dose.	Remarks.
Ferri Pulvis	Fe	gr. j—gr. iij.	Steel gray powder.
Ferri Sulphas	FeO,SO_3+7HO	gr. v.	Green crystals.
Ferri Sulphas Exsiccat.	FeO,SO_3+HO	gr. iij.	Whitish powder.
Ferri Subcarbonas	$Fe_2O_3,2HO+FeO,CO_2$?	gr. v—ʒj.	D'k brown powder.
Ferri Phosphas		gr. v—x.	Bluish powder.
Tinct. Ferri Chloridi	gr. xxxij (Fe_2Cl_3) to fʒj	♏x—xxx.	Clear yel'w liquid.
Ferrum Ammoniatum		gr. iv—x.	Orange col. grains.
Liq. Ferri Per Sulphatis	$Fe_2O_3,3SO_3+Aq.$		Light b'wn liquid.
Ferri Oxidum Hydratum	Fe_2O_3,HO	fʒj—fʒss.	Moist b'wn magma.
Liq. Ferri Citratis		♏iij—v.	fʒj contains ʒj.
Ferri Citras	$Fe_2O_3,\overline{Ci}$	gr. iij—v.	Garnet col. scales.
Ferri et Quiniæ Citras		gr. ij—v.	" "
Syr. Ferri Citratis		♏xx—fʒj.	fʒj contains ʒj.
Syr. Ferri Protocitratis		♏xxx—fʒj.	" "
Ferri Lactas	$FeO,\overline{L},3HO$	gr. j—gr. v.	White plates or powder.
Ferri et Potassæ Tartras	$Fe_2O_3,KO,2\overline{T}$	gr. x—ʒj.	Garnet col. scales.
Ferri Ferrocyanuretum	$3Cfy,4Fe$	gr. v—xv.	Prus'n blue, cakes.
Liq. Ferri Nitratis	$Fe_2O_3,3NO_5+Aq.$	♏x—xx.	ʃ Astring't in bow-
Syr. Ferri Protonitratis	$FeO,NO_5+Syr.$	♏xv—xx.	⌊ el complaints.
Ferri Iodidum	FeI	grs. ij—v.	Decomposes spontaneously.
Liq. Ferri Iodidi	gr. vij (FeI) to ʒj	♏xx—xl.	Light green syrup.
Ferri Bromidum	Fe,Br ?	gr. ij—v.	Brick red powder.
Syr. Ferri Bromidi		♏xx—xl.	Greenish syrup.
Liq. Ferri Bromidi	(Gillespie's)	♏v—x.	See *Bromine.*
Ferri Valerianas	$Fe_2O_3,3\overline{Va}.$	gr. j.	Red, amorphous.

Ferri Pulvis, U. S. (*Iron by Hydrogen. Quevenne's Iron.*)

Prepared by passing a stream of hydrogen over the calcined subcarbonate (dry sesquioxide), contained in a gun-barrel heated to low redness, by which the oxygen of the oxide combines with hydrogen, forming water, and leaves the metal in a very fine condition.

It is an impalpable powder, of a steel gray color, soluble in dilute hydrochloric and sulphuric acids, with rapid evolution of hydrogen. It oxidizes when exposed to damp air, and should be kept in bottles. It is usually contaminated with a little carbon, black oxide, and occasionally sulphuret of iron. The latter impurities give it a dull black color. When well prepared, it will burn on the application of a lighted taper; and a small portion of it, struck on an anvil with a hammer, forms a scale having a brilliant metallic lustre.

Metallic iron possesses in a high degree the property of restoring to the blood this essential ingredient, when, from disease, it is deficient. From its extreme fineness, it is readily soluble in the stomach, and the only objection to its use is that occasionally it produces eructations of hydrogen; and, if it contains sulphuret of iron, sulphuretted hydrogen is evolved.

Iron preparations are apt to produce astringent effects, some more than others, the persalts, it is stated, more than the protosalts; hence the frequent use of mild purgatives during their administration. They all blacken the stools.

Iron, in powder, is usually given in the dose of two grains. It is conveniently given in lozenges, made with or without chocolate, though it has more taste than the subcarbonate. In pills it is much combined with the tonic extracts.

Ferri Sulphas, U. S. (*Sulphate of Iron. Green Vitriol.*)

Prepared by dissolving iron wire in diluted sulphuric acid. One eq. of iron decomposing one of water, combines with its oxygen, and forms a protoxide, which last unites with one eq. of sulphuric acid to form sulphate of protoxide of iron. The hydrogen is liberated in a gaseous form, and may be collected for experiment. Green vitriol of commerce, which is used in the arts, is an impure sulphate, containing peroxide. It is prepared from the native sulphuret, and may be purified by crystallization.

When pure, sulphate of iron is in light bluish green rhomboidal prisms, having an astringent, styptic taste. Composition, $FeO,SO_3 + 7HO$. It dissolves in about one and a half times its weight of cold water; is insoluble in alcohol; when exposed to air and moisture, it oxidizes, and becomes covered with a brownish yellow peroxide. It also effloresces, becoming white on the surface.

Owing to the large amount of water in its crystals, it is inconvenient to dispense, in combination, with vegetable substances in the form of powder or pill; and hence, in the Edinburgh and Dublin

Pharmacopœias, is directed to be exposed to a moderate heat till it is converted into a dry whitish mass, which is to be reduced to powder, and is called *Ferri Sulphas Exsiccatum.* By this it loses six equivalents of water, and is consequently much stronger than the crystallized salt. In addition to the "hæmatic" virtues common to the iron salts, this preparation is decidedly astringent. It is much prescribed internally in cases attended with immoderate discharges, and is also used externally, in injections, &c., though less frequently than sulphates of zinc and copper. Dose, in crystals, 5 grains; dried, 3 grains.

Ferri Subcarbonas, U. S. (*Precipitated Carbonate of Iron.*)

Made by decomposing the sulphate of iron by means of an alkaline carbonate, as the carbonate of soda. When first formed, it is a bulky greenish, almost white, precipitate, which may be converted, by admixture with sugar, into Vallette's mass, which see; but when dried in air, it becomes much darker, and finally brown, from more or less conversion into the sesquioxide and loss of carbonic acid. If the drying is carried on at a low temperature, this change is only partial, and the preparation effervesces rapidly when thrown into acids, and has a dark brown color. This is a much more soluble form, and to be preferred to the bright red colored powder produced by heating it.

The subcarbonate of iron is one of the most popular of the chalybeate salts. It has the properties attributed to the powder of iron, with a more agreeable effect from swallowing it. The carbonate is not astringent, and produces little or no action upon the mucous membranes of the alimentary canal. Dose, gr. v to ʒj.

Ferri Phosphas, U. S. (*Phosphate of Iron.*)

Formed by a double decomposition between solutions of sulphate of iron and phosphate of soda. Phosphate of iron is precipitated as a white powder, which, quickly absorbing oxygen, becomes bluish white. Its composition is variable and uncertain. Sulphate of soda, which remains in solution, is washed out. It has been given with advantage in amenorrhœa and some forms of dyspepsia, and is associated with the phosphates of lime, soda, and potassa in several new preparations elsewhere noticed. Dose, gr. v to x.

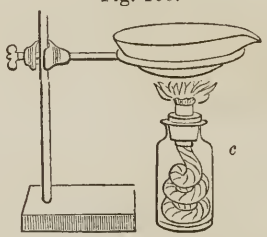
Tinctura Ferri Chloridi, U. S. (*Tincture of Muriate of Iron.*)

This is one of the preparations usually made by the apothecary. It is placed among the preparations of iron in the *Pharmacopœia*, though also adapted to be inserted among the tinctures:—

Take of	Subcarbonate of iron . .	three ounces.
	Muriatic acid . . .	half a pint.
	Alcohol	a pint and a half.

Pour the acid on the subcarbonate of iron in a glass or porcelain vessel. Mix them, and when effervescence has ceased apply a gentle heat and continue it, stirring occasionally until the powder is dissolved; then filter the solution and mix it with the alcohol. It is an equally good plan to mix the dissolved chloride before filtering. The quantity of liquid to be filtered is thus larger, but the filter is less likely to break. As a small portion of the powder will be apt to remain undissolved, the wash bottle, Fig. 201, should be used, as shown in Fig. 200, to spirt a strong jet of alcohol into the dish and thus carry all the contents on to the filter.

Fig. 199.



The tincture of chloride of iron is a solution of the sesquichloride (Fe_2Cl_3) in alcohol; it should contain about thirty-two grains of that salt to f℥j. If a considerable proportion of subcarbonate remains undissolved, it will be too weak from deficiency of strength in the muriatic acid, and a little more acid should be added before withdrawing the heat. In prescribing

Fig. 200.

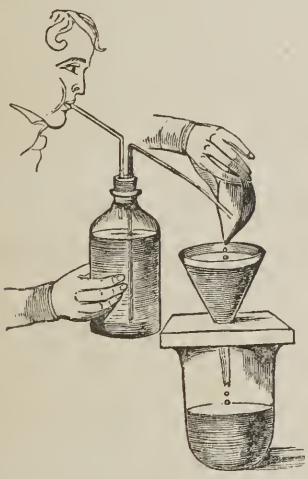


Fig. 201.

this preparation, it should be remembered that the drops are very small, so that, although its dose is from ten to thirty minims, twice that number of drops may be given. It should not be prescribed with strong mucilage, which it has the property of gelatinizing. It is most frequently presented alone, dropped into water.

It is one of the most popular of the iron preparations. Besides the properties which are common to these, it is astringent, used in passive hemorrhages, and a diuretic which adapts it to a variety of

cases. It is also one of the best solvents and vehicles for sulphate of quinia.

Ferrum Ammoniatum, U. S. (*Ammoniated Iron. Flores Martiales.*)

Subcarbonate of iron is mixed with muriatic acid in a glass vessel; water and sesquichloride of iron are formed; a solution of the latter is then evaporated along with a solution of muriate of ammonia; a mixture of the two salts is the result in about the proportions of fifteen per cent. of the former to eighty-five of the latter.

It is met with in the shops in the form of small orange-colored pulverulent grains, sometimes quite crystalline, having a feeble odor and a styptic saline taste. It is deliquescent and soluble in diluted alcohol and water. It also sublimes almost without residue.

In consequence of the small proportion of iron present, it is a compound of little value. The large amount of muriate of ammonia contained in it renders it alterative, and in large doses aperient. It has been used with advantage in amenorrhœa, scrofula, &c. Also as a deobstruent in glandular swellings. Dose, gr. iv to x.

Liquor Ferri Persulphatis.

Under this head I prefer to introduce to notice the first step in the preparation of the officinal hydrated oxide of iron, because it is in the condition of a solution of the undecomposed sulphate of sesquioxide, that the sesquioxide is best kept for extemporaneous precipitation, and because this solution is also useful for other purposes in pharmacy. The following formula for its preparation is compiled from that of the *Pharmacopœia*:—

Take of	Sulphate of iron	one ounce.
	Sulphuric acid	fifty-three minims.
	Nitric acid	a fluidrachm and a half, or sufficient.
	Water	half a pint.

Dissolve the sulphate of iron in the water, adding also the sulphuric acid (this may be done in a flask or evaporating-dish); boil the solution; then add the nitric acid, a few drops at a time, continuing the boiling after each addition till it ceases to produce a dark color; then filter the liquid, if necessary, or pour it off into an appropriate bottle for preservation and future use.

The following process yields the same results with greater facility, and in a very short time:—

Take of	Sulphate of iron	one ounce.
	Sulphuric acid	fifty-three minims.
	Nitric acid	a fluidrachm and a half.

Triturate the sulphate of iron with the sulphuric acid into a pasty mass. Add the nitric acid little by little, and continue the tritura-

tion till red fumes cease to be given off. Then dissolve in water half a pint, and filter if necessary.

In this process the nitric acid, by its facility of yielding oxygen to metallic oxides, converts the protoxide of the proto-sulphate into sesquioxide, but the sesquioxide requires a larger dose of acid to form a salt, hence the addition of sulphuric acid. The solution has a reddish-brown color, and rather styptic ferruginous taste; its composition is shown in the syllabus.

Ferri Oxidum Hydratum, U. S. (*Hydrated Oxide of Iron.*) *Ferri Sesquioxidum Hydratum.*

This is made by adding ammonia in excess to the solution of the persulphate as above. The alkali neutralizes the sulphuric acid and throws down the oxide of iron as a reddish-brown precipitate. This, if designed for use as an antidote for arsenic, is to be collected on a strainer, water being passed through it to dissolve out the sulphate of ammonia, and then squeezed out, and the moist brown magma transferred to a wide-mouth bottle and kept under a superstratum of water. It has been ascertained, however, that by long standing, under these circumstances, the hydrated oxide loses wholly or in part its power of neutralizing arsenious acid, hence the necessity of keeping the solution of persulphate and reserving the addition of ammonia till the emergency requiring its use shall occur. As will appear in several of the recipes which follow, the hydrated sesquioxide comes in play in making some of the persalts of iron; it is also an eligible medicine for producing the usual tonic effects of the iron preparations, and may be dried at a temperature not exceeding 180° F., without losing its constitutional water; at a red heat it becomes anhydrous.

Its dose in the form of magma is f℥j; as an antidote f℥ss every five or ten minutes till a large excess has been given.

Ferri Citras, U. S. (*Citrate of Sesquioxide of Iron.*)

Of the several citrates of iron, the citrate of the sesquioxide is most commonly used. It is made by saturating a solution of citric acid in an equal weight of water (at 150°), with freshly precipitated moist hydrated sesquioxide of iron; this is evaporated to the consistence of a syrup, spread on glass or porcelain plates, where it speedily dries in thin layers, which are separated and broken into fragments.

It is in beautiful garnet red-colored plates, slightly soluble in cold water, readily in boiling, and has an acid ferruginous taste. Dose, grs. iij to v.

Liquor ferri citratis is the name appropriate to the solution of the above salt, which it is convenient to keep on hand for dispensing. This salt is more soluble when freshly prepared than when old, and although it is slowly and imperfectly soluble in cold water,

under ordinary circumstances, it is readily obtained and kept in a very concentrated solution, which, being of known strength, may be readily diluted to the point desired.

In the process of making the citrate, as above, the evaporation of the liquid obtained by adding the sesquioxide to solution of citric acid, may be dispensed with, and the liquid further diluted, if necessary, so that each fluidrachm shall contain a drachm of the citrate, and each minim a grain; this requires that for a drachm of citric acid used, there should be about a fluidrachm and a half of the resulting solution.

Ferri et Quiniæ Citras. (*Citrate of Quinine and Iron.*)

This very popular salt, as met with in commerce, is of uncertain strength, partly in consequence of there being no authoritative formula for its preparation; the usual composition, founded on the relative doses of its two principal ingredients, is five grains of citrate of iron to one of citrate of quinia. The salts are to be mixed while the former is in solution, and afterwards concentrated and dried in scales, like the simple citrate of iron, which it resembles, except in taste; it has the bitter taste of the quinia.

The dose of citrate of quinia and iron is grs. ij to grs. v.—*Citrate of iron and magnesia*, *ammonio-citrate of iron*, and other soluble citrates, have been occasionally prepared and recommended, but none of them are at present much in use. The ammonio-citrate is recommended by greater solubility in cold water than the simple salt.

Syrupus Ferri Citratis. (*Syrup of Citrate of Magnetic Oxide of Iron.*)

Take of	Citric acid	℥v.
	Sulphate of iron	℥j.
	Water,	
	Solution of ammonia, of each .	sufficient.
	Sugar	℥viij.

By either of the processes given for liquor ferri persulphatis, convert ℥ss of the sulphate of iron into sulphate of the sesquioxide; mix this in solution with the remaining ℥ss of the sulphate, and add the solution of ammonia until it ceases to throw down a precipitate of the black or magnetic oxide. Having collected and washed this, add it to the citric acid, dissolved in f℥j of water, heat to about 150° F. and filter; dilute the filtered liquid with water to make f℥v, in this dissolve the sugar, and a clear dark-colored syrup will be the result.

This contains ʒj of the salt to f℥j, and is a very eligible preparation in the dose of ♏xx to f3j. It is apt to deposit the citrate if kept very long.

Syrupus Ferri Protocitratis. (*Syrup of Proto-Citrate of Iron.*)

Take of	Sulphate of iron	℥iiiss.
	Carbonate of soda	℥iv.
	Sugar,	
	Water, of each	sufficient.
	Citric acid	℥ss.
	Simple syrup	f℥iv.

Dissolve the sulphate of iron and carbonate of soda in equal portions of water, and add the one to the other in a beaker or precipitating glass. Wash the precipitated protocarbonate of iron with water, in which a small portion of sugar has been dissolved, and add it to a concentrated solution of the citric acid; evaporate to a greenish deliquescent mass, and dissolve in the syrup. This is a greenish brown liquid, containing nearly ℥j of the salt to f℥j. Dose, ♏xxx to f℥j. It is liable to deposit the salt by long keeping.

The syrup of citrate of iron of *Beral* is a saccharine solution of the citrate of ammonia and sesquioxide of iron.

Ferri Lactas. (*Lactate of Iron.*)

Obtained by digesting metallic iron with dilute lactic acid, or preferably, by decomposing the lactate of lime with sulphate of protoxide of iron.

It is, when pure, in the form of very white crystalline plates, sparingly soluble in water, with acid reaction, and ferruginous taste, though, as generally met with in this country, it is a greenish white or gray powder; it has the advantage of less solubility than some of the other salts, and hence a less powerful taste.

This is regarded as a superior preparation, on the supposition that all the combinations of iron are converted into lactates upon their entrance into the stomach. It has been incorporated with flour in the preparation of bread, and is well adapted to the form of lozenge, of chocolate, &c.

The lactate has been found beneficial in chlorosis, and the kindred forms of disease, in which iron is indicated, and is said to possess a marked influence upon the appetite; it is, however, rarely prescribed in this country. Dose, gr. j to grs. v, repeated at suitable intervals.

Ferri et Potassæ Turtras, U. S. (*Tartrate of Iron and Potassa.*)

This double salt is directed to be prepared by heating together, to 140° F., hydrated sesquioxide of iron with bitartrate of potassa. The excess of tartaric acid in the latter salt is saturated by the iron oxide forming a neutral, uncrystallizable salt. This is obtained by evaporation in a thick syrupy liquid, which is poured on plates of glass to dry. As thus prepared, it forms garnet scales, having the

physical characters of the citrate; soluble in seven times its weight of water, and becoming damp on exposure. Most of that found in commerce appears to be made from proto-carbonate or protoxide of iron; it is in a granular condition, and has a greenish slate-color. Its astringency is much less than the ferruginous preparations generally, and its stimulating influence less obvious. From its slight taste, and ready solubility, it is one of the best preparations for children. Dose, gr. x to xx.

Ferri Ferrocyanuretum, U.S. (*Ferrocyanuret of Iron. Prussian Blue.*)

Obtained by a double reaction ensuing upon mixture of solutions of ferrocyanuret of potassium and sulphate of iron, the latter being first converted into a tersulphate by addition of NO_5 and SO_3.

It is an insipid, inodorous substance, in oblong rectangular cakes, of a rich deep blue color. Insoluble in water, alcohol, and mineral acids, excepting sulphuric.

Tonic and sedative. Has been recommended in intermittent and remittent fever; also in epilepsy and facial neuralgia. Dose, gr. v—xv.

Liquor Ferri Nitratis, U.S. (*Solution of Pernitrate of Iron.*)

Take of	Iron wire, cut in pieces	℥j.
	Nitric acid	fʒiij.
	Distilled water	sufficient.

Mix the acid with a pint of distilled water, add the iron and agitate occasionally until gas ceases to be disengaged, then filter the solution and add to it sufficient distilled water to make it measure thirty fluidounces.

This solution, which is at first of a clear, red color and powerful styptic taste, is apt to throw down, upon standing, a bulky precipitate of subnitrate of sesquioxide. This may be prevented by the addition of a little muriatic acid, or by observing the following directions of Prof. Procter:—

Mix the acid with ten fluidounces of the distilled water in a thin, wide-mouth bottle, which should be surrounded by water. Add the iron gradually, about a drachm at a time, waiting until active effervescence has ceased after each addition before making the next. When all the iron has thus been thrown in, filter the solution through paper, heat it gently in a capsule or flask, and carefully drop in nitric acid, followed by stirring or agitation until a drop of the solution, tested with ammonia, yields a red precipitate without any tinge of black. Then add distilled water until the liquid measures thirty fluidounces. The solution should have a bright, Madeira wine color. It is used as an astringent in diarrhœa, and in hemorrhages from the bowels, uterus, &c. in individuals of pale and feeble constitutions. Dose, ♏ v to xv.

Syrupus Ferri Protonitratis.

It requires a particular course of manipulation to dissolve iron in nitric acid without, as in the above preparation, a large portion passing to the higher stage of oxidation. If, however, instead of adding the iron in divided portions to the nitric acid, we add the nitric acid more diluted to the iron in great excess, the acid gradually becomes saturated, the solution has a light-greenish color when filtered, and is precipitated of a greenish color by ammonia. It is necessary for the solution to stand on the iron for several hours after the last addition of acid.

Take of	Iron wire (card teeth), in pieces .	two ounces.
	Nitric acid (sp. gr. 1.42) . . .	three fluidounces.
	Water	thirteen fluidounces.
	Sugar, in powder	two pounds.

Put the iron in a wide-mouthed bottle kept cool by standing in cold water, and pour upon it three fluidounces of water. Then mix the acid with ten fluidounces of water, and add the mixture in portions of half a fluidounce to the iron, agitating frequently until the acid is saturated, using litmus paper. When all the acid has been combined, filter the solution into a bottle containing the sugar and marked to contain thirty fluidounces. If the whole does not measure that bulk, pour water on the filter until it does. When all the sugar is dissolved, strain, if necessary, and introduce the syrup into suitable vials, and seal them.

This preparation is, I believe, used for nearly the same purposes as the foregoing. Dose, ♏ v to xv.

Ferri Iodidum, U. S. (*Iodide of Iron.*)

Take of	Iodine	℥ij.
	Iron filings	℥j.
	Distilled water	Oiss.

Mix the iodine with Oj water, in a glass or porcelain vessel, and gradually add the iron filings, stirring constantly. Heat the mixture gently, until of a light-green color. Filter, and pour upon it the remaining Oss of water, boiling hot. Evaporate the filtered liquor at a temperature not exceeding 212°, in an iron vessel, to dryness. Keep in a closely stopped bottle. One eq. of iron is here made to unite directly with one eq. of iodine, forming a protiodide, FeI. It is in the form of green, or grayish-black, tabular crystals, sometimes amorphous masses, exceedingly deliquescent, and possessed of a styptic, chalybeate taste. It should be perfectly soluble in water when freshly prepared, imparting to a solution the odor and taste of iodine. By exposure to the atmosphere, it decomposes into free iodine and sesquioxide of iron.

Iodide of iron produces the valuable effects of the ferruginous salts, in addition to those of iodine; it is peculiarly applicable to the

treatment of scrofulous diseases in anæmic patients, and is very much prescribed. It should be remembered that the proportion of iron, in the iodide, is small, and that it is a comparatively powerful preparation. Dose, gr. j to ij. Owing to its liability to decompose and its extraordinary deliquescence, it is rarely prescribed, except in the form of the syrup next described, or in that of pilulæ ferri iodidi, introduced among extemporaneous preparations.

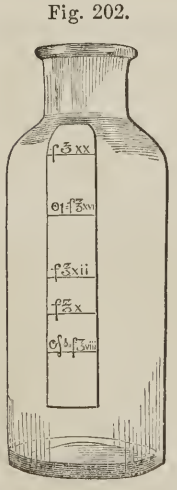
Liquor Ferri Iodidi, U.S. *Syrupus Ferri Iodidi.* (*Syrup or Solution of Iodide of Iron.*)

This important alterative chalybeate is readily made by the apothecary and country physician, by the following process of the *Pharmacopœia:*—

		Reduced quantity.
Take of Iodine . . .	℥ij.	℥ss.
Iron filings . .	℥j.	ʒij.
Sugar, in powder .	℥xij.	℥iij.
Distilled water .	sufficient.	sufficient.

Mix the iodine with f℥v of distilled water (f℥iss, reduced quantity), in a porcelain or glass vessel, and gradually add the iron filings, stirring constantly. Heat the mixture gently, till all the iodine is dissolved, or until the liquid acquires a light greenish color. Then having adjusted a bottle to the measure of twenty fluidounces, or made ready the bottle shown in Fig. 202 (mark f℥v on a vial for the reduced quantity); then introduce the sugar into the bottle, filter the solution on to it, adding fresh water upon the filter above, occasionally shaking the bottle, until the resulting syrup measures f℥xx (f℥v, for the reduced quantity).

Fig. 202.



Graduated receiving bottle.

It is well to transfer this to small vials, f℥ss and f℥j, as by frequent opening and restopping a large bottle, it will undergo a change—becoming brown. This may be partially obviated by leaving a few strips of iron in the bottom of the bottle. The use of heat in this preparation is unnecessary, the reaction, which is the same as that in the process for making the solid iodide, will take place satisfactorily in the cold.

The use of sugar as a preservative of this delicate salt, is an important improvement, introduced about the year 1840, and has brought the iodide of iron into the reach of the practitioner in a very permanent and eligible form. This solution contains about $7\frac{1}{4}$ grains of salt to f℥j. Dose, ♏ xx to xl. It is incompatible with most chemical agents, but may be mixed with the syrups and fluid extracts of the vegetable alteratives, or, what is

perhaps better, prescribed in a separate vial, to be dropped into the syrup at the time of taking it.

A preparation is sometimes prescribed in this city under the name of Dr. Hays's Syrup of Iodide of Iron; the formula is published in the *Amer. Journ. of Med. Sciences*, for 1840, p. 449. It is made from 400 grains of iodine, and 160 of iron, and 2 ounces of sugar to f℥iv. Dose, ♏v.

Bromide of Iron.

This salt is obtained by adding bromine to iron filings in excess under water, and submitting them to a moderate heat. When the liquid assumes a greenish-yellow appearance, it is filtered and evaporated rapidly to dryness in an iron vessel. Bromide of iron is a brick red, very deliquescent salt, of an acrid styptic taste, and requires to be kept closely stopped in glass vials. This bromide has been used quite extensively in Pittsburg, Pa., as a tonic and alterative, and is considered by some physicians a highly efficacious preparation. This salt may be known by the liberation of bromine on the addition of sulphuric acid. An eligible form for its administration is the following:—

Syrup of Bromide of Iron.

Take of Bromine	200 grains.
Iron filings	85 grains.
Water	f℥ivss.
Sugar	℥iij.

Make a solution in the manner directed for preparing the officinal solution of iodide of iron. Dose, ♏ xx, three times a day, gradually increased. (See *Medical Examiner*, vol. vii. p. 162.)

For the preparation of a solution of bromide of iron with excess of bromine, see Bromine.

Valerianate of Iron.

This preparation is made by the decomposition of valerianate of soda by tersulphate of sesquioxide of iron; it is a dark red amorphous powder, having a faint odor and taste of valerianic acid. Its composition is thus shown, $Fe_2O_3,3\overline{Va}$. It is insoluble in cold water, decomposed by hot water, and is soluble in alcohol. In hysterical affections complicated with chlorosis, it is prescribed in doses of about a grain repeated several times a day.

MANGANESE.

This is a metal resembling iron in its therapeutical as well as in some of its chemical properties. It forms several oxides, of which the protoxide, MnO, is present in its most important oxysalts. These have a rose color, and on addition of carbonated alkali precipitate

the white carbonate of protoxide, which, however, has a tendency to pass into the brown sesquioxide. The salts of manganese are not incompatible with vegetable astringents, which is their chief pharmaceutical merit. None of them are officinal.

Preparations of Manganese.

Manganesii Oxidum Nigrum, MnO_2. Native impure mineral.
Manganesiæ Sulphas, $MnO,SO_3.7(?)HO$. Pale rose-colored crystals, soluble.
Manganesiæ Carbonas, $2MnO,CO_2+HO$. Whitish insoluble powder.
Manganesiæ Phosphas, $MnO,PO_5+(?)$. Whitish insoluble powder.
Syrupus Manganesiæ Phosphatis. Contains five grains, MnO,PO_5, to each ʒj.
Syrupus Manganesii Iodidi. Contains ʒj MnI, to each fʒj.
Syrupus Ferri et Manganesii Iodidi. Same strength as Liq. Fer. Iod., *U. S.*

The native impure form of manganese in commerce, that of black oxide, is used to prepare all the rest; it is imported in lumps and in powder, and should have a dark, shining, crystalline appearance.

Sulphate of Manganese.

This salt may be prepared by a process published in the *American Journal of Pharmacy*, vol. xxiv. p. 10, by the late W. W. D. Livermore as follows:—

Mix in a sand crucible the black oxide of manganese with sulphuric acid until of a thick pasty consistence. Cover with a smaller crucible and expose the mixture to a red heat for half an hour. At the end of this interval, remove the crucible from the fire, and when cool reduce the dark brown mass to a coarse powder. Introduce this into a crucible, and saturate as before with sulphuric acid. Again apply heat and continue it till white vapors cease to be expelled. The mass remaining contains the sulphate, which may be obtained impure by solution and evaporation. To purify this from iron, the following directions are given: The filtered solution is to be heated in a porcelain capsule, and when nearly boiling, drop into it carbonate of manganese in small portions at a time until all the iron shall have been precipitated and the liquid changes from a dark red to a pale rose tint. Now evaporate and crystallize. These crystals are of a pale rose color, styptic taste, freely soluble in water, and may be given as a tonic in a dose of gr. v; as a cholagogue cathartic, ʒj to ʒij is required.

Some processes recommend the heating of black oxide with carbon previous to adding the sulphuric acid, others direct the addition of the moist carbonate to diluted sulphuric acid.

Carbonate of Manganese.

This is made by precipitating sulphate with a carbonated alkali, or directly from the native black oxide, as follows:—

Take of black oxide of manganese ℔j, in powder, put it in a porcelain dish on a sand bath or other source of heat; pour on it

muriatic acid Oij, and stir well. Chlorine is evolved, which makes it necessary to operate in the open air or under a chimney. Muriatic acid should be added until it is nearly dissolved. To get rid of free muriatic acid and sesquichloride of iron, add carbonate of soda, boiling, after each addition, as long as the carbonate precipitated is contaminated with iron, or until a portion of the solution tested with yellow prussiate of potassa does not produce a blue color. The solution of chloride of manganesc, being now separated from the oxide of iron by filtration, will furnish, on the addition of an excess of carbonate of soda, a bulky white precipitate, which, being washed in cold boiled water and dried, constitutes carbonate of manganese. It is a white or pale rose-colored powder, insoluble in water, and liable to pass into a higher state of oxidation; it may be given in powder, dose, gr. v, or in the form of saccharine powder, or made into a mass with honey.

Phosphate of Manganese.

This salt is prepared by mixing solutions of sulphate of manganese four parts, and phosphate of soda five parts, washing the precipitated phosphate till the sulphate of soda is completely removed, and drying at a moderate heat. It is a white, nearly insoluble powder, and may be made into pills, lozenges, or syrup.

A phosphatic salt of manganese is deemed peculiarly eligible therapeutically, as the phosphates generally have been found advantageous in anæmic conditions of the system. The following formula, combining these prerequisites, is of such a strength that each fluidrachm contains five grains of phosphate of manganese. It is by Thomas S. Wiegand.

Syrup of Phosphate of Manganese.

℞.—Sulphate of manganese (in crystals) .	℥jss, gr. xvij.
Phosphate of soda	℥iiss or q. s.
Muriatic acid	f℥iv.
Water, q. s., to make	f℥vii.
Sugar, q. s., to make, with the foregoing	f℥xiiss.

Dissolve the salts separately, each in half a pint of water, and add the solution of phosphate of soda to the solution of sulphate of manganese, as long as it produces a precipitate, which wash with cold water, and dissolve by means of the muriatic acid; dilute till it measures seven fluidounces, then add sugar sufficient to make up the bulk of twelve and a half ounces.

Syrup of Iodide of Manganese.

Take of Sulphate of manganese . .	℥ij.
Iodide of potassium . . .	℥ij, ℥iij.
Sugar	℥xij.
Water,	
Syrup, of each	sufficient.

Dissolve the sulphate and iodide each in f℥iij of cold water, to which f℥ij of syrup have been added, mix them in a glass stoppered bottle, and after the crystals of sulphate of potassa cease to precipitate, throw the solution on a filter of fine muslin, and allow it to pass into a pint bottle containing the sugar, add sufficient water to the filter to bring up the measure of the resulting syrup to exactly a pint. This contains about ℥j of the iodide to each f℥j. Dose, ♏ x.

Syrup of Iodide of Iron and Manganese. (Procter.)

This preparation nearly represents the officinal solution of iodide of iron, and is used for the same purposes, and in the same doses.

Take of	Iodide of potassium . . .	1000 grains.
	Protosulphate of iron . .	630 "
	Protosulphate of manganese .	210 "
	Iron filings (free from rust) .	100 "
	White sugar (in coarse powder)	4800 "
	Distilled and boiled water .	q. s.

Triturate the sulphates and the iodide separately to powder, mix them with the iron filings, add half a fluidounce of distilled water, and triturate to a uniform paste. After standing a few minutes, again add half a fluidounce of distilled water, triturate and allow it to rest fifteen minutes. A third addition of water should now be made and mixed. The sugar should then be introduced into a bottle capable of holding a little more than twelve fluidounces, and a small funnel, prepared with a moistened filter, inserted into its mouth. The magma of salts should then be carefully removed from the mortar to the filter, and when the dense solution has drained through, distilled or boiled water should be carefully poured on in small portions, until the solution of the iodides is displaced and washed from the magma of crystals of sulphate of potash. Finally, finish the measure of twelve ounces, by adding boiled water, and agitate the bottle until the sugar is dissolved. The solution of the sugar may be facilitated when desirable, by standing the bottle in warm water for a time, and then agitating.

Each fluidounce of this syrup contains fifty grains of the mixed anhydrous iodides in the proportion of three parts of iodide of iron to one part of iodide of manganese, and the dose is from ten drops to half a fluidrachm.

For paper on the preparations of manganese and iron, including effervescing powders, lozenges, pills, chocolate, and syrup, see *Am. Journ. Pharm.*, vol. xxv. p. 174, also vol. xxii. p. 297.

CHAPTER VI.

PREPARATIONS OF COPPER AND ZINC.

CUPRUM. (COPPER.)

THE properties of metallic copper are generally familiar; it furnishes, by oxidation and combination with acids, some important medicines, which are also, in excessive doses, corrosive poisons. The best antidote is white of egg, or milk and other bland liquids; magnesia will aid in the case of sulphate, by decomposing that salt. Copper is apt to contaminate stewed fruit, from the use of copper vessels in their preparation; it may be detected by immersing a clean spatula in the suspected liquid, which deposits a film of metallic copper, or by ammonia, which strikes a rich blue color with copper salts.

COPPER PREPARATIONS.

Cupri Sulphas, CuO,SO_3+5HO. Blue vitriol, blue efflorescent crystals.
Cuprum Ammoniatium, $CuO,SO_3,HO+2NH_3$. Blue amorphous moist powder.
Cupri Subacetas, $2CuO\overline{Ac}+6HO$. (?) Verdigris, amorphous green masses.

Cupri Sulphas, U. S. (*Blue Vitriol. Blue Stone.*)

Four methods are in use for obtaining this salt. 1st. By evaporating the waters which flow through copper mines, and which hold it in solution. 2d. Roasting copper pyrites, lixiviating the residuum to dissolve the sulphate, and evaporating so as to obtain crystals. Both the S and the Cu of the pyrites abstract O from the air, and become, the one SO_3, and the other Cu_3O; and these uniting form sulphate of copper. 3d. Another mode is to sprinkle plates of copper with sulphur, which are next heated to redness and plunged into water; the sheets are entirely corroded; a sulphuret is formed, which, by the action of heat and air, gradually passes into a sulphate; this is dissolved in water, and crystals obtained by evaporation. 4th. By dissolving the scales, obtained in the process of annealing sheet copper, in diluted sulphuric acid, evaporating and crystallizing. The salt is in large, rhombic, blue crystals, with a styptic metallic taste; it contains five equivalents of water, and is represented by CuO,SO_35HO. It effloresces slightly in dry air; soluble in water, precipitated by ammonia, but redissolved in an excess, forming a rich blue solution. The impurities contained in it, when in crystals, seldom affect its value as a medicine.

Sulphate of copper is much used as a tonic and astringent, in from gr. $\frac{1}{4}$ to gr. $\frac{1}{2}$, and as a prompt and powerful emetic in five grain doses; as an injection in gonorrhœa, &c., it is dissolved in water in the proportion of 2 to 8 grains to f℥j. A crystal polished by trituration on a damp cloth, is applied as an astringent to inflamed eyelids, &c.

Cuprum Ammoniatum, U. S. (*Ammoniated Copper. Ammonio-Sulphate of Copper.*)

Sulphate of copper, ℥ss, and carbonate of ammonia, ʒvj, are rubbed together in a glass mortar until effervescence ceases; the ammoniated copper is wrapped in bibulous paper, and dried with a gentle heat. When thus rubbed together, these salts give out part of their water of crystallization, by which the mixture becomes moist, and, at the same time, a portion of the carbonic acid of the sesquicarbonate escapes, producing effervescence, and the compound assumes a deep azure blue color.

The composition is nearly represented thus: $CuO,SO_3+HO,+NH_3$. Ammoniated copper is regarded as a tonic and antispasmodic. It is occasionally prescribed in combination with assafœtida in pill; dose, gr. $\frac{1}{2}$ repeated.

Cupri Subacetas, U. S. (*Ærugo. Impure Subacetate of Copper. Verdigris.*)

Made by exposing copper plates to the action of the fermenting refuse of the wine-press, or to pyroligneous acid, when this salt forms on the surface.

It is obtained in powder, or amorphous masses, or consisting of very minute crystals, of a bluish green color, with a peculiar metallic odor, and styptic metallic taste; resolved by water into a soluble neutral acetate, and insoluble tris-acetate; when treated with sulphuric acid, gives off acetic acid fumes; from the solution, ammonia precipitates the oxide, but redissolves it when in excess.

Composition: $2CuO,\overline{Ac}+6(?)HO$. It is sometimes met with in a distinctly crystalline form, which is, I believe, the neutral acetate as deposited from an acetic acid solution. It is used exclusively externally as an escharotic, and there is an officinal ointment made from it.

Zincum. *U. S.* (Zinc.)

This metal occurs in nature in two principal forms: as a sulphuret, *blende*, and as a carbonate or silicate, *calamine*, from which the metal is extracted, by distilling them with carbonaceous matters.

It is a bluish, white crystalline metal, soluble in dilute hydrochloric and sulphuric acids, with evolution of hydrogen, also in nitric acid; melted and dropped into water, it constitutes granulated zinc. It is used in pharmacy for the preparation of the sulphate, acetate, and chloride, which are officinal.

Preparations of Zinc.[1]

Calamina. Native, impure carbonate of zinc. A gray coarse powder.
" Præparata. Calcined, powdered, and levigated.
Tutia. A product of smelting lead ores containing zinc. Slate colored.
Zinci Sulphas, $ZnOSO_3+7HO$. Small, white, efflorescent crystals. Emetic gr. x.
" Carbonas Præcipitatus, $8ZnO,3CO_2+6HO$. (?) A pure white, very light powder.
" Oxidum, ZnO. A pure, white powder, not effervescing with acids.
" Acetas, ZnO, $\overline{A}c$. Micaceous, freely soluble crystals.
" Chloridum, ZnCl. White, translucent plates or masses. Very deliquescent.
Zinci Cyanuretum, ZnCy. White powder, insoluble, poisonous. Gr. ¼ to j.
" *Valerianas*, ZnO, $\overline{V}a$. White, pearly scales, soluble in alcohol. Dose, gr. j to ij.

Calamina, U.S. (*Calamine. Native Impure Carbonate of Zinc.*)

This mineral is found abundantly in Germany, England, and the United States. It is, however, as recently procured, very impure, and seldom contains a considerable proportion of carbonate of zinc. For use, it must be brought to the condition of an impalpable powder, when it constitutes:—

Calamina Præparata, U.S. (*Prepared Calamine.*)

Obtained by heating the impure carbonate to redness and pulverizing the product, which is then levigated and elutriated.

It is in the form of a pinkish or gray powder, of an earthy appearance. It should be almost entirely soluble in sulphuric acid, and the precipitate thrown down by ammonia and potash should be redissolved by these reagents. The calcination of calamine drives off a quantity of CO_2 and water, so that little remains except oxide of zinc and earthy impurities. The precipitate, carbonate or oxide of zinc, may be substituted with advantage.

It is only used externally as a dusting powder and exsiccant, or in the form of cerate as a mild astringent.

Tutia. (*Impure Oxide of Zinc. Tutty.*)

This oxide is formed during the smelting of lead ores containing zinc; it is, as I have seen it, usually in little nodules, like those of

[1] The unofficinal preparations, as in the other tables, in Italic.

prepared chalk, of a bluish or slate-color. It is said to be much adulterated, and is very properly substituted by the officinal oxide of zinc.

Zinci Sulphas, U.S. (*Sulphate of Zinc. White Vitriol.*)

Prepared by dissolving zinc in dilute sulphuric acid, evaporating and crystallizing.

Water is decomposed in the presence of the acid and metal, hydrogen is liberated, the zinc oxidized, and the oxide formed combines with the sulphuric acid.

Usually in small four-sided, colorless prisms, of the same form as sulphate of magnesia, possessing a disagreeable, metallic, styptic taste, very soluble in water, insoluble in alcohol, slightly efflorescent, precipitated, and again redissolved by ammonia. When heated, it dissolves in its water of crystallization, and by prolonged ignition, the acid is all expelled, and oxide of zinc is left. Its composition is thus represented, ZnO, SO_3+7HO.

In small doses it acts as an astringent and tonic; in large doses as a quick, direct emetic; externally, as a powerful astringent. It is used as a tonic, chiefly in diseases affecting the nervous system, and when gradually increased, tolerance soon becomes established; sometimes it is given as an astringent in chronic passive discharges. As an emetic, it is used when the rapid emptying of the stomach is desired without the production of much depression, as in narcotic poisoning. Externally, in solutions of different strengths, it is employed as a lotion or injection, in ophthalmia, gleet, &c.

Dose, gr. $\frac{1}{2}$ to ij in pill. As an emetic, gr. x. The strength of a solution for external employment, may be from gr. j to vj to f$\bar{3}$j water.

Zinci Carbonas Præcipitatus, U.S. (*Precipitated Carbonate of Zinc.*)

Solutions of carbonate of soda and sulphate of zinc in equal parts are mixed together; a double decomposition takes place; sulphate of soda is formed in solution, and carbonate of zinc is precipitated. A white flocculent powder resembling magnesia subsides, which is frequently washed till the washings are tasteless; the powder is dried by a gentle heat.

Uses same as those of calamine. In the form of the officinal cerate, it is much used as a dressing for burns.

Zinci Oxidum, U.S. (*Oxide of Zinc. Flowers of Zinc.*)

This is made by exposing the precipitated carbonate to a strong heat, by which CO_2 is driven off, and the residue is the oxide of zinc.

It is a white or yellowish-white powder, without odor or taste; insoluble in water, but soluble in hydrochloric and other acids without effervescence, and in ammonia and potash; composition ZnO. When a salt of zinc is treated with sulphuretted hydrogen (HS), a white precipitate is the result, which distinguishes zinc from any other metal, and furnishes a means of detecting lead or other impurities.

Oxide of zinc is a tonic, especially to the nervous system; also somewhat astringent; used in chorea, epilepsy, and neuralgia. Locally, it is slightly astringent and desiccant, and constitutes an excellent application to excoriated surfaces, and to chapped or cracked nipples. An ointment of oxide of zinc is officinal.

Zinci Acetas, U.S. (*Acetate of Zinc.*)

It may be procured in either of the following ways: 1. By dissolving oxide of zinc in acetic acid, and crystallizing the saturated solution. 2. By double decomposition between a solution of sulphate of zinc and a solution of acetate of lead. 3d. The officinal process, granulated zinc ℥ix, is added to a solution of ℔j of acetate of lead in water Oiij, and agitated occasionally till no precipitate is formed on the addition of iodide of potassium. The familiar experiment of forming the zinc or lead tree leaves this salt in solution. In concentrating the solution to one-fifth its bulk, previously to crystallizing, a little of the acetic acid is apt to be dissipated, and should be replaced by dropping in a small excess of the acid.

When carefully crystallized, it is in the form of very handsome pearly or silky hexagonal crystals, which effloresce in a dry air. As found in the shops, it is sometimes in white micaceous scales; very soluble in water, moderately soluble in alcohol, and has an astringent metallic taste.

When heated, it fuses and gives out an inflammable vapor having the odor of acetic acid; the mineral acids decompose it.

It is used as a topical remedy, in the form of collyrium, in ophthalmia, and as an injection in gonorrhœa, gleet, leucorrhœa, &c.

Zinci Chloridum, U.S. (*Chloride of Zinc. Butter of Zinc.*)

Take of Zinc, in small pieces,	.	℥iiss.
Nitric acid (sp. gr. 1.42),		
Prepared chalk, each	.	℥j.
Muriatic acid . .	.	a sufficient quantity.

To the zinc, in a glass or porcelain vessel, add gradually sufficient muriatic acid to dissolve it; then strain, add the nitric acid, and evaporate to dryness. Dissolve the dry mass in water; add the

chalk, and, having allowed the mixture to stand for twenty-four hours, filter and again evaporate to dryness.

This beautiful preparation is well prepared by the above process of the *Pharmacopœia*. The chloride of zinc being first formed by the action of the muriatic acid on the metal, the next step is to separate the iron derived from the muriatic acid, and from the zinc; this is done by the use of nitric acid, which peroxidizes the iron, and, on evaporation to dryness, dissolving, and filtering, it is left behind. The pure chloride is now digested with chalk to free it more completely from iron by neutralizing any free acid. Another method, which is effectual in removing iron, is to add to the solution as at first formed a little freshly precipitated hydrated carbonate of zinc; filter and evaporate.

The final concentration of the liquid requires care, as by pushing the heat too far the chloride is decomposed, and contains a portion of insoluble subchloride or oxide; on the other hand, care must be taken to free it entirely of water, otherwise it will not harden into solid and dry masses. The proper point is ascertained by dipping into it a glass rod, on which it should thicken into a hard dry condition. There are two ways of finishing this operation. In one case, the mass, in its fused condition, is poured on to a dry marble slab, and when nearly cool, is broken into fragments and put immediately into dry salt mouth bottles, usually f℥j capacity. Another plan is to warm the bottles thoroughly in a sand bath, and drop the fused mass, a little at a time, into them; if in the proper condition, the separate concretions will not run together, but remain in a convenient shape for removal from the bottle when required.

Chloride of zinc, as thus prepared, is white, crystalline, and semi-transparent, rapidly absorbing water if exposed to the air; soluble in alcohol and water. If a large amount of sediment is present in the aqueous solution, it may be inferred that by the intense heat employed in its concentration and fusion, a portion has been reduced to the condition of oxide as above.

It is used as a powerful escharotic and as a remedy for toothache, and in solution for its antiseptic properties; for this latter use, especially for dissecting-room purposes, it is convenient to employ a solution of zinc in the muriatic acid without either purifying or concentrating it to dryness. Such a solution is diluted by the addition of from four to seven parts of water to inject the dead subject.

Cyanuret of Zinc.

Prepared by precipitating a recently formed solution of cyanuret of potassium with an equivalent of sulphate of zinc, washing and drying the precipitate. It is a white insoluble powder, and has been used in epilepsy, chorea, neuralgia, &c., and as a substitute for hydrocyanic acid. Dose, gr. $\frac{1}{4}$ to j.

Valerianate of Zinc.

Prepared by decomposing sulphate of zinc with valerianate of soda in solution at 200° F. On evaporation, crystals of the valerianate collect on the surface, and are skimmed off, washed with cold water to separate adhering sulphate of soda, and dried. The salt is in pearly scales with a faint valerian odor, astringent metallic taste; sparingly soluble in water, more so in alcohol. It is a good deal prescribed, perhaps more than any other salt of valerianic acid, being adapted to a variety of nervous affections. Dose, gr. j to ij in pill, repeated at intervals.

CHAPTER VII.

ON LEAD, SILVER, BISMUTH.

Plumbum. (Lead.)

Metallic lead is not used in medicine, nor is it officinal for use in preparing any of its salts. It is abundantly diffused in the form of galena, a native sulphuret, which is extensively worked in this country for the production of the metal. Exposed for a long time to its influence, individuals exhibit symptoms of slow poisoning, called lead colic. In over-doses its salts are poisons.

Lead is a soft bluish-colored metal, very malleable and fusible; its properties are familiar to most. It forms five oxides, of which the only one important in a pharmaceutical point of view is the first in the following series.

Preparations of Lead.

Plumbi Oxidum Semivitreum, Pb,O, Litharge. Yellow or reddish flakes or powder.
Emplastrum Plumbi. See fixed oils, also plasters.
Plumbi Acetas, $PbO,\overline{Ac},3HO_1$. Matted acicular crystals, whitish by efflorescence.
Liquor Plumbi Subacetatis. A clear heavy liquid, depositing white carbonate.
Liquor Plumbi Subacet. Dilutus. f℥ij liq. plumb. sub. acet. to Oj. Sedative astringent.
Plumbi Carbonas, PbO,CO_2. A heavy, white, opaque powder.
Plumbi Nitras, PbO,NO_5. White crystals, soluble in water, disinfectant.
Plumbi Iodidum, PbI. A bright yellow amorphous powder, used in ointment

Plumbi Oxidum Semivitreum, U.S. (*Semivitrified Oxide of Lead, Litharge.*)

Generally obtained as a secondary product in the cupellation of argentiferous galenas, when the oxide becomes fused or semivitri-

fied, and is driven off in hard particles of a scaly texture. English litharge is the best. It is in the form of small red or orange red scales, devoid of smell or taste; soluble, or almost entirely so, in dilute nitric acid. It is much contaminated with iron and copper, and usually contains a little carbonic acid. It is chiefly used for its effect on fixed oils, with which it combines, and hence occasions paint to which it is added to dry and harden rapidly.

Plumbi Acetas, U. S. *Saccharum Saturni.* (*Sugar of Lead.*)

Made by dissolving litharge in dilute acetic acid, evaporating the solution, and crystallizing; also by the direct action of vinegar upon sheets of lead partially exposed to the air, so as to become oxidized, when the oxide being dissolved in the acid, the salt may be obtained in spongy masses composed of interlaced acicular crystals, possessing an acetic odor, and sweet metallic taste; exposed to the air it effloresces slightly, is soluble in four times its weight of cold water, and much less of boiling water, communicating a turbidness to the solution from taking up CO_2, which ordinary water generally holds; this turbidness may be removed by the addition of a little acetic acid or vinegar.

It is precipitated as a white carbonate by carbonate of soda, a yellow iodide by iodide of potassium, and a black sulphuret by sulphuretted hydrogen. It is also incompatible with all acids, and with numerous soluble salts.

Sugar of lead is very extensively employed, both internally and externally. It ranks as a sedative astringent, checking morbid discharges, diminishing the natural secretions, and is capable by various combinations of filling a variety of indications in disease. Dose, gr. ss to iij in pill, care being taken not to induce its poisonous effects. Externally, it is used in solution from gr. j to gr. viij to f℥j as a sedative, astringent, and desiccant to inflamed parts.

Liquor Plumbi Subacetatis, U. S. (*Solution of Diacetate of Lead. Goulard's Extract. Strong Lead Water.*)

		Reduced.
Take of Acetate of lead	℥xvj	℥ij.
Semivitrified oxide of lead, in fine powder	℥ixss	℥ixss.
Distilled water	Oiv	Oss.

Boil them together in a glass or porcelain vessel for half an hour, occasionally adding distilled water so as to preserve the measure, and filter through paper; keep the solution in closely stopped bottles. By the action of litharge on acetate of lead, the diacetate is formed by an additional equivalent of the oxide entering into the composition of the salt.

This is one of the simple preparations readily prepared by the

Fig. 203.

Closed filter.

Fig. 204.

Capsule.

country practitioner. The litharge should be in very fine powder before commencing the process, and care should be taken to prevent its caking, and the consequent fracture of the vessel, by constant stirring; an evaporating dish will be found convenient, and in filtering, a covered funnel will be useful. It may be well to mention as necessary, in this case, that the filter should be strengthened by a little plain filter set into the funnel at its narrowest part, in which the plaited filter may rest.

Solution of subacetate of lead is a clear colorless liquid, sp. gr. 1.267, with an alkaline reaction, and sweet, metallic astringent taste; agrees with the acetate in most of its properties, except that it precipitates gum from solution. It is remarkable for its great affinity for carbonic acid, which occasions a precipitate of carbonate of lead, merely on exposure to the air. Diluted with water, it is applied as a sedative lotion to sprains, bruises, &c. (See *Ceratum, and Linimentum Plumbi Subacetatis.*)

Liquor Plumbi Subacetatis Dilutus, U. S. (*Lead-Water.*)

Take of Solution of subacetate of lead . .	f℥ij.
Distilled water	Oj.

Mix them.

The water containing carbonic acid will produce a precipitate of carbonate of lead, which exposure to the air will increase so that the preparation is liable to become inert, and should be mixed when required. Lead-water is generally regarded as a very weak preparation, and but for its very general popular employment as a cooling wash, might be made much stronger, as may be readily done by extemporaneous prescription.

Plumbi Carbonas, U. S. (*White Lead.*)

This important substance, which, as ground in oil, is extensively used as a pigment, is obtained by two methods: 1. By passing a

stream of CO_2 through a solution of subacetate of lead. The CO_2 combines with the excess of PbO, and precipitates as PbO,CO_2, while a neutral acetate of lead remains in solution; this is boiled with a fresh addition of PbO, and again brought to the condition of subacetate, and treated as before with CO_2. This plan is pursued by the French and Swiss manufacturers. 2. Our own manufacturers cast the lead into thin sheets, which are then rolled into cylinders, five or six inches in diameter, and seven or eight high; each cylinder is placed in an earthen pot, containing Oss vinegar, the lead being supported by projecting pieces from contact with the vinegar. Strata of these pots are arranged in sheds, with refuse stable materials, which are giving off CO_2, and have a certain elevation of temperature due to fermentation. At the end of six weeks, the stacks are unpacked, and the sheet lead is found almost entirely converted into a flaky, white, friable substance, which is the white lead. This is separated, and reduced to fine powder. Carbonate of lead is a heavy, opaque substance, in powder or friable lumps, insoluble in water, of a fine white color, inodorous, and nearly insipid. Wholly soluble with effervescence in dilute nitric acid.

This is regarded as the most poisonous of the lead salts; it is employed externally as a dusting powder in excoriations of children, and as an astringent and sedative dressing to ulcers and inflamed surfaces.

Plumbi Nitras, U. S. (*Nitrate of Lead.*)

Litharge is dissolved in nitric acid, by the aid of heat; the liquid filtered, and set aside to crystallize; the PbO unites directly with the NO_5 to form the nitrate, which is an anhydrous salt, in beautiful white, nearly opaque, octahedral crystals, permanent in the air, of a sweet astringent taste, soluble in water and alcohol.

It is an effectual disinfectant, decomposing sulphuretted hydrogen, and the hydrosulphurets contained in decomposing animal fluids.

Ledoyen's Disinfecting Fluid, which is greatly esteemed abroad, is a solution of this salt in water ℥j to f℥j. It may be made directly by dissolving carbonate of lead, or litharge, in diluted nitric acid, to saturation, and will be found extremely useful in sick chambers, where the alvine discharges are extremely fetid and even infectious.

Plumbi Iodidum, U. S. (*Iodide of Lead.*)

Take of	Nitrate of lead,	
	Iodide of potassium, each .	℥iv.
	Distilled water . . .	a sufficient quantity.

With the aid of heat, dissolve the nitrate of lead in Oiss, and the iodide of potassium in Oss of the distilled water, and mix the solu-

tions. Having allowed the insoluble matter to subside, pour off the supernatant liquid, wash the precipitate with distilled water, and dry it with a gentle heat.

This process may be readily accomplished with the apparatus usually pertaining to a country practitioner's outfit; in fact, it is one of the easiest processes of the *Pharmacopœia*. The two salts dissolved separately, may be mixed in a wide mouth bottle (Fig. 204), the precipitate collected in a plain filter (Fig. 205).

Fig. 205. Fig. 206.

Bottle and filter for precipitating iodide of lead.

Iodide of lead is a bright yellow, heavy, tasteless, inodorous powder, very sparingly soluble in cold, but readily soluble in boiling water, acetic acid, and alcohol. Fuses and sublimes yellow, but soon gives off violet vapors from decomposition.

This preparation is supposed to have the resolvent properties of iodine, combined with those peculiar to lead, and hence it is used in ointment to reduce indolent tumors, scrofulous and syphilitic.

Argentum, *U. S.* (Silver.)

This well-known metal is placed in the list of the *Pharmacopœia* on account of its use in preparing the several salts. It is found most abundantly as sulphuret combined with copper, lead, and antimony; the argentiferous galena, already referred to as furnishing litharge, is the most abundant source of silver.

Preparations of Silver.

Argenti Nitras, AgO,NO_5 (crystals). Colorless; soluble in water; staining the skin.
Argenti Nitras Fusus. In sticks; thickness of a quill wrapped in paper.
Argenti Oxidum, AgO. A blackish insoluble powder; soluble in ammonia.
Argenti Cyanuretum, AgCy. A white, odorless, tasteless, insoluble powder.

Argenti Nitras, U. S. (*Crystallized Nitrate of Silver.*)

This salt is made by dissolving silver in nitric acid, evaporating the solution, and crystallizing. It is a new officinal, as in former

editions of the *Pharmacopœia* the name was applied to the fused article in sticks. It is in crystals, which are anhydrous and colorless; it is soluble in its weight of water, stains the skin black, and, when moistened and applied, acts as a caustic, which is its chief use. The crystallized article is preferred for solution, being less liable to be adulterated, and to decompose by the action of light, than the fused and wrapped article. Internally, it is given in pill with a tonic extract, preferably extract of quassia, as an astringent and alterative affecting the nervous system. When administered a long time, it is capable of staining the whole surface of the body blue or lead color. Dose, gr. $\frac{1}{4}$ to gr. j.

Argenti Nitras Fusus, U.S. (*Lunar Caustic.*)

This is made as the preceding, except that instead of crystallizing it the evaporation is carried further, and after becoming dry it is fused, and when it runs like oil is poured into moulds. It is thus obtained in sticks of suitable sizes for application as a caustic; it is, however, crystalline in structure, and very brittle. When the sticks have cooled, they are wrapped tightly in paper, in which they are sold. The crystals are more economical to the purchaser from having less paper weighed with them. The high heat applied in the fusion of nitrate of silver is apt to reduce a portion to the metallic condition, so that it has a gray color, and is not entirely soluble. The fusible nature of this salt enables us to introduce it readily into silver catheters and other surgical instruments, and also, by a very ready expedient, to point the sticks and alter them in size thus: Heat a half dollar held in a pair of pincers over a lamp, and apply to it the end of the stick of caustic, rotating it at such an angle as to give the requisite sharpness; if the coin is hot enough, it will fuse at the point and take the shape desired.

The extensive use of the nitrate and its high price lead to the admixture of nitrate of potassa, especially with the fused article; this adulteration may be detected by passing a stream of sulphuretted hydrogen into its solution till it ceases to throw down sulphuret of silver, then filtering and evaporating; there should be no residue. If 17 grains of the nitrate are dissolved in water, it should precipitate entirely the chlorine of 6 grains of common salt.

The stain of nitrate of silver on the fingers and on articles of clothing is sometimes very inconvenient; it may generally be removed by a little cyanide of potassium, or by moistening the part with tincture of iodine and immediately applying iodide of potassium, and then washing it off.

So numerous are the incompatibles of nitrate of silver that it should generally be prescribed in pill, and singly, except with some vegetable excipient. It generally forms a white cloud, with the purest undistilled water, from the presence of chlorides.

Argenti Oxidum, U. S.

		Reduced.
Take of Nitrate of silver . .	℥iv.	℥ss.
Distilled water . . .	Oss.	f℥j.
Solution of potassa . .	Oiss, or q. s.	f℥iij.

Dissolve the nitrate of silver in the water, and add the solution of potassa as long as it produces a precipitate; wash the precipitate repeatedly with water until the washings are nearly tasteless. Lastly, dry the powder and keep it in a well-stopped bottle protected from the light. This is a dark brown or black powder, insoluble in water, but soluble in ammonia and in acids. It is used instead of nitrate of silver for the tonic effects of the silver salts. Dose, gr. $\frac{1}{2}$ to gr. ij.

Argenti Cyanuretum, U.S. (*Cyanide of Silver.*)

The salt has been described on page 300, in connection with its use in preparing hydrocyanic acid. It is a tasteless, white powder, insoluble in water, soluble in ammonia and in cyanide of potassium. When heated, it yields cyanogen and metallic silver.

BISMUTHUM, *U. S.* (BISMUTH.)

This is a rare metal, of a pinkish-white color, found native; fuses readily and crystallizes; soluble in nitric acid, and the nitrate is precipitated by water.

Bismuthi Subnitras, U.S.

By adding diluted nitric acid to bismuth, red fumes are given off; the metal is oxidized, and the oxide dissolved by the undecomposed acid, forming a solution of ternitrate of teroxide ($BiO_3,3NO_5$); this is thrown into water and decomposed. Four equivalents are resolved into three of neutral, generally called subnitrate (BiO_3,NO_5), and one of the nine nitrate ($BiO_3,9NO_5$); the latter remains in solution, while the officinal salt goes down as heavy white powder, almost insoluble, tasteless, odorless. It is darkened by sulphuretted hydrogen.

It is tonic and antispasmodic. Dose, gr. j to vj, and is employed as a cosmetic, and with asserted advantage in skin diseases.

CHAPTER VIII.

ANTIMONY AND ARSENIC PREPARATIONS.

Antimony.

This metal is imported from France under the name of *Regulus of Antimony;* it is a brittle metal, usually of a lamellated texture, of a bluish white color; its Latin name *Stibium*, as abbreviated Sb, furnishes its symbol. It forms three combinations with oxygen, teroxide, Sb,O_3, antimonious acid, Sb,O_4, and antimonic acid, Sb,O_5. Teroxide and the tersulphuret enter into the officinal compounds. The preparations are here represented:—

Preparations of Antimony.

Antimonii Sulphuretum, Sb,S_3. Native; black sulphuret or crude antimony.
Antimonii Sulphuretum Præcipitatum, Sb,O_3+5Sb,S_3+16HO. (?) Reddish-brown powder.
Kermes' Mineral, $Sb,O_3.2Sb,S_3+6HO$. (?) Dark-brown.
Golden Sulphur. (?) Yellowish; contains sulphur.

Antim. et Potass. Tartras, $Sb,O_3,KO,2\overline{T}+3HO$. Translucent crystals or white powder.
Vinum Antimonii. Gr. ij to f℥j White wine. =gr. ½ to f℥j.
Pulvis Antimonialis. A variable mixture of Sb,O_3+Sb,O_5, with CaO,PO_5, &c.

Antimonii Sulphuretum, U. S. (*Black Sulphuret of Antimony.*)

This drug should be procured in powder somewhat purified by fusion and levigated, in which condition it is kept by the druggists; it may then be considered as tolerably pure Sb,S_3; it should be soluble in boiling muriatic acid, giving off sulphuretted hydrogen. The terchloride produced (Sb,Cl_3) is precipitated when thrown into water as a white oxychloride. Crude antimony is used as a medicine for horses, and to furnish the salts which follow.

Antimonii Sulphuretum Præcipitatum, U. S. (*Precipitated Sulphuret of Antimony.*)

This officinal salt is made by boiling black sulphuret of antimony with a solution of potassa, straining it, and, while yet hot, dropping into it diluted sulphuric acid as long as it produces a precipitate, which, being washed and dried, and rubbed into a fine powder, constitutes the officinal precipitated sulphuret.

In this process, the alkali decomposes a portion of the black sulphuret, forming sulphuret of potassium, and holds in solution both the undecomposed tersulphuret and the teroxide liberated by the alkali. On the addition to this of an acid, the sulphuret of potassium being decomposed and the excess of potassa neutralized, the

mixed tersulphuret and teroxide are thrown down, so that this powder has the complex composition represented in the syllabus.

This powder is of a color varying from yellowish-red to reddish-brown, insoluble in water, but nearly soluble in solution of potassa. It is used as an alterative and diaphoretic, especially in combination with calomel and guaiacum, as in Plummer's pill, or with extract of conium or hyoscyamus in the treatment of chronic rheumatism.

As its action depends very much upon the amount of acid in the stomach, it is of varying activity. Its dose is from gr. j to iij, twice a day.

Kermes' Mineral. (*Oxysulphuret of Antimony.*)

If the solution obtained by boiling the black sulphuret in potassa, instead of being treated with sulphuric acid as in the foregoing process, be allowed to cool after filtration, a dark brown powder will fall, which will consist of teroxide and tersulphuret of antimony in different proportion, constituting one variety of Kermes. There are modifications of the process of manufacture adapted to yielding this preparation, and the result is by no means uniform, though the composition given in the syllabus is approximate, and the dose may be stated at from gr. $\frac{1}{2}$ to gr. iij.

Golden Sulphur of Antimony.

Is deposited on the addition to the solution from which Kermes has been precipitated, of an acid; it varies in composition and in color according to the degree of change which has taken place spontaneously, and the consequent proportion of sulphur thrown down with the antimonial sulphuret and oxide. It may be given in larger doses than either of the foregoing.

The three preparations above described all owe their activity chiefly to oxide of antimony, in which ingredient Kermes is usually considered the richest. Golden sulphur has it in the smallest proportion, and the officinal precipitated sulphuret is intermediate and the most uniform in composition and effects.

Antimonii et Potassæ Tartras, U.S. *Antimonii Potassio Tartras.* (*Tartar Emetic.*)

This preparation, as its name implies, is a double salt, consisting of the oxide of antimony, and potassa, united, each with an equivalent of tartaric acid. The first step in its preparation is the precipitation of teroxide of antimony, SbO_3; this is accomplished by boiling the black sulphuret with muriatic acid, forming chloride of antimony, and liberating sulphuretted hydrogen; the chloride is then thrown into water, which, as already stated, decomposes it, precipitating oxychloride (oxide of antimony contaminated with chloride, $9SbO_3 + 2SbCl_3$). The second step is to boil this oxychloride with bitartrate of potassa. The oxide unites with the

excess of tartaric acid of the bitartrate, forming a double tartrate of oxide of antimony and potassa, in the same way that oxide of iron is combined, as already stated, so as to form, with the bitartrate, the double tartrate of iron and potassa, &c. (See, also, *Sodæ et Potassæ Tartras, and Potassæ Tartras.*) The chloride of antimony present in the oxychloride is decomposed by water, during the boiling, into oxide and free muriatic acid, the former aiding in the production of the tartar emetic, and the latter by its presence preventing the precipitation of iron and other metallic impurities, which would otherwise contaminate the product.

Tartar emetic crystallizes in beautiful colorless, rhombic, octahedral crystals, which effloresce and become opaque by exposure to the air. It is wholly soluble in 20 parts of water. Its solution does not yield a precipitate with chloride of barium, or, if very dilute, with nitrate of silver. The watery solution is remarkable for decomposing rapidly, forming algæ.

It is incompatible with acids, alkalies, and alkaline carbonates. Astringent solutions precipitate it in an insoluble form.

Internally administered, tartar emetic, in doses of gr. ij to iv, is a powerful emetic; in doses of gr. $\frac{1}{16}$ to $\frac{1}{4}$, it is a diaphoretic and expectorant; gr. $\frac{1}{6}$ to gr. j, is a decided sedative. It is very much prescribed, and in a great variety of diseases, both alone and combined with other remedies. Externally, it is applied in ointment to raise a pustular eruption.

Vinum Antimonii, U.S.

Take of Tartrate of antimony and potassa	℈j.
White wine	f℥x.

Dissolve the tartrate of antimony and potassa in the wine. This is best done by trituration in a mortar, as explained under the head of Solution. It is regarded an improvement by some to triturate the antimonial with a few ounces of water, and then bring up the quantity to the required measure by the addition of wine.

Dose, as an expectorant diaphoretic, ♏ x to xxx, at intervals; its chief use is to furnish a convenient method of giving very divided doses of the salt; f℥j contains $\frac{1}{4}$ grain.

Pulvis Antimonialis. Pulvis Jacobi. (*James' Powder.*)

This is directed to be made by mixing tersulphuret of antimony with horn shavings, throwing into a red-hot crucible, and stirring till vapor no longer rises, then rubbing the residue to powder and heating it to redness for two hours. Reduced to a fine powder, the resulting compound is constituted chiefly of a mixture of teroxide of antimony (SbO_3), antimonic acid (SbO_5), with phosphate of lime. It is a white, inodorous, tasteless, insoluble powder, which was formerly much in use as an alterative and diaphoretic, and was officinal previous to 1830. Its dose is gr. iij to gr. x, every three or four hours, in fevers.

Arsenicum, U.S.

This metal, which is made officinal on account of its use in preparing its iodide, exists in nature in combination with nickel and cobalt. Owing to its volatile and oxidizable character, it is conveniently collected as arsenious acid, during the smelting of these ores. When pure, metallic arsenic is brittle and granular, steel-colored, but usually dull and blackish on the surface. When heated, it sublimes, giving off a garlicky odor, and, if exposed to the air, absorbing oxygen and passing into arsenious acid, AsO_3. It forms, by higher oxidation, arsenic acid, AsO_5; and also combines readily with sulphur.

Pure metallic arsenic may be readily obtained by mixing, in a suitable reduction tube, arsenious acid and charcoal, and applying heat, when the metal will be sublimed.

Preparations of Arsenic.

Acidum Arseniosum, AsO_3. White, opaque, sometimes translucent, masses.
Liquor Potassæ Arsenitis, AsO_3 and KO,CO_2, 64 grains each to Oj; gr. iv, AsO_3=f ℥j.
Arsenici Iodidum, AsI_3. A soluble, orange-colored salt.
Liquor Hydrargyri et Arsenici Iodidum. Solution of AsI_3+HgI_2, each 70 grs. to Oj.

Acidum Arseniosum, U.S. (*White Arsenic.*)

As before stated, this compound is a collateral product in the smelting of cobalt ores. These ores, which are worked extensively in Bohemia and Saxony, furnish the supplies of arsenic to commerce. It comes in broken masses; sometimes translucent and sometimes opaque, white or buff-colored. Soluble in about 100 parts of cold water; more soluble in boiling water, which, on cooling, deposits octahedral crystals. It should be preferred for chemical uses in mass, though the powder, which is liable to adulteration, answers well for common purposes.

In medicine, it is used as an alterative and febrifuge. Dose, $\frac{1}{16}$ to $\frac{1}{8}$ grain.

Externally it is occasionally applied in cancerous affections. Arsenious acid is well known to be a violent corrosive poison, and being cheap and abundantly sold as a poison for rats and for other purposes, is apt to be taken accidentally or with criminal design. The best antidote is *hydrated peroxide of iron*, which is described in its appropriate place. It should be given in tablespoonful doses, repeated every ten minutes, till a large excess has been given.

Pereira, Wood and Bache, and Fownes, give full descriptions of the mode of detecting arsenic in the stomach for medico-legal investigations. It is, however, well for the inexperienced to avoid such examinations, as there are many precautions necessary to an accurate and definite result. In a general way, the reactions may be stated as follows: 1. The solid substance, besides its physical

characters already described; *a*, is volatile; *b*, emits a garlic odor if thrown on ignited charcoal; *c*, if heated in a test tube with charcoal, a mirror of the metal is collected, which, on the outer surface, is very brilliant, and within of a gray, crystalline aspect.

2. In solution arsenic is precipitated, *a*, as a yellow sulphuret by sulphuretted hydrogen; *b*, as a lemon-colored arsenite of silver by a solution of nitrate of silver to which an excess of ammonia has been added; *c*, as a pale green arsenite of copper by a solution of sulphate of copper, rendered alkaline by ammonia or potash.

3. In vapor with nascent hydrogen (as liberated from water, sulphuric acid, and zinc); *a*, smells like garlic; *b*, burns with a bluish-white flame, and with the production of AsO_3 in white smoke; *c*, deposits on a cold plate, held in the flame, a black spot or ring of As, surrounded by a larger white ring of AsO_3; *d*, burned in a tube it deposits a ring of metallic arsenic.

Liquor Potassæ Arsenitis, U.S. (*Fowler's Solution.*)

Take of	Arsenious acid, in small fragments,	
	Pure carbonate of potassa, each	sixty-four grains.
	Distilled water	a sufficient quantity.
	Compound spirit of lavender	half a fluidounce.

Boil the arsenious acid and carbonate of potassa in a glass vessel or porcelain capsule, with twelve fluidounces of distilled water, till the acid is entirely dissolved; to the solution, when cold, add the spirit of lavender, and afterwards sufficient distilled water to make it fill exactly the measure of a pint.

This very popular medicine is so simple in its mode of preparation as to be conveniently made by the country practitioner. It will be found to facilitate its completion, to triturate the arsenic into a fine powder before introducing it into the flask or capsule. The officinal recipe directs pure carbonate of potassa, KO,CO_2; but it is more common to use the ordinary granulated article $2(KO,CO_2)$ $3(HO)$, which, although usually contaminated with a little silica, and differing in its combining proportion by reason of the water it contains, is quite satisfactory. Fowler's Mineral Solution has a characteristic reddish, almost opalescent appearance, a faint odor of lavender, and very little taste; by some it is stated to be a solution of arsenious acid in the alkaline solution; by others, a solution of arsenite of potassa. Four grains of arsenious acid are used to each fluidounce. Dose, ♏ iij to xv.

Arsenici Iodidum, U.S. (*Iodide of Arsenic.*)

Take of	Arsenic (the metal)	a drachm.
	Iodine	five drachms.

Rub the arsenic in a mortar until reduced to a very fine powder, free from metallic lustre, then add the iodine, and rub them together

till they are thoroughly mixed, then put the mixture into a small flask or test-tube, loosely stopped, and heat it very gently until liquefaction occurs, then incline the vessel in different directions in order that any portion of the iodine which may have condensed on its inner surface may be returned into the fused mass. Lastly, pour the melted iodide on a porcelain slab, and when it is cold break it into pieces and put it into a bottle, which is to be well stopped. This is an orange-red crystalline solid, readily reduced to powder, entirely soluble in water, and wholly volatilized by heat. It is seldom prescribed extemporaneously, being little known to practitioners, although doubtless capable of valuable therapeutic applications.

It is made officinal for the purpose of furnishing a ready means of forming the solution which follows:—

Liquor Arsenici et Hydrargyri Iodidi, U.S. (*Donovan's Solution.*)

Take of Iodide of arsenic,
Red iodide of mercury, each . thirty-five grains.
Distilled water . . . half a pint.

Rub the iodides with half a fluidounce of the water used, and when they have dissolved, add the remainder of the water; heat to the boiling point, and filter. According to my experience, there is no utility in the application of heat to this solution, at least in a majority of cases. Of course, the mixed powder should be entirely dissolved.

Donovan's solution is a clear, very pale straw-colored, or colorless liquid, with a slightly styptic taste. It should not be prescribed with other chemical preparations, as a general rule. It is a powerful alterative, said to be particularly adapted to the treatment of venereal diseases. Dose, ♏ v to xx. Each f℥j contains about $\frac{1}{8}$ grain of arsenic estimated as arsenious acid.

CHAPTER IX.

MERCURY.

Hydrargyrum, *U. S.* (Mercury.)

Mercury is obtained chiefly from its bisulphuret, native cinnabar, by distillation with lime; sometimes it is met with in its metallic state, and rarely combined with chlorine. Very rich cinnabar is found in California, from which a considerable proportion of our mercury is obtained.

When pure, mercury is a brilliant white, metallic liquid, becoming solid at —39° F., boiling at 662° F.; sp. gr. 13.5; entirely vaporized by heat; when small globules of it are rolled slowly on a sheet of paper, not a particle should adhere. It dissolves many metals, as tin, bismuth, zinc, silver, and gold, forming amalgams with them. It may be separated from these when they contaminate it by distillation. It is not attacked by muriatic nor by cold sulphuric acid, though the latter acid at a boiling temperature, forms with it a bisulphate of the deutoxide, sometimes called bipersulphate. Nitric acid also dissolves it, forming a binitrate of the deutoxide. Mercury forms numerous salts, of which the following are officinal preparations, and will be presented to view in the present chapter.

MERCURIAL COMPOUNDS.

Off. Name.	Comp.	Uses.	Dose.
Hydrargyri Chloridum Corrosivum	$HgCl_2$	Alterative, antiseptic, &c.	$\frac{1}{16}$ to $\frac{1}{4}$ gr.
" " Mite	Hg,Cl	Cathartic and alterative.	$\frac{1}{12}$ to 20 grs.
" Sulphas Flavus	$3HgO_2,2SO_3$	Emetic and errhine.	Emetic, 3 grs.
" Iodidum Rubrum	HgI_2	Alterative in syphilis, &c.	$\frac{1}{16}$ to $\frac{1}{4}$ gr.
" Iodidum	HgI	do.	$\frac{1}{4}$ to 1 gr.
" Sulphuretum Rubrum	HgS_2	Alterative fumigations.	
" " Nigrum		Mild alterative.	gr. v to ʒj.
" Oxidum Rubrum	HgO_2	Externally stimulant.	
" " Nigrum	HgO	Alterative, sialagogue, &c.	$\frac{1}{4}$ to 3 grs.
" Cyanuretum	$HgCy_2$	Alterative in syphilis, &c.	$\frac{1}{16}$ to $\frac{1}{8}$ gr.
Hydrargyrum Ammoniatum	$HgCl,NH_2$	Externally in ointment.	
" cum Creta	$3,Hg+5,CaO,CO_2$	Antacid and alterative.	$\frac{1}{2}$ to 3 grs.

The composition stated in the syllabus is that generally adopted by pharmacologists in this country; it is founded on the view that the combining equivalent of mercury is 202. Supposing the equivalent to be 101, as European chemists generally do, we should call corrosive chloride, protochloride (HgCl); calomel, subchloride (2Hg,Cl), and so on.

Hydrargyri Chloridum Corrosivum, U. S. (*Corrosive Sublimate.*)

By the action of boiling sulphuric acid on mercury, the bipersulphate ($HgO_2,2SO_3$), is first formed. When this is heated with common salt, mutual exchange takes place, and bichloride of mercury

and sulphate of soda, the former of which sublimes, are produced. The changes are represented in the formula $HgO_2 2SO_3 + 2NaCl = HgCl_2 + 2(NaO,SO_3)$. Corrosive sublimate is in heavy white crystalline masses, of a styptic and metallic taste; soluble in about twenty parts of cold water; much more so in alcohol; soluble also in ether; it melts and entirely sublimes when heated. Its watery solution, precipitated by alkalies or lime-water, throws down the red or yellowish binoxide. (See *Extemporaneous Prescriptions.*) When this precipitate is heated, it gives off oxygen, and runs into globules of metallic mercury; a solution of corrosive sublimate precipitates albumen, and forms with it a definite insoluble compound, to which property its use as an antiseptic is due.

It is a very powerful irritant; when taken in large doses, it causes burning at the epigastrium, vomiting and purging; applied to the skin, it is corrosive. It is less apt to produce salivation than the other preparations of mercury, and in very small doses it is useful as an alterative in chronic affections, syphilitic or not; externally, it may be used as a lotion, gargle, injection, or ointment, in chronic skin diseases, ulcerated sore throats, and chronic discharge, from mucous membranes.

Dose, $\frac{1}{16}$ gr. to $\frac{1}{4}$ gr. in solution, or pill, with crumb of bread. The solution for external use is usually made in the proportion of $\frac{1}{4}$ or $\frac{1}{2}$ gr. to f℥j of water. It is much used in solution with muriate of ammonia, which increases its solubility, as a poison for bedbugs; the proportions to be used are one ounce of corrosive sublimate, half ounce of muriate of ammonia to two pints water. When taken in poisonous doses, recourse should be had immediately to albuminous liquids; eggs, if at hand, should be administered freely, or a thin paste of wheat flour or milk, care being taken to evacuate the bowels and to carry off completely the precipitated material, which, though comparatively insoluble, is by no means inert.

Hydrargyri Chloridum Mite, U. S. (*Calomel.*)

To prepare this, the bipersulphate of mercury first formed, as explained under the bichloride, is afterwards, by being rubbed with a second equivalent of the metal, reduced to a condition capable of forming, when heated, the neutral sulphate (HgO,SO_3); and this, by the action of the common salt, is converted into the protochloride of mercury, sulphate of soda being produced at the same time.

Calomel, when sublimed, occurs in cakes, with a crystalline structure; but as a drug, it is met with in the form of a white, or yellowish white, heavy powder, without odor or taste; sublimes with heat; treated with potash, it is blackened, from the precipitation of the protoxide, which, when heated, runs into metallic globules. When boiled or washed in water, this fluid should afterwards give no precipitate with nitrate of silver, lime-water, or sulphuretted hydrogen. By the action of nitric and hydrochloric

acids, it is converted slowly into the bichloride. Calomel should not be prescribed at the same time with muriate of ammonia, or with nitro-muriatic acid, a remedy which like it seems specially indicated in torpor of the liver, as symptoms of violent gastric irritation have been unexpectedly produced from this cause.

The peculiarities of calomel as a mercurial agent, are, that it produces little local irritant action; it acts as a purgative by increasing the secretion of bile and other intestinal fluids; hencc, is much relied on in affections of the liver, and obstructions to the portal circulation. It is much combined with other remedies, being greatly modified in its effects by judicious combination with sedatives, cathartics, astringents, &c.

Dose, as a purgative, 5 grs. to ℈j; to produce ptyalism, ½ grain to 1 grain, frequently repeated. It has become customary to administer exceedingly minute quantities of this preparation, so low as the $\frac{1}{2}\frac{1}{4}$ of a grain repeated every hour or two, the constitutional effects being perceptible after a grain has been given in this way. I am informed that its power to salivate is greatly increased by long trituration with sugar of milk.

Hydrargyri Sulphas Flavus, U. S. (*Turpeth Mineral.*)

The bipersulphate of mercury, formed by the action of boiling sulphuric acid on the metal, and mentioned in the two preceding formulæ, is readily decomposed by reducing it to powder and submitting it to the action of warm water, which changes its composition and properties, producing a yellow-colored insoluble subsalt, $3HgO_2+2SO_3$. This is used almost exclusively as an errhine, variously diluted with snuff, powdered liquorice root, lycopodium, &c.

Hydrargyri Iodidum Rubrum, U. S. (*Biniodide or Red Iodide of Mercury.*)

The two iodides of mercury resemble the two chlorides in their relative medicinal activity. This is, like corrosive sublimate, a powerful poison, as it is one of the preparations easily made from ingredients always at hand. The following is the officinal process in detail:—

Take of	Corrosive chloride of mercury . . .	half an ounce.
	Iodide of potassium	five drachms.
	Distilled water	a pint.

Dissolve the chloride of mercury in twelve fluidounces of water by trituration in a mortar, adding small quantities of this solvent at a time, and pouring it into a precipitating jar, Fig. 207, till the salt is completely taken up; then dissolve the iodide of potassium in four fluidounces of water by shaking them together in a vial. Now pour the solution of iodide into the solution of chloride contained in the precipitating jar; this will produce immediately a brilliant scarlet-colored precipitate of biniodide of mercury, leaving in solu-

tion the very soluble chloride of potassium. Now fold a plain filter, Fig. 209; having poured off the supernatant liquid from the

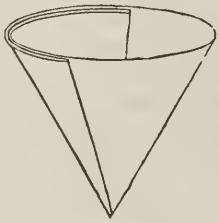
Fig. 207.

Precipitating jar.

Fig. 208.

4 oz. fluted vial.

Fig. 209.



Plain filter.

precipitated biniodide, throw the latter on the filter in a funnel and wash it by adding repeatedly fresh portions of pure water. Wrap the filter up in soft paper, and lay it away with a weight on it in a warm place till dry.

Biniodide of mercury is a beautiful scarlet-colored powder. Insoluble in water, but soluble in alcohol, and in solutions of iodide of potassium and chloride of sodium. It is wholly sublimed by heat, condensing in scales which are at first yellow but afterwards red. It is conveniently given in pill, but, perhaps, more frequently in solution of iodide of potassium with or without the addition of vegetable alterative preparations. Dose, $\frac{1}{16}$ to $\frac{1}{4}$ gr. (See *Extemporaneous Formulæ.*)

Hydrargyri Iodidum, U. S. (*Protiodide, or Green Iodide of Mercury.*)

Conveniently made by the apothecary or physician as follows:—

Take of Mercury	. . . .	an ounce.
Iodine	. . . .	five drachms.
Alcohol	. . . .	sufficient.

Rub the mercury and iodine together, adding sufficient alcohol to form a soft paste, and continue the trituration till the globules disappear. Then dry the iodide in the dark with a gentle heat, and keep it in a well-stopped bottle, covered with dark paper to protect it from the light.

The mercury is conveniently weighed by balancing a small paper pill-box on the scales, and giving to one side of it a little crimp, as shown in Fig. 210; so that a small stream of the metal may be poured out conveniently. The accurate adjustment of the quantity is troublesome. The iodine also requires care in weighing, owing to its corrosive action on the metals. The most convenient method is to balance a pair of watch-glasses by filing away the heavier of the two, or by pasting on to the lighter a small piece of tin foil, and then to lay them away for weighing corrosive substances. In the absence of this, a piece of

Fig. 210.

thick and well glazed writing paper may be put on to each plate and balanced. If the scales are kept in a case, as shown in the first chapter, they should be taken out whenever iodine is to be weighed on them, as the vapor becoming diffused through the air inside the case will corrode the metal.

Iodide of mercury is a greenish-yellow powder, insoluble in water, alcohol, or solution of chloride of sodium, but soluble in ether. Heated quickly, it sublimes in red crystals, which afterwards become yellow by age; it is converted into sesquiodide, which has a yellow color, and is believed to be more active. It is used as an alterative, usually in pill. Dose, $\frac{1}{4}$ gr. to 1 gr.; it is incompatible with iodide of potassium, which converts it into biniodide with separation of mercury.

Hydrargyri Sulphuretum Rubrum, U. S. (*Red Sulphuret of Mercury. Artificial Cinnabar.*)

When melted sulphur is brought in contact with mercury, direct union ensues; and if the compound is afterwards sublimed, it consists of dark scarlet, shining, crystalline masses, forming, when powdered, a beautiful scarlet color known by the name of vermilion; insoluble in water or alcohol. Volatilizes entirely when heated alone, but with potash it is reduced to metallic globules.

When the fumes are brought into contact with the surface of the body, the drug acts as a topical alteration, and becomes absorbed, affecting the system the same as other mercurials. It is used as a fumigation in some syphilitic skin diseases; ʒss, thrown on a hot iron and placed beneath the patient, wrapped in a blanket, will affect the object. The vapor should not be allowed to enter the lungs.

Hydrargyri Sulphuretum Nigrum, U. S. (*Ethiops Mineral.*)

Made by rubbing mercury and sulphur together till the globules disappear and a powder is formed.

Ethiops is an insoluble black powder which is rarely used for any purpose. It may be safely given in doses of from gr. v to ʒj, though marked by no very active properties.

Hydrargyri Oxidum Rubrum, U. S. (*Peroxide of Mercury. Red Precipitate.*)

Prepared by dissolving, with heat, mercury, ℔iij, in a mixture of nitric acid, f ʒxviij, and water, Oij; evaporating the liquor, and triturating what remains to a powder. This is put into a very shallow vessel, and heated till red fumes cease to rise. Red oxide is in orange-red, shining, crystalline scales; when strongly heated, it yields oxygen and metallic mercury, without the production of red fumes. It is insoluble in water, but soluble in nitric and hydrochloric acids. It is used only externally, as a stimulant and escharotic; it is much applied as an ointment to the eye; as an escha-

rotic, in powder, alone, or mixed with sugar, to specks in the cornea, over chancres, and fungous ulcers.

It requires long trituration to deprive it of its crystalline structure, the presence of which, of course, interferes with its successful application to delicate surfaces.

Hydrargyri Oxidum Nigrum, U. S. (*Black Oxide of Mercury.*)

Made by triturating calomel with a solution of caustic potassa. The protoxide of mercury precipitates, while chloride of potassium remains in solution, and is separated by washing.

Black oxide of mercury is in powder, which becomes olive-colored by the action of light. It is wholly dissipated by heat, metallic globules being sublimed. It is insoluble in water, but is wholly dissolved by acetic acid.

As a medicine, it is like calomel in its action, and is occasionally substituted for it, but is said to be liable, from occasionally containing deutoxide, to operate harshly. ʒij, placed on a hot iron, answers the purposes of a mercurial vapor bath. Triturated with lard, it substitutes mercurial ointment. Its dose, as an alterative, is $\frac{1}{4}$ to $\frac{1}{2}$ grain daily; as a sialagogue, gr. j to iij, three times a day, in pill.

Hydrargyri Cyanuretum, U. S. (*Bicyanide of Mercury.*)

By boiling ferrocyanuret of iron with red oxide of mercury, till the mixture becomes of a yellowish color, filtering, and crystallizing, this may be made with great facility by following, literally, the officinal directions. It is in freely soluble, permanent, transparent crystals, which evolve hydrocyanic acid, on the addition of hydrochloric acid. By heat it is decomposed, giving off cyanogen, and leaving a black residuum containing metallic mercury.

Bicyanide of mercury is, like the bichloride, a powerful poison, differing from that remedy in producing no epigastric pain in its operation. Some practitioners prefer it to bichloride in the same doses, and for the same purposes.

Hydrargyrum Ammoniatum, U. S. (*White Precipitate of Mercury.*)

When ammonia is added to a solution of corrosive sublimate, a peculiar compound, and not the oxide of mercury, is precipitated. This is a white, amorphous powder, in irregular masses, frequently bearing the impression of the fabric on which it is drained and dried. It sublimes when heated; is insoluble in water; dissolves in hydrochloric acid without effervescence; and, when heated with potash, gives off ammonia, and becomes yellow from the formation of the binoxide of mercury. Generally considered as a compound of amidogen or amide (NH_2) with chloride of mercury. This salt is never used internally; it is applied externally, to chronic skin affections in the form of ointment.

Hydrargyrum cum Creta, U. S. (*Mercury with Chalk.*)

Made by triturating three parts of mercury with five parts of prepared chalk, till it loses its fluidity and metallic lustre, and assumes the form of a dark-gray powder.

This process is one of great labor; and other modes of preparation have been employed. Those which proceed upon the principle of oxidizing the mercury are objectionable, as rendering this very mild powder drastic and violent in its action. It is much less used than blue mass (which it resembles in its action). The proportion of mercury is, partly from its defective preparation, larger than in blue mass, but it is said to be equally mild when well made. A good substitute is formed by mixing powdered blue mass with prepared chalk, extemporaneously.

Its chief use is in treating the complaints of children, the chalk neutralizing acid in the stomach, while the mercury increases the biliary secretion. Dose for a child, from $\frac{1}{2}$ to gr. iij.

For other mercurial preparations, see *Pills and Ointments.*

The following convenient test for the mercurials is very delicate, and well adapted to pill masses, &c.:—

On to a copper coin, brightened with a little NO_5, a small portion of the suspected substance is placed and moistened with a drop or two of water into a pasty consistence; a small fragment of KI is added to it, and on washing it a mercurial stain will remain. Numerous so-called "vegetable" and other "quack" pills will be found to show the presence of calomel in this way. The reaction in the case of blue mass is less rapid, though equally certain.

PART V.

EXTEMPORANEOUS PHARMACY.

CHAPTER I.

ON PRESCRIPTIONS.

In assigning a place in this work to prescriptions, and to the art of prescribing medicines, it is with a full appreciation of its intimate connection with therapeutics, a branch of knowledge with which the pharmaceutist can lay claim to but little practical acquaintance; and yet it must be apparent, that this subject has bearings which are peculiarly adapted to arrest the attention and claim the investigation of one whose daily avocations place him directly between the physician and the patient, and give him most favorable opportunities for judging of the pharmaceutical eligibility of combinations, and not unfrequently of their effects.

The art of prescribing medicines has so intimate a connection with that of preparing and dispensing them, that a treatise on the latter subject, not embracing the former, would be wanting in its most interesting feature to the student of medicine and the physician, and in a work like the present, designed in part for these classes, it seems appropriate to approach the art of dispensing through a brief general treatise on that of prescribing.

If any evidence were needed of the necessity of this kind of instruction, it would be furnished in the acknowledged inaccuracy of extemporaneous prescriptions as generally issued, especially by inexperienced practitioners. It is a common remark of recent graduates of medicine, that one of their greatest difficulties is in writing prescriptions; lacking the means of systematic instruction in this most important practical duty, they are exceedingly apt to fall into confused and unscientific methods of prescribing, from which no amount of experience entirely rids them.

To those who have opportunities of judging, it will be scarcely necessary to add illustrations of this, but for my own information, and that of my readers, I have made the following table, founded upon an examination of a large number of prescriptions compounded by myself and several other apothecaries, in different

parts of Philadelphia. They were taken indiscriminately from the files of different years, and different seasons of the year. Although the number and extent of the prescriptions examined, and of the points noted, are not sufficient to justify any very important conclusions, the tables may serve as a nucleus for future investigations, and may illustrate some points connected with the subject of the present chapter.

Analytical Table of Prescriptions. Showing the percentage of Errors in Nomenclature, the Proportion of each of the Prevailing Forms of Preparation, the Extent to which some of the leading Drugs are prescribed, &c.

Prescriptions.	First 100.	Second 100.	Third 100.	Fourth 100.	Fifth 100.	Sixth 100.	Average.
Correct in nomenclature	42	59	39	...	75	70	57
Incorrect in nomenclature	58	41	61	...	25	30	43
With directions for use	43	65	...	59	65	55	57
Without directions for use	57	35	...	41	35	45	43
Single permanent preparations	26	36	19	...	22	25	26
Compound and strictly extemporaneous preparations	74	64	81	...	78	75	74
In the form of pills	22	17	28	16	21	21	21
" powders	21	18	17	10	20	19	17
Various liquid forms	41	46	42	50	50	47	46
Directed for infusion	4	5	1	4	4	1	3
For external use	9	21	14	20	6	15	14
Suppositories	1	...	...	...	...	...	1
Containing pil. hydr. or hydr. c. creta	13	9	5	5	15	13	10
" calomel	11	11	15	8	16	14	13
" op. morph. or hyosc.	26	27	16	3	30	39	24
" iodine or iod. potas.	6	2	12	1	4	10	6
" cinchona or its alkaloids	7	11	11	7	12	7	9
	63	60	59	24	77	73	62

NOTE.—The first, second, and third hundred were all compounded at one shop, the remainder at different establishments. Very slight errors in nomenclature were not counted among those marked incorrect in nomenclature, and as the observation was made by different parties, an entirely uniform standard was not adopted. Among the various liquid forms, in some of the columns, are a few which are also included under the head, for external use.

From an analysis of 140 prescriptions in a western city, the following items are extracted: Correct in nomenclature, 81; incorrect do. 59. In pills 15, powders 29, liquid forms 72. For external use 18.

The art of prescribing properly is the practical application of the knowledge of therapeutics, chemistry, and pharmacy, to the cure of disease. No department of his duties puts the skill of the physician to a closer test; none calls for the exercise, to a greater extent, of that invaluable quality, whether intuitive or acquired,

called *tact;* and yet few departments of medical knowledge are to be acquired with less facility, or are less insisted upon as necessary branches of a medical education.

Although the art of prescribing can only be acquired practically, the general principles pertaining to it are capable of classification, and have been fully discussed.

The celebrated *Pharmacologia* of Dr. Paris, of London, published originally in 1812, and republished in this country in 1844, contains the fullest dissertation in our language upon "the science and art of prescribing." The reader is referred to that elaborate work for a full discussion of the subject. Many of the views taught at that time are, however, abandoned, and the subject is capable of being much simplified in accordance with the more modern improvements in pharmacy. The large number of efficient and permanent Galenical preparations make prescribing comparatively simple to the practitioner who has kept pace with the advance of the times, while the publication of *Formularies* in which all the preparations of each drug, whether permanent or extemporaneous, are detailed, has to a certain extent substituted an original and extemporaneous system of selection and combination of remedies.

Medicinal preparations which are kept on hand by the apothecary, to be dispensed alone or used in compounding prescriptions, are called *permanent*, while those compounded by direction of the practitioner to meet the indications as they arise, in the course of disease, are called *extemporaneous.*

This distinction, however, is far from being absolute or even well marked. Some of those called permanent are known to deteriorate in a greater or less degree by age, while many classed as extemporaneous will keep an indefinite length of time. For most of the permanent class we have formulæ or prescriptions, either published in *Pharmacopœias*, *Dispensatories*, or *Medical Formularies*, while the extemporaneous are the product of the skill and ingenuity of the prescriber at the bedside of his patient. The publication of well contrived formulæ, by which the crude drugs are brought into suitable conditions for use, as the infusions, tinctures, syrups, extracts, &c., and by which these and the drugs themselves are combined into still more available preparations, greatly facilitates the practice of medicine, particularly in those districts where, from the absence of apothecaries, it is impossible to reach perfection in extemporaneous pharmacy. Objections lie against the general use of this last class of preparations to the exclusion of those which are dictated by the emergencies of the case, from the impracticability of adapting any set of formulæ to every shade of disease and of idiosyncrasy, and from the impossibility of the practitioner storing securely in his memory their ingredients, proportions, &c.; so that the thorough student has no resource but to acquire a knowledge of the *principles*, to regulate the selection and combination of remedies, and learn the *art* of prescribing *experimentally.* A limited number of formulæ, framed with a view of illustrating these

principles and modes of combination, will, with this object in view, be found highly useful, if not indispensable to the student; but these must be regarded as stepping-stones to a knowledge of the art of prescribing rather than as embodying that knowledge. The vast extent and variety of adaptation of the materia medica preclude the possibility of compressing into any series of formulæ, a complete view of all the shades of combination and modification which are attainable on enlightened therapeutical and pharmaceutical principles.

In the preparations introduced to view thus far, a prominent distinction has been drawn between those which are officinal in the *U. S. Pharmacopœia*, and those which are not, introducing the former alone into the syllabi intended for the use of the student in committing to memory their names, proportions, properties, and doses. In the part of the work which follows, this distinction is regarded as less important, and most of the formulæ are introduced less with a view to impress them upon the memory, than to illustrate the pharmaceutical principles on which they are based.

The very obvious division of preparations into simple and compound needs no other mention than to explain that the addition of a vehicle or menstruum, not added with a view to its medical effect, does not render a preparation compound, in the sense in which that term is ordinarily applied. *Simple* rhubarb pills contain rhubarb and soap; while *compound* rhubarb pills contain rhubarb, aloes, myrrh, and oil of peppermint; and with a view to furnish distinctions between preparations which have very similar composition, the term compound is sometimes useful. Opium pills contain 1 grain of opium and $\frac{1}{5}$ grain of soap; while *compound* soap pills contain the same ingredients in different proportions.

The Language used in Prescriptions.

In Great Britain and the North of Europe, prescriptions are written in Latin; in France, in the vernacular language. We mostly follow the British custom, although some of our practitioners occasionally depart from the usual style, and follow the *Pharmacopœia* by inditing their prescriptions in plain English. The relative adaptation of Latin and English for the purpose has long been discussed, and is still a mooted point among physicians and pharmaceutists. It is scarcely worth while to dwell upon the arguments advanced on either side, and which seem naturally to suggest themselves. The chief desideratum is to secure accuracy without an unnecessary and cumbersome phraseology, and for this purpose the *officinal names* of all medicines are to be preferred to either of their common and changing synonyms. An extended view of the subject cannot fail to convince one of this. Many medicines are called by very different names in different parts of the country, and the same name is liable to be applied to either of several different drugs.

If snakeroot were ordered, the pharmaceutist might be at a loss

whether serpentaria, cimicifuga, asarum, senega, eryngium, or some of the numerous other roots occasionally, or perhaps locally, denominated snakeroots, were desired; while, if the specific English name, as *Virginia*, *Canada*, *black*, or *button* snakeroots, was applied, the merit of conciseness would be sacrificed.

If chamomile were ordered, it would be necessary to specify whether Roman, German, or American; while in Latin, anthemis, matricaria, or anthemis cotula would be both short and distinctive.

In the foregoing illustrations, however, we have the least forcible instances. There can be no comparison between the names sugar of lead and plumbi acetas, white vitriol and zinci sulphas, liver of sulphur and potassii sulphuretum, salt of tartar and potassii carbonas. The name which expresses the chemical composition of a substance is generally, of all that can be devised, the best; and hence, even in common language, most familiar chemical substances are beginning to be called by their chemical names. Although there is little difference between the English and the Latin chemical names, the latter has the advantage for use in prescription: it is easier of abbreviation, or its abbreviations are more familiar; while the omission of the connecting preposition *of*, between the two parts of the name, reduces it to a single compound word, rendering it shorter and more quickly written.

It is often said, and not without truth, that the Latin used in prescription is, for the most part, quite incorrect, and especially when the terminations are written out, or attempted; but grammatical errors are certainly far less important than either chemical, pharmaceutical, or therapeutical; and when we consider how few physicians, even among those classically educated, have advantages of keeping up, throughout the busy scenes of their professional career, the knowledge of Latin acquired in their schoolboy days, we can scarcely wonder that many errors of this description occur. Moreover, the language used in prescription, viewed with reference to its abbreviations, signs, and Latinized names of various origin, must be regarded as distinct from the Latin taught in schools, and requires to be studied in connection with scientific nomenclature generally, and, in fact, constitutes a part of the study of materia medica and pharmacy. Every officinal drug and preparation has its particular name given to it authoritatively in the *Pharmacopœia*, and those not there mentioned may be distinguished by their appropriate botanical or chemical designations. The groundwork of a correct writing of prescriptions is a knowledge of these names; and it matters little whether the physician write his prescriptions in Latin or English, if he designates each individual article by its *officinal name*.

The propriety of using the officinal Latinized names in a plain English formula may admit of a doubt, but, if sanctioned by custom and authority, might be adopted, and thus the principal objection to the plain English prescription would be removed.

The officinal name, though framed upon a Latin model, might be separated from the idea of its origin, and used in the prescription as a distinctive pharmaceutical term, following the genius of the language in which it is used: in a Latin prescription, its terminations might be varied as the construction of that language requires; and in an English prescription, might follow the rules for the construction of a correct English sentence. We have very many officinal names that are as commonly incorporated into our language as the English synonyms attached to them, and the objections to considering all the names in the American *Pharmacopœia* as American names are, it appears to me, not such as to overrule a custom which, on so many accounts, is to be desired.

The officinal names are spoken of in detail in the chapter on the *Pharmacopœia*, and the importance of a study of them has been elsewhere referred to; and I repeat, if these were properly mastered by the student, and invariably used to designate the drugs and preparations to which they belong, the garb in which the prescription is clothed would be comparatively of little importance.

There are some cases in which the use of an explanatory synonym in parentheses seems quite necessary, whether the name be Latinized or not; and in such cases it should never be omitted for the sake of elegance or attempted correctness of diction. In prescribing the finer kinds of magnesia, there is no other resource than to say in parentheses, (Henry's), (Husband's), or (Ellis's), as the case may be. Liquor aloet. comp. would be quite indefinite without (Mettauer) appended, and tinct. guaiaci comp. would be misunderstood unless accompanied by the added (Dewees) to explain it.

The remarks before made apply to the *names* of substances designated in prescriptions; the other parts of the prescription, which will be referred to more particularly in the sequel, consist chiefly of abbreviations and signs which custom has long sanctioned, and which are considered to pertain particularly to the *Latin* prescription, though, as before stated, occasionally, and without any breach of propriety, used in connection with the English.

In the prescriptions appended to the several chapters which follow, numerous examples are given of both Latin and English prescriptions, and they will be appropriately preceded by the following, taken from Dr. Pereira's *Selecta e Prescriptis*.[1]

Grammatical Explanation of Prescriptions.

(1.) R.—Ferri Carbonatis, drachmam cum semisse (℥jss).
(2.) Rhei pulveris, grana quindecim (gr. xv).
(3.) Olei Anthemidis, guttas quinque (gtt. v).
(4.) Conservæ Rosæ, quantum sufficiat ut fiat massula in pilulas viginti dividenda, quarum sumat æger tres octavis horis.

(1.) Recipe, verb active, imp. mood, 2d pers. sing. agreeing with *Tu*, understood; from *Recipio, ĕre, cepi, ceptum*, 3d conj. act. Governs an accusative.

[1] Republished in this country as the *Physician's Prescription Book*.

Drachmam, noun subst. acc. sing. from *Drachma, æ*, f. 1st decl. Governed by *Recipe.*
Cum, preposition. Governing an ablative case.
Semisse, subst. abl. case, from *Semissis, is*, f. 3d decl. Governed by *cum.*
Carbonatis, subst. gen. sing. from *Carbonas, atis*, f. 3d decl. Governed by *Drachmam.*
Ferri, subst. gen. sing. from *Ferrum, i*, n. 2d decl. Governed by *Carbonatis.*

(2.) Recipe, understood.
Grana, subst. acc. pl. from *Granum, i*, n. 2d decl. Governed by *Recipe*, understood.
Quindecim, adj. indeclin.
Pulveris, subst. gen. sing. from *Pulvis, eris*, m. 3d decl. Governed by *Grana.*
Rhei, subst. gen. sing. from *Rheum, i*, n. 2d decl. Governed by *Pulveris.*

(3.) Recipe, understood.
Guttas, subst. acc. pl. from *Gutta, æ*, f. 1st decl. Governed by *Recipe*, understood.
Quinque, adj. indeclin.
Olei, subst. gen. sing. from *Oleum, ei*, n. 2d decl. Governed by *Guttas.*
Anthemidis, subst. gen. sing. from *Anthemis, idis*, f. 3d decl. Governed by *Olei.*

(4.) Recipe, understood.
Quantum, adverb. Governing the genitive case.
Sufficiat, verb impers. potent. mood, pres. tense, from *Sufficio, ĕre, feci, fectum*, neut. and act. 3d conj.
Conservæ, subst. gen. sing. from *Conserva, æ*, f. 1st decl. Governed by *Quantum.*
Rosæ, subst. gen. sing. from *Rosa, æ*, f. 1st decl. Governed by *Conservæ.*
Ut, conjunct. Governing a subjunct. mood.
Massula, subst. nom. case, *a, æ*, f. 1st decl.
Fiat, verb, subj. mood, pres. tense, 3d person singular, from *Fio, fis, factus sum* vel *fui, fieri*, neut. Governed by *Ut*, and agreeing with its nominative case *Massula.*
Dividenda, particip. nom. case, fem. gend. from *Dividendus, a, um* (à *dividor, i, sus*, pass. 3d conj.). Agreeing with *Massula.*
In, preposition. Governing an accusative case.
Pilulas, subst. acc. pl. from *Pilula, æ*, f. 1st decl. Governed by *In.*
Viginti, adj. indecl.
Quarum, relative pronoun, gen. pl. fem. from *Qui, quæ, quod.* Agreeing with its antecedent *Pilulas* in gender and number. Governed in the gen. case by *Tres.*
Æger, adj. mas. gend. nom. *Æger, ægra, ægrum.* Agreeing with *homo*, understood.
Sumat, verb, 3d pers. sing. imp. mood, from *Sumo, ere, psi, ptum*, act. 3d conj. Agreeing with *homo*, understood; governing an acc. case.
Tres, ad. acc. pl. fem. from *Tres, tres, tria.* Agreeing with *Pilulas*, understood, and which is governed by *Sumat.*
Horis, subst. abl. plural, from *Hora, æ*, f. 1st decl.; signifying part of time, and therefore put in the abl. case.
Octavis, adj. abl. plur. fem. from *Octavus, a, um.* Agreeing with *horis.*

Symbols or Signs used in Prescriptions.

♏. Minim, $\frac{1}{60}$ part of a fluidrachm.
gtt. Gutta, a drop; guttæ, drops.
℈j. Scrupulus vel scrupulum, a scruple=20 grains.
ʒj. drachma, a drachm=60 grains.
f℥j. fluidrachma, a fluid or measured drachm.

℥j. Uncia, an officinal ounce=480 grains.
f℥j. Fluiduncia, a fluid or measured ounce.
℔j. Libra, a pound, understood in prescriptions to apply to an officinal pound of 5,760 grains.
Oj. Octarius, a pint.
gr. Granum, a grain; plural, grana, grains.
ss. Semis, half, affixed to signs as above.

The Latin numerals are employed in prescription—i, ij, iij, iv, v, vi, vij, viij, ix, x, xi, xij, xv, xx, XL, L, C, &c.; and in the directions, when written in Latin, a variety of antiquated terms, explained in Dr. Pereira's little work before mentioned, but requiring too much space for insertion here.

Before leaving the subject of the signs employed in prescription, it seems proper to advert to the errors which frequently occur from their careless use, and which have led some practitioners to advocate their entire abandonment. They are, however, too well established in the actual practice of this country and England, and too convenient to be readily supplanted. The angle and curve ʒ may be made so carelessly as to resemble the ϑ with a flourish at top, and ℥j may look like a ʒj, or may be so completely perverted from its recognized shape as to leave the reader in doubt whether a ϑ or ʒ is intended. Notwithstanding the apparent absurdity of this, there are not a few prescriptions on our files in which the sign intended has been reached only by guessing, or by reasoning upon the known dose of the drug, rather than upon the shape of the sign. A flourishing style of chirography is nowhere less in place than on a physician's prescription. The numerals are equally liable to error if carelessly made, the difference between j and v, and between iv and iij, and between x and v, is often quite obscured by a neglect of the plain and necessary precautions of accuracy and care. It is not easy to illustrate in print what an examination of the chirography of many prescriptions would make apparent, that the *reading* of a prescription frequently requires more skill and judgment than *compounding* it.

Abbreviations.

Mistakes not unfrequently arise from unskilful abbreviations, for, while there can be no objection to shortening many of the long names given to medicines, there is certainly great danger from the inordinate and unskilful exercise of this privilege; the word *cal.* is an occasional and very poor abbreviation of hydrargyri chloridi mite. Through a careless termination of familiar words, serious accidents are liable to occur. Several years have elapsed since I received a prescription for *hydrate potassa* ʒj, to be dissolved in water f℥iij (dose, a teaspoonful), and it was only through a care which has become habitual that I saved a delicate lady in that case from taking large doses of hydrate of (caustic) potassa instead of hydriodate of potassa. There were no directions for use appended,

so that I had not the advantage they give in cases of doubt. The abbreviations allowable in prescriptions might fill some pages if tabulated, but it appears to me useless to go into detail on the subject, as no practical advantage would result except to the student who should make them his especial study, while the habit once acquired of writing every word so fully as that it could be mistaken for no other, would quite obviate the evils complained of.

CHAPTER II.

ON THE WRITING OF PRESCRIPTIONS.

The first care to observe in writing a prescription, is to have suitable paper and pencil, or preferably, pen and ink. The habit of some of using the margin of a newspaper, the fly-leaf of a schoolbook, or any piece of flimsy material at hand, for inditing a prescription, upon which may depend the life of the patient, cannot be too strongly condemned. It indicates a want of care in the physician, which, if carried into other duties, would quite unfit him for the responsibilities of his profession. Many physicians adopt the plan of cutting, from time to time, suitable fragments of good paper, which are carried in a pocket-book or wallet, and are always at hand on emergencies. With a view to economy, the fly-leaves of letters, and notices, which would be otherwise wasted, may be pressed out, and appropriated to this object. In Philadelphia, and probably elsewhere, pharmaceutists are in the habit of printing their cards at the head of suitable prescription sheets, and distributing them among physicians with a view to attracting business to their shops; a practice more honored in the breach than in the observance. Some physicians print prescription papers, with their name and address attached, which, however unprofessional some may consider it, is not without one advantage—it enables the apothecary always to trace the prescription readily to its source in case of difficulty.

Having the proper prescription paper, the next step is to write at the top the name of the patient; this precaution, which is very often neglected, is important for several reasons: 1st. It enables the nurse or attendant to distinguish, by a certain and ready means, between prescriptions designed for different patients; and the name being transferred to the label, there is no excuse for a similar mistake in "administering." 2d. It enables the apothecary, in every case, to avoid the mistake so often made in the hurry of

business, of dispensing a package of medicine to one of several customers in waiting which should have been given to another. 3d. It facilitates the recognition of the prescription upon the apothecary's file when its renewal is called for; and, finally, it evinces a care which is commendable on so important an occasion as prescribing for the sick.

The practice of heading a prescription with the generic name of the class of medicines to which it belongs, should be observed when there are two or more in use; as the *Gargle*, the *Liniment*, or the *Fever Mixture*. Frequently, however, this is superseded by giving its designation in the *subscription*, or by proper directions for its use. As a general rule, I would say that all topical remedies should be distinctly marked *For external use*. Some mistakes have originated from neglect of this precaution which would be most ludicrous if the subject was not often too serious for merriment. The administration of an ammoniated liniment, in tablespoonful doses, while a cinchona bark mixture is applied over the seat of rheumatic pain, is a blunder which has occurred, and may again.

It is well, in many cases, to copy on the label the entire prescription. A physician in large practice, unless favored with a very retentive memory, may forget the details of his prescription of the previous day. An aged practitioner of our acquaintance, while in practice for the last few years of his life, made this an invariable rule, with the view of assisting him in the accurate and judicious dispensation of advice from day to day to his patients. The same precaution is important also in travelling. It is often prudent for the physician to direct the apothecary to mark the medicine prescribed *Poison*, or, as is sometimes done, "*Use with care;*" giving, at the same time, the particular instructions for its use.

The prescription may be divided, for the purpose of study, into the following parts, each of which will be separately considered:—

1. The superscription.
2. The inscription.
3. The subscription.
4. The signature.

The *Superscription* is of very little importance; divested of its superstitious origin, it consists of a very short abbreviation of the Latin verb *Recipe*, imperative mood of *Recipio*, I take, viz: the letter ℞, which is often printed near the top of the prescription sheets above mentioned. In French, the letter *P* is used for *Prenez*. In English formulas, the ℞ may be substituted by *Take of*.

The *Inscription* is the indication, seriatim, of the names and quantities of the remedies prescribed. The order in which these are written is not a matter of much real importance, as a competent pharmaceutist will, in mixing them, depart from the sequence observed in the prescription, if thought best; while the physician,

particularly if not experienced in writing prescriptions, will find it more convenient to follow the order of their therapeutical importance rather than the rotation in which they should be added.

In the sequel I shall refer to the therapeutical classification of ingredients, which, in a well contrived prescription, would be written in the following order:—

1. The basis.
2. The adjuvant.
3. The corrective.
4. The excipient.
5. The diluent.

This is not only the most elegant, but the most natural rotation to be observed.

One of the greatest difficulties to the beginner, in connection with this subject, is in determining, as the prescription proceeds, the appropriate quantity of each ingredient, so as to have each in due proportion, and with its right dose; this becomes easy by the employment of the following

Rule for Apportioning Quantities.—Write down the names of the several ingredients first, without regard to quantity; then *having determined upon the quantity of the whole preparation*, and the *dose to be prescribed, the whole number of doses it will contain will be readily calculated.*

As doses are, at best, only approximate, we may depart from the precise figures obtained by dividing the whole number of drachms, grains, &c., in the preparation, by the number of doses it will contain, so as to get even numbers or fractions of a drachm and ounce.

In directing pills, or powders, we have the means of attaining considerable accuracy, and may readily direct a mixture, divided into ten, twenty, or thirty parts, from the very convenient relations of these numbers to the drachm and scruple weights; but it will be found more convenient in dispensing and administering the preparations, to have six, or twelve, or twenty-four parts ordered, as these numbers have relation to the number of grooves in the pill machine, and to the number of hours in a day.

The Table below will assist the beginner in prescribing liquids, and will serve for reference until he becomes accustomed, practically, to this rather difficult part of his duties. Having fixed upon the bulk of his mixture or solution, he will remember that there are *about*

8 wineglassfuls	(each containing	f℥ij)	in a pint	(Oj, f℥xvj).
30 tablespoonfuls	("	" f℥ss)	in a pint	(Oj, f℥xvj).
15 tablespoonfuls	("	" f℥ss)	in half a pint	(f℥viij).
12 tablespoonfuls	("	" f℥ss)	in 6 fluidounces	(f℥vj).
20 dessertspoonfuls	("	" f℥ij)	in 6 fluidounces	(f℥vj).
15 dessertspoonfuls	("	" f℥ij)	in 4 fluidounces	(f℥iv).
30 teaspoonfuls	("	" f℥j)	in 4 fluidounces	(f℥iv).
15 teaspoonfuls	("	" f℥j)	in 2 fluidounces	(f℥ij).
8 teaspoonfuls	("	" f℥j)	in 1 fluidounce	(f℥j).

We have an illustration of this method of division in the officinal liquor morphiæ sulphatis, in which one grain of the salt is dissolved in one fluidounce of water; as there are 8 teaspoonfuls in an ounce, one teaspoonful represents $\frac{1}{8}$ grain, which is about the usual dose. In the case of liquids to be given by drops, care must be taken to distinguish between aqueous, alcoholic, and oily liquids. By reference to the table, given in the chapter on Metrology; the relative size of drops pertaining to different liquids will appear; in this connection it will be only necessary to refer to that table, and to apply the same general mode of calculation to the apportionment of doses of these.

One cause of fallacy, with the student, in prescribing by drops, arises from confounding the size of drops of one ingredient of a preparation with the size of drops of the whole preparation after it is made. Thus, if a fluidrachm of tincture of belladonna were added to seven fluidrachms of an aqueous solution of morphia, or tartar emetic, we should calculate about 60 drops to each fluidrachm, not 120, which would be proper, were the alcoholic liquid in much the larger proportion.

It will aid the student to acquire facility in the apportionment of qualities, to inquire of himself, or his companion in study, how much of each ingredient is contained in each dose of the various compounds for which prescriptions are given.

The *Subscription* has reference to the manner of mixing and dividing the medicine. In Latin prescriptions, it usually consists of short abbreviations, or signs, which are familiar to pharmaceutists, though in some cases it is written out in full in Latin, and, in others, in plain English. The verb *misce* (imperative mood of misceo, I mix), or the letter *M.*, designed to represent it, constitutes the most common subscription. Sometimes, where especial skill or care is required in the preparation, *secundum artem*, or *S. A.* is affixed to it; when omitted, however, this is understood. The verb *solve* (imperative of solvo, I dissolve), is more appropriate where a simple solution is prescribed; or *macera* (imperative of macero), where the process of maceration is directed. Where filtration is necessary, write thereafter *et cola.* When a medicine is directed in very fine powder, the practitioner may make choice of *tere bene* (triturate well), or *fiat pulvis subtilissimus* (make a very fine powder). It is, perhaps, an improvement on the above to direct more specifically the sort of preparation designed; it gives the pharmaceutist a clue, which is sometimes useful to him in compounding, as well as in correcting gross error. The following terms, with their proper abbreviations and translations, may serve to guide the student in writing his *subscription.* They include the appropriate directions for dividing medicines into powders, pills, lozenges, &c., and will close the notice of this part of the prescription.

Fiat pulvis, Ft. pulv. Make a powder.
Fiant pulveres xij ; Ft. pulv. xij. } Make twelve powders.
Fiat pulvis et divide in chartulas xij ; Ft. pulv. et divid. in chart xij. } Make twelve powders.
Fiat pulvis in chartulas xij, dividenda : Ft. pulv. in ch. xij, div. } Make twelve powders.
Fiant chartulæ xij ; Ft. chart. xij, divid. } Make twelve powders.
Fiat solutio, Ft. solut. Make a solution.
Fiat injectio, Ft. inject. Make an injection (for urethra).
Fiat collyrium, Ft. collyr. Make an eye-wash.
Fiat enema, Ft. enema. Make an injection (for rectum).
Fiat suppositorium, Ft. supposit. Make a suppository.
Fiant suppositoria iv ; Ft. suppos. iv. Make 4 suppositories.
Fiat massa, Ft. massa. Make a mass.
Fiant pilulæ xij ; Ft. pil. xij. } Make twelve pills.
Fiat massa in pilulas xij, dividenda ; Ft. mas. in pil. xij, div. } Make twelve pills.
Fiat massa et divide in pilulas xij ; Ft. mas. div. in pil. xij. } Make twelve pills.
Fiat infusum, Ft. infus. Make an infusion.
Fiat haustus, Ft. haust. Make a draught.
Fiat gargarysma, Ft. garg. Make a gargle.
Fiat mistura, Ft. mist. Make a mixture.
Fiat emulsio, Ft. emuls. Make an emulsion.
Fiat electuarium, Ft. elect. Make an electuary.
Fiat confectio, Ft. confect. Make a confection.
Fiat emplastrum 6 x 4 ; Ft. emp. 6 x 4. Make a plaster 6 x 4.
Fiat emp. epispasticum, Ft. emp. epispast. } Make a blister.
Fiat emp. vesicatorium, Ft. emp. vesic. } Make a blister.
Fiat unguentum, Ft. ung. Make an ointment.
Fiat ceratum, Ft. cerat. Make a cerate.
Fiat cataplasma, Ft. cataplas. Make a poultice.
Fiat linimentum, Ft. linim. Make a liniment.
Fiant trochisci xxiv ; Ft. troch. xxiv. Make 24 lozenges.
Fiat massa in trochiscos xl, dividenda ; Ft. mas. in troch. xl, div.

The *Signatura* is rarely written in Latin, at least in this country. It comprises the directions as to the dose and mode of administering the medicine, and is especially addressed to the patient, or those in attendance upon him. This should be distinctly written in the vernacular. None of the reasons for the employment of a learned, or technical language, in the other portions of the prescription, apply to this; on the contrary, a due regard to the avoidance of mistakes by the apothecary, and by the patient or his attendant, forbids it. It is very common to omit this part of the prescription entirely, and to depend upon a verbal direction as to the use to be made of the medicine. Sometimes two boxes of pills are ordered for the same patient simultaneously, or at short intervals, without any reliable means of distinguishing them, and when they are to be renewed, the apothecary may confound them, in consequence of the patient sending the wrong box, or through a slight error in his own labelling. Of 500 prescriptions taken indiscriminately from the files of three different shops, I find 43 per cent. have no definite directions, as shown in the table on p. 410, and a considerable proportion have no *signatura*. The practice of writing—"To be used as directed"—is equivalent to omitting this part of the prescription, and in labelling, this is adopted by the apothecary in all cases, where the physician has omitted giving any directions.

As an example of the results which may follow from this kind

of direction, the following incident has been related by a professional friend. Two vials were in the chamber of a patient, each containing a fluidounce of liquid, and each about the same size; one contained sweet spirit of nitre, and the other blistering collodion. The nitre was to be given in teaspoonful doses occasionally, and the blistering liquid was of course to be applied externally. At twilight, the nurse, not noticing the difference in the color, and consistency of the liquids, and finding them both labelled alike, put in the patient's mouth what she should have applied to her chest, thus producing a most distressing inflammation, which deprived the poor patient of her proper food, and doubtless contributed to exhaust her struggling vitality.

The danger of this kind of mistake is lessened by using for any two prescriptions of very different properties, different kinds of vials; thus for a preparation to be taken internally, a fluted flint vial, and for a liniment, one of the plain German flints, or better still, in the one case a round, and in the other an oval vial.

The only remaining part of the prescription to be mentioned, is the addition to the foregoing of the name or initials of the writer, and the date; of these, it may be remarked, that the *name* in full is on every account preferable. In a large city, where there are hundreds of physicians, it is impossible for pharmaceutists, and much less their clerks and assistants, to become familiar with the handwriting and initials of all of them, to say nothing of those instances in which two or more have the same initials. Now if this practice of signing prescriptions has any utility at all, it must be, that it should be understood by the apothecary, so that if he suspects an error, or requires any explanations, he may make the necessary inquiries to correct it, without interrogating his customer and exciting alarm. Besides, there are some dangerous substances, especially such as are used for criminal purposes, that the druggist is only justified in vending by the sanction of a responsible name, and this name should therefore, be clearly and intelligibly written.

The date of the prescription is almost universally written in numerals, at least in Philadelphia; this fashion is probably owing, mainly, to a large number of the most eminent practitioners of the last generation being members of the Society of Friends, and to the wide diffusion of the peculiarities of this sect in the "Quaker City," and from it, as the centre of medical instruction to other localities.

When the patient is in moderate circumstances, the physician indicates that fact to the apothecary by the letter P, in one of the lower corners of the paper. If very poor, P P is written; from a conscientious apothecary, either of these marks secures a reasonable reduction in the price charged, and its omission by the physician leads to suspicions that the patient is not deserving of charity.

CHAPTER III.

ON THE ART OF SELECTING AND COMBINING MEDICINES.

The study of Materia Medica and Therapeutics is designed to acquaint the student with the uses and powers of remedies, and to prepare him to make a proper selection from these to meet the ever varying phases of disease.

The importance of this kind of knowledge cannot be appreciated until the actual emergencies of practice arise, and the necessity becomes apparent of an extended and a thorough knowledge of the weapons for combating disease.

A full and recent treatise on Materia Medica should always be within reach of the physician, and one or more of the best medical journals should replenish his library with the most recent discoveries and improvements; nowhere can a professional man less afford to economize than in his books.

In this age of active inquiry and unceasing investigation, a very few years suffice to produce important changes, both in the theory and practice of medicine; and the physician who stands still while progress is all around him, can expect no better fate than that of the mechanic, the farmer, or the man of business, who is content with the appliances of the past age in endeavoring to compete with those possessed of the facilities of the present.

While a sound conservatism, a becoming deference to those who have gone before us, and to the great medical authorities in our own time, should prevent a hasty departure from established principles or mode of treatment, there is a wide and profitable range for experiment in the vast extent and variety of the materia medica, and the combinations of which individual remedies are susceptible.

It cannot be denied, that many skilful physicians employ a very restricted materia medica; there are hundreds in the United States who carry about with them all the weapons they use for combating the usual forms of disease, in some twenty or thirty vials, inclosed in a pair of saddle-bags; while, for unusual cases, they keep perhaps as many more on their office shelves. Though the frequent success of such cannot be questioned, we can draw no inferences from this fact to disparage the employment of an extended and varied assortment of remedies.

To what purpose has the bounty of nature spread everywhere

plants of such varied and unsuspected properties; and why is art from the exhaustless mine of nature ever turning up some new product, endowed with varied and perhaps health-restoring powers, if the physician into whose special keeping the business of testing their virtues is given, neglects the injunction "prove all things; hold fast that which is good."

In the foregoing remarks, I would not be understood as countenancing a departure from the usual materia medica, except where called for by the requirements of practice, and justified by sound discretion; and much less would I encourage any of those innovations upon well established principles, which have taken shape in the various *Pathies*, now so prevalent and so lamentably deficient in the indispensable elements of common sense and common honesty.

In the selection of medicines, then, let the physician have before him the whole known materia medica, with a complete knowledge of which he should be equipped from the start. Let him *first* select an individual from its class, with a view to all its properties, as likely to effect the immediate symptoms he is combating, and the general result of the case; and *second*, let him select the best preparation of it with reference to efficiency, to safety, to physical properties, and to all other circumstances. When there is a single medicine, which will fully meet the indication, there is no use of mixing it with others, except so far as its preparation in eligible form requires, a subject treated of in the sequel; when there is an officinal preparation, whether simple or compound, which is adapted to the case, it is generally better to prescribe it by its officinal name, than to attempt a similar original combination; thus *pilulæ catharticæ compositæ* are found to answer a common indication in disease so very frequently, that they have almost superseded extemporaneous preparations of the same, or nearly the same ingredients: this is the case, though to a less extent, of other officinal formulæ. A common exception is furnished in *pilulæ quiniæ sulphatis*, which are frequently prescribed extemporaneously, in proportions slightly varying from the officinal, in order to secure their being freshly prepared.

Officinal preparations are best selected in emergencies, since they are ready without the delay of compounding them, while most forms of extemporaneous prescription require considerable time for their preparation. Physicians should be somewhat influenced by economical motives, in prescribing for persons of moderate means. Preparations which are kept on hand by the apothecary, are cheaper than those which are mixed extemporaneously. In almost every class of medicines, there are those which are very costly; and it is well when they can be substituted by others in prescribing for the poor. Many practitioners are in the habit of directing for such, the sulphates of cinchonia and quinidia, instead

of that of quinia; a plan much resorted to by those residing in remote situations, who have to act as their own apothecaries.

On the Art of Combining Medicines.

Simplicity is an object not to be overlooked in prescribing, notwithstanding the advantage obtained by combining, in a single preparation, the virtues of several medicines; there is, I think, more danger of the inexperienced attempting complications, not sanctioned by sound science, than of his erring on the side of simplicity.

In the remarks which follow, I shall endeavor to treat methodically, and as briefly as possible, the several advantages to be attained by medicinal combinations, and the means by which they may be most readily and safely fulfilled; and in the series of Prescriptions appended, shall seek further to illustrate the subject.

In compound prescriptions, we usually recognize one ingredient selected from the materia medica as the most important in a therapeutical point of view. This is designated as the *basis*. Sometimes two or three remedies may be combined to form the basis, but if they have different therapeutical effects, they are considered as *adjuvants*, *correctives*, &c.

Although this classification of ingredients is not absolute, it seems to facilitate the study of the subject, and we proceed to notice

1st. The objects to be attained by adding to the basis.

a. Dilution.

A great many of the remedies are too strong to be eligible for use without the addition of some menstruum, so as to increase the dose and to allow of a more ready division. In giving calomel, in very small alterative doses, it is impossible to apportion it properly without dilution with some suitable substance, such as sugar, as in Prescription No. 54. In using small doses of tartar emetic, sulphate of morphia, or other soluble salts, in the liquid form, it is usual to dilute them with water. In the case of concentrated liquid preparations, as tinctures of aconite root, nux vomica, &c., a less active liquid should generally be added, so as to bring the strength of the preparation to a less dangerous point, especially when prescribed for ignorant or careless persons.

The simple act of dilution may then be regarded as the first, though one of the least important objects in view, in adding to the basis or starting point of the prescription, and the substance so employed, if simply for this end, may be called the *diluent*. Many prescriptions consist merely of the basis and diluent.

b. To Heighten, or give Direction to the Effects of the Basis.

It was formerly considered that substances of similar therapeutical powers were mutually increased in energy by admixture.

This idea is now generally abandoned, except in so far as the powers of medicines may be heightened by combining them with others capable of rendering the system more susceptible to their action, or of giving them specific direction; thus, aromatic stimulants greatly heighten the effects of tonics, and will be found generally combined with them in tonic preparations. (See *Tonic Tinctures and Prescriptions* Nos. 6, 11, 16, and 20.) So rhubarb, by its astringency, modifies the effects of other cathartics, as in Warner's Cordial. We have a further illustration of this in the use of tartar emetic, to give a sedative and diaphoretic direction to saline remedies, as in Prescription No. 35; and of Dover's Powder, to render ext. of colchicum more sedative, as in Prescription No. 28.

Not to multiply illustrations, many of which will naturally occur to the student, it requires to be mentioned that, in some cases, this adjuvant may be best given at a different time from the basis, or rather, that the two may be most profitably separated. Thus, it is customary to purge a patient affected with intermittent before giving quinia; but few practitioners would, unless in unusual cases, combine the cathartic with the tonic dose.

There are sometimes ingredients in a prescription which may be considered either in the light of adjuvants or of vehicles. Thus sulphuric acid in quinia solutions both adds to the effect, as is commonly considered, and affords a means of solution. So extracts, combined with other remedies, may heighten their action, while affording a convenient vehicle for making them into a pilular mass. The adjuvant is, however, rarely introduced, practitioners generally relying upon the independent action of one agent, modified, if required, by another, which is used for the next object.

c. To Correct some objectionable Property in one or both of the other Active Ingredients.

The instances in which this motive for adding to the basis is called into play, are so numerous that it will scarcely be necessary to illustrate, further than to refer to the numerous prescriptions which follow. The combination of opium with calomel, in dysentery, is one of the strongest cases in point. The mercurial is, by this means, made to act as a corrective, in conditions of the system in which, if employed singly in the same dose, might aggravate the symptoms. Certain effects of opium, as a basis, are obviated by many additions. Thus compound spirit of ether is said to diminish its nauseating effect on the stomach, &c.

In administering oil of turpentine, or wormseed oil, as a vermifuge, some corrective is needed which will insure a purgative effect, and prevent its undue absorption.

In the same way oil of turpentine and laudanum are used as correctives to castor oil, diminishing its purgative effects, and preventing griping.

In prescribing senna, the custom is almost universal of adding some aromatic seed to the infusion, to prevent griping. In Prescriptions No. 35, No. 40, No. 65, we have especial instances of the value of correctives.

We may frequently make one substance answer the double purpose of a corrective, and diluent or vehicle. In this connection we find the medicated waters useful for liquid preparations; soap for pills; aromatics for powders; certain stimulating oils in ointments, liniments, &c.

It will be observed that the corrective may be either therapeutical or chemical in its operation, or both. While the effect of adding essential oils or opiates to cathartics, is purely therapeutical, that of combining soap with resins, to correct insolubility, is chemical or pharmaceutical. So, in combining mastic, or other very insoluble resin with aloes, its insolubility is increased or lengthened—an object sometimes of importance, as in Chapman's Dinner Pill.

d. The Proper Incorporation of the Ingredients together.

This object is one of paramount importance in the preparation of medicines. The excipient added for this purpose may be either chemical or mechanical, or both; it may be connected with the therapeutic plan of the prescription, or may be added solely to make it more agreeable to the taste, and more uniform in consistence. This ingredient is more important to the physician, from the fact that, owing to its therapeutic application, the excipient cannot always be left to the choice of the pharmaceutist, whose practical acquaintance with the subject would otherwise qualify him to select the best excipient. The numerous rules that suggest themselves in regard to the proper incorporation of ingredients together can be best brought into view in connection with the next subject to be treated of.

e. On the Different Forms of Medicines.

These are of two kinds: those which are adapted to *internal*, and those to *external* use. Or they may be divided into *solid*, *liquid*, and *semifluid* forms; as they are not very numerous, however, and neither classification of them is very important, I shall treat of them in the order which experience has shown to be most convenient to the student.

CHAPTER IV.

ON POWDERS AND PILLS.

PULVERES. (POWDERS.)

IN the chapter on Drying and Powdering Drugs, &c., some general views are given on the utility of this form of preparation, but it yet remains to point out in a particular manner the uses of powders in extemporaneous prescribing.

1. *The kind of Substances best adapted to this Form of Prescription.*

a. Those medicines which are insoluble; as calomel, phosphate of lime, subnitrate of bismuth, subcarbonate of iron, magnesia, &c.

b. Drugs possessing, in the natural condition, peculiar properties, differing from those which are artificially prepared from them; as cinchona, colomba, digitalis, &c.

c. Those which, in solution, would possess more nauseous or bitter properties than in their undissolved, finely-divided condition; as sulphate of quinia, kino, catechu, &c. They are, for the most part, best suited for making into pills.

d. Those which, combined in a liquid form, would be chemically incompatible.

e. The extracts and blue mass, when dry enough to be reduced to powder.

2. *The kind of Substances unsuited to this Form.*

a. Deliquescent substances; as carb. potassa, unless with special precautions.

b. Substances containing a large amount of water of crystallization (unless dried); as carbonate of soda.

c. Substances, the active principles of which are very volatile; as valerian and assafetida.

d. Substances physically unsuited to mechanical division; as camphor and guaiacum, unless with certain precautions.

e. Blue mass, and the extracts in their usual condition, although the former and some of the latter are very convenient in the form of powder.

Powders may be prescribed in the form of mixture or draught, always directing the bottle to be shaken before pouring out the dose; or in pill, if their dose is small. They may be prescribed in papers (chartulas), each containing a dose, or in a single large package, the dose being indicated in the directions by some familiar standard of measurement.

These last are the only forms of prescription coming under the present head. Mixtures, pills, &c., will be considered in their appropriate places. Soluble substances, prescribed in powder, may be directed to be dissolved in water, and the solution taken by small doses, so as to save expense to the patient, or to have the medicine in a more portable form, as in travelling. This, however, is a rather inaccurate way. Seidlitz, soda, and citric fever powders are elegant forms for giving single doses of soluble salts.

When the dose of an insoluble powder is large, as in the case of magnesia or of phosphate of lime, and it is to be mixed by the patient or attendant, it is well to direct the particular mode of suspending it in water. The directions for magnesia are as follows:—

Put the requisite quantity of clear and cold water (not too much) in a clean glass, and drop into it from the blade of a knife or spoon, the required dose; allow it gradually to mix with the water and subside, after which stir it up and drink immediately. This will be found a more satisfactory way than to pour the water upon the dry powder in the bottom of the glass.

Powders which are viscid and slightly soluble are, I think, generally more disagreeable than those which are not. Rhubarb is much less pleasant to take in fine powder than when chipped into very small shavings or grated, and swallowed suspended through a glass of water. Some viscid vehicle seems quite necessary to heavy powders like calomel, or mercury with chalk; by sinking to the bottom of the spoon from which administered, these are liable to miss of being swallowed. With medicines prescribed in the form of powders there is no occasion for the use of excipients, as they are not, strictly speaking, incorporated together; where the dose is small, however, an additional substance may be directed for the purposes of dilution, such as sugar, or a mixture of sugar and gum, or liquorice, or arrowroot fecula. An illustration of this kind of admixture is seen in Prescription No. 54, in which the only utility of the sugar is to give body to the otherwise very small bulk of the powders; also in Castillon's Powders, in which an antacid and astringent, calculated to act as a remedy for the diseased condition, are combined with appropriate nutritious ingredients. In *Dover's Powder* we have an instance of the diluent being made to subserve an important mechanical end; and I am informed by an intelligent pharmaceutist that, in his vicinity, physicians combine sugar of milk with powders in prescriptions for a like purpose, directing long trituration. Calomel is said by this means to acquire increased efficiency where a rapid constitutional effect is desired;

although the assertions of homœopathists, in regard to the virtues of trituration, are both extravagant and absurd, yet there is little doubt that, in a case like that of calomel, long attrition with a hard substance, in contact with the atmosphere, is calculated to produce chemical, as well as physical changes of importance.

The use of adjuvants and correctives is appropriate in the case of powders, equally with other classes of remedies; and, by reference to the prescriptions appended, it will be observed that they are very commonly added. Prescriptions in the form of powders will be associated with those in pilular form in the list which follows that class.

Pilulæ.

Pills are the most popular and convenient of all forms of medicine. In common with powders, they have the advantage of being accurately divided, so that the patient is not dependent upon any of the uncertain means of approximate measurement necessary in administering liquids. They are also more portable. The contact is so slight with the organs of taste, in swallowing, that the most offensive substances can be swallowed in this form with comparatively little inconvenience. There are, however, a few people who cannot swallow them; this is the case, too, with young children, for whom some other form is preferable.

The size of pills is necessarily limited to from 4 to 5 grains of vegetable powders, or 5 to 6 grains of heavy mineral substances, *including the excipient*, though these quantities are larger than usual.

The kind of Substances best adapted to the Pilular Form.

a. All those suitable to the form of powders, which are given in small doses.
b. The gum resins, balsams, and turpentine.
c. Substances, the operation of which it is desirable to retard; as in certain aperient and alterative pills.
d. Insoluble substances, which are too heavy to give conveniently suspended in water.
e. Very disagreeable and fetid substances.
f. The vegetable extracts.

The kind of Substances unsuited to the Pilular Form.

a. Those which operate only in doses too large for 3 or 4 pills.
b. Deliquescent, or efflorescent salts.
c. Bodies of such consistence as to require an undue proportion of dry or viscid material to make a mass, except such as have a very small dose; as croton oil.
d. Very volatile substances; as carbonate of ammonia, except with certain precautions.

e. Deliquescent salts, and those containing a large proportion of water, unless this be suitably absorbed by associated dry powder.

f. Those which are prescribed for immediate effect; as emetics, diffusible stimulants.

g. Essential oils, in quantity exceeding half a drop to each pill.

The formation of a pill mass is sometimes a matter of considerable difficulty; sometimes, from a want of adhesiveness of the ingredients; sometimes from the difficulty of incorporating them equally together. Under the head of The Art of Dispensing, I shall introduce some hints upon the mode of overcoming difficulties of this kind, and for the present shall confine myself to the mode of *prescribing* pills.

Should the physician indicate the excipient, or leave it optional with the apothecary? In answering this, we necessarily bring into view the therapeutical relations of this ingredient, and shall find that it may be active or inert, according to the choice of the prescriber.

If the basis be a vegetable powder, like rhubarb or aloes, a mass can be readily formed by moisture, without the aid of any adhesive material; if, on the contrary, it be a metallic salt, or an unadhesive vegetable powder, it requires an addition to give it the form of a mass; that addition will add somewhat to the bulk of the ingredients prescribed, and perhaps, if the dose be large, will make the pills too bulky; in this case, it is important that the physician should not overlook the excipient, which he may include among the medicinal ingredients, or make due allowance for, in apportioning the quantity to each pill.

The following rule for prescribing pills will obviate the disadvantage of adding to the size by the use of inert excipients: *when the basis is an unadhesive material, one of the other medicinal ingredients should be an extract or a vegetable powder, which will form a mass by moisture alone.*

To illustrate this, I would refer to prescriptions No. 12 and No. 55, in both of which the adjuvant possesses this quality, while in a large number of cases, the constituent or vehicle is of little or no therapeutic value.

It will be proper in this connection to run over the several substances, added with a view to giving body to pill masses, so as to point out the special adaptations of each.

Soap, which is employed in the officinal pills more than any other excipient, is well adapted to combine with resinous substances, the solubility of which it increases, while it acts as an antacid, and perhaps aperient. It has been suggested, that it is incompatible with opium, with which it is prescribed in the officinal *pil. opii*, as the alkali, especially when present in excess, tends to separate the morphia from its native combination. Some ex-

periments made by my assistant, Thomas Weaver, confirm this idea.

Syrup is often used as an excipient, which adds but little to the bulk of a pill mass, and is effectual in some cases, where water alone would not give the requisite tenacity; it does not answer a good purpose, however, with certain metallic salts, which dispose the mass to crumble.

Honey and *molasses*, forms of uncrystallizable sugar, are better adapted to the general purposes of pill making. Masses made with these are not so liable to crumble, and possess the great advantage of remaining moist and soluble for a longer period. On account of the last-named property, honey has been substituted for syrup in the officinal recipe for sulphate of quinia pills, in the last edition of the *Pharmacopœia*.

Gum Arabic is directed to be added, where the requisite adhesiveness will not result from the use of syrup or honey alone; it is not a very good excipient, either added in the form of powder, or of a thick mucilage. Pills made with gum are apt to be very hard. Tragacanth forms a less hard and insoluble mass than acacia. The officinal syrup of gum Arabic is made with a special view to this use.

Alcohol and *essential oils*, by softening down resinous substances, facilitate their incorporation together in mass, and, being held by these with considerable tenacity, prevent their rapidly becoming too hard. Oil of turpentine is well adapted to softening white turpentine, so as to incorporate it with other ingredients, as in Otto's emmenagogue pills. These excipients must be added with care, or they will render the mass quite too soft.

An important use of essential oils in pills, is to prevent mouldiness, and the disagreeable odor which vegetable powders acquire when moistened; they should be added in very small proportion for this purpose, as they rather interfere with than promote the adhesiveness of the mass.

Crumb of bread furnishes a convenient, and when not too dry, a very tenacious vehicle for substances given in small dose, and which require diluting, rather than combining in a small bulk.

Confection of rose is adapted to similar uses, though more moist and less tough in consistence. When made from the rosa gallica, it is astringent, and adapted to combining certain vegetable powders belonging to that class; as usually met with, it contains no tannin, being made from our common varieties of rose. Confection of orange-peel, and aromatic confection, are adapted to similar uses.

The Officinal Pill Masses.—These may be described in this place as preparations well adapted to use as excipients, though very frequently prescribed singly.

Pilulæ Hydrargyri, U. S.

This is the officinal designation of the preparation commonly called blue pill, and directed in the *Pharmacopœia* to be divided into pills of three grains each; as usually kept by physicians and druggists in an undivided state, it is more appropriately called massa hydrargyri, mercurial mass. It is usually prepared by drug millers and chemical manufacturers, by triturating together in appropriate mechanical contrivances, mercury, conserve of rose, liquorice root in powder, and some rather moist viscid material, as powdered althea root, in such proportion that three parts by weight of the mass shall contain one of mercury, thoroughly divided, and partially oxidized.

To my young friend and assistant, Thomas Weaver, the reader is indebted for the suggestion of the following good extemporaneous process for the preparation of this heretofore troublesome mass. It is adapted equally to producing a soft or a pulverulent article, and is so rapid and easy as to supersede the necessity for the use of machinery for small quantities. Its importance as a practical improvement will be appreciated by those who have attempted to prepare blue mass with a pestle and mortar by the officinal process, and by such as have been disappointed in the quality of the manufactured article as met with in commerce.

To make three ounces of Blue Mass Extemporaneously by a few minutes' Trituration.

Take of	Mercury	℥j.
	Powdered liquorice root	℥ss.
	" rose leaves	ʒvj.
	Honey	ʒvj.

Triturate the honey, liquorice root, and mercury, rapidly together for three minutes, or until all the globules of mercury disappear, then add the rose leaves, and work the whole into a uniform mass; if it is too stiff, moisten with a little water. According to James Beatson, late apothecary to the U. S. Naval Hospital, at New York, the same object may be accomplished by triturating the mercury with the honey, until the former is completely extinguished; then adding rose-water, powdered rose leaves, powdered liquorice root, and sugar, to make up the requisite proportion.

To make Powdered Blue Mass.

Take of	Mercury	℥j.
	Powdered liquorice root	℥ss.
	" rose leaves	ʒvj.
	Simple syrup (by weight)	ʒij.

Triturate the mercury, half of the powdered liquorice root, and

the simple syrup rapidly together for three minutes, or until the globules disappear, and then incorporate the powdered rose leaves, and the remainder of the powdered liquorice root, and spread the whole out to dry in a warm place. Reduce this to powder.

Blue mass is, perhaps, the most popular, as it is the mildest form of mercurial preparation; it is well adapted to use in pill or powder, either combined, as in several prescriptions which follow, or singly, in doses of from one to ten grains.

Blue mass, when designed to act on the liver without producing a cathartic effect, may be combined with opium or a pure astringent. It is more frequently, however, combined with cathartics, to increase its tendency to operate on the bowels. Perhaps a majority of the mild cathartic pills, prescribed by practitioners and those sold as universal remedies, contain this useful ingredient; and, in fact, blue pills are very commonly known and taken by those who prescribe for themselves, for what is popularly known as "biliousness," and various forms of liver complaint.

I have recently prepared, by the modified process above, and from specimens which have been dried at a moderate heat, a very convenient powder of blue mass, which is well suited for conversion into the pilular form, and into that of compound powder.

Blue mass was formerly much adulterated, but is now supplied to the trade of reliable quality by several first-rate manufacturers.

Pilulæ Ferri Carbonatis, U. S.

Vallette's Mass is a very mild and soluble preparation of iron, made by incorporating freshly precipitated protocarbonate of iron with honey, or a mixture of honey and gum tragacanth, or some similar saccharine vehicle which experience has taught the manufacturer to prefer, and by evaporation concentrating into a solid pilular mass. This may be taken by itself, in a dose of from ten to thirty grains, or may be used as an adjuvant or vehicle to other medicinal substances, particularly dry powders, as in those numerous cases where iron, in small doses, is indicated along with bitter tonics.

Pilulæ Copaibæ, U. S.

Copaiba mass, although seldom employed as a vehicle, is not unsuited to this use; it is directed to be made by incorporating one drachm of calcined magnesia with two ounces of copaiva, a recipe which it is very difficult to follow, so as to get a solid mass. The copaiva must be thick and resinoid, and the magnesia recently calcined, or the required thickening will not occur. The introduction of wax, in considerable quantity, to give it consistence, should not be allowed. Its dose is from 5 to 10 grains.

The Extracts.

This class, which is much the best adapted to the pilular form, should not be overlooked, in prescribing several ingredients. Some one extract can usually be selected which will meet a therapeutical indication, while it serves the purpose of an excipient.

Thus, in sedative or narcotic pills, we have the choice of five or six extracts to incorporate with any unadhesive or other material, so as to gain efficiency without too large a bulk.

In directing a tonic remedy in this form, extract of gentian, quassia, cinchona, or nux vomica will come in play. While, as a vehicle, for the mercurials in cutaneous or syphilitic diseases, extract of conium, or of sarsaparilla, may be used. The use of the cathartic extracts, and of extract of taraxacum for similar purposes, is too common to need comment. We also have an illustration of an elegant and efficient compound, made on this principle, in the so-called Dr. Vance's Gout Pills (Prescription No. 28).

The following Tables show, in a general way, the classes of drugs adapted to the form of powder and pill.

Medicines adapted to the Form of Powder.

INSOLUBLE MINERAL SUBSTANCES, VEGETABLE PRODUCTS AND SOME SOLUBLE SUBSTANCES.

INSOLUBLE: TOO LARGE DOSES FOR PILLS.	IN CERTAIN COMBINATIONS, AND WHEN PILLS ARE OBJECTED TO.
Carbo. ligni.	Powd. pil. hydrarg.
Magnesia.	" ext. coloc.
Calcis phosph.	" opium.
Pot. bitart.	" digitalis.
Sulphur sub.	" nux vom.
Creta ppt.	" kino.
Ferri subcarb.	" acid, tannic.
Calomel, and others.	" " gallic.
Vegetable Powders:—	" potas. nit.
Powd. cinchona.	Opium alkaloids.
" colomba.	Cinchona "
" gentian.	Subnit. bismuth,
" rhubarb (coarse).	and many others.
" Jalap.	
" cubebs,	
and others.	

Diluents for Substances prescribed in Form of Powders.

Sugar.	Aromat. powd.
Lactin.	P. Ext. liquorice.
Powd. acacia.	P. Tragacanth.
" cinnam.	P. Elm Bark.
and others.	

Medicines adapted to Pilular Form.

POWDERS GIVEN IN LESS THAN GR. XV DOSES, GUM RESINS, EXTRACTS; ALSO OLEO-RESINS AND OILS IN SMALL PROPORTION.

UNADHESIVE MATERIALS.	GOOD MEDICINAL EXCIPIENTS.
Calomel.	Extracta.
Dover's powd.	Pil. hydrarg.
Subnit. bismuth.	" copaibæ.
Morphiæ, acetas, &c.	" ferri carb.
Strychnia.	Terebinthina.
Pulv. digitalis.	*With Moisture:*—
" ipecac.	Powd. aloes.
Plumbi acetas.	" rheum.
Ant. et pot. tart.	" kino.
" sulphuret.	" tannin.
Argenti nitras.	" opium.
Argenti oxidum.	" scilla.
Ferri pulvis.	S. bebeerina.
" subcarb.	Ferri citras.
" (other salts).	Assafœtida, and others.
Potass. iodid.	*With Alcohol:*—
Camphor, and others.	Guaiacum, and others.
Difficult to combine, except by Peculiar Treatment:—	*With Dil, SO_3:*—
Ol. tiglii.	Quiniæ sulph.
" terebinth.	Cinchoniæ sulph.
Ferri iodidum.	Quinidiæ sulph.
Copaiba, and others.	Quinoidine.

Inert Excipients.

	MUCILAGES.
Powd. acacia.	Syrup of gum.
" tragacanth.	Honey.
Soap.	Treacle.
Crumb of bread.	Syrups.
Confections.	

In the following officinal and extemporaneous prescriptions, some of which are extracted from standard works, others from the extensive files of the dispensing establishment over which I preside, and a few which I venture to offer for trial, I have endeavored to point out the most approved methods of compounding medicines in the form of powders and pills.

Examples of Extemporaneous Prescriptions in the form of Powders and Pills, including those in the Pharmacopœia under the heads Pulveres and Pilulæ.

ASTRINGENTS.

No. 1.—*Used in Obstinate Diarrhœa.*

		1 powder.
Take of Alum	ʒij	20 grs.
Kino	ʒss	5 grs.

Mix and reduce to a very fine powder, and distribute this into 6 papers. Dose, one every 2 or 3 hours.

The alum and kino are incompatible in liquid form, and hence, when associated together, should always be prescribed in powder. The dose is too large for the pilular form.

No. 2.—*Adapted to substitute many Simple Vegetable Astringents.*

		Each.
Take of Tannic acid . .	gr. xij	1 grain.
Confection of rose .	gr. vj	½ grain.

Make a mass and divide into 12 pills. Dose, one every two hours.

The above may be made into powders by substituting an aromatic, astringent, or inert powder for the confection.

No. 3.—*Used in Diarrhœa.*

		Each.
Take of Tannic acid . . .	℈j	2 grs.
Acetate of morphia . .	gr. j	$\frac{1}{10}$ gr.
Sugar	gr. x	1 gr.
Oil of caraway . . .	♏ j	trace.

Triturate together, and distribute into ten papers. Dose, one every 3 hours.

Five grains of opium may be substituted for the morphia salt, or by the substitution of sufficient syrup for the sugar, the whole may be made into the pilular form.

No. 4.—*Chalk Powders.*

		Each.
Take of Prepared chalk . .	ʒij	15 grs.
Gum Arabic, in powder .		7½ grs.
Sugar, each . . .	ʒj	7½ grs.
Powdered cinnamon .	gr. x	1¼ grs.

Triturate together into a uniform powder, and divide into 8 doses.

Chalk mixture, No. 61, spoils by keeping in hot weather, and is, moreover, much more bulky than an equal quantity of the ingredients in the above form, which is especially convenient for travellers. Opium, kino, or other remedies adapted to increase or modify its action, may be added in powder, as their Galenical solutions are to the mixture. One of the very best additions for a common form of diarrhœa is that of powdered blue mass, of which gr. xvj to ʒss may be added to the above.

No. 5.—*For the Diarrhœa of Young Children.*

		Each.
Take of Acetate of lead . . .	gr. ij	$\frac{1}{6}$
Opium	gr. ss	$\frac{1}{24}$
Camphor	gr. j	$\frac{1}{12}$
Sugar	gr. iij	$\frac{1}{4}$

Triturate, and divide into 12 papers. Dose, one every 2 or 3 hours.

The child should be kept quiet, and fed upon arrowroot, flour boiled in milk, or a mixture of barley-water and cream.

For adults, the whole quantity prescribed may be taken at one dose.

Tonics and Aromatics.

No. 6.—*Anti-Intermittent Powders.*

		Each.
Take of Powdered cinchona . .	℥j	ʒj.
" serpentaria .	ʒij	gr. xv.
Sulphate of quinia . .	gr. viij	gr. j.

Mix, and distribute into eight papers. Dose, one every hour, commencing eight hours before the expected paroxysm.

The sulphate of quinia is often omitted, but increases the efficiency of the powder, especially when the bark is not of the finest quality. The serpentaria is often substituted by more powerful stimulants, as cloves, or capsicum, or oil of black pepper; and sometimes to obviate costiveness, a saline cathartic is added.

No. 7.—*Pilulæ Quiniæ Sulphatis*, U. S.

		Reduced.	Each.
Take of Sulphate of quinia . .	℥j	℈ij	1 gr.
Powdered gum Arabic .	ʒij	gr. x	$\frac{1}{4}$ gr.
Honey	q. s.	q. s.	

Make a mass, and divide into 480 pills (reduced quantity, 40), of which the dose in intermittents is one every hour, between the paroxysms.

These officinal pills are less used than formerly, as it is now customary to give larger doses, and less frequently, and they are found less convenient than pills or powders, of three, four, or five grains each.

Sulphate of quinine may be made into pills by the following process, which has been called Parrish's. (See paper by the author, in the *American Journal of Pharmacy*, vol. xxv. p. 291.)

No. 8.—*Pills of the Soluble Sulphate of Quinia.*

			Each.
Take of Sulphate of quinia	. .	℈j	gr. v.
Aromatic sulphuric acid	.	fifteen drops	♏ iv.

Drop the acid upon the sulphate on a tile or slab, and triturate with a spatula, until it thickens and assumes a pilular consistence, then divide into four pills.

The five grain quinine pill made in this way, is not larger than many pills in common use, so that by this process they may be made of two, three, four, or five grains.

The large number of combinations in which sulphate of quinia is associated with other remedies cannot be here noticed; to some of these the elixir of vitriol process is well adapted as in combining the other alkaloids with it; in other cases it is inadmissible. If an extract in small quantity, or a vegetable powder is to be added to the mass, it should be incorporated with the quinia salt, when by trituration on the slab it begins to thicken into a paste.

Persons not accustomed to making quinine pills by this process, sometimes allow the sulphate to become too dry and unadhesive to mould into pills. This is from not seizing the proper moment just as the mass has ceased to be too soft, and before it becomes dry; it is then quite plastic, and becomes particularly so by contact with the warmth and moisture of the thumb and fingers. A drop of syrup or honey, which should always be at hand on the counter, by being added at the proper moment will prevent this hardening.

No. 9.—*Pills of Sulphate of Cinchonia.*

			Each.
Take of Sulphate of cinchonia	. .	℈j	gr. j.
Powdered tragacanth	. .	gr. ij	gr. $\frac{1}{10}$.

Triturate together, and add sufficient water to make a mass, which divide into twenty pills; these pills are esteemed about equal to those of sulphate of quinia.

No. 10.—*Pills of Sulphate of Quinidia.* (*Quinidina.*)

			Each.
Take of Sulphate of quinidia	. .	℈j	gr. j.
Powdered tragacanth	. .	gr. ij	gr. $\frac{1}{10}$.

Triturate together, and add water sufficient to make a mass, which divide into twenty pills. These are esteemed about equal to sulphate of quinia pills of the same proportion.

The use of tragacanth instead of gum Arabic would be an im-

provement in the officinal sulphate of quinia pills; it diminishes the size, and keeps them longer moist and soluble.

I have experimented with sulphate of cinchonia and sulphate of quinidia with reference to the formation of pill masses with elixir of vitriol, and find that sulphate of cinchonia requires one drop to three grains, and sulphate of quinidia three drops to two grains. They thicken into a firm mass with less facility than the quinine salt, and in fact require sometimes an hour or two to become firm enough to roll out; this is remedied by adding a little of some vegetable powder, as gum Arabic or starch, which, however, increases the bulk.

Practitioners are increasingly disposed to examine the relative merits of the cinchona alkaloids as antiperiodics. In the Pennsylvania Hospital, and other of our large charities, the experience of the medical staff has been thus far favorable to substituting for the more expensive sulphate of quinia, sulphate of cinchonia, and sulphate of quinidia in the same dose. See *Cinchona Alkaloids.*

Combinations of salts of quinia and iron are much resorted to in anæmia accompanied by want of appetite; of these, two instances are given below.

No. 11.—*Powders of Iron and Quinia.*

		Each.
Take of Subcarbonate of iron . .	ʒj	5 grs.
Sulphate of quinia . .	gr. vj	½ gr.
Aromatic powder . . .	gr. xij	1 gr.

Triturate together, and distribute into 12 powders. Dose, take a powder three times a day before meals.

The proportion of sulphate of quinia should be increased when it is to be employed in convalescence from intermittents.

No. 12.—*Pills of Proto-Carbonate of Iron and Quinia.*

		Each.
Take of Sulphate of quinia	℈j	1 gr.
Mass of carbonate of iron (Vallette's)	ʒj	3 grs.

Mix, and make into 20 pills. Dose, one twice or three times a day.

In this class of prescription, the sulphates of cinchonia and quinidia, and of bebeerina, may generally be substituted for that of quinia without disadvantage.

No. 13.—*Pills of Quevenne's Iron.*

		Each.
Take of Iron in powder . .	gr. CC	2 grs.
Manna	gr. C	1 gr.

Triturate into a mass and divide into 100 pills.

Manna is an excellent excipient for Ferri pulvis, and will answer in less proportion, if very small pills are desired; when not at hand, it may be substituted by honey and a little gum Arabic, or tragacanth.

In a number of cases it will be desirable to introduce adjuvants; which may be in the form of extract. Extracts of conium, of aconite, cinchona, and quassia, are favorite adjuvants with Quevenne's iron.

No. 14.—*Pulvis Aromaticus*, U. S.

Take of Cinnamon,
Ginger, of each . . . . . ℥ij.
Cardamom, deprived of the capsules,
Nutmeg, grated, of each . . . . ℥j.

Rub them together into a very fine powder.

In this preparation, the dry powders of cinnamon and ginger enable us to reduce the oily nutmeg and cardamoms to a fine condition; the whole should be passed through a sieve.

By trituration with honey, syrup of orange-peel and saffron, this furnishes confectio aromatica.

In compound powders, as in Prescription No. 11, this is a frequent ingredient, and is recommended by an agreeable flavor.

No. 15.—*Dr. Mitchell's Tonic Pills.*

		Each.
Take of Extract of quassia . .	gr. xxxvj	3 grs.
Extract of conium . .		¼ gr.
Subcarbonate of iron, of each	gr. iij	¼ gr.

Make into a mass with a few drops of solution of arsenite of potassa (if required); then divide into 12 pills. Dose, a pill twice or three times daily.

No. 16.—*Tonic and Aromatic Pills.* (Dr. Parrish, Senior.)

		Each.
Take of Sulphate of quinia . .	gr. iij	¼ gr.
Powdered capsicum . .		½ gr.
Mace		½ gr.
Powdered cloves . .		½ gr.
Carbonate of ammonia, each	gr. vj	½ gr.
Oil of caraway . . .	gtt. iij	¼ ♏.
Confection of rose . .	sufficient	q. s.

Form a uniform tenacious mass, and divide into 12 pills.

No. 17.—*Used in Obstinate Intermittents.* (Dr. Chapman.)

			Each.
Take of	Sulphate of copper . .	gr. iij	$\frac{1}{4}$ gr.
	Powdered opium . .	gr. iv	$\frac{1}{3}$ gr.
	" gum Arabic .	gr. viij	$\frac{2}{3}$ gr.
	Syrup	sufficient.	

Make a mass, and divide into 12 pills. Dose, one every three hours.

No. 18.—*Pilulæ Ferri Compositæ*, U. S.

			Each.
Take of	Myrrh, in powder . .	ʒij	$1\frac{1}{2}$ gr.
	Carbonate of soda . .		FeO, CO_2.
	Sulphate of iron, of each .	ʒj	$\frac{5}{16}$ gr.
	Syrup	q. s.	q. s.

Rub the myrrh with the carbonate of soda, then add the sulphate of iron, and again rub them; lastly, beat them with the syrup so as to form a mass to be divided into eighty pills.

This pill is similar in composition to Griffith's Iron Mixture. Supposing a reaction to take place between the salts present, protocarbonate of iron would be produced, which, with the myrrh, forms an admirable remedy in chlorosis, &c. I should greatly prefer the use of a lump of fresh myrrh to the powdered article of commerce.

No. 19.—*Pilulæ Ferri Iodidi*, U. S.

			Each.
Take of	Sulphate of iron . . .	ʒj	FeI.
	Iodide of potassium . .	ϑiv	$1\frac{2}{3}$ grs.
	Tragacanth, in powder .	gr. x	$\frac{1}{4}$ gr.
	Sugar, in powder . .	ʒss	$\frac{3}{4}$ gr.

Beat them with syrup, so as to form a mass, to be divided into forty pills.

The formation of iodide of iron depends upon the presence of moisture and fluids to produce deliquescence. The mass should be as dry as possible to be plastic, and may then be advantageously kept in a tightly stopped bottle.

No. 20.—*For Chronic Indigestion and Irritability of Stomach.*

			Each.
Take of	Bismuthi subnitratis . .	ʒj	10 grs.
	Pulveris rhei . . .	ʒss	5 grs.
	" aromatici . .	ϑij	$6\frac{2}{3}$ grs.

Make into 6 powders. Take one before each meal.

Nervous Stimulants; Antispasmodics.

No. 21.—*Pilulæ Assafœtidæ*, U.S.

		Reduced.	Each.
Take of Assafœtida	℥iss	gr. xxxvj	gr. iij.
Soap	℥ss	gr. xij	gr. i.

Beat them with water, so as to form a mass, and divide into 240 pills. (The reduced quantity into 12 pills.) Dose, one to 4 pills.

No. 22.—*Pilulæ Aloes et Assafœtida*, U.S.

		Reduced.	Each.
Take of Aloes, in powder		gr. xvj	gr. $1\frac{1}{3}$.
Assafœtida			gr. $1\frac{1}{3}$.
Soap, each	℥ss		gr. $1\frac{1}{3}$.

Beat them with water, so as to form a mass, to be divided into 180 pills. (Reduced, 12 pills.) Dose, one to four pills.

No. 23.—*Pilulæ Galbani Compositæ*, U.S.

		Reduced.	Each.
Take of Galbanum			gr. $1\frac{1}{2}$.
Myrrh, each	℥vj	each gr. xviij	gr. $1\frac{1}{2}$.
Assafœtida	℥ij	gr. vj	gr. $\frac{1}{2}$.
Syrup	sufficient	sufficient	gr. $3\frac{1}{2}$.

Beat them together, so as to form a mass, to be divided into 240 pills. (Reduced, 12 pills.) Dose, one to three pills.

No. 24.—*Dr. Otto's Antispasmodic Powders.*

Take of Black mustard seed,
Powdered sage,
Powdered ginger, equal parts by measure.
Mix thoroughly.

Dose, three teaspoonfuls, for three mornings in succession; discontinue three; then give as before. To be moistened with water or molasses.

This powder is highly recommended, in epilepsy, by several practitioners, and recently by Dr. Charles D. Hendry, of Haddonfield, N. J.

Arterial Stimulants.

No. 25.—*Powders or Pills of Carbonate of Ammonia, &c.*

Take of Muriate of ammonia (granulated),
Dried carbonate of soda, of each . . . . ℈ij.
Powdered capsicum . . . . . ℈j.

Triturate into a uniform fine powder, and divide into 10 papers, which should be wrapped in tinfoil.

By the aid of moisture, these powders are made to react with each other and develop carbonate of ammonia. To make into pills, add a portion of firm and rather dry conserve of rose. Divide into 20 pills, and keep them in a vial.

Cerebral Stimulants, or Narcotics.

No. 26.—*Pilulæ Opii*, U. S.

		Reduced.	Each.
Take of Opium, in powder .	ʒj	gr. xij	gr. j.
Soap . . .	gr. xij	gr. iiss	gr. $\frac{1}{5}$.

Beat into a mass with water, and divide into 60 pills. (Reduced, 12.)

The officinal pills of opium have long appeared to me to be defective, and when it is left optional what excipient to employ, I use syrup, or syrup of gum in preference to soap, which is apt to be incompatible with the opium.

Old opium pills are sometimes in request, from their being better retained by an irritable stomach, and from the fact that by their more gradual solution, they affect more favorably the diseases of the lower intestine. The best way to make pills to be kept for this purpose is to select a portion of the solid mass in its natural and plastic condition, and to divide it, without admixture, into the required number of pills; these, as they contract and harden, will become compact and of slow solubility.

No. 27.—*Anodyne Pills.*

		Each.
Take of Acetate of morphia . .	gr. j	gr. $\frac{1}{8}$.
Extract of hyoscyamus .	gr. iv	gr. $\frac{1}{2}$.

Triturate into a pill mass, and divide into 8 pills. Dose, one pill, repeated if necessary.

These are very small, and are not astringent in their effects on the bowels.

No. 28.—"*Dr. Vance's Rheumatism and Gout Pills.*"

		Each.
℞.—Extracti colchici acetici . .	ʒss	gr. $1\frac{1}{4}$
Pulveris ipecacuanhæ et opii .	ʒiss, gr. vj	gr. iv.

Misce et divide in pilulas xxiv. *Signa.*—Take two at night and one before breakfast and dinner.

This is a most valuable combination, having been found efficacious in a great many cases.

No. 29.—*Lartique's Gout Pills.*

		Each.
℞.—Extracti colocynthidis compositi .	ʒiss, gr. vj	gr. 4.
" colchici acetici . .	gr. x	gr. $\frac{2}{5}$.
" digitalis . . .	gr. v	gr. $\frac{1}{5}$.

Misce, fiat massa in pilulas xxiv, dividenda. *Signa.*—Take 2 for a dose.

No. 30.—*Pills of Camphor and Opium.*

		Each.
℞.—Camphoræ	gr. xxiv	gr. 2.
Pulveris opii	gr. vj	gr. $\frac{1}{2}$.
Alcoholis	gtt. vj	trace.
Confectionis rosæ . . .	q. s.	q. s.

Misce, et fiant, secundum artem, pilulæ xij. *Signa.*—Dose from one to two pills.

"Excito-Motor Stimulants."

No. 31.—*Powders given in Uterine Hemorrhages.*

		Each.
Take of Ergot, freshly powdered .	ʒj	gr. 10.
Alum, in powder . .	℈j	gr. $3\frac{1}{3}$.

Mix and divide into 6 equal parts.

Sometimes borax is substituted for alum in similar combinations.

Arterial Sedatives.

No. 32.—*Powders of Nitre and Tartrate of Antimony.*

		Each.
Take of Tartrate of antimony and potassa	gr. j	gr. $\frac{1}{12}$.
Nitrate of potassa . . .		gr. $2\frac{1}{2}$.
Sugar, each	ʒss	gr. $2\frac{1}{2}$.

Triturate into powder, and distribute equally into 12 papers.

Some powders of this class are introduced among the liquid preparations.

Emetics.

No. 33.—*A Prompt and Efficient Emetic.*

		Each.
℞.—Pulveris ipecacuanhæ . . .	ʒss	gr. xv.
Antimonii et potassæ tartratis .	gr. ij	gr. j.

Misce et divide in pulveres ij. *Signa.*—Take one in a little molasses, or sugar and water, and follow it by a draught of warm water. If one powder does not produce the effect, the second may be taken soon after.

Sometimes *calomel* is added to emetic powders, and both a purgative and emetic effect are produced. Emetics, as such, are never given in pill.

Cathartics and Laxatives.

To this class belong six of the pills, and two of the compound powders of the *Pharmacopœia.*

No. 34.—*Pilulæ Rhei*, U.S.

		Reduced.	Each.
Take of Rhubarb, in powder .	℥vj	gr. xxxvj	gr. 3.
Soap	℥ij	gr. xij	gr. 1.

Beat them with water, so as to form a mass, to be divided into 120 pills. (Reduced, into 12 pills.)

No. 35.—*Pilulæ Rhei Compositæ*, U.S.

		Reduced.	Each.
Take of Rhubarb, in powder	℥j	gr. xxiv	gr. 2.
Aloes "	℥ij	gr. xviij	gr. 1½.
Myrrh "	℥ss	gr. xij	gr. 1.
Oil of peppermint	f℥ss	♏ij	♏⅙.

Beat them with water, so as to form a mass, to be divided into 240 pills. (Reduced, into 12 pills.)

No. 36.—*Pilulæ Aloës*, U.S.

		Reduced.	Each.
Take of Aloes, in powder .			gr. 2.
Soap, each . .	℥j	℈ij	gr. 2.

Beat them with water, so as to form a mass, to be divided into 240 pills. (Reduced, 20 pills.)

No. 37.—*Pilulæ Hydrargyri Chloridi Mitis*, U.S.

			Each.
Take of Mild Chloride of mercury	℥ss	gr. xij	gr. j.
Gum Arabic, in powder .	℥j	gr. iij	gr. ¼.
Syrup, sufficient quantity.			

Mix together the chloride of mercury and the gum, then beat them with the syrup, so as to form a mass, to be divided into 240 pills. (Reduced, 12 pills.)

These pills are very rarely prescribed, as they contain too large a dose for the slow alterative effects, and are inconveniently small for a cathartic dose. (Compare No. 42 and No. 54.)

No. 38.—*Pilulæ Catharticæ Compositæ*, U. S.

		Reduced.	Each.
Take of Compound extract of colocynth, in powder	℥ss	gr. xvj	$1\frac{1}{3}$.
Extract of jalap[1]			1 gr.
Mild chloride of mercury, each	ʒiij	gr. xij	1 gr.
Gamboge, in powder	ϑij	gr. iiss	$\frac{1}{5}$.

Mix them together; then with water form a mass, to be divided into 180 pills. (Reduced, 12 pills.)

These well-known and popular pills are very easy to make, if the extracts, both of colocynth and jalap are powdered before being incorporated with the other ingredients; but if the extract of jalap is of a tough consistence, which it frequently reaches by partial drying, it is almost impossible to incorporate it with the other ingredients. Powdered extract of jalap, as elsewhere stated, is now generally obtainable, and may be kept in a salt mouth bottle like any other powder, a few drops of moisture will form it into a plastic mass. The tough extract should be further dried and powdered, or, if required to be used on an emergency, may be softened by heating and triturating in a capsule with diluted alcohol.

Under the name of *anti-bilious pills*, this preparation is vended in great quantities over the country, and by its admirable combination of cathartic properties, is well adapted to supersede as a popular remedy the numerous nostrums advertised and sold for similar purposes.

No. 39.—*Pilulæ Aloës et Myrrhæ*, U. S.

		Reduced.	Each.
Take of Aloes, in powder	℥ij	gr. xxiv	2 grs.
Myrrh do.	℥j	gr. xij	1 gr.
Saffron do.	℥ss	gr. vj	$\frac{1}{2}$ gr.
Syrup, sufficient quantity		q. s.	

Beat the whole together so as to form a mass, to be divided into 480 pills. (Reduced, 12 pills.)

A tonic and emmenagogue cathartic. Saffron may be reduced to powder by heating it in a capsule till it becomes crisp, then triturating it in a mortar.

No. 40.—*Pulvis Aloës et Canellæ*, U. S. (*Hiera Picra.*)

		Reduced.
Take of Aloes	℔j	℥iss.
Canella	℥iij	ʒiij.

Rub them separately into a very fine powder, and mix them.

[1] Extract of podophyllum might be well substituted in half the quantity, or if in the full proportion would increase the activity of the pill.

Hiera picra is generally macerated in some kind of spirits, and taken in draughts as a stomachic laxative.

No. 41.—*Pulvis Jalapæ Compositus*, U. S.

Take of Jalap, in powder	℥j.
Bitartrate of potassa	℥ij.

Mix them.

This is a mild laxative, given in doses of gr. xv to ʒss. Sulphur and bitartrate of potassa are much associated in about equal bulks.

No. 42.—*Calomel and Jalap Powder.*

℞.—Hydrargyri chloridi mitis	gr. xv.
Pulveris jalapæ	℈j.

Misce. To be given at a dose.

In the same way rhubarb is very commonly associated with calomel.

No. 43.—*Rhubarb and Magnesia Powder.*

℞.—Pulveris rhei	℈j.
Magnesiæ	℈ij.
Olei menthæ viridis	♏ j.

Misce. To be given at a dose.

Charcoal and magnesia constitute another very popular laxative combination.

The weighing and putting up of these powders is very improving practice for the student at the commencement of his novitiate.

No. 44.—*Mitchell's Aperient Pills*, U. S.

		Each.
℞.—Pulveris aloës	gr. xij	1 gr.
" rhei	gr. xxiv	2 grs.
Hydrarg. chlor. mit. . . .	gr. ij	$\frac{1}{6}$ gr.
Antim. et potas. tart. . . .	gr. j	$\frac{1}{12}$ gr.

Misce, fiant pilulæ No. xij.

One acts as an aperient, two or three as a cathartic; they, as well as most of the other aloetic pills, are contraindicated where there is a tendency to hemorrhoids.

No. 45.—*Laxative Tonic Pills.* (Dr. Parrish, Sen.)

Take of Powdered socotrine aloes	℈ij.
" rhubarb	℈iv.
Oil of caraway	gtt. xij.
Extract of gentian	℈ij.

Make into 40 pills. Dose, two before dinner.

No. 46.—*Dr. Alberty's Small Antibilious Pills.*

		Each.
℞.—Calomelanos	gr. x,	$\frac{1}{3}$ gr.
Pulv. gambogiæ	gr. v	$\frac{1}{6}$ gr.

Misce et fiant pilulæ xxx. Dose, 2 or 3 pills.

No. 47.—*Pills of Croton Oil.*

		Each.
Take of Croton oil	♏ iv	♏ $\frac{1}{4}$.
Crumb of bread . . .	gr. xvj	♏ j.

Make into 16 pills.

Croton oil and castor oil are both capable of forming soaps with caustic soda, which, being purified by solution in alcohol, and solidified in moulds, are eligible cathartic preparations.

No. 48.—*Dr. Chapman's Dinner Pills.*

		Reduced.	Each.
Take of Powdered aloes . .			$1\frac{1}{2}$ gr.
" mastich, of each	ʒij	gr. xviij	$1\frac{1}{2}$ gr.
" ipecac. . .	℈iv	gr. xij	1 gr.
Oil of caraway . . .	♏ xij	♏ ij	trace.

Mix and make into mass with water, and divide into 80 pills. (Reduced quantity, 12 pills.)

These pills are much used in habitual costiveness; the presence of the mastich protracts the solvent action of the fluids upon the aloes, so that one pill, which is a dose, taken before dinner, will produce a gentle operation the next morning.

No. 49.—*Lady Webster Pills.*

Take of Powdered aloes	ʒvj.
" mastich,	
" red roses, each	ʒij.
Syrup	q. s.

Make a mass, and divide into pills of 3 grains each.

One or two of these taken before a meal, will usually produce an evacuation.

Diuretics and Expectorants.

These classes of medicines are very little given in the form of pill or powder.

No. 50.—*Pilulæ Scillæ Compositæ*, U. S.

		Reduced.	Each.
Take of Squill, in powder	ʒj	gr. vj	½ gr.
Ginger do.			1 gr.
Ammoniac do., each	ʒij	gr. xij	1 gr.
Soap	ʒiij	gr. xviij	1½ gr.
Syrup, a sufficient quantity		q. s.	

Mix the powders together, then beat them with the soap, and add the syrup so as to form a mass, to be divided into 120 pills. (12 pills for the reduced quantity.)

Soap and syrup seem to me as a poor kind of mixture, especially as either would be a sufficient excipient without the other.

No. 51.—*Aromatic Pills.* (*Müller's.*)

Take of Oil of copaiva,	
" cubebs,	
" turpentine, each	fʒj.
Magnesia	ʒij.

Mix, and form 60 pills.

These are very large, though quite popular in the treatment of gonorrhœa. Some recipes direct gr. iv of powdered opium to this number. They would be improved in a pharmaceutical aspect by substituting copaiva and Venice turpentine for the oils of copaiva and turpentine. The dose is two pills three times a day.

Diaphoretics.

No. 52.—*Pulvis Ipecacuanhæ et Opii*, U. S. (*Dover's Powder.*)

		Reduced.
Take of Ipecacuanha, in powder,		gr. j.
Opium, in powder, of each	ʒj	gr. j.
Sulphate of potassa	℥j	gr. viij.

Rub them together into a very fine powder. Dose, 10 grains, the reduced quantity in the above recipe.

This valuable preparation is too well known to require much comment, it is used in a great variety of cases in which a sedative diaphoretic is indicated. It should be remembered, that the opium is to be dried before being weighed, otherwise the powder may be deficient in strength. It should also be well and thoroughly triturated from containing hard crystals to an almost impalpable powder. It is said to be less liable to nauseate in the form of pills.

Alteratives.

No. 53.—*Compound Pills of Iodide of Mercury.*

		Each.
Take of Iodide of mercury . .	gr. x	½ gr.
Resin of guaiacum . .	gr. ℈ij	2 gr.
Extract of conium . .	gr. ʒss	1½ gr.

Triturate the resin of guaiacum into a mass with a little alcohol, then incorporate with it the extract of conium and iodide of mercury, and divide into 20 pills.

These pills are alterative, and may be used in scrofulous, and skin diseases. Extract of sarsaparilla may be added to, or substituted for, some of the other ingredients.

No. 54.—*Alterative Powders of Calomel.*

		Each.
℞.—Hydrargyri chloridi mitis .	gr. j	$\frac{1}{12}$.
Sacchari	gr. xj	$\frac{11}{12}$.

Misce, fiat pulvis in chartulas xij, dividenda.

Signa.—Take one every hour (or two hours), till the gums are touched.

When there is a disposition to undue purging, from gr. ss to gr. ij of powdered opium may be added to the above quantities.

Emmenagogues.

No. 55.—*Dr. Otto's Emmenagogue Pills.*

Take of Calcined sulphate of iron . .	gr. xlviij.
Aloes, in powder . . .	gr. xij.
Turpentine	gr. xxxij.
Oil of turpentine	gtt. x or q. s.

Make a mass, and divide into 30 pills. Dose, 2, three times a day.

Prescribed originally by the late Dr. J. C. Otto, and very frequently by the late Dr. Isaac Parrish; a similar recipe is often directed by Dr. Pepper in the Pennsylvania Hospital Clinique.

The cautious addition of oil of turpentine insures an adhesive and plastic mass.

Numerous pills containing aloes, myrrh, and iron, given under the head of tonics and cathartics are much used as emmenagogues. (See also *Hooper's Female Pills*, among the patent medicines.)

Suppositoria.

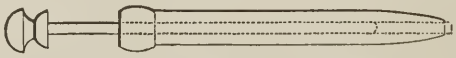
Suppositories, as a class of medicines, are so seldom prescribed, that I can lay claim to little practical familiarity with their preparation. They are used to insert into the rectum to fulfil several indications; sometimes their action is mechanical, but they usually owe their utility either to a narcotic, astringent, or cathartic ingredient.

The only officinal preparation commonly prescribed in this form, is:—

No. 56.—*Pilulæ Saponis Compositæ*, U. S.

Consisting of opium a half ounce, and soap two ounces, triturated into a mass; this is made into a round or oblong mass of suitable size, say 10 grains, and inserted, either by the finger, or by the tube here figured, which is made for the purpose of wood or ivory.

Fig. 211.



Tube and piston for introducing suppositories.

The suppository is improved by being smeared with some bland fixed oil, which facilitates its introduction. From a paper by Alfred B. Taylor, in the *American Journal of Pharmacy*, vol. xxiv. p. 211, the following recipes are extracted:—

"There is perhaps no substance so well adapted to serve as the vehicle of these applications, as the butter of cocoa (oleum cacao), as no combination of suet, spermaceti, or wax, &c., combines in so great a degree the proper hardness or firmness of substance, with the requisite fusibility.

"The following formula is a prescription of Dr. S. W. Mitchell, and has been considerably used.

No. 57.—Take of Cocoa butter . . . . ℥iss.
Powdered opium . . . . . gr. xij.

Mix, and make into twelve suppositories.

"The butter of cocoa is to be melted by a gentle heat. The opium is then to be well rubbed up with a small quantity of the fluid, until thoroughly incorporated, and the remainder of the melted butter gradually added. When cool and slightly thickened, the mass, being well stirred, should then be poured into paper cones.

"If the cocoa butter is too fluid when transferred to the moulds, the opium will settle to the apex of the cone, and not be thoroughly diffused through the substance.

"When perfectly hard, these cones should be pared or scraped at the base until they weigh just one drachm, giving one grain of opium to each suppository.

"Practically, therefore, it will be necessary to make one less than the required number, reserving the parings for another operation.

The following formula has been prescribed by Dr. Pancoast:—

No. 58.—Take of Cocoa butter . . . ℥j.
Extract of krameria . . . . ℈ij.
Powdered opium . . . . gr. v.

Mix and make into ten suppositories as above.

"It is stated that cocoa butter is much esteemed in France for its supposed healing qualities, and is a favorite application in cases of piles. With powdered galls or tannic acid this substance would therefore, probably, form a useful substitute for the ordinary pile ointment.

"The proportions to be employed would, of course, be regulated entirely by the physician's order.

"In Dorvault's French work on *Practical Pharmacy*, suppositories are described as varying from the size of the little finger to that of the thumb, and weighing from ℥j ¼ to ℥ij ½ (five to ten grammes). The author gives as a formula for the vehicle, butter of cocoa melted with an eighth part, by weight, of white wax; or as an inferior substitute, and one less used, common tallow mixed with the same proportion of wax. Soap suppositories are formed by simply cutting soap into convenient shapes. Suppositories are also prepared from honey, by boiling down this substance till it becomes sufficiently hard to retain its shape. There are also formulæ given for anthelmintic, anti-hemorrhoidal, astringent, emmenagogue, laxative, and vaginal suppositories, as well as belladonna, calomel, cicuta, mercurial, and quinine suppositories.

"In Gray's *Supplement to the Pharmacopœia*, there is given the following formula for a suppository, taken from the *Codex Medic. Hamberg*, 1845.

No. 59.—Take of Aloes . . . . ℥vj.
Common salt . . . . . ℥iss.
Spanish soap . . . . . ℥iss.
Starch . . . . . ℥viij.

Mix and make into a mass with honey, and then form into cones of the required size."

No. 60.—*Anthelmintic Suppositories.*

Take of Aloes, in powder . . . . . ℥ss.
Chloride of sodium . . . . . ℥iij.
Flour . . . . . ℥ij.
Honey . . . . . sufficient.

Form into a firm paste, and make into 12 suppositories. Used in the treatment of ascarides.

CHAPTER V.

LIQUID PREPARATIONS, SOLUTIONS, MIXTURES, &c.

THESE forms include a great variety of preparations. The term mixture is applied strictly to those liquids in which insoluble substances are suspended, but, in a more general sense, to all liquid medicines not included in one of the several classes of solutions, infusions, tinctures, &c. In treating of them here, I shall for convenience include all extemporaneous preparations prescribed in the liquid form, endeavoring to adopt such a classification as will aid the student in acquiring a knowledge of the principles which should guide the practitioner in their composition.

The hints given toward the preparation of ingredients into the form of pills are generally quite reversed in the case of mixtures, which should mostly be composed of substances in part or entirely soluble, or by their lightness readily diffusible in water. In mixtures, the use of excipients is not limited, as in the other case, by the necessity of not exceeding a certain bulk, but they may be freely added with a view to improving the composition physically, pharmaceutically, and therapeutically, and within certain pretty wide bounds, while the range of medical agents prescribed is enlarged by the addition of a great number of fluids as the fixed and essential oils, ethers, solutions of ammonia, &c. There are reasons, however, which make the art of combining in the liquid, much more difficult than in the solid form. In the presence of the great neutral solvent, the chemical affinities of various saline ingredients are fully brought into play, which, when in a dry or even a plastic condition, are without action upon each other; again, the physical difficulties to be overcome in this form of preparation are greater than in the foregoing, because the variety of materials to be combined is increased. The proper suspension of fixed and essential oils, for instance, is a matter of no little skill, and the division and diffusion of various powders require judgment and skill only attainable by a familiarity with their physical properties.

There is also in the introduction of excipients and adjuvants, great scope for the exercise of ingenuity, to improve not only the flavor, but the appearance of mixtures. (See Prescriptions No. 72 and 73, and others.)

Next to a considerable range of practice in the composition of mixtures, I know of no better way to become familiar with the subject than by a study of a syllabus like that here presented, together

with a number of approved formulæ, such as are grouped together in this chapter.

Medicines suited to Liquid Form.

MOST SOLUBLE SALTS, LIGHT INSOLUBLE POWDERS, EXTRACTS, GUM RESINS, FIXED AND ESSENTIAL OILS, AND ALL THE GALENICAL SOLUTIONS.

SOLUBLE.

FORMING ELIGIBLE SOLUTIONS WITH WATER.

Alumen.
Ammon. murias.
Antim. et potass. tart.
Barii chloridum.
Calcii chloridum.
Ferri sulphas.
" et pot. tartras.
Manganesii sulphas.
Magnesiæ sulphas.
Potassæ acetas.
" bicarbonas.
" carbonas.
" citras.
" chloras.
" tartras.
Potassii bromidum.
" iodidum.
Morphiæ acetas.
" sulphas murias.
Sodæ bicarbonas.
" boras.
" carbonas.
" sulphas.
" et pot. tartras.
Sodii chlorid.
Sodæ phosphas.
Acid, citric.
" tartaric.
" tannic.

REQUIRING CERTAIN ADDITIONS TO FORM ELIGIBLE SOLUTIONS.

Quiniæ sulphas.
Cinchoniæ sulphas.
Quinidiæ sulphas.
Chinoidine.
Iodinium.
Hydrarg. iodid. rub.
Requiring viscid substances, as correctives or vehicles.
Ammoniæ carbonas.
Hydrarg. chlorid. corros.
Potassii cyanuretum.
Potassa.

BEST FORMED INTO SOLUTION IN MAKING THE SALTS.

Ammoniæ acetas.
Magnesiæ citras.
Acid, phosphoric.
Potassæ arsenitis.
" bitartras.
Arsenici et hyd. iod.
Potassa.
Ferri citras.
" nitras.

INSOLUBLE.

MIXING WITH WATER, BUT NOT FORMING CLEAR SOLUTIONS.

Diffused by agitation:—
Magnesia.
Potassæ bitart.
Sulphur præcip.
Pulv. cinchonæ.
" ipecac.
Quiniæ sulph.
Miscible by trituration alone:—
Extractum aconiti.
" belladonnæ.
" conii.
" hyoscyamii.
" stramonii.
" taraxaci.
" krameriæ.
" glycyrrhizæ.
Confectiones.
Assafœtida.
Ammoniac.
Guaiacum.
Myrrha.
Scammonium.
Suspended by the aid of viscid excipients:—
Copaiba.
Ol. amygdalæ.
" ricini.
" olivæ.
" terebinthinæ.
Olea essentia.
Ferri protocarb.

Preparations adapted to Use as Vehicles or Correctives of the Unpleasant Taste, and other Properties, especially of Saline Substances.

Aquæ medicatæ (generally).
Syrupi (generally).
Tinctura cinnamomi.
" " comp.
Tinctura cardamomi.
" " comp.
Mistura amygdalæ.
Spt. lavandulæ comp.
Infusum rosæ comp.
Saccharum.
Pulv. acaciæ, saccharum, and with these—
Olea destillata.
Tinct. Tolutana.
" zingiberis.

Of the most numerous class in the syllabus, those which form eligible solutions, without the addition of any chemical or other excipient, it should be remarked that many are so well adapted to combinations with other medicinal or corrective substances as to be rarely prescribed alone. Thus, muriate of ammonia is nearly always prescribed with expectorant remedies in cough mixtures. The bicarbonate and carbonate of potassa, and of soda with prophylactics, as in hooping-cough mixtures; or with stimulants, as in ordinary carminative and antacid remedies, acetate of potassa is much used with other diuretics. Alum and borax are best adapted to gargles and astringent washes, in which other medicines, not incompatible, may be combined. Bromide and iodide of potassium are instances of mineral substances, often combined with vegetable alteratives, which increase their effect and take off at the same time their very unpleasant sensible properties.

In the formulæ which follow, these modes of combination are illustrated as well as those of the less soluble substances displayed in the other groups of the syllabus. The part of this work devoted to pharmaceutical chemistry, contains the mode of preparing those solutions, the medicinal ingredients of which are developed spontaneously in the process of preparation.

Incompatibles.

The subject of incompatibles is, it appears to me, too much of a stumbling-block to the student. A moderate amount of chemical knowledge will serve to guard the practitioner against the use of incompatibles entirely, while the observance of a few simple rules will be sufficient to protect from glaring errors in this respect In the list of substances incompatible with each other, as published in the books, perhaps a majority are not likely to be ordered, on account of any fitness they have for each other in their therapeutical relations, while it is well known that some of the most popular of prescriptions are framed with the especial design of producing precipitates, which, being diffused in the resulting liquid, aid its general effect.

Authors have given too absolute a sense to the term incompatible, by giving sanction to the idea that all substances which form insoluble precipitates are incompatible with each other. An insolu-

ble compound is not necessarily inert, but, as experience abundantly proves, is frequently the best and most eligible form for a medicine.

The reactions which occur in the organism are not to be judged of by ordinary chemical laws, as manifested in the laboratory of the chemist. The difference of action between the animal solvents under the influence of the life force, and those employed by the chemist with the mechanical means at his command, are too well known and appreciated to require extended notice. Living beings can dissolve, appropriate, and circulate in their fluids, substances which, to ordinary agencies, are most intractable and insoluble.

Corrosive sublimate, when precipitated by albumen, gluten, and casein, is presented in the most insoluble form possible, and yet this mode of combination is highly recommended by the French as being more easily endured by the stomach, while the alterative effect is both mild and certain. This mode of procedure is stated by Dorvalt to be adapted to a number of mineral salts, such as lead, tin, zinc, copper, silver, platina, gold, &c., all of which form, with albuminous substances, compounds insoluble in water and ordinary solvents, but soluble in the liquids of the alimentary canal, by the aid of which they are placed in condition very suitable for medicinal action.

These facts are applicable to toxicology. When in a case of poisoning from vegetable alkalies, tannin, or an astringent decoction is given; or, after the use of a poisonous dose of arsenious acid, we give hydrated peroxide of iron; or, after corrosive sublimate, albumen; an insoluble compound is formed in each case, and yet it does not follow that these compounds are inert, but only that their immediate effects are destroyed, and their absorption diminished; indeed, it has been proved that, in cases of poisoning, where antidotes had been used successfully, the urine contained both the poison and antidote five or six days after they were taken. The practice of administering purgatives and emetics for the complete evacuation of poisons, even after neutralization, is founded on the fact that they are still capable of slow absorption.

In connection with this subject, it may be well to mention the fact that when active metallic substances, as, for instance, the salts of mercury and of antimony, are taken for some time continuously, they seem to be deposited in the alimentary canal in an insoluble form, so that, by administering a chemical preparation which forms with them soluble salts, they sometimes display their activity to an alarming and even dangerous extent. The rationale of the use of iodide of potassium, after the long-continued use of mercurials, is, that it forms an iodide of mercury, which it dissolves and carries off through the secretions; salivation is sometimes induced, unexpectedly, in this way. It is stated that patients, who have used antimonials, are sometimes nauseated by lemonade made from tartaric acid, owing to the formation of tartar emetic from the undissolved oxide of antimony. These facts are not without interest, in connection with the subject of prescribing.

Considering it necessary, as a general rule, to avoid the association of substances which, by contact, may produce unknown or ill-defined compounds, or compounds different from those intended to be administered, I proceed to state briefly the most important rules relative to incompatibles:—

1. Whenever two salts, in a state of solution can, by the exchange of their bases and acids, form a soluble and an insoluble salt, or two insoluble salts, the decomposition takes place, and the insoluble salt is precipitated, or, by combining with the soluble salt, gives birth to a double salt, which is rarely the case.

2. If we mix the solutions of two salts which cannot create a soluble salt, and an insoluble salt, a precipitate will not be formed, and most frequently there will be no decomposition, although this is not invariably the case.

3. In mixing any salt and a strong acid, a decomposition is very apt to take place.

4. Salts with feeble acids, especially carbonic and acetic, are always decomposed by strong acids.

5. Alkalies in contact with the salts of the metals proper, or of the alkaloids, decompose them, precipitating their bases.

6. Metallic oxides, in contact with acids, combine with them and form salts whose properties are sometimes unlike either the acid oxides.

7. Vegetable astringents precipitate albumen, gelatin, vegetable alkalies, and numerous metallic oxides, and with salts of iron produce black inky solutions.

8. The condition most favorable to chemical action is a solution of the salts in concentrated form without the intervention of viscid substances, so that when the indications require the employment of two substances which are incompatible, it is well to form a dilute solution of one of them in a mucilaginous or syrupy liquid before adding the other. In this way the decomposition may often be averted.

In the table appended, some preparations are mentioned which, as a general rule, the practitioner should avoid combining with chemical substances; they are best given in simple solution, or some of them, with the addition of the Galenical preparations, or simple saccharine or mucilaginous excipients:—

Acidum hydrocyanicum.
" nitro-muriaticum.
Liquor hydrarg. et arsen. iodid.
" potassæ arsenitis.
" calcis.
" barii chloridi.
" calcii chloridi.
" iodinii compositus.
" potassæ.
" ferri citratis.
" morphiæ sulphatis.
" " nitratis.
Tinct. ferri chloridi.
Tinct. iodinii.
Antimonii et potassæ tartras.
Potassii cyanuretum.
" bromidum.
" iodidum.
Ferri et pot. tartras.
Quiniæ sulphas.
Cinchoniæ sulphas.
Quinidiæ sulphas.
Morphia sulphas.
" murias.
" acetas.
" valerianas.
Zinci acetas.
Potassæ acetas.

In addition to what has been said, it seems proper to notice what will be more particularly brought into view in commenting on the formulas which follow; the intentional use of medicines, in one sense, incompatible for the purpose of producing new and more desirable compounds. The proto-carbonate of iron is in this way produced from the sulphate and a carbonated alkali. The acetate of ammonia by the addition to a solution of the carbonate of acetic acid. In the same way black and yellow wash are extemporaneously prepared by adding to lime-water, calomel and corrosive sublimate, respectively. The association of sulphate of zinc and acetate of lead furnishes a familiar illustration of the same fact; the resulting precipitate of sulphate of lead, occurring as an impalpable powder or magma, is favorable to the therapeutic object in view.

Laudanum is quite incompatible with subacetate of lead; but one of the most popular of lotions contains these ingredients associated, so that it is not correct to say that these substances are incompatible in a medical sense, however, in a purely chemical point of view, they may be considered so.

Pharmaceutical incompatibles are those in which a disturbance of a solution takes place in a way not considered strictly chemical. My observation has satisfied me that these are very commonly associated, though little observed. In speaking of pills, I referred to some pharmaceutical incompatibles, and may now instance others. If we add tincture of Tolu to an aqueous solution, the resin of the Tolu separates almost entirely as a coagulum, and collects on the side of the bottle, thus being lost as a medicinal ingredient of the preparation, besides rendering it very unsightly. The same remark applies to other resinous tinctures.

The admixture of tincture of guaiacum with the spirit of nitric ether is another instance; the resinous tincture gelatinizes into a mass, and is unfit for use. The addition of tincture of cinnamon to infusion of digitalis after filtration, as directed in the *Pharmacopœia*, occasions a precipitate.

List of Pharmaceutical Incompatibles.

Comp. infusion of cinchona, with comp. infusion gentian.
Essential oils with aqueous liquids in quantities exceeding 1 drop to f ℥j.
Fixed oils and copaiva, with aqueous liquids, except with excipients.
Spirit of nitric ether with strong mucilages.
Infusions generally with metallic salts.
Compound infusion of gentian with infusion of wild cherry.
Tinctures made with strong alcohol, with those made with weak alcohol.
Tinctures made with strong alcohol, with infusions and aqueous liquids.

Excipients used in Mixtures, &c.

The consideration of excipients will bring into view the best modes of overcoming some of these pharmaceutical incompatibilities.

In the form of mixture we use, in the first place, as diluents—

Water.
The medicated waters.
Syrups.
Compound infusion of rose.
Emulsion of almonds.
Honey of rose.

As excipients or constituents in a stricter sense—

Pow'd acacia, Sugar, } mixed or singly.
Powd. tragacanth.
Confections.
Extracts.
Yelk of egg.
White of egg.

As flavoring agents with viscid ingredients—

Essential oils of { Cinnamon. Lemon. Aniseed. Caraway, &c.
Tinctures of { Ginger. Tolu. Oil of P. mint. " of mint.

As flavoring and coloring agents with or without viscid ingredients—

Tincture of cinnamon.
Compound tincture of cinnamon.
Tincture of cardamom.
Compound tincture of cardamom.
Compound spirit of lavender.
Comp. tincture of gentian.
Fluid extract of vanilla.
Ginger syrup.
Tolu syrup.
Fruit syrups, &c.

The diluents are useful as enabling us to divide the doses of an active medicine to almost any extent; they correspond to the sugar, gum, aromatic powder, &c., prescribed for a similar purpose with powders, and with conserve of rose and some other bulky additions used in pill masses.

The immense utility of excipients, and flavoring agents generally, will be best illustrated by the examples which follow. The skilful employment of these adds greatly to the success of the prescriber.

The necessity of limiting the number of prescriptions given, and the importance of including in them a considerable variety of medicinal agents, will forbid the illustration of all the numerous points in this connection, and much will necessarily be left to be filled up by the ingenuity of the learner.

EXTEMPORANEOUS SOLUTIONS, MIXTURES, &c.

Astringents.

No. 61.—*Mistura Cretæ*, U. S. (*Chalk Mixture, or Chalk Julep.*)

Take of Prepared chalk . . . . ℥ss.
Sugar,
Powdered gum Arabic, each . . ʒij.
Cinnamon water,
Water, each . . . . . fʒiv.

Rub them together till they are thoroughly mixed.

To this, which is a very popular antacid astringent, the addition is often made of tincture of kino, or some similar vegetable astringent, either with or without tincture of opium. In the absence of cinnamon water, two drops of the oil of cinnamon for each ounce of that water ordered, may be added to the dry ingredients. As the mixture does not keep very well, it is a convenient plan to keep the powders ready mixed, and add the water when required. Chalk mixture is giving in an adult dose of ℥ss.

No. 62.—*Parrish's Camphor Mixture.* (Dr. Parrish, Sen.)

℞.—Aquæ camphoræ . . . . . f℥iij.
Spiritus lavandulæ compositi . . . f℥j.
Sacchari . . . . . ℥j.
Misce.

Give a tablespoonful every two hours in diarrhœa and cholera-morbus, adding ten drops of laudanum when there is much pain.

This preparation, which was originally prescribed in 1832, has been found so generally useful and safe that it has become a standard remedy, and is prepared and sold by all druggists in Philadelphia and its vicinity.

No. 63.—*Hope's Camphor Mixture.*

℞.—Aquæ camphoræ . . . f℥iv.
Acidi nitrosi . . . . ♏ xxx.
Tincturæ opii . . . . ♏ xx vel. xl. Misce.

Dose, a tablespoonful every two hours in diarrhœa and dysentery.[1]

[1] *Extracted from the Edinburgh Medical and Surgical Journal*, January, 1824. *Observations on the Powerful Effects of a Mixture containing Nitrous Acid and Opium in curing Dysentery, Cholera, and Diarrhœa.* By Thomas Hope, Esq., Surgeon, Chatham. —"More than twenty-six years ago, when attending a case of dysentery in which the usual remedies had been prescribed in vain, the patient determined, on his own accord, to take a medicine I had sent for his nurse, who was worn out with attention to her charge, and complained of excessive thirst. It occurred to me to give an acid to alleviate her complaint, and in order to obviate any unpleasant effects, to join opium with it; I accordingly sent the following: ℞.—Acidi nitrosi ℥ij; Ext. opii gr. ij; Aquæ ℥ij.—M. Cap. cochl. minus ter quarterve in die; and the patient with dysentery having taken some of this medicine, the effect produced was so great that it no less surprised him, who, by a continuance of it, recovered, than it did myself.

"The form of the medicine, as I have used it in all the cases referred to, is as under:—

℞.—Acid. nitrosi . . . . . ℥j.
Mist. camphor . . . . . ℥viij. Misce et adde
Tinct. opii . . . . . gtt. xl.

Sig.—One-fourth part to be taken every three or four hours.

"In chronic dysentery, the dose of two ounces three times a day is quite sufficient; the remedy is grateful to the taste; abates thirst; soon removes the intensity of pain; and procures, in general, a speedy and permanent relief. No previous preparation is required for taking it, nor any other care whilst taking it, except the keeping of the hands and feet warm, preserving the body as much as possible from exposure to ex-

No. 64.—*A New Remedy in Hemorrhages.*

Take of Oil of erigeron . . . . . f℥j.
Sugar . . . . . ℥ij.
Gum Arabic . . . . . ℥j.

Triturate the oil with the gum and sugar into a dry powder, then add—

Water . . . . f℥ij, f℥vj.

Sig.—Take a tablespoonful three times a day.

Dr. E. Wilson and others have had considerable success in the treatment of uterine hemorrhages with the oil of erigeron; in the doses here prescribed, each f℥ contains gtt. v of the oil.

Alteratives, &c.

No. 65.—*Blue Mass and Chalk Mixture.*

Take of Mercurial mass, in powder . . ℥ss.
Prepared chalk, ... ℥j.
Gum Arabic, in powder,
Sugar, do., of each . ℥ss.
Tincture of opium . . . . ♏xxx.
Aromatic syrup of rhubarb . . f℥j, f℥vj.

Triturate into a uniform mixture.

Dose, f℥j to stimulate the secretion of bile, and check diarrhœa. Tincture of kino or other astringents may be added.

No. 66.—*Creasote Mixture.*

Take of Creasote . . . . . gtt. xvj.
Powdered gum Arabic . . . . ℥j.
Sugar . . . . . ℥ss.
Water . . . . . f℥ij.

Triturate the creasote with the gum and sugar, then gradually add the water and triturate to a uniform mixture.

Dose, a teaspoonful containing one drop of creasote, used in bronchitis, phthisis, &c., and to check vomiting. Creasote is soluble in water to the extent of ♏v to f℥j, and for external use is best made into a suitable solution by shaking up with water.

treme cold or currents of air, and making use of warm barley-water or thin gruel, and a diet of sago or tapioca.

"It is necessary to mention that the remedy, the good effects of which I now detail, is *nitrous* acid with opium, not *nitric* acid. I have not found nitric acid with opium to produce any good effect, for, having expended my nitrous acid, I sent to a chemist for a fresh supply, who, by mistake, sent me nitric acid, which I used merely by way of trial, but found it not in any way beneficial to my patients."

Tonics.

No. 67.—*Fever and Ague Mixture.*

℞.—Powdered red bark . . . . . ℥iij.
Confection of opium,
Lemon-juice . . . . . ℥iss.
Port wine . . . . . f℥iij.

Mix by trituration in a mortar.

Dose, three tablespoonfuls morning, noon, and night, the day the fever is off.

Some recipes direct powdered serpentaria in addition to the above.

Though not an elegant, this is a most efficient and valuable combination.

No. 68.—*Mistura Ferri Composita*, U. S. (*Griffith's Myrrh Mixture.*)

Take of Myrrh,
Sugar, of each . . . . . ℥j.
Carbonate of potassa . . . . gr. xxv.

Triturate together into a fine milky mixture with

Rose water . . . . . f℥viiss.

Then add Spirit of lavender (simple) . . . f℥ss.
Sulphate of iron, in powder . . . ℈j.

Dose, a tablespoonful according to circumstances, given as a tonic in phthisis, and in anæmic cases generally.

The strict phraseology of the *Pharmacopœia* has been departed from above in the hope of rendering the pharmaceutical points in the preparation more clear.

The sulphate of iron and carbonate of potassa here used, form by double decomposition the sulphate of potassa and protocarbonate of iron, which latter floats in the milky mixture of myrrh and sugar, giving it a green color. This is, however, in very small proportion, so that in each f℥ss dose, there is not more than gr. ss. This preparation is, however, a very useful and an elegant one. (See *Pil. Ferri Carbonatis* and *Ferri Subcarbonatis.*)

No. 69.—*A good Preparation of Iron and Cinchona.*

(Substitute for Tinctura Cinchonæ Ferrata.—See p. 118.)

℞.—Tinct. cinchon. comp.[1] . . . . . f℥iv.
Ferri citratis . . . . . ℥j.
Acidi citrici . . . . . gr. xv.

[1] Tinct. cinchonæ et quassiæ comp. makes a better preparation, and scarcely precipitates at all.

Triturate the citric acid and citrate of iron together, and dissolve in the tincture of cinchona. Liq. ferri citratis f℥j may be used as a substitute for the rather insoluble salt. The dose is a teaspoonful, containing two grains of citrate of iron.

The citric acid breaks up any tannate of iron as soon as formed, and it is reproduced on the addition of an alkali. There is a liability to considerable precipitate of cinchonic red, but very little iron is thrown down.

No. 70.—*A Concentrated Solution of Quinia and Iron.*

℞.—Quiniæ sulphatis . . . . . ℈j.
Tr. ferri chloridi . . . . . f℥iiss.

Ft. solutio.

One grain of sulph. quinia is contained in every 7½ minims (about 15 drops) of the solution, which is an appropriate dose; it may be made three times the strength. To prescribe it in a more diluted form, add water f℥ij, and syrup of orange-peel (or other suitable syrup) f℥iij. The dose will then be a teaspoonful, equivalent to 1 gr. of the quinia salt.

No. 71.—*A Bitter Tonic for Dyspepsia.*

℞.—Tr. cinchonæ et quassiæ comp. . . . f℥iv.
Tincturæ nucis vomicæ . . . . f℥j.

Misce.

A teaspoonful 3 times a day in a little sugar and water.
This is one of the very best recipes of its kind.

No. 72.—*Aromatic and Antacid Corrective of Indigestion.*

℞.—Sodæ bicarbonatis . . . . . ℈iv.
Infus. gentianæ comp. . . . . f℥iiss.
Aquæ menthæ pip. . . . . f℥iij.
Tinct. cardamomi comp. . . . . f℥ss.

Dose, a tablespoonful as required.

The above makes a handsome preparation; it was furnished me by my friend Dr. J. J. Levick.

Arterial Stimulants.

No. 73.—*Carbonate of Ammonia Mixture.*

		Dose contains
Take of Carbonate of ammonia . .		gr. x.
Powdered gum Arabic . .		gr. x.
Sugar, each	℥iss	gr. x.
Comp. spirit of ether, . .		♏ xv.
" tinct of cardam., each .	f℥ij	♏ xv.
Water	f℥iijss	

Make a mixture. Dose, a tablespoonful every two or three

hours. A stimulant in low conditions, as in the last stages of disease.

No. 74.—*Oil of Turpentine Mixture.*

℞.—Olei terebinthinæ	f℥iij.
Pulv. acaciæ,	
Sacchari, āā	℈ij.
Tinct. opii	♏ L.
Aquæ cinnamomi	f℥vss.

Triturate the gum and sugar with f℥j of the cinnamon water, and add the other ingredients. The yelk of an egg may be substituted advantageously for the gum and sugar, and a part of the water. Dose, f℥j, containing about ♏ iv of the oil, and ♏ j of tincture of opium.

Nervous Stimulants.

No. 75.—*Mistura Assafœtidæ*, U. S. (*Milk of Assafœtida.*)

Take of Assafœtida	℥ij.
Water	Oss.

Rub the assafœtida with the water gradually added until they are thoroughly mixed. A good extemporaneous way to prepare this very popular antispasmodic, is to form a wine of assafœtida, as directed by Henry N. Rittenhouse, of this city, by triturating ℥ss of the gum resin, with f℥x wine. It should be carefully selected, so as not to require straining; this wine will keep, and is converted into the mixture by adding to water in the proportion of ℥j (by weight) to each f℥j.

Milk of assafœtida is much prescribed and extensively used as a domestic remedy. Dose, from f℥j to f℥ss.

No. 76.—"*Chloroform Paregoric*" *of Dr. Henry Hartshorne.*

Take of Chloroform,	
Tincture of opium,	
" of camphor,	
Arom. spt. of ammonia, of each . .	f℥iss.
Oil of cinnamon	gtt. iij.
Brandy	f℥ij.

Dose, f℥ss, or less in spasmodic affections of the stomach, cholera, &c. Several practitioners have used this preparation with favorable results in severe cases.

Narcotics.

No. 77.—*Liquor Morphiæ Sulphatis*, U. S.

		Reduced.
Take of Sulphate of morphia . .	gr. viij	gr. j.
Distilled water . . .	Oss.	fʒj.

Dissolve the morphia in the distilled water. This is an illustration of the most convenient method of giving small doses of soluble substances; here the proportions are so adjusted, that each teaspoonful shall represent $\frac{1}{8}$ gr. of morphia, which is a rather small dose.

A favorite prescription for after-pains in obstetric practice, is a solution of sulphate of morphia in camphor water, in the same proportion as the above. Dose, the same.

Arterial and Nervous Sedatives.

No. 78.—*A good Anti-Fever Combination.*

		In each, fʒj.
℞.—Vini antimonii,		♏ viij.
Spt. ætheris nit., āā . .	fʒss	♏ viij.
Tinct. digitalis . . .	fʒj	♏ ij.
Syr. acidi citrici . . .	fʒiij	

Misce.

Sig.—Take a teaspoonful every 3 or 4 hours.

No. 79.—*Remedy in Pulmonary and Catarrhal Diseases, &c., Unattended by Fever.*

℞.—Acidi hydrocyanici	gtt. xl.
Vini antimonii	fʒss.
Syrupi tolutana	fʒiss.
Mucil. acaciæ	fʒij.

M., fiat mistura, capiat cochl. parvum ter quarterve die.

This, with several similar combinations of hydrocyanic acid, is highly recommended by Dr. Horace Green, and published by him among his selections from favorite prescriptions collected from distinguished American physicians, in a scrap-book kept for the purpose. Rendered much more dilute, this is recommended as the best of remedies for hooping-cough.

Cathartics.

No. 80.—*Castor Oil Mixture.*

Take of Gum Arabic, in powder,	
Sugar, of each	ʒiij.
Oil of mint	gtt. iv.

Triturate into a uniform powder, and add water f℥vj, or sufficient to bring the mucilage to the consistence of castor oil, then add, by degrees, castor oil f℥j, continuing the trituration till it combines into a perfect emulsion. Dilute this by adding water sufficient to make f℥iv.

This will make a perfect castor oil emulsion. If oil of turpentine is to be incorporated with it, let it be added to the mixed gum and sugar, before introducing the water and oil, or let it be first perfectly mixed with the castor oil. If laudanum, or some carminative and coloring adjuvant is desirable, it may be added at the time of bottling. In no case should the oil be introduced into the bottle until combined with the other ingredients, as a portion will then adhere to the sides, and be imperfectly incorporated with the gum. Each tablespoonful of this mixture contains f℥j of oil, and may be given every hour till the desired effect is produced.

Several demulcent mixtures—as those of olive oil, almond oil, &c.—may be made upon this model. Copaiva mixture, introduced among the diuretics, may have a similar composition. The proportion of gum and sugar to the oily ingredient (℥iij each, to f℥j) should be remembered, as it applies equally to the other cases named.

Taraxacum and other Mixtures.

By the judicious admixture of the fluid extracts of taraxacum, senna, &c., with saline cathartics, some excellent purgative combinations may be formed.

No. 81.—*A good Antibilious Mixture.*

℞.—Carbo ligni	. . . . .	℥j.
Sodæ bicarb.	. . . . .	℥ss.
Mass hydrargyri	. . . .	gr. viij.
Syrupi rhei aromat.	. . . .	f℥ij.
Aquæ	. . . . .	f℥ij.

Triturate together into a uniform mixture. Dose, a tablespoonful.

This was furnished by Dr. John D. Griscom, who finds it to meet a very common indication in general practice.

No. 82.—*A good Magnesia Mixture for Children.*

Take of Magnesia (Husband's)	. . .	℥j.
Powd. gum Arabic	. . .	℥ss.

Triturate together, and add

Aromat. syrup of rhubarb	. .	f℥iij.
Fennel-seed water	. . . .	f℥iss.

A teaspoonful is an appropriate dose. To this mixture may be added, say gr. xv of mercurial mass, which should be triturated

with the powder, and, if required, the addition of say ♏viij of laudanum, or f℥j of paregoric. The precaution of shaking up before administering should not be overlooked.

No. 83.—*Extemporaneous Cream of Tartar Draught.*

Take of Tartaric acid . . . . . ℥ix.
Water . . . . . f℥vj.

Make solution, and label No. 1.

Bicarb. potassa . . . . . ℥iv.
Water . . . . . f℥vj.

Make solution, and label No. 2.

Mix from one to two tablespoonfuls of No. 1 with the same quantity of No. 2, and drink immediately. In this way, the bitartrate of potassa is obtained in solution, although, if the mixture be allowed to stand a few minutes, it will deposit the salt in a white crystalline powder.

The following soluble powders may not inappropriately be introduced here.

No. 84.—*Aperient Seidlitz Powders.*

Take of Bicarbonate of soda . . . ℈ij.
Tartrate of potassa and soda . ℥ij.

Mix, and fold in blue paper.

Tartaric acid . . . . gr. xxxv.

Fold in white paper.

Directions for use.—Take two glasses, with about a gill of cold water in each; dissolve in one the contents of the blue and in the other of the white paper. Mix, and drink immediately.

Diuretics.

No. 85.—*Emulsion of Fluid Extract of Cubebs.*

Take of Fluid ext. of cubebs . . . gtt. cxx.
Yelk of egg . . . . one.
Sugar, powdered . . . ℥ij.
Mint water sufficient to make a . f℥iij mixture.

Triturate the fluid extract with the powdered sugar and yelk of egg, and then dilute with the water. Direct a teaspoonful four times a day.

This may be made by substituting ℥ij powdered gum Arabic, and ℥j sugar, for the yelk of egg. It is a fine stimulant to the

mucous surfaces, adapted to catarrhs, &c., as well as to urinary diseases. The dose is f℥j, containing ♏v of the oleo-resin of cubebs.

No. 86.—*Alkaline Copaiva Mixture.*

℞.—Copaibæ,
Liq. potassæ, āā . . . f℥ij.
Pulv. acaciæ,
" sacchari, āā . . . ℥ij.
Aq. menth. virid. . . . q. s. ut fiat f℥iv.

Mix the copaiva and solution of potassa, add the water, and triturate with the gum and sugar.

In this prescription, which is prescribed by my friend, Dr. William Hunt, the copaiva is combined into a soap with the alkali, and would be perfectly suspended without the aid of gum and sugar, which are added to obtund the acrid taste. Of course, oil of cubebs, tincture of opium, and other adjuvants, may be added if required. The usual method of suspending copaiva is similar to that given in prescription No. 80. The dose is a tablespoonful, containing ♏xv of copaiva.

No. 87.—*Extemporaneous Solution of Acetate of Potassa.*

Take of Acetic acid . . . . f℥vj.
Water . . . . . f℥iij.
Potass. bicarb. . . . ℥iijss, or sufficient to form a neutral solution.

This is designed to obviate the necessity of weighing the very deliquescent acetate of potassa, and will contain, to each f℥j, about ten grains of the salt, which is an appropriate dose. The admixture of fluid extract of taraxacum, or of buchu, or of spirit of nitric ether, will be appropriate in certain cases.

No. 88.—*Scudamore's Mixture for Gout.*

℞.—Sulphate of magnesia . . . . ℥j.
Mint water . . . . . f℥x.
Vinegar of colchicum . . . . f℥j.
Syrup of saffron . . . . f℥j.
Magnesia . . . . . ℥ij, ℈ij.
Mix.

Dose, one to three tablespoonfuls every two hours till four to six evacuations are procured in the twenty-four hours.

No. 89.—*Dewees' Colchicum Mixture.*

℞.—Wine of colchicum seed . . . gtt. xxx.
Denarcotized laudanum . . . gtt. xxv.
Sugar . . . . . gr. xxx.
Water . . . . . f℥j.
Mix. To be taken at night in one draught.

Diaphoretics.

No. 90.—*Liquid Substitute for Dover's Powder.*

℞.—Vin. ipecac. . . . . ℥ xvj.
Tinct. opii . . . . . ℥ xiij.
Spirit. ætheris nit. . . . . f℥j.
Mix.

Sig.—Take at one dose at going to bed.

No. 91.—*Liquor Potassæ Citratis*, U. S. (*Neutral Mixture, or Saline Draught.*)

		Reduced.
Take of Fresh lemon-juice . . .	Oss	f℥iv.
Bicarbonate of potassa . .	q. s.	q. s.

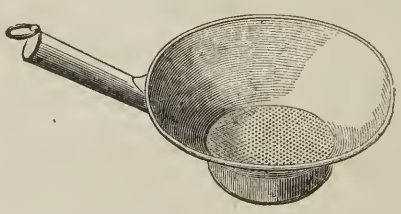
Add the bicarbonate to the lemon-juice till it is perfectly saturated, then filter, or

		Reduced.
Take of Citric acid	℥ss.	℥ij.
Oil of lemons	℥ ij.	℥ j.
Water	Oss.	f℥iv.
Bicarbonate of potassa . . .	q. s.	q. s.

Rub the citric acid with the oil of lemon, and afterwards with the water till it is dissolved, then add the bicarbonate gradually till the acid is perfectly saturated; lastly, filter.

The lemon-juice may be obtained by cutting and expressing the lemon either with the fingers or a lemon-squeezer, and the little strainer, Fig. 212, which will set into the top of the graduated mea-

Fig. 212.



sure or of a beaker glass, Fig. 213, will serve to separate the seed or any portion of the pulp of the lemon. Care must be taken in adding the bicarbonate to use a glass rod, porcelain spatula, silver spoon, or similar utensil which will not corrode or impart a metallic taste to the preparation. It will also facilitate the operation of saturating the acid to triturate the crystals of bicarbonate in a dry mortar into a powder before adding it little by little to the liquid. The delay of filtering through paper may be very much obviated

by using a fine linen strainer, or by plugging the base of the glass funnel, Fig. 214, with some cotton, and pouring the liquid through it into the containing vial; it is an object to conduct this operation

Fig. 213.

Fig. 214.

quickly, so as to retain and bottle up as much as possible the carbonic acid gas liberated in the reaction. There is another point worth attention; in making the solution by the second process with citric acid, it is well to weigh the bicarbonate beforehand, and then the whole amount being added there will be no doubt as to the exact saturation of the acid; this is not practicable in the lemon-juice process, as there is no certainty as to its strength; the proper proportion of bicarbonate, to the ℥ss (240 grs.) of citric acid, is 336 grains; or to the ʒij of acid, 168 grains, or about ʒij, ϑij; a proportion which it is well to remember, as it comes in play in all the other processes. It has always been my custom to cease the addition of the alkaline carbonate before it becomes perfectly saturated, or rather to err on the side of acidity than that of alkalinity. A slight excess of alkali may render the solution quite disagreeable, while, on the other hand, the excess of acid should be extremely small. This prolific subject will be concluded by presenting the following additional formulas:—

		Reduced.
No. 92.—Take of Citrate of potassa . .	ʒvj	ʒiij.
Water	Oss	f℥iv.
Sugar	℥ss	gr. xv.
Oil of lemon . . .	♏ j	gtt. j.

Make a solution.

Here there is no effervescence, and, consequently, no carbonic acid in the solution. In other respects it is the best recipe, because so perfectly neutral and so readily made. The sugar may be omitted or not, at pleasure, but seems to me to improve it.

The following recipe is that of my friend, Ambrose Smith:—

No. 93.—*To Make Effervescing Neutral Mixture Extemporaneously.*

		Reduced.
Take of Bicarbonate of potassa . .	℥iij	ʒvj.
Citric acid	ʒij, ʒiij	℥ss, ϑij, gr. v.
Sugar	℥iss	ʒiij.
Oil of lemon	gtt. xvj	♏ iv.

Mix thoroughly and reduce to a uniform powder, and keep in a well-stopped bottle. To make neutral mixture dissolve ʒvj, ϑj in Oss water (ʒiij, gr. x to fʒiv); this proportion, however, is somewhat less than the strength of the lemon-juice saturated with bicarbonate of potassa, and is graduated to suit the views of many practitioners.

No. 94.—*Effervescing Draught.*

Take of Bicarbonate of potassa . . ʒij to ϑij.
Water . . . . . fʒiv.
Make a solution.

Directions.—Take a tablespoonful of lemon-juice diluted with a tablespoonful of water, and add to it in a tumbler a tablespoonful of this solution, then drink immediately; or thus—

Take of Citric acid . . . . . ʒiij.
Oil of lemon . . . . . ♏j.
Water . . . . . fʒiv.
Make a solution and label No. 1; the acid solution.

Take of Bicarbonate of potassa . . . ʒij, ϑij.
Sugar . . . . . ʒj.
Water . . . . . fʒiv.
Make a solution and label No. 2; the alkaline solution.

Directions.—To a tablespoonful of No. 1, add a tablespoonful of water, and to the mixture, in a clean tumbler, add a tablespoonful of No. 2; drink immediately.

No. 95.—*Effervescing Fever Powders.*

Take of Citric acid, dried and powdered, ʒv.
Divide into twelve parts wrapped in white writing paper.
Take of Bicarbonate of potassa, dried and powdered, ʒviss.
Divide into twelve parts, wrapped in blue paper.

Inclose these white and blue powders alternately in a tin box.

Directions.—Dissolve the contents of a white paper in a tumbler, one-third full of cold water, then stir in the contents of a blue paper and drink immediately.

A dose is usually given every two or three hours, during the prevalence of the fever.

The various forms of citrate of potassa, which are now described, constitute favorite remedies in fever; sometimes spirit of nitric ether, tartar emetic, tincture of digitalis, or other remedies are added to them. The effervescing draught is said to be the best way to give alterative or sedative doses of tartar emetic when the stomach is irritable.

Soda and yeast powders may be introduced here, although not strictly belonging to the class under consideration.

No. 96.—*Carbonated Soda Powders.*

For making a draught of soda water extemporaneously.

Take of Bicarbonate of soda gr. xxiij. Fold in a blue paper.
Tartaric acid . . gr. xx. Fold in a white paper.

Directions for use.—Dissolve one of the powders contained in the white and blue papers in separate tumblers, each nearly half full of water (spring water is preferable), stir them up for a few seconds, to render the solution complete, then mix their contents and drink immediately. A little syrup may be added to one or both of the glasses before mixing. These are usually put into boxes containing twelve of each kind of powders.

Yeast Powders.

A substitute for yeast in making batter cakes, having the advantage of making the batter perfectly light and ready for baking without delay, and greatly diminishing the liability to become sour. Many dyspeptics, who cannot tolerate fresh light cakes when made with yeast, can eat them with impunity when raised in this way.

Fold in a blue paper Bicarbonate of soda . . 120 grs.
" in a white paper Tartaric acid . . . 100 grs.

Directions for use.—Put the contents of a white and blue paper into separate teacups filled with water, and stir until perfectly dissolved. Mix a sufficient quantity of batter for six or eight persons a little thicker than usual, to allow for the liquid in which the powders are dissolved; and when ready for baking stir in well the contents of one teacup, then add the other and stir it well, and commence baking immediately.

A more economical way, and sufficiently accurate in view of the harmlessness of the ingredients, is to keep supplies of the bicarbonate of soda and tartaric acid in separate bottles, which will insure their perfect dryness, and then when wanted for use take a small teaspoonful of each, and dissolve as above. The equivalent weights of these ingredients, as given above, have very nearly the same bulk. If bitartrate of potassa is substituted for tartaric acid, it must be used in about twice the quantity, and being insoluble, must be suspended in water and thoroughly stirred in.

EXPECTORANTS, &c.

No. 97.—*Mistura Ammoniaci*, U.S. (*Lac Ammoniac.*)

Take of Ammoniac . . . . . ℥ij.
Water . . . . . Oss.

Rub the ammoniac with the water, gradually added, until they are thoroughly mixed.

No. 98.—*Mistura Glycyrrhizæ Composita*, U. S. (*Brown Mixture.*)

		Reduced.
Take of Liquorice, in powder		℥j.
Gum Arabic "		℥j.
Sugar, each	℥ss	℥j.
Camph. tincture of opium	f℥ij	f℥ss.
Antimonial wine	f℥j	f℥ij.
Spirit of nitric ether	f℥ss	f℥j.
Water	f℥xij	f℥iij.

Rub the liquorice, gum Arabic, and sugar with the water, gradually poured upon them; then add the other ingredients, and mix.

The dose of this very popular cough medicine is a tablespoonful, or for children f℥j.

No. 99.—*Mistura Amygdalæ*, U. S.

Take of Sweet almonds	℥ss.
Gum Arabic	℥ss.
Sugar	℥ij.
Distilled water	f℥viij.

Macerate the almonds in water, and, having removed their external coat, beat them with the gum Arabic and sugar in a marble mortar till they are thoroughly mixed; then rub the mixture with the distilled water, gradually added, and strain.

This mixture is introduced here, though not belonging appropriately to either of the therapeutical classes. Its chief use is as a vehicle for substances to be used in the liquid form; it may be well substituted by *Syrupus Amygdalæ*, for most purposes.

No. 100.—*A good Cough Mixture.*

℞.—Syrupus tolutanus,	
" ipecacuanhæ, āā	f℥j.
Pulv. acaciæ	℥j.
Tinct. opii camph.,	
" lobeliæ, āā	f℥iij.
Aquæ	℥j.

Triturate the gum and water together, and add the other ingredients in the vial. Dose, a teaspoonful.

This was furnished by Dr. S. W. Butler, of Burlington, N. J., who has used it with great satisfaction.

No. 101.—*A Cough Mixture of Acetone, Wine of Tar, &c.*

℞.—Acetone	f℥j.
Camph. tinct. of opium,	
Antimonial wine, of each	f℥j.
Wine of tar (Jew's beer)	f℥ij.

Mix. Dose, a teaspoonful.

Often prescribed by Dr. Washington L. Atlee.

No. 102.—*Spermaceti Mixture.*

Take of Spermaceti	℥ij.
Olive oil	℥j.
Powd. gum Arabic	℥ss.
Water	f℥iv.

Triturate the spermaceti with the oil, until reduced to a paste, then add the gum, and lastly the water, gradually. Dose, f℥j.

No. 103.—*Hooping-Cough Mixture.*

℞.—Carbonate of potassa	℈j.
Powdered cochineal	℈ss.
Sugar	℥j.
Water	f℥iv.

Make a mixture. Dose for children, f℥j, every two or three hours.

An old and very popular remedy.

No. 104.—*For Hooping-Cough.* (By Golding Bird.)

℞.—Aluminis	gr. xxiv.
Ext. conii	gr. xij.
Aq. anethi (vel fœniculi)	f℥iij.
Syrup. papav.	f℥ij.—M.

Sig.—For an adult, a dessertspoonful every six hours.

No. 105.—*Tolu Cough Mixture.*

℞.—Syr. scillæ	f℥j.
Pulv. acaciæ,	
Sacchari, āā	℥iij.
Aquæ	f℥vj.
Tinct. tolutani	f℥ij.

Misce secundem artem. Dose, f℥j.

No. 106.—*Cod-liver Oil and Biniodide of Mercury.*

Take of Red iodide of mercury	gr. viij.
Cod-liver oil	Oj.

Triturate together.

This forms a clear solution, and each tablespoonful dose contains ¼ gr. biniodide of mercury. This is a combination occasionally indicated. Iodine itself is sometimes given in the oil, and from ¼ to ⅛ grain to f℥j, makes a good addition in certain cases.

The mode of administering the fixed oils may here claim attention. None of the modes of compounding these materially improve

their taste, but by observing to prevent their contact with the mouth in swallowing, the chief objection to them is obviated. This may be variously accomplished by enveloping them in the froth of fermented liquors, or by pouring them into a glass partially filled with iced water, or an aromatized water, so that no portion of the oil shall touch or adhere to the sides of the glass. When mineral water is convenient, it furnishes, with sarsaparilla syrup, one of the best vehicles for castor or cod-liver oil; there should be but little water drawn, but it should be thrown up as much as possible into froth.

Alterative preparations are much made by the addition to the various iodine, mercurial, and other alterative salts, of the Galenical preparations of sarsaparilla, conium, &c. As a general rule, these salts are incompatible with each other; those which are insoluble are generally conveniently prescribed with iodide of potassium, which is, in fact, one of their most natural associated solvents. (See *Syrups*.)

CHAPTER IV.

EXTERNAL APPLICATIONS, &c.

Lotions, Collyria, Injections, Gargles, Baths, Inhalations, Cerates, Ointments, Liniments, and Plasters.

The preparation of these classes requires no different manipulations from the foregoing; indeed they are, for the most part, simple solutions prepared without any particular skill.

Soluble salts, chiefly of the astringent class, dissolved in distilled water, or in distilled rose-water, designed for external application, constitute *lotions*, or washes; these are to be applied to the surface, usually upon a folded piece of muslin or lint, chiefly for cooling and astringent purposes. Lead-water (page 391) is the only officinal lotion. Vinegar and water, or water alone, is applied for the same purposes. In various chronic skin diseases, lotions containing sulphuret of potassium, chloride of zinc, corrosive chloride of mercury, borax, solution of chlorinated soda, and other chemical agents are employed. Glycerin, by its solubility in water, and its emollient properties, is well adapted to this form of application. The recipes appended are selected as illustrations of this class; they are all well-known preparations.

No. 107.—*Creasote Lotion.*

℞.—Creasoti . . . . . gtt. x.
Aceti . . . . . f℥ij.
Aquæ . . . . . f℥ij.

Mix.

Applied to phagedenic ulceration, chancres, and a variety of sores.

No. 108.—*Yellow Wash.* (*Aquæ Phagœdenica.*)

℞.—Hydrargyri chloridi corrosivi . gr. xvj.
Liquoris calcis . . . . f℥viij.

Mix.

The binoxide of mercury is precipitated as a yellow powder, and diffused through the liquid; sometimes the proportion is diminished to gr. j in each f℥. It is a very popular application to certain skin affections and to venereal sores.

No. 109.—*Black Wash.*

℞.—Hydrargyri chloridi mitis . . ℥j.
Liquoris calcis . . . . f℥iv.

Mix.

Protoxide of mercury is here thrown down by the lime as a black precipitate, though there is quite an excess of calomel. It has similar applications to the foregoing.

No. 110.—*Granville's Counter-irritant, or Antidynous Lotions.*

The mild:—

℞.—Liquoris ammoniæ fortioris . . f℥j.
Spiritus rosmarini . . . . f℥vj.
Tincturæ camphoræ . . . . f℥ij.

Misce.

No. 111. The strong:—

℞.—Liquoris ammoniæ fortioris . . f℥x.
Spiritus rosmarini . . . . f℥iv.
Tincturæ camphoræ . . . f℥ij.

Misce.

These preparations will blister in periods varied from two to ten minutes, by saturating with them a piece of linen folded five or six times over a coin, and pressing it upon the part. Over more extended surfaces, a similar method is adopted by protecting the lotion from evaporation.

Collyria.

Collyria are lotions for application to the eye, called eye-washes. They are generally composed of astringent salts, as sulphate or acetate of zinc, sulphate of copper, or of iron or nitrate of silver,

the proportion seldom exceeding gr. viij to f℥j. A good prescription is appended.

No. 112.—*A good Eye-Water.*

Take of Sulphate of zinc,
Chloride of sodium, each . . . ℈j.
Rose-water (distilled) . . . f℥j.

Make a solution and apply, suitably diluted, to inflamed eyes.

The infusion of sassafras pith is a good addition to this and similar eye-washes. The aqueous extract, or the wine of opium, is much used in collyria.

Injections.

Injections are solutions intended to be thrown into the external ear, the urethra, bladder, vagina, &c. They resemble the foregoing class in composition and in strength. In gonorrhœa, the use of injections of the astringent metallic salts is very common, as also of vegetable astringents. It will not be important in this work to give formulas for any of the numerous injections used for these purposes.

The custom of injecting tepid water and various bland liquids into the rectum, for the relief of costiveness, has become exceedingly common of latter years, and the forms of apparatus contrived are numerous and ingenious, constituting a considerable article of trade with druggists and apothecaries.

Gargles.

Gargles and mouth-washes are applications much used in the treatment of so-called sore throat, and in scorbutic affections of the gums, which are exceedingly common and are popularly treated by counter-irritation, and by the use of astringent and stimulating gargles. Infusions of capsicum, of vegetable astringents, and of sage, with the addition of alum, borax, or sulphate of zinc, and almost invariably honey, are the prevailing remedies of this class. A single recipe may be given.

No. 113.—*For a good Gargle and Mouth-Wash.*

℞.—Sodæ boratis . . . . . ℥j.
Aquæ rosæ . . . . . f℥ij.
Mellis . . . . . f℥j.
Misce et adde

℞.—Tincturæ myrrhæ . . . . f℥ss.
" capsici . . . . . f℥ij.

Use as a gargle every two or three hours, diluted with water.

Baths.

Baths are either hot, warm, tepid, or cold, or consist in the application of vapor merely. They are variously medicated for the

treatment of diseases of the skin, and for producing general or local revulsive effects. They possess little strictly pharmaceutical interest.

Inhalations.

Inhalation has lately become a good deal resorted to as a remedy in chronic catarrhs, bronchitis, incipient phthisis, &c. I have repeatedly prepared the apparatus and furnished the ingredients for the following:—

No. 114.—*Prescription for Inhalation.*

Into an inhaler of glass put infusum humuli, *U. S.*, f℥iv, at a temperature of about 120° F., and add liq. iodinii compositus, ♏xx. Inhale from five to ten minutes, morning and evening.

In acute cases, this is found to give great relief, and by continued application produces most happy restorative effects. In place of Lugol's solution, it has been suggested to use an ethereal or chloroform tincture of iodine, adding a little iodide of potassium to prevent precipitation on adding it to the hop-tea, or other aqueous liquid.

Fig. 215.

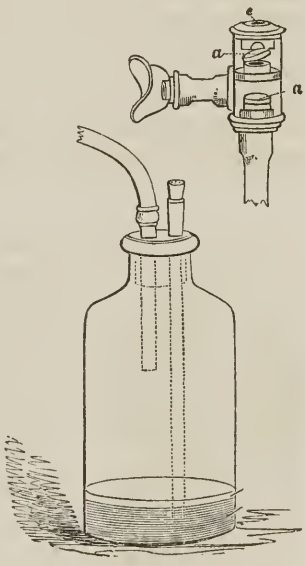


Fig. 215 exhibits two forms of inhaling apparatus; the lower one is adapted to this use. An ordinary wide-mouth packing bottle is fitted with a cork which is perforated by the cork-borer or rat-tail file (see Figs. 169 and 170, page 220), so as to admit of two tubes, the smaller for the ingress of air passing nearly to the bottom of the bottle, while the larger, which is bent to be applied to the mouth, may have its origin just below the bottom of the cork. A little cork may be put into the top of the small tube when not in use. In replenishing the inhaler, before each operation, the cork is removed. The tube may be bent by softening it over the flame of an alcohol lamp or gas-furnace, and holding it in such position that its own weight will cause it to bend gradually and uniformly to the required curve.

Cerates and Ointments.

These classes of preparations are widely separated in the *Pharmacopœia*, where an alphabetical arrangement is adopted, but they so closely resemble each other in a pharmaceutical point of view as to be naturally associated in a work like the present.

The difference between a cerate and an ointment is in their relative firmness and fusibility; the former is designed to be adhesive at the temperature of the body, so as to be applied in the form of a dressing or sort of plaster; the latter is intended to be rubbed upon the surface or applied by inunction; this distinction is, however, not absolute, and the two classes nearly approach each other in properties; the name cerate is derived from cera, wax, and most of the cerates, as also some of the ointments, contain this ingredient.

The medicinal ingredients which enter into these classes of preparations are very numerous; indeed, almost every kind of medicine capable of exercising a topical effect may be prescribed in this form.

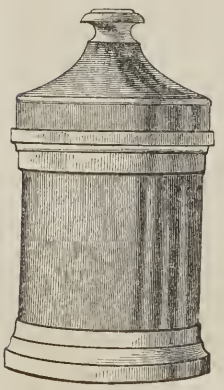
The unctuous ingredients used in ointments are chiefly bland and unirritating fats and fixed oils, with more or less wax; the reader is referred, for some account of these, to pages 271—276.

Lard and *suet* resemble each other in most of their properties except that the latter is more solid and fuses at a higher temperature, while *spermaceti* is still more firm, almost brittle in consistence, and fuses with still less facility; it is recommended by a beautiful pearly whiteness which it imparts, to a certain extent, to its oily combinations. *Wax* is more tough in consistence and still less fusible, its chief use being to give body to cerates and the stiffer ointments.

The uses of *resin* and *turpentine* are twofold, to give body to the cerates into which they enter, and to render them useful as stimulants and fit vehicles for other stimulating substances.

The greatest practical difficulty with ointments arises from their tendency to become rancid by keeping, particularly in warm climates; this is best overcome by observing to free them from unnecessary moisture, and to keep them in well-covered jars. The ointment jar, Fig. 216, is made for the purpose, but as the lid is not air-tight, a piece of stout tin foil, or of bladder, or of waxed paper, should be stretched over the top before covering it with the lid.

Fig. 216.



Ointment jar.

The introduction of benzoic acid or of small portions of balsams and essential oils, into the melted ointment, seems to have a favorable effect upon this tendency; and it is observed that the resinous ointments are not liable to it.

For the purposes of study, the cerates and ointments may be thus classified: 1*st*. Those prepared by the fusion of their ingredients together, and most of them adapted to serve as vehicles for medicinal substances. 2*d*. Those prepared from these first, or from lard alone, by mechanical incorporation of the ingredients with some active medicinal agent. 3*d*. Those in which the unctuous ingredient

is decomposed in the process of preparation. So great a variety of ointments and cerates have been made officinal, that there seems less occasion for departing from the national standard than in the other classes of extemporaneous preparations. Those which are officinal will be presented in syllabi, and a few new remedies with their mode of preparation adverted to separately.

FIRST CLASS.—*Cerates and Ointments, much used as vehicles for Medicinal Substances.*

Ceratum Simplex.	1 part white wax, 2 lard.	*Firmest* "healing" dressing.
Ceratum Cetacei.	1 part sp. cet., 3 white wax, 6 olive oil.	*Firm* "healing" dressing.
Unguentum Simplex.	1 part white wax, 4 lard.	*Softer* "healing" dressing.
Ung. Aquæ Rosæ.	Almond oil, sp. ceti, white wax, rose-water.	*Softest* "healing" dressing.
Ceratum Resinæ (Basilicon).	5 parts resin, 8 parts lard, 2 parts yellow wax.	*Stimulant* dressing.

All these are simple in their mode of preparation; the ingredients are to be placed in a tin cup or a capsule and brought to the melting point, care being taken not to burn them, which may be known by the odor and appearance of smoke given off. When there is a great difference in the fusing points, the least fusible may be placed over the fire first, and the others added afterwards, so as to involve no unnecessary application of heat. Then the whole is to be stirred or triturated together till they have thickened by cooling into a homogeneous soft mass; it may now be set away to harden by further cooling. When rose-water is added, as in the case of cold cream, it is well to warm it a little, otherwise it may chill the spermaceti to its solidifying point and deposit it in a granular condition before the mixed oil and wax are sufficiently stiffened to be homogeneous with it. The first four preparations on the above list are distinguished by different degrees of firmness and fusibility; they are all perfectly bland and unirritating, and are used for their property of protecting the part to which applied from external irritating causes and from the drying action of the air.

Simple cerate is almost exclusively applied to blistered or other raw surfaces as a "healing" dressing; it is not adapted to use as a vehicle for medicinal substances to be applied by inunction, nor can it be conveniently mixed with powders at ordinary temperatures. From overlooking this fact, the mistake is constantly made by physicians of prescribing simple cerate as the vehicle for iodine, the mercurials, &c.; and in view of this, some of the apothecaries make it softer, putting in one-fourth instead of one-third wax; this partially unfits it for the use for which it is mainly designed, to furnish a firm dressing which will not fuse entirely at the temperature of the body.

Simple ointment is designed for the purpose just mentioned as not

suited to the cerate, that of furnishing, in warm weather, a good vehicle for medicines in the form of ointment. In the winter, it is frequently substituted by lard when it can be obtained fresh and sweet. It is not unusual to add to simple cerate and simple ointment, when fused in the process of preparing them, a little rose-water, and sometimes a very small portion of borax, which renders them very white without interfering with their remedial qualities.

Spermaceti cerate is intermediate between the foregoing, and has the advantage of being made without the use of lard, which is sometimes difficult to procure of good quality.

Ointment of rose-water, the softest of its class, may be best introduced by giving the following modified recipe, which produces an article superior to that of the *Pharmacopœia*:—

Unguentum Aquæ Rosæ. (*Cold Cream.*)

Take of White wax	℥j.
Oil of almonds	f℥iv.
Rose-water	f℥ij.
Borax	℥ss.
Oil of roses	♏v.

Let the wax be melted and dissolved in the oil of almonds by a gentle heat, then dissolve the borax in the rose-water and add the solution to the heated oil, stirring constantly till cool; then add the oil of roses, stirring. It is well to warm the rose-water a little, or to add it to the ointment before it is much cooled, thus preventing any granulation of the wax.

When properly prepared by this, which is the recipe of Dr. L. Turnbull, cold cream is a beautiful, snow white, bland ointment, about the consistence of good lard, and an admirable substitute for that excipient where expense is no object, and especially for applications about the face. It is commonly sold as a lip-salve, and as a healing application to abraded and chapped surfaces generally. The following recipes will produce good substitutes for this, the former of a firmer, and the latter of a more fluid consistence:—

Rose Lip Salve.

Take of Oil of almonds	℥iij.
Alkanet	℥ij.
Digest with a gentle heat and strain; then add—	
White wax	℥iss.
Spermaceti	℥ss.

Melt with the colored oil and stir it until it begins to thicken, then add—

Oil of rose geranium	gtt. xxiv.

This may be put into small metallic boxes for the waistcoat pocket.

Milk of Roses for Chapped Hands.

Take of Almonds, blanched . . . ℥j.
Beat to a paste and mix with—
Rose-water . . . . . f℥vj.
Heat to about 212° F., and incorporate with—
White wax . . . . . ℥j.
Almond oil . . . . . ℥ij.
White Castile soap . . . ℥j.
Melt together and thoroughly incorporate; then add—
Honey water . . . . . f℥ij.
Cologne water . . . . f℥j.
Oil of bitter almond . . . gtt. iv.
Oil of rose geranium . . . gtt. v.
Glycerin . . . . . f℥ss.

After washing the hands with warm water, and Castile or other mild soap, apply the milk of roses, and rub it thoroughly in, then wipe them with a dry towel.

Milk of roses is adapted to being put up in rather wide-mouth vials, and is directed to be applied to chapped hands, or other excoriated parts.

Resin cerate, or *basilicon*, differs from the foregoing in being composed of stimulating substances; it is much used as a dressing to blistered surfaces with a view to keeping up the discharge, and is also a good vehicle for other stimulating substances, as savine, Spanish flies, &c.

SECOND CLASS.—*Those in which the Medicinal Substance is mechanically mixed with the Unctuous Ingredient.*

GROUP I.—*Incorporated by Fusion, &c.*

Cerat. Resinæ Comp.	Resin; suet; yellow wax, turpentine; flaxseed oil.	Stimulating.
Unguent. Picis Liq.	Tar and suet equal parts,	Stimulating; antiseptic.
Ceratum Cantharidis.	Canth. 12 parts; lard 10 parts; y. wax, resin, each 7 parts.	Epispastic (Blistering Cerate).

Compound resin cerate, or *Deshler's salve*, is both firmer and more stimulating than basilicon; it is used for similar purposes in burns, scalds, &c.; it is too firm for ready incorporation with dry powders, and is mostly used by itself.

Tar ointment, which is made by melting suet, and, while it is fluid, stirring into it an equal weight of tar until it cools and thickens, is used in scald head and various scaly eruptions with excellent effects

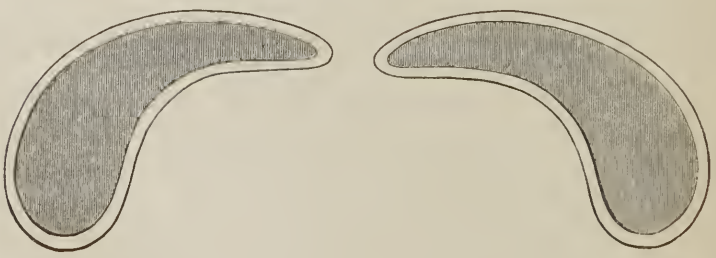
Blistering Cerate. (*Cerate of Spanish Flies.*)

This well-known preparation is conveniently made by melting together in a tin cup, lard, wax, and resin, and sifting into the fused mass powdered Spanish flies; continuing the heat for half an hour, and then removing from the fire and stirring till cool; the active principle of the flies, *cantharidin*, is extracted to a great extent by this digestion in the grease, and the powder itself is also retained and adds to the effect of the preparation. This is sometimes kept in jars, and sometimes, by increasing the proportion of wax and resin, a very little is made firm enough to roll out into rolls like other plasters. Blistering cerate, when ordered in prescription as a cerate to be dispensed by weight and spread at the bedside of the patient, is ordered by its officinal name given in the syllabus; when designed to be spread as a plaster, it is called *emplastrum epispasticum*, the size being generally conveyed thus, 3×6 (meaning three inches wide by six long), or any other size desired, or a pattern may accompany, giving the shape and size. Sometimes the purpose for which required is expressed, and the precise size and shape are left to the pharmaceutist; at others, it is left optional with the attendant whether to spread the blister himself, or to have it spread at the shop by a prescription like the following: ℞.—Cerati cantharidis q. s., ut fiat emplastrum epispasticum 3×6.

The best material for spreading the blister is, I think, adhesive plaster cloth; if a wide margin is left, it is readily made to adhere by warming the margin over a lighted lamp and pressing it carefully on to the part. It should also be so incised from the edges inward as to be readily adapted to the inequalities of the surface to which applied. Kid or split sheep skin also answers a good purpose, in which case the margin is made very narrow, and three or four strips, about half an inch wide, of adhesive plaster are warmed and drawn over the outside to hold it in its place.

Fig. 217 is a pattern for a pair of blisters to be applied behind

Fig. 217.



the ears; care must be taken to have these the reverse of each other, or, after they are spread, it may be found they both fit the same ear. It is well, in the case of these, to leave the margin much the widest

at the part furthest from the ear and below, where the hair will not interfere with its adhesion.

The mode of spreading blisters is too simple to require comment; in cold weather, or when the cerate is very stiff, I use the thumb, which makes a smooth and very neat surface; a spatula slightly warmed answers very well. After the blister is spread, it is well to paint over its surface with ethereal tincture of cantharides, which increases its activity, or to lay a piece of tissue paper over its whole surface, and coat this with the ethereal tincture.

It is considered a good precaution to remove the blister as soon as it has thoroughly reddened the skin, and then to apply a cataplasm of bread and milk, elm bark, or ground flaxseed, to raise the skin. A blistering plaster usually requires from six to twelve hours to raise the skin.

Blistering Collodion.

Take of Spanish flies, in powder	℥j.
Ether	℥iv, or q. s.
Alcohol	f℥j.
Prepared cotton	q. s.

Treat the flies with the ether by displacement, and having obtained a saturated tincture, or nearly so, evaporate it to f℥ij, and dissolve the cotton in it. Fig. 218 represents the syringe pattern displacer, which is very convenient for this purpose, for small operations; a cork may be fitted, not too tightly, in the top, or it may be covered by a little piece of tinfoil, and inserted in a common vial. Fig. 219 shows the collodion vial, arranged with a camel-hair brush, and well-suited to contain this preparation. The great merit of blistering collodion is its applicability to circumscribed surfaces, the fact that it requires no covering of any kind. and that it cannot be improperly removed by the patient, as in cases of insanity, &c. Its action is greatly hastened by repeating the application till the coating is thick, and covering the pellicle before it is dry with a piece of oiled silk or bladder. (For an account of prepared cotton, see pages 235 to 243.)

Fig. 218.

Small syringe pattern displacer.

Fig. 219.

Vial for blistering collodion.

The different *blistering tissues* are, I believe, all made by extracting cantharidin from the flies with ether or oil of turpentine, and forming it into a plaster, which is then spread on paper, silk, or other suitable fabric. *Brown's*

cantharidin tissue is an admirable article, and a most convenient substitute for the old-fashioned blister.

GROUP II.—*Incorporated by Trituration.*

Cerat. Sabinæ.	1 part powdered savin. 6 parts resin cerate.	Stimulating dressing applied to blisters.
Ung. Gallæ.	1 part powdered galls. 7 parts lard.	Astringent, used in piles.
Ung. Veratri Alb.	1 part powdered root. 4 parts lard and oil lemon.	Specific in itch.
Cerat. Calaminæ.	℥iij calamine. Lard ℥xij ; wax ℥iij.	Mild astringent and desiccant.
Cerat. Zinci Carb.	1 part ZnO,CO_2. 5 parts simple ointment.	Mild astringent and desiccant.
Ung. Zinci Oxidi.	1 part ZnO. 6 parts lard.	Mild astringent and desiccant.
Ung. Cupri Subacet.	1 part $2CuO,\overline{Ac},6HO$. 15 parts simple ointment.	Mild escharotic.
Ung. Antimonii.	1 part $KO,SbO_3,2\overline{T}$. 4 parts lard.	Vesicant, producing pustular eruptions.
Ung. Hydrargyri.	Equal parts Hg, and lard.	Alterative, used to produce mercurial impression.
Ung. Hydrar. Ammon.	1 part $HgCl,NO_2$. 12 parts simple ointment.	Alterative, desiccant.
Ung. Hydr. Oxid. Rub.	1 part HgO_2. 8 parts simple ointment.	Stimulating, alterative.
Ung. Iodinii.	1 part I; ½ parts KI. 24 parts lard.	Discutient, alterative.
Ung. Iodinii Comp.	1 part I; 2 parts KI. 32 parts lard.	Discutient, alterative.
Ung. Potassii Iodid.	1 part KI+1 part Aq. 8 parts lard.	Discutient, alterative.
Ung. Plumbi Carb.	1 part PbO,CO_2. 6 parts simple ointment.	Astringent and desiccant.
Ung. Sulphuris.	1 part S. 2 parts lard.	Specific in itch.
Ung. Sulphuris Comp.	Sulphur ℥j. Ammon. merc. ʒj. Benz. acid ʒj. Oil bergam. f ʒj. Sulph. acid f ʒj. Nit. potass. ʒij. Lard ℥vj.	Specific in itch.
Ung. Belladonnæ.	1 part extract. 8 parts lard.	Anodyne.
Ung. Stramonii.	1 part extract. 8 parts lard.	Anodyne.
Ung. Creasoti.	Creasote f ʒss. Lard ℥j.	Antiseptic, mild escharotic.

It would extend this chapter beyond the limit laid down, to dwell in detail upon each of these numerous officinal triturated ointments. They may be made in a mortar with the use of the pestle, or on a tile or slab with a spatula. The medicinal ingredient should be invariably in a very fine powder before incorporating it with the ointment; in a few instances, it is found necessary to soften the latter beforehand by a moderate heat.

Ointment of galls may be well substituted by an ointment of tannic acid in the proportion of about ℈j to ʒj.

The following is recommended as a compound adapted to treating piles:—

No. 115.—*Pile Ointment.*

Take of Tannic acid	ʒss.
Liniment of subacetate of lead . .	f ʒss.[1]
Simple ointment	ʒvij.

Triturate the tannic acid first with the liniment, and then incorporate with the ointment.

Cerate of calamine is a modification of *Turner's cerate*, an old and highly approved astringent and desiccant, used especially in treating burns and scalds; its preparation is easy, but its principal ingredient being very inferior, as generally met with, it has been almost entirely superseded by the *cerate of precipitated carbonate of zinc*, and the *ointment of oxide of zinc* which follow it; the latter is much softer in consistence than either of the former, which are designed to be applied on a piece of lint or old linen.

Red precipitate ointment (ung. hydr. oxid. rub.) is a very important preparation, being most extensively used as an eye-salve and the basis of almost all the popular medicines of that description. By trituration, the oxide becomes changed to an orange-colored powder, which imparts a similar hue to the ointment; it is variously diluted to meet the case for which prescribed; when it becomes rancid it assumes a red color, and should be thrown away.

Mercurial ointment requires special mention from its mode of preparation; it is directed to be made by long trituration of mercury one part, with mixed lard and suet one part; it is, however, a very slow process unless facilitated by appropriate machinery, and even then the temptation is strong to sacrifice its bland and pure alterative effect to the convenience of using a portion of rancid grease to reduce the mercury, thus producing intentionally the very condition which in ointments it is desirable to avoid. This ointment is usually made of one part of mercury to two or three of the unctuous ingredients. When ordering it, the physician should specify "one-half mercury." Its uses are numerous, one of the chief of which is that of inducing the mercurial impression by its application to the thighs, armpits, &c. The numerous curious synonyms applied to this ointment it would be interesting to collect.

The *ointments containing iodine* are much prescribed, and by the introduction of sufficient iodide of potassium and water form homogeneous and perfect ointments.

The use of the narcotic extracts in the preparation of ointments of that class is a recent improvement.

Belladonna and *stramonium* ointments, as shown in the syllabus, are made in that way, taking care to soften the extract by triturating with water before adding the simple ointment or lard.

[1] See page 494, Prescription No. 121.

Aconite ointment may be made in the same way and in the same proportion, ʒj to ℥j.

The following unofficinal ointment is of use of latter time in neuralgia, a piece the size of a pea to be applied over the part three or four times a day.

No. 116.—*Aconitia Ointment.*

Take of Aconitia . . . . . gr. xvj.
Olive oil . . . . . ʒss.
Triturate together, and then incorporate with
Lard . . . . . ℥j.

A good substitute for this, which is a very expensive preparation, will be found among the liniments.

No. 117.—*Tetter Ointment prescribed by the late Dr. S. G. Morton.*

Take of Calomel,
Alum (dried), in powder,
Carbonate of lead,
Oil of turpentine, each . . . ʒij.
Simple ointment . . . . ℥iss.

Triturate the powders together till they are impalpable and thoroughly mixed, then incorporate them with the oil and cerate.

This is one of the very best ointments of its class, as proved by trials during a series of years.

The mode of using it is to apply it at night, wash off with pure Castile soap in the morning, wipe dry, and dust with pure starch.

No. 118.—*A Salve closely resembling "Becker's Eye Balsam."*

℞.—Calamine,
Tutty, of each . . . . . ʒiss.
Red oxide of mercury . . . . ʒvj.
Camphor, in powder . . . . ʒj.
Almond oil . . . . . ʒj.
White wax . . . . . ℥iss.
Fresh butter . . . . . ℥viij.

Reduce the mineral substances to a very fine powder, and incorporate with the oil in which the camphor has been dissolved with the wax and butter previously melted together. The butter must be deprived of salt, if it contains it, by washing with warm water. The reputation of Becker's Eye Balsam is widely extended.

THIRD CLASS.—*Ointments made by digesting the Medicinal Ingredient in Lard.*

Ung. Tabaci, ʒj leaves to ℔j lard. Narcotic.
Ung. Mezerei, ʒiv bark to lard ℥xiv, wax ℥ij. Stimulating.
Ung. Cantharidis (with boiling water), ʒij to ℥viij resin cerate. Stimulating.

The members of this class are made by the action of lard at an elevated temperature upon medicinal substances. As long as moisture is extracted from the leaf or bark, it is shown by escaping as steam through the fused grease; when it becomes perfectly placid, it is decanted and strained. The vegetable structure is now found to have become crisp, dry, and inert, and the lard is impregnated with its properties. This plan was formerly more in vogue; the use of extracts, as in the case of Ung. belladonnæ and Ung. stramonii, is a much shorter and equally good way.

Improved Tobacco Ointment.[1]

Take of Tobacco leaves	℥v.
Vinegar	Oij.

Digest the leaves in the vinegar till evaporated to Oss; strain and express the liquid, then evaporate by moderate heat to about f℥iij; triturate this with

Extract of belladonna	℥j.
Then take Camphor, in powder	℥viss.
Resin cerate	℥viss.

Mix these by fusion at a moderate heat, and incorporate them with the mixed extracts of tobacco and belladonna. This is a very superior stimulating and anodyne application prescribed by my brother, Dr. Joseph Parrish, and made public in this form by Wm. J. Allinson, of Burlington, N. J.

Garlic Ointment.

Take of Fresh garlic	2 or 3 cloves.
Lard	℥j.

Digest at a moderate heat for half an hour and strain; a useful application to the chest in croup.

Ung. cantharidis is not made as described for this class, though not classifiable elsewhere. Boiling water is here the solvent used, and the aqueous extract is incorporated with the resin cerate, which here, as in the case of savine ointment in the last group, is used as a vehicle. These two ointments are, I believe, chiefly used for the same purpose. Care must be taken to distinguish, in prescriptions, between the cerate and ointment of cantharides; the former being blistering cerate, and the latter only a stimulating dressing for blisters.

FOURTH CLASS.—*In which the Unctuous Ingredient is decomposed.*

Ung. Hydrarg. Nit. A powerful stimulant and alterative; citrine ointment.
Ceratum Saponis. A bland and soothing dressing.
Cerat. Plumbi S. Acet. A cooling and mild application; Goulard's cerate.

[1] Those only which are strictly extemporaneous are numbered.

Citrine ointment is made by mixing f℥ix hot oil (the officinal recipe orders neat's foot, but lard oil does very well),[1] and ℥iij lard, with an acid nitrate of mercury; prepared by dissolving ℥j mercury in f℥xiv nitric acid, which should be of full officinal strength, a brisk effervescence occurs, nitric oxide is given off, and the olein of the fat is converted into elaidin; by stirring with a wooden spatula till it cools, a beautiful citrine colored soft ointment will generally be obtained. It is a very uncertain preparation, however.

Soap cerate is made by boiling solution of subacetate of lead with soap; the oil acids of the soap being liberated, combine with the oxide of lead of the subacetate, and the acetic acid is saturated by the alkali of the soap; by the addition of olive oil and white wax, a beautiful and very stiff cerate is formed, which forms a connecting link between the cerates and the plasters.

Goulard's Cerate.

This preparation contains subacetate of lead combined with olive oil, white wax, and camphor; it should be made in small quantities so as to be used before it becomes rancid, which is shown by its odor and white color on the surface exposed to the air. An excellent combination of this, attributed to Dr. Parrish, Senior, is as follows:—

No. 119—*Compound Cerate of Lead.*

℞.—Cerat. plumbi subacet.,
Cerat. simp., āā . . . . . ℥ss.
Hydr. chlor. mit.,
Pulveris opii, āā . . . . . ℥j.
Mix.

Used in cutaneous eruptions of a local character.

Emplastra, *U. S.* (Plasters.)

These are external applications of a consistence thicker than cerates, and of such tenacity and adhesiveness at the temperature of the body that when warmed and applied they will adhere firmly. They are used for two principal objects: 1st, to furnish mechanical support and to protect the part from the air; and, 2d, to convey medicinal effects, especially of a stimulant and discutient character.

In the chapter on Fixed Oils, page 271, the subject of the preparation and properties of lead plaster, oleo-margarate of lead, is fully presented. This preparation is the basis of most plasters, though a considerable number are made from resinous substances which were treated of under that head on pages 288 to 291.

Lead plaster associated with soap is rendered less adhesive and more bland in its characters, furnishing an emollient preparation often confounded with soap cerate. By mixing with resin, lead plaster is rendered more adhesive, and somewhat more irritating.

[1] Dr. A. Hewson recommends cod-liver oil for this purpose.

This is its most common preparation, and, when spread on cotton cloth, constitutes *adhesive plaster* cloth.

This should be kept in tin cans, and when it is disposed to crackle, should be held to the fire till fused on the surface, and then laid away to cool thoroughly before being again rolled up. In applying adhesive plaster, it should be warmed from the unspread side, to insure its being softened throughout.

The skilful association of these ingredients, and of the other medicinal substances prescribed in the officinal plasters, is accomplished mainly by fusion and stirring together; in the case of *opium plaster*, water is added to lessen the liability to injury from the heat employed. *Belladonna plaster* is made by incorporating the extract with resin and lead plaster.

In *mercurial plaster*, and plaster of *ammoniac* and *mercury*, a little sulphur and oil are used to extinguish the mercury before associating it with the plaster.

EMPLASTRA.—*Syllabus of Officinal Plasters.*

Emp. Plumbi.	(See page 272). Diachylon plaster.	
Emp. Resinæ.	1 part p. resin. 6 parts lead plaster.	Adhesive plaster.
Emp. Saponis.	1 part soap. 9 parts lead plaster.	Very mild and less adhesive.
Emp. Belladonnæ.	1 part extract. 2 parts emp. resinæ.	Anodyne in neuralgia, &c.
Emp. Ferri.	1 part $F2O_3$,+FeO,CO_2. 8 parts lead plaster. 2 parts B. pitch.	Red strengthening roborant plaster.
Emp. Hydrargyri.	3 parts mercury. 1 part olive oil. 1 part resin. 6 parts lead plaster.	Discutient; alterative.
Emp. Opii.	1 part opium. 1½ parts B. pitch. 6 parts lead plaster.	Anodyne.
Emp. Ammoniaci.	G. resin, purified by dil. acet. acid.	Stimulant; resolvent.
Emp. Ammoniaci cum Hydrarg.	Ammoniac ℔j. Mercury ℥iij. Olive oil f℥j. Sulphur gr. viij.	Discutient; stimulant.
Emp. Assafœtida.	Assafœtida ℔j. Lead plaster ℔j. Galbanum ℔ss. Yellow wax ℔ss.	Antispasmodic.
Emp. Picis Burgundicæ.	12 parts B. pitch. 1 part y. wax.	"Strengthening plaster."
Emp. Picis cum Canth.	7 parts B. pitch. 1 part cerat. canth.	Warming plaster.

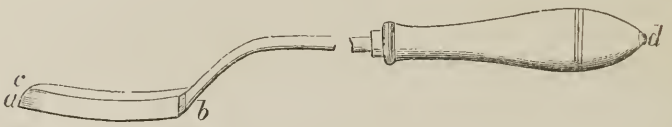
Ammoniac plaster is peculiar in its mode of preparation consisting of the pure gum-resin as dissolved in vinegar, strained and evaporated.

The spreading of plasters, which was formerly an important part of the business of the apothecary, has now, like many other opera-

tions of his art, been monopolized by manufacturers who bring machinery to their aid, so that it will scarcely require a detailed description in a work of the design and scope of the present.

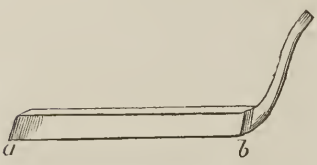
Figs. 220 and 221 show plaster irons of the kinds adapted to different sizes and kinds of plasters, the larger size being suitable to spread a large plaster of a slowly fusible material. The heat

Fig. 220.



necessary to melt the plaster is derived from the iron, which should be first warmed to such temperature as that, while it will occasion the plaster to flow, it will not scorch it. The iron should also retain sufficient heat till the operation is complete, to impart a smooth surface to the stiffened plaster. The small iron will do well to spread a warming plaster, belladonna plaster, or the similar easily fusible kinds.

Fig. 221.



The material on which plasters are spread, may be varied according to their use. Resinous plasters and warming plasters to be applied to the back or breast, as counter-irritants and mechanical supports, are spread on thick sheepskin, while opium and belladonna plasters, which are generally smaller and frequently applied about the face, may be spread on kid or split skin. I have found advantage in spreading the large lead plasters and others to be applied over the breast of the female on the kind of skin called "*chamois*," which is made more flexible and yielding, though equally durable with the differently dressed "sheepskin."

Machine-spread Strengthening Plasters

Are immensely popular outside the profession for a great variety of ailments, and they are undoubtedly better adapted to meet the public demand for cough remedies, "pain eradicators," &c., than the great majority of the "pectoral syrups" and "hot drops," &c., so extensively vended. Recently, the manufacturers have prepared specific kinds of plasters, and sold them under appropriate names, as Burgundy pitch, hemlock, and warming plasters, so as to put them within the range of physicians' prescriptions. Some of them should make the series of officinal plasters in appropriate sizes and compounded according to the *Pharmacopœia*, and there would cer-

tainly be a demand for them, as apothecaries seldom covet the labor of preparing them extemporaneously.

Annular Corn-Plasters.

Under this name I have prepared, in imitation of Ellis's corn-plasters, a very convenient form of corn-plaster. Adhesive plaster is spread on *thick buckskin*, and then with a punch cut into small round plasters, about $\frac{5}{8}$ inch in diameter, then with another punch a small hole is cut in the middle. Applied over a sore corn, it protects from the pressure of the shoe and gives great relief.

Cataplasms.

The following is introduced as a specimen of the unofficinal class of cataplasms, of which mustard plaster and the numerous varieties of poultices are examples. (See page 252.)

No. 120.—*Spice Plaster.* (Dr. Parrish, Sen.)

Take of Powd. capsicum,
" cinnamon,
" cloves, each . . . 2 ounces.
Rye meal,
Spirits,
Honey, of each . . . . sufficient.

To be made into a cataplasm by trituration on a plate, and spreading upon a close fabric. It should be made up when required.

Linimenta, *U. S.* (Liniments.)

These are fluid or semifluid preparations designed to be smeared upon the surface, and either covered by lint or rubbed on until partially absorbed. The officinal members of this class are displayed in the following syllabus.

The Officinal Liniments.

Class 1.—*In which the Oily Ingredient is saponified.*

Linimentum Ammoniæ. (Volatile Liniment.)	Liq. ammonia, 1 part. Olive oil, 2 parts.	Stimulating. Rubefacient.
Linimentum Calcis.	Lime-water, Flaxseed oil, equal parts.	"Healing," or demulcent.

Class 2.—*Oils charged with Stimulating Ingredients.*

Linim. Cantharidis.	Cantharis ℥j. Oil turpentine Oj.	Digested and strained.
" Camphoræ.	Camphor 1 p. Olive oil 4 p.	Triturated in a mortar.

CLASS 3.—*Semifluid Mixtures, made with Heat.*

Linim. Terebinthinæ. (Kentish's Ointment.)	Resin cerate ℔j. Oil turpentine Oss.	A useful stimulant in burns and scalds.
Linim. Saponis Camphoratum. (Opodeldoc.)	*Common* soap ʒiij. Camphor ʒj. Oil rosemary fʒj. " origanum fʒj. Alcohol Oj.	The soap dissolved in alcohol by heat, and the stimulants added.

The first class contains two very opposite therapeutical agents.

Volatile liniment is a powerful stimulant, much used as a counter-irritant in sore throats, and also in rheumatism.

Lime liniment is applied with the most happy effects to recent sores and burns; it is one of the most useful of preparations in the apothecaries' daily routine of minor surgery.

Liniment of Spanish flies is capable of use as a vesicant, being applied on lint, and covered to confine its vapor.

Camphor liniment is well adapted as a vehicle of many substances applied in the form of stimulating liniment; it is well combined with liq. ammonia, forming a good modification of the volatile liniment.

Kentish's ointment, though so different from lime liniment, is used in the same cases; it is applied to recent burns, until the peculiar inflammation, called the fire, subsides.

Opodeldoc is much used as an application to sprains, rheumatic pains, &c.; it is always put up in small wide-mouth vials, into which the finger is inserted, to soften and extract it.

Linimentum Plumbi Subacetatis.

Take of Solution of subacetate of lead,
Glycerin, of each . . . . . ʒj.

This is designed to enable the physician to apply subacetate of lead in a concentrated form, and to facilitate its dilution with neutral liquids, without its becoming decomposed.

Linimentum Aconiti Radicis. (Prof. Procter.)

Take of Aconite root, in powder . . . . ʒiv.
Glycerin . . . . . fʒij.
Alcohol . . . . . q. s.

Macerate the aconite with half a pint of alcohol for 24 hours, then pack it in a small displacer, and add alcohol gradually, until a pint of tincture has passed.

Distil off fʒxij, and evaporate to fʒxij; to this add alcohol ʒij and the glycerin.

This is intended to substitute ointment of aconitia as an external anæsthetic application. Cut a piece of lint of the required size, and saturate it with the liniment; when applied, it should be

covered with oiled silk, should be used with great care, and never on an abraded surface.

Linimentum Hyperici. (*Red Oil.*)

Take of Flowers of hypericum (fresh), a convenient quantity.
Olive oil, sufficient to cover it.

Macerate in the sun for 14 days, express and strain.

A well-known popular application to recent bruises and sprains.

In this connection, it may be well to mention

Tinctura Arnicæ.

Take of Arnica flowers	℥iv.
Alcohol	Oj.

Digest together, express and filter, or displace.

Some pharmaceutists use diluted alcohol, which, in view of its extensive and well-known external use, is not so good as alcohol of full strength. There is no authoritative direction as to its strength. The above recipe is that I have long used satisfactorily.

CHAPTER V.

ON THE ART OF DISPENSING MEDICINES.

This very extensive subject constitutes the most difficult practical branch of pharmacy, for, in addition to the variety and extent of knowledge required for the performance of the various duties involved in it, a salesman and dispenser of medicines must possess rare personal qualities to render him popular and successful in his calling.

Neatness, agility, and readiness of manner, combined with uniform watchfulness and care in all the important manipulations required of him, will always inspire confidence, and secure patronage—while slothfulness, negligence, and indifference to what may seem petty details, will invariably inure to the disadvantage of their possessor. It is not designed, in this *Introduction to Practical Pharmacy*, to devote much space to this subject; it is too important a matter to be superficially treated, and yet it would require more space to systematize its various details, than would comport with

the general plan of this work, which has been already extended much beyond its original design.

In the hints which are here offered, I shall have chiefly in view the country practitioner, whose necessities compel him to undertake the business of dispensing, and the *student* of medicine and pharmacy, who would seek to obtain from books the leading topics on which to found his practical and experimental routine of studies.

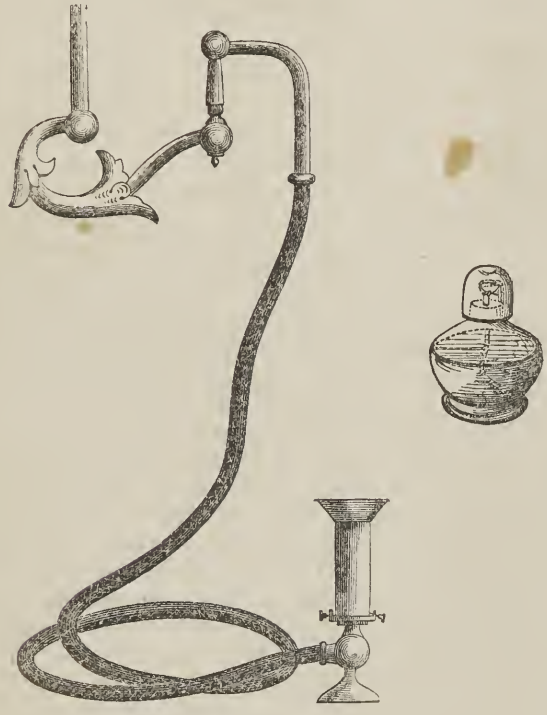
In the first preliminary chapter, most of the forms of apparatus required by the country practitioner in dispensing were described and fully illustrated, and in the succeeding parts of the work, many useful implements, chiefly employed in manufacturing processes, have been described in connection with their uses and modes of construction, a few will be illustrated along with the manipulations yet to be described. It will be observed that many of the forms of apparatus described are by no means indispensable, and that all the processes described throughout the work can be performed with but few and cheap implements.

Furniture of the Office.

The *dispensing office or shop* should have a counter of size proportioned to its anticipated use, with a closet in it, and a few drawers; it should be placed very near to the bottles containing the medicines. In large establishments, a few rows of f℥iv and f℥ij ground stoppered bottles and extract jars are frequently placed in a case on the counter, within reach of the operator when using the scales; these are filled with all the medicines most prescribed in small quantities, and entering into usual extemporaneous prescriptions. The counter should contain the large scales (see Fig. 22, p. 26), and the prescription scales and case (Fig. 20, p. 24), which, however, should be so placed as not to be jarred by the contusion of substances with the pestle and mortar, and may very appropriately be placed on an adjacent shelf or table appropriated exclusively to them, and quite within reach in manipulating at the counter. The closet or shelves under the counter may be appropriated to mortars and pestles, funnel, displacement apparatus, infusion mug, evaporating dishes, &c.; one shallow drawer with divisions should be appropriated to papers, cut for dispensing, as below described; another to labels, pill boxes, powder boxes, corks, scissors, &c., each in a separate apartment; another may contain the pill machine and tile, the spatulas, and plaster iron; a place must be appropriated to a towel, and a tank, or preferably a hydrant with a sink, should be near at hand; a few deep drawers will be found useful for containing the drugs bought in packages, and for which no bottles are provided. On the top of the counter, which may be covered with oil-cloth, the cork presser, the twine reel, and the alcohol lamp and graduated measure, may be appropriate orna-

ments. If practicable to have another counter for small manufacturing operations, it would be well to avoid cumbering the dispensing counter with a gas furnace, but otherwise the arrangement described on pp. 139 and 140, and here again figured, will be conve-

Fig. 222.



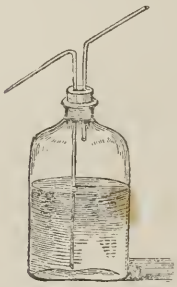
Counter lamps.

nient; it may be led by a ground burner from the pendant or sidelight nearest at hand, and will be very convenient for heating purposes. The remarks on p. 135, in regard to the office stove, should not be overlooked.

Among the little conveniences, it is well not to overlook a corkscrew, Fig. 224, which should be hung on a tack, in an accessible place. With an eye to convenience and to furnishing a manipulating counter, a *spritz*, Fig. 223, may be suitably disposed on it; much will depend on the size of the top, and care must be taken not to crowd the space to be used in manipulation. A retort stand, Fig. 225, or the improved Wiegand's pattern, Fig. 151, p. 153, should be on the counter or at hand, to be used for filtering, displacement, &c.; although for such purposes, it seems quite important that a table or shelf should be especially appropriated.

The little mill, Fig. 37, p. 32, can be screwed on to the end of the working counter, and removed at pleasure. It is well to have

Fig. 223.

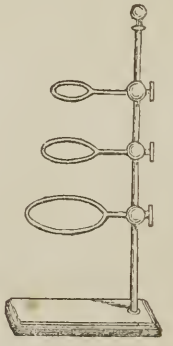


Spritz.

Fig. 224.

Cork-screw.

Fig. 225.



Retort stand.

immediately under the top of the dispensing counter, two slides, on which most of the manipulations are performed; one of these should be kept exclusively for powders, and the other used indiscriminately, to save the top from being soiled.

The stock of medicines should be arranged in a case, or on plain shelves, within a few feet of the counter. In the appendix will be found the dimensions necessary for the outfits there published. The shelves should be somewhat more extended than the actual dimensions required at first, to allow for additions from time to time, and care should be taken in making these additions to have the glass ware correspond with the original stock. In the first preliminary chapter, the whole subject of glass ware is fully displayed.

The books of reference, which should be ample—and if the proprietor himself, and those under his instructions, would keep pace with the advance of the times, should contain the *American Journal of Pharmacy*, bound from year to year—should be in a neighboring case; this might be advantageously arranged to contain also a skeleton, and the surgical, dental, and obstetric instruments, bandages, splints, &c.

The bougies and catheters should be in a tin case, so also the adhesive plaster, blistering tissue, gum-elastic bougies, nipple shields, &c. It is to be regretted that the proper arrangement and garnishing of the dispensing office should be generally considered of so little importance by practitioners at the commencement of their career; it is apt to have more effect upon the future success of the physician than he can appreciate in advance.

Folding of Powders.

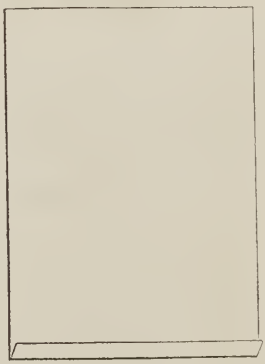
The first manipulation taught my students in the school of practical pharmacy is this very elementary pursuit. There are, however,

thousands who have felt the want of such instruction all their lives. The paper usually purchased for folding packages of medicine is called "white druggists' wrapping paper;" its size is called double medium, each sheet being about $38 \times 24\frac{1}{2}$ inches. This sheet cut into 2 sheets $24\frac{1}{2} \times 19$ = the *medium* size. The medium sheet is thus conveniently divided for dispensing purposes:—

Into 4 sheets	$12 \times 9\frac{1}{2}$	inches	=	$\frac{1}{2}$ ℔ papers.
6 "	$9\frac{1}{2} \times 8$	"	=	$\frac{1}{4}$ ℔ papers.
12 "	$6\frac{1}{4} \times 6\frac{1}{4}$	"	=	1 oz. papers.

Fig. 226 shows a $\frac{1}{4}$ ℔ paper. To fold a package, this is laid upon the scale plate and filled with an appropriate quantity; of a moderately heavy article, like Epsom salts or cream of tartar, this will be 4 oz. (com.); of a light article, like senna or chamomile, say 1 oz. (com.). The paper is placed before the operator in the direction here shown; a little crease is made on the nearest end so as to form a flap into which the furthest edge is fitted, and the whole turned over upon the containing substance so as to form a crease when laid evenly down upon it, at the middle or near the furthest side, according as a wide or narrow bundle is desired.

Fig. 226.



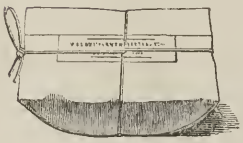
Paper for package.

The cylinder is now loosely closed up at one end by turning it over, and is held up with the crease toward the operator, the thumb pressing it firmly to prevent its bulging. Now, with the forefinger, the upper end of the cylinder is pressed in against the containing substance, and the two sides of the paper being rolled into the position they naturally take, the whole upper flap is laid down immediately above the containing substance and pressed into a firm and even crease. The package is now inverted, the other end is opened out, rolled in, and folded over in like manner.

The next operation is to label the package; this requires very little paste, only sufficient to prevent its slipping about; the label is put immediately in line with the crease, unless this is too low down, and then it connects the crease with the part below. The next operation is to tie the package, which is done by laying it on the flat or labelled side and passing the string first across it and then lengthwise, securing it by a bow-knot at the edge where it was first creased. When the package is large or quite oblong, the string is made to pass twice across it and once lengthwise. The string used should be thin and free from fuzz; linen is the best material. The ball of tying string may be put into a small apartment of the drawer and gradually unwound as required, or it may be used from

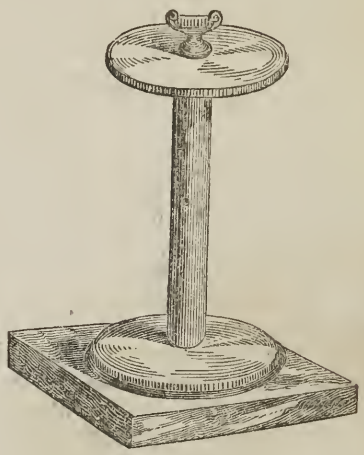
a reel. Fig. 228 shows a new upright reel, made by Wiegand, possessing several advantages over the horizontal form; the twine can

Fig. 227.



Paper package.

Fig. 228.

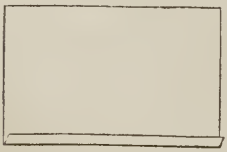


Upright reel.

be drawn from it in every direction with equal facility, and by means of a rim of brass surrounding the lower head of the spool, all possibility of the twine tangling upon the spindle is effectually precluded; a cutter is fixed upon the top, which proves very convenient for cutting the string; the reel is made of brass, handsomely finished, and set upon a polished Italian marble base.

Small powders for containing but a single dose of medicines are, or ought to be, put up in glazed writing paper. The kind called *flat-cap* is economical and adapted to the purpose. A sheet of flat-cap will furnish sixteen of the most common size, or nine of the larger or Seidlitz powder size. Fig. 229 represents the shape of

Fig. 229.

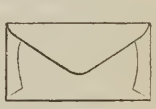


Paper for powder.

Fig. 230.

"Powder."

Fig. 231.



Envelop for single powders.

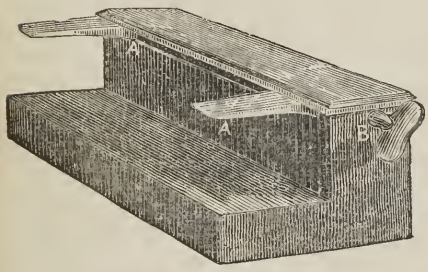
these. A little crease is made along the long side into which the opposite edge is laid, and the paper being folded over is laid down in the crease just beyond the middle, or *at* the middle, according to the width desired. The ends are now folded over a spatula so as to make flaps of equal length, and the package or powder, as it is called,

is complete. In dispensing simple powders, I use a small envelop, Fig. 231, which is just the right size, and leaves nothing to desire.

Powders are often directed in considerable numbers, frequently, as in Prescription No. 54, twelve at once; in this case it is important to have the powders all of one length, so as to fit in a little box called a powder-box or lozenge-box.

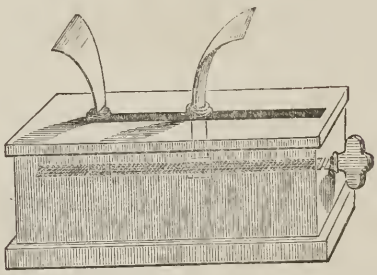
Figs. 232 and 233 represent gauges for folding powders; their use is twofold—to regulate the length of the powder and to facilitate the folding with a folder; the two end creases are made by simply pressing the paper over the blades between the thumb and finger.

Fig. 232.



Wiegand's powder folder.

Fig. 233.



Powder folder.

Fig. 232 is a recent improvement of S. Lloyd Wiegand, of this city; the blades A A are less liable to become unsteady, and are of better shape than those of the old kind. The screw regulates their distance apart. The expense of these is saved by cutting a piece of tin of the required width, and tacking it on to one corner of the slide appropriated to powders. With a penknife, the board may be cut out to the thickness of the tin, so that the paper will slip readily on to the tin and be turned over by the thumb and finger; a great many powders can be put up in a few minutes by this plan.

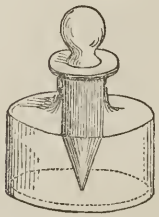
Preparation and Dispensing of Pills.

The preparation of pills can only be learned by practice, and I am not about to attempt to explain it in detail.

The ingredients in the form of powder being weighed, are placed in a mortar and thoroughly mixed; two spatulas being at hand, a small addition of some excipient, as already pointed out, is to be made, care being taken not to add an excess, which the inexperienced are apt to do. The little bottle, Fig. 234, is made for the use of the analytical chemist in moistening substances with a single drop of a reagent; it will be useful to contain water for the purpose named. The drop guide, Fig. 235, or a similar extemporaneous contrivance, will answer the same purpose. Many pill masses are spoiled by getting a few drops too much water accidentally into them; they

should always be very thoroughly triturated before the addition of fresh portions of liquid.

Fig. 234.



Bottle for moistening pill masses.

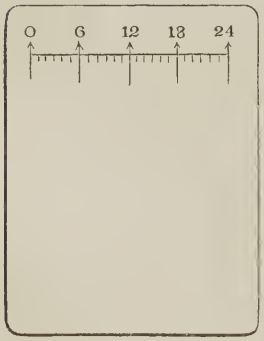
Fig. 235.

Bottle with drop machine.

The use of extracts in making pills has already been treated of, as also the whole subject of the selection of ingredients and excipients, and we proceed to a few hints on the mode of dividing and preserving them.

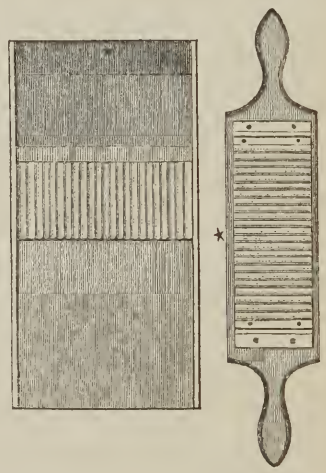
Pills may be divided with a spatula, by the eye or by the aid of a graduated tile; a great many pharmaceutists use this altogether, but it has always appeared to me it must be from ignorance of the

Fig. 236.



Pill tile.

Fig. 237.



Pill machine.

proper use of the pill machine, Fig. 237. If the mass is plastic, it may be rolled between the two smooth surfaces into a perfect

cylinder equally thick at both ends, and by then adjusting the cutting surfaces, the whole mass will be immediately turned into the appropriate number of pills, which, if about the size appropriate to the machine, will be so round as to require no further rolling. In large dispensing establishments, several machines are sometimes kept adapted to different sizes, one for pills of opium (No. 26), or Quevenne's iron (No. 13); another for compound cathartic (No. 38), or aloetic pill (No. 36); and another for compound rhubarb (No. 35), and other large pills. There is a practical hint in relation to the use of the pill machine which should be mentioned in this connection: it is, that the cutting surfaces will only work on each other perfectly in one way; every roller is, therefore, marked with a star, a little brass tack, a number, or some other designation, and a corresponding one is made on the machine, indicating in which direction the roller is to be worked on the machine in cutting. In the figure, this is shown by two stars. From not being aware of this precaution, many abandon the use of a machine, which is one of the greatest of conveniences in pharmacy.

Pills, when kept on hand, should be kept in ground stoppered bottles, into which they should not be put until well dried on an open box lid or paper folded at the edges for the purpose. There are three kinds of pill boxes described on pages 36 and 37. Pills containing very volatile ingredients should be dispensed in a small wide-mouth vial.

Fig. 238.

Dusting bottle.

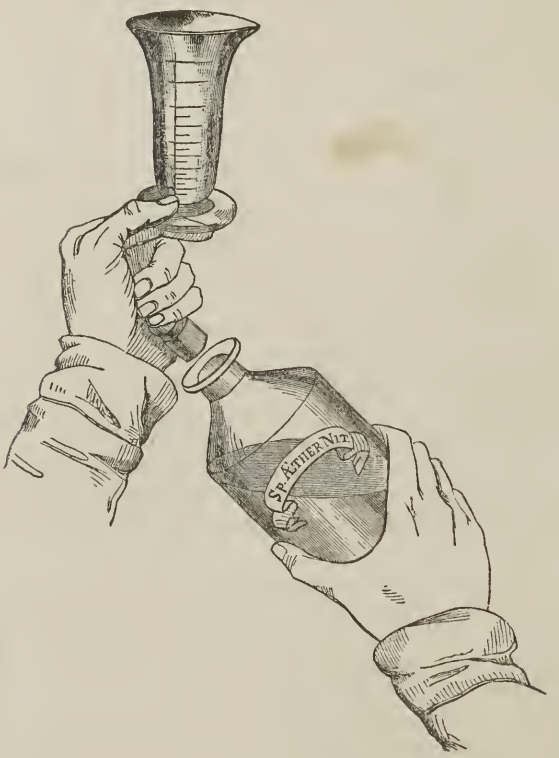
Fig. 238 shows a bottle arranged to contain lycopodium, powdered liquorice root, or sifted arrowroot, one or more of which may be kept at hand in dispensing pills, both for the dusting of the pill machine and for filling into the box in which they are dispensed. One of these bottles may have powdered gum Arabic also, so as to add that ingredient conveniently to pill masses in process of their manufacture. The mode of construction will scarcely need a remark; a perforated cork, short piece of tube, and ℥j or ℥ij vial, constitute the apparatus.

The Dispensing of Liquids.

Here the graduated measure will at once come in play. We draw from the tincture bottles both for dispensing directly and mixing in prescription, and the habit should be fixed, which is easily established, of holding the stopper by the little finger while holding the measure with the thumb and forefinger. The measure must be held opposite the eye to measure the quantity with accuracy, and, after it has been done, the stopper is immediately to be replaced and the bottle set back on the shelf. The whole process is well shown in Fig. 239. The liability to mistakes in compounding is greatly increased by the accumulation of bottles on the

counter; and it should be the habit to replace each bottle immediately, and to note the label as it is taken down and as it is put

Fig. 239.



back; if a drop of liquid remains on the lip after decanting, it should be collected on the point of the stopper before putting it in again, and thus prevented from running down the side.

Under the head of Solution, in the second part of this work, and of the liquid forms of medicines in the fifth part, and, indeed, throughout all the practical parts, I have endeavored to impress such facts connected with the preparation and use of this class of medicines as would be most useful to the student, and I may conclude the subject here by reference to the selection of vials, corking, labelling, &c., on which a few hints may be given. Of the several varieties of vials shown on page 35, the kind best adapted to the purposes of the country physician is the German flint, Fig. 240; it has the advantage over the flint vial of being cheaper, and, as is generally believed, stronger; while it is far better than the common quality of green glass. The manufacturers of green glass

have recently made many of their vials without lips, from the fact that dealers in handling and repacking the lipped vials suffer loss from these being much broken about the lip. A vial is, however, of little use for many of the purposes of the physician without a good, rather broad, and thin lip, which will allow of the pouring of the liquid from it without its running back and down the sides of the vial. This is especially true of small vials from which drops are to be administered.

Fig. 240.

Fig. 241.

There is no economy in procuring cheap corks, as prices are pretty exactly according to quality, and of the inferior qualities a large number are quite unfit for use. The cork presser, Fig. 241, is now so common and well known as scarcely to require a mention; in using it, care should be taken to press the whole length of the cork, otherwise, if it is rather dry, it may be cracked at the point where the pressure of the machine ceases, and hence will break off in attempting to remove it from the bottle.

The cork drawer should not be too near the fire, as they are deteriorated by long-continued drying. The cork should always be adjusted to the bottle before putting the liquid into it, so that if it should not fit, it may not be injured by contact with the liquid, and may be thrown in with the corks again.

The neat appearance depends chiefly on its being clean and having a clear fresh surface at top; this may generally be attained by the use of a sharp knife, care being taken not to cut it off so short as to be inconvenient to extract again. The practice of capping over the cork with a piece of fancy paper or damp kid gives a handsome finish to the preparation, but in small sales scarcely repays for the time consumed.

The fashion of stamping the cork at top with a dye upon sealing-wax has lately become quite general. Heavy and good quality tin foil is a beautiful capping for corks, and may be applied without a string to secure it; it will take the impression of a stamp with considerable distinctness. With a view to capping operations, a small pair of scissors, different from those adapted to the general purposes of the counter, will be almost indispensable.

Labelling medicinal preparations is very much neglected by country practitioners, frequently for want of facilities; it is, however, too important a matter to be overlooked in any well-ordered

dispensary. A small sheet of blank labels may be procured for a trifling sum, adapted exactly to the wants of the particular individual, or the druggist should have them printed for his customers. I have for several years sold from a set somewhat like the following, which by filling up the blanks serve most the purposes of the physician:—

Take spoonful every hour as directed by Dr.

TO BE USED AS DIRECTED BY Dr.

AS DIRECTED BY Dr.

PILLS. Take for a dose, as directed by Dr.

Take drops times a day. By Dr.

PILLS. As directed by Dr.

PILLS. Take every hour, as directed by Dr.

Fig. 242.

Paste bottle and brush.

The next facility for labelling is a good paste bottle, and a recipe for a permanent paste. Fig. 242 shows a convenient little wide mouth bottle, which may be of f℥j or f℥ij capacity, with a perforated cork into which a plug is inserted, extending half an inch below the cork, on to which is fitted a camel-hair brush, always dipping into the paste; this little vial may be supplied with paste from another and larger bottle. It may be made by either of the following processes:—

Glycerin Paste.—Recommended by Dr. Goddard as suitable for fixing paper to glass and other surfaces, and as keeping very well:—

Take of Gum Arabic	. . .	one ounce.
Boiling water	. . .	two fluidounces.
Glycerin	. . .	two fluidrachms.

Make a solution.

Another good Paste.

Take of Powdered gum Arabic,
Powdered tragacanth, of each . . ℥ss.
Water . . . . . ℥iss.
Acetic acid . . . . . ♏ xx.
Mix them.

The application of paste to a series of labels may be accomplished by laying the labels successively upon a small piece of soft paper, which must be renewed as soon as it has become somewhat daubed, or by laying them on a piece of smooth and hard wood, which should be cleaned and dried once every day. When the label is applied to the glass, it should be covered by a piece of paper somewhat larger than itself, and tightly and uniformly pressed till quite smooth; it is a mistake to put a thick coating of paste on the paper, as it then spreads on to the surrounding parts of the vial, soiling them, and in drying shrinks and wrinkles the label. When filled and properly corked, the vial should be carefully wiped off and wrapped in a piece of white paper. The ¼lb size, page 499, is suitable for a f℥iv vial.

A good pen, with a fine point, suitable for filling up the blanks on the labels, and a desk, should be within convenient reach; also a blank book or file on which to preserve the prescription for future reference, and a note-book of facts and experiences, which, if diligently kept, will, by lapse of time, become a valuable heirloom of the office or shop.

APPENDIX.

PHYSICIANS' OUTFITS.

Catalogue of One Hundred and Twenty-five Medicines and Pharmaceutical Preparations which can be put up in the best ground glass stoppered bottles, and substantial white-ware jars, uniformly and correctly labelled, and furnished ready packed for transportation for SEVENTY-FIVE DOLLARS (*exclusive of implements and apparatus*).

1 ℔ Acacia.
½ ℔ " pulvis.
1 pint Alcohol.
½ pint Acidum aceticum.
1 oz. " benzoicum.
4 oz. " citricum.
1 oz. " hydrocyanicum dil.
4 oz. " muriaticum.
4 oz. " nitricum.
½ pint " sulphuric. aromat.
1 oz. " tannicum.
4 oz. Aloes pulvis (Soc.).
8 oz. Alumen.
4 oz. Ammoniæ carbonas.
1 pint " liquor.
4 oz. " murias.
½ pint " spiritus arom.
4 oz. Antim. et potass. tartras.
¼ oz. Argenti nitras cryst.
½ oz. " " fusum.
4 oz. Assafœtida.
1 oz. Bismuthi subnitras.
8 oz. Camphora.
2 oz. Cardamomum.
6 oz. Creta præparata.
4 oz. Calc. carb. præcip.
6 oz. Chloroformum.
8 oz. Cinchona rub. pulv.
1 oz. Cinchoniæ sulphas.
1 oz. Creasotum.
8 oz. Ceratum cantharides.
8 oz. " resinæ.
8 oz. " simplex.
½ pint Copaiba.
1 ℔ Cubebæ pulv.
2 oz. Collodium.
1 oz. " cantharidal.
4 oz. Ergota (whole or in powder).
1 ℔ Æther (letheon).
1 oz. vial Extractum aconiti (Tilden's).
1 oz. vial " belladonnæ "
1 oz. vial Extractum conii (Tilden's).
1 oz. vial " hyoscyami "
2 oz. Extractum coloc. comp. pulv.
2 oz. " jalapæ pulv.
1 oz. " nucis vomicæ.
1 oz. " quassiæ.
8 oz. " taraxaci (Tilden's).
1 ℔ " sennæ fluidum.
1 ℔ " spigeliæ et sennæ fluidum.
½ pint " valerianæ fluidum.
4 oz. Ferri carb. massa (Vallette).
8 oz. " subcarb.
1 oz. " citras.
1 oz. " pulvis.
½ pint " sesqui sulph. solut. (with directions for preparing hydrated peroxide when required).
8 oz. Fœniculum.
1 oz. Gambogiæ pulv.
1 ℔ Gentiana contus.
4 oz. Glycyrrhiza ext. pulv.
4 oz. " rad. pulv.
2 oz. Glycerin.
½ ℔ Hydrarg. massa.
½ ℔ " chlor. mit.
1 oz. " cum creta.
2 oz. " oxid. rub.
½ oz. " prot. iodid.
1 oz. Iodinum.
4 oz. Ipecacuanhæ pulvis.
4 oz. Jalapæ pulvis.
8 oz. Juniperus.
2 oz. Kino.
4 oz. Liquor iodinii comp.
4 oz. " ferri iodid.
½ pint " hydrarg. et arsen. iodid.
½ pint " potassæ arsenitis.
1 ℔ bot. Magnesia.
½ ℔ Magnesia carb.
5 ℔ " sulphas.

6 oz. Manna.
$\frac{1}{8}$ oz. Morphiæ sulphas.
$\frac{1}{8}$ oz. " acetas.
$\frac{1}{8}$ oz. " murias.
4 oz. Myrrha.
1 oz. Oleum anisi.
1 oz. " cinnamomi.
1 oz. " limonis.
1 oz. " menthæ pip.
1 bot. " olivæ.
1 pint " ricini.
1 pint " terebinthinæ.
1 oz. " tiglii.
2 oz. Opii pulvis.
8 oz. Plumbi acetas.
2 oz. " carbonas.
2 oz. Potassa (caustic).
4 oz. " bicarbonas.
$\frac{3}{4}$ ℔ " bitartras.
4 oz. " citras.
4 oz. " nitras.
8 oz. " sulphas.
2 oz. Potassii iodidum.
3 oz. Pulvis ipecac et opii.
8 oz. Quassia.
1 oz. Quiniæ sulphas.
6 oz. Rheum (E. Ind.).
4 oz. Rhei pulvis.
4 oz. Sapo (Castil.).
9 oz. Sarsaparilla.
2 oz. Scilla pulv.
8 oz. Senna (Alex.).
8 oz. Senega.
8 oz. Serpentaria.
℔iss. Sodæ bicarbonas.
4 oz. Sodæ boras pulv.
8 oz. " et potass. tart.
4 oz. " phosphas.
8 oz. Spigelia.
$\frac{1}{8}$ oz. Strychnia.
4 oz. Sulphur præcip.
$\frac{3}{4}$ ℔ " sublim.
$\frac{1}{2}$ pint Spt. ammon. arom.
$\frac{1}{2}$ pint Spt. ætheris comp.
1 pint " " nitrici.
$\frac{1}{2}$ pint " lavand. comp.
$\frac{1}{2}$ pint Syrupus ipecacuanhæ.
1 pint " pruni virg.
1 pint " rhei aromat.
1 pint " scillæ.
$\frac{1}{2}$ pint " senegæ.
4 oz. Tinctura aconiti rad.
1 pint " cinchonæ C.
$\frac{1}{2}$ pint " digitalis.
$\frac{1}{2}$ pint " ferri chloridi.
1 pint " opii.
1 pint " " camph.
1 pint " zingiberis.
$\frac{1}{2}$ ℔ Unguentum hydrargyri.
$\frac{1}{2}$ ℔ " " nitratis.
$\frac{1}{2}$ ℔ " simplex.
$\frac{1}{2}$ ℔ Uva ursi.
$\frac{1}{2}$ ℔ Valeriana.
1 pint Vinum antimonii.
$\frac{1}{2}$ pint " ergotæ.
$\frac{1}{2}$ pint " colchici rad.
$\frac{1}{8}$ oz. Veratria.
4 oz. Zinci oxidum P.
8 oz. " sulphas.

The necessary implements can be purchased for twenty-five dollars, making, with the foregoing, an aggregate expense of *one hundred dollars.*

The following list embraces the number and character of the bottles used in this collection:—

12 Oij SM. Bottles.
11 Oj " "
13 Oj Tr. Bottles.
15 Oss SM. Bottles.
18 ℥iv SM. Bottles.
24 f℥j and f℥ij SM. and Tr. Bottles.
12 Covered Jars.
6 Packing Bottles.

A case made to contain the above collection should be 5 feet high, exclusive of cornice, and 4 feet wide. It should contain shelves arranged as follows:—

1. For ointment, and extract jars and implements.
2. " (narrow) two dozen 2oz. and 1oz. ground stoppered bottles.
3. " 12 quart salt-mouth bottles.
4. " 13 pint " "
5. " 13 pint tincture bottles.
6. " 15 half-pint salt-mouth bottles.
7. " 15 " tincture bottles.
8. " 18 4oz. tincture and salt-mouth bottles.

An under case and several drawers might be appropriated to additional apparatus and implements.

FIFTY DOLLAR OUTFIT.

The following list of One Hundred Medicines and Preparations can be put up in substantial Ground Stoppered Bottles, neatly and uniformly labelled, so as to form a convenient and compact Cabinet of Materia Medica, for Forty-Three Dollars, and with the Apparatus and Implements attached for Fifty Dollars.

6 oz. Acacia.
½ pint Acidum aceticum.
3 oz. " citricum.
2 oz. " muriaticum.
3 oz. " nitricum.
½ pint " sulph. arom.
1 oz. " tannicum.
2 pints Alcohol.
4 oz. Alumen.
4 oz. Ammoniæ carbonas.
4 oz. " murias.
1 pint " liquor.
½ pint " spiritus arom.
1 oz. Antim. et potass. tart.
¼ oz. Argenti nitras cryst. }
½ oz. " " fus. }
4 oz. Assafœtida.
8 oz. Camphora.
2 oz. Cardamomum.
4 oz. Ceratum cantharidis.
3 oz. Chloroformum.
2 oz. Collodium.
½ pint Copaiba.
1 oz. Creasotum.
6 oz. Creta præparata, or }
4 oz. Calcis carb. præcip. }
4 oz. Cupri sulphas.
2 oz. Ergota (whole or powdered).
½ pint Æther (Letheon).
1 oz. Extractum aconiti (Tilden's).
1 oz. " belladonnæ "
1 oz. " colocynth. comp. pulv.
1 oz. " conii (Tilden's).
2 oz. " gentianæ "
1 oz. " hyoscyami "
1 oz. " jalapæ pulv.
8 oz. " valerianæ fl'd.
8 oz. Ferri subcarbonas.
1 oz. " pulvis (per hydrogen).
½ pint " chloridi tinct.
4 oz. Fœniculum.
8 oz. Gentiana contus.
4 oz. Hydrarg. massa.
6 oz. " chlorid mit.
2 oz. " oxid. Rub.
2 oz. " cum. creta.
1 oz. Iodinium.
½ pint Liquor hydrarg. et arsen. iod.
½ pint " potassæ arsenitis.
3 oz. Magnesia.
3 ℔ " sulphas.
⅛ oz. Morphiæ sulphas.
2 oz. Myrrha.
½ oz. Oleum cinnamomi.
½ oz. " limonis.
½ oz. " menthæ pip.
1 pint " ricini.
1 pint " terebinthinæ.
½ oz. " tiglii.
6 oz. Plumbi acetas.
3 oz. Potassæ bicarb.
12 oz. " bitartras.
3 oz. " citras.
6 oz. " nitras.
2 oz. Potassii iodidum.
6 oz. Pulvis acaciæ.
3 oz. " aloes, Soc.
1 oz. " digitalis.
4 oz. " ext. glycyrrhizæ.
1 oz. " gambogiæ.
1 oz. " ipecacuanhæ.
3 oz. " " et opii.
4 oz. " jalapæ.
1 oz. " opii.
4 oz. " rhei (E. Ind.)
2 oz. " scillæ.
6 oz. " sodæ boras.
8 oz. Quassia.
1 oz. Quiniæ sulphas.
4 oz. Rheum.
6 oz. Sapo (castil. alb.)
6 oz. Sarsaparilla.
4 oz. Senega.
4 oz. Serpentaria.
1 ℔ Sodæ bicarb.
4 oz. Spigelia.
8 oz. Sulphur sublim.
1 pint Spiritus ætheris nit.
½ pint " " comp.
1 pint " lavand. comp.
½ pint Syrupus ipecacuanhæ.
½ pint " scillæ.
½ pint " rhei arom.
1 pint Tinctura cinchonæ comp.
1 pint " opii.
1 pint " " camph.
4 oz. Unguentum hydrarg. (½ mercury).
4 oz. " " nitratis.
4 oz. Uva ursi.
½ pint. Vin. colchici rad.
2 oz. Zinci oxidum.
6 oz. " sulphas.
4 oz. Zingiberis.

IMPLEMENTS.

Scales and weights.		½ doz. ℥viij.	1 Funnel.
℥iv. Grad. Meas.		½ doz. ℥vj.	1 qr. Wrap'g & filtering paper.
1 Mortar and pestle.	½ gross vials.	1 doz. ℥iv.	1 gr. Vial corks.
1 Pill tile.	German flint.	1½ doz. ℥ij.	2 papers Pill boxes.
2 Spatulas.		1½ doz. ℥j.	2 yds. Adhesive plaster in tin
		1 doz. ℥ss.	case.

The Medicines contained in the Fifty Dollar Outfit are differently arranged as follows:—

12 pint Salts and Tinctures.

Oj Liquor ammoniæ.	Oj Tinct. opii.	℥viij Camphora.
Oj Spt. æther. nit.	6 oz. Acacia.	℥iij Magnesia.
8 oz. Sulphur sublim.	Oj Tinct. opii camph.	12 oz. Pot. bitart.
Oj Spt. Lavand. comp.	Oj " cinchonæ comp.	℔ Sodæ bicarb.

14 eight oz. Tinct. Bottles.

½ pint Acidum aceticum.	½ pint Syrup. ipecac.	½ pint Tinct. ferri chlor.
½ pint Acid. sulph. arom.	½ pint Copaiba.	½ pint Syrupus rhei arom.
½ pint Fowler's solution.	½ pint Vin. colchici.	½ pint Donovan's solution.
½ pint Æther.	½ pint Syrup. scillæ.	½ pint Ext. valerian. fluid.
½ pint Spt. ammon. arom.	½ pint Spt. æther. comp.	

14 eight oz. Salt-mouth Bottles.

6 oz. Pulv. acacia.	6 oz. Potass. nit.	4 oz. Assafœtida.
4 oz. Pul. ext. glycyrrhizæ.	6 oz. Pulv. sodæ boras.	4 oz. Ammon. murias.
6 oz. Plumbi acet.	6 oz. Zinci sulph.	6 oz. Creta præparata.
4 oz. Jalapæ pulv.	4 oz. Alumen.	8 oz. Ferri subcarb.
4 oz. Pulv. rhei.	4 oz. Ammon. carb.	

17 four oz. Salt-mouth and Tinct. Bottles.

3 oz. Acid citricum.	2 oz. Zinci oxidum.	3 oz. Potass. citras.
1 oz. " tannicum.	2 oz. Acid. muriat.	2 oz. " iodid.
1 oz. Quiniæ sulph.	6 oz. Hydr. chlor. mit.	3 oz. Pulv. aloes, Soc.
3 oz. Chloroform.	2 oz. Myrrha.	3 oz. " ipecac. et opii.
4 oz. Cupri sulph.	3 oz. Acid. nitric.	3 oz. " scillæ.
2 oz. Ergot.	3 oz. Potassæ bicarb.	

20 two oz. Salt-mouth and Tinct. Bottles.

1 oz. Antim. et pot. tart.	1 oz. Creasotum.	1 oz. Pulv. digitalis.
½ et ½ Argent. nit. (cr's f'd).	2 oz. Hydr. ox. rub.	½ oz. Ol. limon.
1 oz. Ext. colocynth. comp.	2 oz. " cum creta.	1 oz. Pulv. gambogia.
½ oz. Ol. tiglii.	½ oz. Ol. cinnamomi.	1 oz. " ipecac.
1 oz. Ext. jalapæ.	1 oz. Iodinum.	2 oz. Collodium.
1 oz. Ferri pulvis.	½ oz. Morphiæ sulph.	½ oz. Ol. menth. pip.

EXTRACTS AND OINTMENTS, &c.

4 oz. Cerat. canth.	4 oz. Pil. hydrarg.	1 oz. Ext. conii.
4 oz. Ung. hydrarg.	1 oz. Ext. aconit.	2 oz. " gentianæ.
4 oz. " " nit.	1 oz. " belladonna.	1 oz " hyoscyami.

PACKAGES, ETC.

Oj Alcohol in pint packers.
Oj Ol. ricini.
Oj Ol. terebinth.
6 oz. Sarsaparilla.
4 oz. Senega.
4 oz. Spigelia.
4 oz. Ginger.
3 oz. Fœniculum.
3 ℔ Mag. sulph.
4 oz. Rheum.
8 oz. Quassia.
6 oz. Sapo.
4 oz. Serpentaria.
4 oz. Uva ursi.
2 oz. Cardamom.
8 Gentiana contus.

This collection will conveniently fill a case three feet six inches wide and four feet high, containing six shelves and two or more drawers, to contain packages, &c.

1st shelf for Ointment and Extract Jars and Implements.
2d shelf for 12 pint Salt-Mouth and Tinct. Bottles.
3d shelf for 14 half-pint Tincture Bottles.
4th shelf for 14 half-pint Salt-Mouth Bottles.
5th shelf for 17 four ounce Salt-Mouth and Tinct. Bottles.
6th shelf for 20 two ounce Salt-Mouth and Tinct. Bottles.

TWENTY-FIVE DOLLAR OUTFIT.

The following Sixty-One articles can be put up in handsome Ground-Stoppered Bottles, and Queensware Jars, neatly labelled, and packed for transportation, for Twenty Dollars, and the list of Implements attached for Five Dollars.

2 oz. Acidum citricum.
4 oz. " sulph. arom.
8 oz. Alcohol.
¼ oz. Argenti nitras.
2 oz. Camphora,
4 oz. Ceratum cantharidis.
3 oz. Chloroformum.
2 oz. Collodium.
4 oz. Copaiba.
3 oz. Creta præparata, or
2 oz. Calcis carb. præcip.
3 oz. Cupri sulph.
8 oz. Æther (Letheon).
1 oz. Extract. aconiti.
1 oz. " belladonnæ.
1 oz. " coloc. c. pulv.
1 oz. " gentianæ.
1 oz. " hyoscyami.
1 oz. " jalapæ pulv.
8 oz. " sennæ fl'd.
8 oz. " valerianæ fl'd.
3 oz. Ferri subcarb.
1 oz. " pulvis.
8 oz. " chlor. tinct.
4 oz. Hydrarg. massa.
3 oz. " chlorid. mit.
1 oz. " oxid. rub.
8 oz. Liquor ammoniæ.
4 oz. " iodinii comp.
4 oz. " hydr. et arsen. iod.
8 oz. " potassæ arsenitis.
½ oz. Morphia sulph.
2 oz. Myrrha.
½ oz. Oleum limonis.
½ oz. " cinnamomi.
½ oz. Pil. cathart. comp.
3 oz. Plumbi acetas,
2 oz. Potassæ bicarb.
3 oz. " citras.
3 oz. Pulvis acaciæ.
3 oz. " aloes, Soc.
2 oz. " ext. glycyrrhizæ.
1 oz. " ipecacuanhæ.
2 oz. " " et opii.
1 oz. " opii.
2 oz. " rhei.
½ oz. Quiniæ sulphas.
2 oz. Sapo, castil.
4 oz. Sodæ bicarb.
8 oz. Spt. æther. nit.
4 oz. " ammon. arom.
4 oz. " æther. comp.
8 oz. " lavand. comp.
4 oz. Syrup. ipecac.
8 oz. " rhei ar.
8 oz. " scillæ.
8 oz. Tinct. opii.
8 oz. " zingiberis.
4 oz. Ung. hydrarg. nit.
8 oz. Vin. antimon.
4 oz. Vin. colchici R.
3 oz. Zinci sulph.

IMPLEMENTS.

Scales and weights.
4 oz. Grad. measure.
1 Mortar and pestle.
1 doz. 1 oz. Vials.
1 doz. ½ oz. "
½ doz. 2 oz. "
½ doz. 4 oz. Vials.
2 Spatulas.
2 papers Pill boxes.
½ gross Vial corks.
1 case Adhesive plaster.
1 Funnel. 1 Pill tile.

This collection will conveniently fill a case twenty-one inches wide, and four feet high, having seven shelves, to be filled as follows:—

1st with Ointment Jars and Implements.
2d " 7 8 oz. Tincture Bottles.
3d " " " "
4th " 9 4 oz. S.M. Bottles.
5th for 9 4 oz. S.M. Bottles.
6th " 9 4 oz. Tincture Bottles.
7th " 11 2 oz. G.S. Bottles.

List of Plants growing in Philadelphia City limits, and the adjacent parts of New Jersey, with their habitat and time of flowering, proper time for collection, &c. The nomenclature is chiefly that of Gray, late edition, the months expressed in numerals.

Botanical name.	Common name.	Flowers.	Collect.	When.	Habitat and Remarks.
Achillea millefolium	Yarrow, milfoil	6—9	Herb	6—9	All fields:
Acorus calamus	Sweet flag	5—6	Rhizome	Late in Autumn or early Spring	Swamps.
Actea alba	Baneberry	5	Root		Rare. Rocky woods.
Adiantum pedatum	Maiden hair		Leaves		A beautiful fern. Moist woods.
Æsculus hippocastanum	Horsechestnut		Young bark	Spring	
Agrimonia Eupatoria	Agrimony	6, 7	Herb and root		Borders of woods.
Aletus farinosa	Stargrass		Root		Woods and hills.
Alisma plantago	Water plantain		Leaves		Swamps.
Ambrina anthelminticum	Wormseed	7, 8	Fruit	10	Said to grow in South Camden. Difficult to distinguish from A. ambrosioides; odor stronger, which is retained when dried.
Ambrina ambrosioides		7, 8	Fruit	10	Odor same as preceding.
Ambrina botrys	Jerusalem oak	7, 8	Fruit	10	Odor dissipated in drying.
Anagallis arvensis	Scarlet pimpernel	6, 7			Fields.
Andromeda mariana	Stagger-bush	5			North of Camden; abundant.
Anemone nemorosa	Wind flower	4			Moist woodlands and clearings.
Anthemis arvensis	Wild chamomile	6 and after	Heads	6, 7	Cultivated grounds; sub. for A. nobilis.
Apocynum androsæmifolium	Dog's bane	6	Root	Autumn	Copses and fence rows; flowers delicate pink.
Apocynum cannabinum	Indian hemp	6	Root	Autumn	Copses and fence rows; flowers white.
Aquilegia Canadensis	Wild columbine	5, 6			Rocky woods, near streams.
Aralia nudicaulis	False sarsaparilla	6	Root	Autumn	Rocky woods.
Aralia racemosa	Wild spikenard	7			Rich woods and fence rows.

List of Plants—Continued.

Botanical name.	Common name.	Flowers.	Collect.	When.	Habitat and Remarks.
Archangelica atropurpurea	Purple angelica	5	Root and herb		Meadows; sub. for Angelica archangelica of Europe.
Arum triphyllum	Indian turnip	5	Dried cormus	8, 9	Damp woods and meadows.
Arctostaphylos uva ursi	Bearberry		Leaves	Autumn	New Jersey woods.
Aristolochia serpentaria	Virginia snakeroot	5	Root	Autumn	Moist woods.
Asarum Canadense	Wild ginger	5, 6	Root	Autumn	Moist, rich woodlands.
Asclepias incarnata	Flesh-colored asclepias	6, 7, 8	Root		Meadows; along streams.
" syriaca (or A. cornuti)	Wild cotton	6, 7, 8	Root	Autumn	Meadows; along streams.
Asclepias tuberosa	Pleurisy root	7	Root	Autumn	Sandy old fields; juice *not* milky; orange-colored flowers.
Aspidium filix mas	Male fern		Rhizome	Summer	
Berberis vulgaris	Barberry	7, 8	Berries		
Baptisia tinctoria	Wild indigo	7	Root and all		Woods.
Cassia Marilandica	Wild senna	7, 8	Leaves	8—9	Near streams; common N. of Camden.
Catalpa cordifolia	Catawba tree	6	Seeds		
Ceanothus Americanus	N. Jersey tea	6	Root and leaves	Summer	Woods.
Celastrus scandens	Climbing staff-tree	6	Bark		Thickets and fence rows.
Chamælirium tuteum		6			Clearings and woods.
Chelidonium majus	Celandine	5	All	Autumn	Near old settlements.
Chimaphila umbellata	Pipsissewa	6	Leaves and stem	Autumn	Common in woods of N. exposure.
Chimaphila maculata	Spotted winter-green	6		Autumn	Common in woods of N. exposure.
Cicuta maculata	Water hemlock	7		7, 8	Along swampy rivulets.
Cichorium intybus	Succory, chickory	9	Dried root		Fields near Wissahickon.
Cimicifuga racemosa	Black snakeroot	6, 7	Root	Autumn	Common in rich moist woods.
Clematis Virginica	Virgin's bower	7, 8	Leaves		Moist thickets; sub. for C. erecta.
Collinsonia Canadensis	Heal-all	7, 8, 9			Rich woods.
Comptonia asplenifolium	Sweet fern	4	All		Slaty woods and hillsides.
Conium maculatum	Hemlock	6, 7	Leaves and fruit	7, 8	Old settlements and waste places; an active poison; when partially dry the odor is remarkably like that of mice.
Convallaria polygonatum	Solomon's seal	5	Root	Autumn	Rich woods, and fence rows.
Convolvulus panduratus	Wild potato	6, 7, 8	Root	Autumn	West of Schuylkill.
Cornus Florida	Dogwood	5	Bark	Spring	Woods, everywhere.
Cornus sericea	Swamp dogwood	6, 7	Bark	Spring	Swamps; same properties as preceding.
Cunila mariana	Dittany	6, 7	Herb	6, 7	Slaty hills.
Cynoglossum officinale	Hound's tongue		Root		Rich woods.
Cypripedium acaule		5			Swamps; common near Camden.
Cytisus scoparius	Broom	6, 7	Tops	6, 7	Back of Fairmount.

List of Plants—Continued.

Botanical name.	Common name.	Flowers.	Collect.	When.	Habitat and Remarks.
Datura stramonium	Jamestown weed	6, 7	Leaves, root, and seed	7—8 8—9	A rank weed.
Daucus carota	Wild carrot	6, 7	Root and seed	7, 8	A common nuisance among farmers.
Diospyros Virginiana	Persimmon	5, 6	Fruit and bark	10	Abundant near Camden and elsewhere.
Dirca palustris	Leatherwood		Bark		
Erigeron Canadense	Canada fleabane	7, 8	All	7, 8	Old fields.
Erigeron Philadelphicum	Philadelphia fleabane [scabious]	6, 7	All	6, 7	Fields everywhere.
Erigeron Heterophyllum	Various-leaved fleabane	6, 7	All	6, 7	Fields everywhere.
Eryngium Virginianum	Button snakeroot	8	Root	Autumn	Swamps near Camden.
Erythronium Americanum	Dogtooth violet	5	Bulb		Swampy woods near streams.
Epiphegus Virginianus	Cancer root	8, 9			Under beech trees.
Epigæa repens	Trailing arbutus	4	Leaves	Summer	Near Camden woods; common.
Euonymus Americanus	Burning bush	9	Bark and seeds		Near Wissahickon.
Eupatorium perfoliatum	Bone-set	8, 9	All	8, 9	Meadows.
Euphorbia corollata	Large flowering spurge	7, 8	Root	Autumn	Dry soil near Camden.
Euphorbia ipecacuanha	Ipecac. spurge	5, 8	Root	Autumn	Sandy shores, near Camden, N. J.
Fumaria officinalis	Fumitory	5, 8	Leaves		
Galium Aparine	Goosegrass	5	Herb		Fence rows and hedges.
Gaultheria procumbens	Teaberry	7	Leaves	Autumn	Moist grounds, near Redbank.
Gentiana andreuzer	Gentian	8, 9			Confounded with G. catesbæi.
Geranium maculatum	Crow-foot	5, 7	Root	Autumn	Moist fields and fence rows.
Geum rivale	Purple avens	5, 6	Root	Autumn	Wet meadows; rare near Philadelphia.
Gillenia trifoliata	Indian physic	6, 7	Root	Sept.	Rocky woods and hillsides.
Hamamelis Virginica	Witch hazel	10	Bark and leaves		Woods, near streams.
Hedeoma pulegioides	Pennyroyal	7	All	7	Sterile fields.
Helenium autumnale	Sneezeweed	8	Leaves, flowers	8	Along the Delaware.
Helianthemum Canadense	Frost-weed	6	All	6	Dry sandy soil, near Camden, N. J.
Hepatica triloba	Liverwort	4, 5	Leaves	Summer	Woods.
Heracleum lanatum	Cow parsnips	5	Root		Meadows, when dried very fragrant.
Heuchera Americana	Alum root	6, 7	Root	Autumn	Rocky hill-sides and shady places.
Humulus lupulus	Hop	7	Ripe strobiles	7, 8	Cultivated; indigenous along streams.
Hydrangea arborescens			Root	Spring	West bank of Sch'kill, above Manayunk.
Hydrastis Canadensis	Yellow root	5	Root and bark	Autumn	Sch'kill, opposite Manayunk; rich woods.
Hypericum perforatum	St. John's wort	7	Summits	7	A common weed in fields.
Ilex opaca	American holly		Leaves and seed		
Inula helenium	Elecampane	7, 8	Root	Autumn	Low meadows.
Impatiens fulva	Touch-me-not	7, 8			Low grounds.

List of Plants—Continued.

Botanical name.	Common name.	Flowers.	Collect.	When.	Habitat and Remarks.
Iris versicolor	Blue flag	6	Rhizome		Meadows.
Juglans cinerea	Butternut	5	Inner brk of root	5, 6	
Juniperus communis	Juniper	4	Fruit and tops		Collect in the year after flowering.
Juniperus Virginiana	Red cedar	4	Leaves and tops		
Kalmia latefolia	Laurel	6	Leaves	Summer	Hilly woods.
Lactuca elongata	Wild lettuce	7	Herb	7	Virtue resides in milky juice.
Laurus benzoin	Spice-wood	4	Bark	Spring	Moist woods.
Lappa major	Burdock		Root		Collect in Spring.
Liatris spicata	Gay feather	7	Root		Moist woods (Button snakeroot.)
Ligustrum vulgare	Privet		Leaves, flowers		
Linaria vulgaris	Toad-flax	6—9	Herb	in flower	
Liquidambar styraciflua	Sweet gum				Meadows and swamps, near tide-water.
Liriodendron tulipifera	Tulip tree	5	Bark		Forests.
Lithospermum officinale	Stone-weed	5			
Lobelia inflata	Indian tobacco	7, 8, 9	Root and tops	8, 9	Fields and roadsides; common.
Lobelia cardinalis	Cardinal flower	7, 8			
Lycopodium clavatum	Club moss		Pollen		Thickets.
Lycopus Virginicus	Bugle weed, pile wort	8	Herb	8	Swamps and meadows.
Lycopus sinuatus	Water horehound	7			Swamps.
Magnolia glauca	Magnolia	6, 7	Bark	Spring	Swamps; abundant near Camden.
Malva rotundifolia	Running mallows	5	Herb		Substitute for M. Sylvestris of Europe.
Marrubium vulgare	Horehound	7, 8	All	7, 8	
Maruta cotula	Dog's fennel	6—9			Roadsides and yards; sub. for Anthemis nobilis.
Melissa officinalis	Balm	7, 8	Leaves	6, 7	Gardens.
Melissa clinopodium	Wild basil				Fence rows.
Menispermum Canadense	Moonseed	7	Root		Along Wissahickon.
Mentha piperita	Peppermint	8	All	8	Escaped from gardens.
Mentha viridis	Spearmint	8	All	8	
Monarda punctata	Horsemint	6—9	Herb	Summer	Near Camden.
Monarda fistulosa	Wild bergamot	7			Along streams.
Medeola Virginica	Indian cucumber	6	Root		Moist woods.
Nepeta Cataria	Catmint	6	All	Summer	A common weed on farms.
Nepeta glechoma	Ground ivy	5	Herb	5, 6	Old settlements.
Nymphæa odorata	Water lily	7	Root		Rare; in ditches south of Camden.
Œnothera biennis	Primrose	7, 8			Common everywhere.
Origanum vulgare	Marjoram	6—10	Herb	Summer	Dry soil; near Columbia Railroad bridge.
Oxalis acetosella	Wood sorrel	6	All	6	Very common.
Panax quinquefolium	Ginseng	7	Root	Autumn	Found, but very rare, near Philadelphia.
Phytolacca decandra	Poke	7	Berries and root	9, 10	Common clearings and fence rows.
Plantago major	Plantain				Common in fields and yards.
Podophyllum peltatum	May apple	5	Rhizome	10	Moist woods.

List of Plants—Continued.

Botanical name.	Common name.	Flowers.	Collect.	When.	Habitat and Remarks.
Polygala senega	Seneka snakeroot	5	Root	9, 10	Rare; rich, hilly woodlands.
Prinos verticillatus	Black alder	6	Bark	10—4	Swamps.
Populus tremuloides	Aspen	4	Bark	9—4	
Prunella vulgaris	All-heal	6	Herb	6, 7	Waysides; common.
Prunus Virginiana [cerasus serotina]	Wild cherry	5	Bark		Common in fields and forests.
PulmonariaVirginica	Lungwort				Near Wissahickon.
Quercus alba	White oak		Bark	Spring	Woods.
Quercus tinctoria	Black oak		Bark	Spring	Woods.
Ranunculusbulbosus	Buttercup	5, 6	All	5, 6	Common everywhere.
Rhus glabrum	Sumach	7	Fruit	9, 10	Old fields, &c.
Rhus radicans	Poison vine	6, 7			Fences.
Rhus toxicodendron	Poison oak	6, 7	Leaves		Woods.
Rhus vernix	Swamp sumach		Leaves		Swamps; powerful poison.
Rubus trivialis	Dewberry	5	Root	Autumn	
Rubus villosus	Blackberry	5	Root	Autumn	
Rumex obtusifolius	Dock	6, 7	Root	Autumn	Common in fields and yards.
Rumex acetosella	Sorrel	5, 6	Leaves	Summer	Common pest in fields and yards.
Rumex crispus	Curled, or sour dock	5	Root		
Sabbatia angularis	Wild centaury	7, 8	All	8	A common, showy plant.
Salix alba	White willow	4, 5	Bark		
Sambucus Canadensis	Elder	5, 6	Flowers	5, 6	
Sanguinaria Canadensis	Bloodroot	4	Rhizome	Autumn	Clearings.
Sanicula Marilandica	Sanicle	7			Woods.
Saponaria officinalis	Soapwort				Old settlements.
Sarracenia purpurea	Fly-trap	7			Rare; swamps south of Camden.
Sassafras officinale	Sassafras	5	Bark of root	9—4	Fence rows.
Scutellaria lateriflora	Skullcap	7			Moist places.
Sisymbrium officinale	Hedge mustard	5			Waste places.
Solanum dulcamara	Bittersweet	7, 8		Autumn	About houses.
Solidago odora	Sweet golden rod	8, 9		8, 9	Abundant north of Camden.
Symplocarpus fœtidus	Skunk cabbage	3, 4		9—3	Swamps.
Tanacetum vulgare	Tansy	7—9			Escaped from gardens.
Taraxacum Dens-leonis (Leontodon Taraxacum)	Dandelion	4—5	Root	8, 9	A common weed.
Trillium cernuum	Three-leaved nightshade	5			Moist woods.
TephrosiaVirginiana	Goat's rue				Near Camden.
Triosteum perfoliatum	Fever root	6			Moist fields, near limestone.
Ulmus fulva	Slippery elm	4	Bark		Rare.
Urtica dioica	Nettle				Too common.
Veratrum viride	Am'can hellebore	6	Root	Autumn	Shady swamps.
Verbascum thapsus	Mullein				Very common.
Veronica officinalis	Speedwell	6			Fields.
Veronica Virginica	Neckweed				Meadows.
Viola pedata.	Violet	5			North of Camden; very abundant.

Preparations used as Articles of Diet for the Sick and Convalescent.

Arrow Root Pap.

Take of arrow root one large tablespoonful; water, one pint. First mix the arrow root well into a paste with a little of the cold water; bring the balance of the water to a boiling heat; then stir in the arrow root; let it boil a few minutes; sweeten it with loaf sugar.

The preparation of arrow root pap, with milk, renders it richer and more nutritious, though sometimes not allowable.

The application of direct heat to preparations of this description, always involves the danger of scorching them, and the intervention of a water bath is found to prevent the accident. The apparatus here figured, is made for the purpose, and is a useful utensil in any family. The drawing explains itself.

Fig. 243.

Arrow Root Pap, with Milk.

Put in a saucepan, to boil, one pint of milk; stir very smoothly, into a cup of cold milk, a dessertspoonful of arrow root; when the milk boils, stir in the arrow root; continue to stir until it is cooked, which will be in five or ten minutes; then remove it from the fire, and sweeten to the taste.

Toast Water.

Cut a slice of stale bread half an inch thick, a finger length long; cut off the crust, and toast it quite brown, but not scorched; while hot, put it into a half pint pitcher; pour over half a pint of boiling water; cover it tightly, and when cool, remove the bread.

Mulled Wine.

Put cinnamon or allspice (to the taste) into a cup of hot water to steep; add three eggs, well beaten, with sugar; heat to a boil, a pint of wine; then put in the spice and eggs, while boiling, and stir them until done, which will be in three minutes.

Jelly for Invalids.

Cut a penny roll into thin slices; toast them a light brown; then boil gently in a quart of water until it jellies; strain it upon a few shavings of lemon-peel; sweeten, and add, if liked, a little wine and nutmeg.

Eggnog.

Take the yelks of eight eggs; beat them with six large spoonfuls of pulverized loaf sugar; when this is a cream, add the third part of a nutmeg, grated; into this stir one tumblerful of good brandy, and one wineglass of good Madeira wine; mix them well together; have ready the whites, beaten

to a stiff froth, and beat them into the mixture; when all are well mixed, add three pints of rich milk.

Panada.

Cut two slices of stale bread half an inch in thickness; cut off the crust; toast them a nice brown; cut them into squares of two inches in size; lay them in a bowl, sprinkle a little salt over them, and pour on a pint of boiling water; grate a little nutmeg.

Tapioca.

Soak two tablespoonfuls of very clean tapioca in two teacups of cold water over night; in the morning, add a little salt, one pint of milk, or water, if milk cannot be taken; simmer it until quite soft; stir well while cooling; when done, pour into a bowl, and, if allowed, add sugar, a spoonful of wine, and a little nutmeg.

Rice Jelly.

Take of rice, one-quarter of a pound; white sugar, half a pound; water, one quart. Boil these well together, carefully stirring them till the whole becomes a glutinous mass. Strain off into a dish or form. When cool, it is fit for use. This preparation may be flavored with rose-water, orange-flower water, lemon-juice, as may best suit the palate of the patient, or as directed by the physician.

Iceland Moss Jelly.

Take of Iceland moss two ounces; water, one quart. First wash the moss in some cold water; then put it into the quart of water, and boil slowly till very thick, adding white sugar till sufficiently sweet, then strain through a cloth. When cold, it will be fit for use, and may be eaten with spices, if allowed. Irish moss jelly may be prepared in the same way.

Sago Jelly.

Take four tablespoonfuls of sago, one quart of water, juice and rind of one lemon; sweeten to the taste. Mix all the ingredients well together; let it stand for half an hour; then put it on to boil, till the particles are entirely dissolved; it should be constantly stirred. It is very much improved by the addition of wine.

Calves' Feet Jelly.

Boil two calves' feet in one gallon of water, down to a quart; then strain it, and, when cold, skim off all the fat: take up all the clear jelly. Put the jelly into a saucepan, with a pint of wine, half a pound of loaf sugar, the juice of four lemons, the white of six or eight eggs beaten into a froth. Mix all well together. Set the saucepan upon a clear fire, and stir the jelly till it boils. When it has boiled ten minutes, pour it through a flannel bag till it runs clear.

Essence of Beef.

This is prepared from lean meat, by cutting it into small pieces, adding a little salt, then introducing into a wide-mouth bottle, corked tightly, and heating it gradually by immersing in a kettle of water, to which heat is applied till it boils. After a few hours digesting in this way, the juice is drawn off, and constitutes the most concentrated form of nourishment.

Beef Tea.

Take of lean beef one-quarter of a pound, a pint and a half of water, salt sufficient to season it. When it begins to boil, skim it five minutes; then add two blades of mace; continue the boiling ten minutes longer, when it will be ready for use.

Chicken Broth.

Clean half a chicken; on it pour one quart cold water, and a little salt; put in a spoonful of rice: boil two hours, very slowly, and tightly covered; skim it well; just before using it, put in a little chopped parsley.

Chicken Jelly.

Cut up a chicken; put it into a stone jar; break all the bones; cover very closely; set the jar into boiling water; keep it boiling three hours and a half; strain off the liquor; season with salt and a very little mace.

Rice Jelly.

Boil a quarter of a pound of the best rice flour, with half a pound of loaf sugar, in a quart of water, until the whole becomes one glutinous mass; strain off the jelly, and let it stand to cool; this is nutritious and light.

Slippery Elm Bark Jelly.

Four large spoonfuls of the bark, chipped; pour on it one quart of cold water; let it stand all night; stir it, and let it settle; the next morning pour off the water; slice the rind of a lemon very thinly, and, with the juice, put it in the water strained: let it simmer, very gently, fifteen minutes; then sweeten, and pour in a mould to cool and harden; take out the rind before putting in the mould.

Wine Whey.

Boil a pint of new milk; add to it a glass or two of white wine; put it on the fire until it just boils again; then set it aside till the curd settles; pour off the clean whey; sweeten to the taste; cider is as good as wine to curdle, if it is good country cider.

Corn Meal, or Oatmeal Gruel.

Put in a clean saucepan one pint of water to boil; when boiling, mix of oatmeal two large spoonfuls, in a half pint of milk, and a little salt; stir this into the boiling water; stir it well; let it simmer thirty minutes; then strain it through a hair-sieve; if the patient can bear it, a large spoonful of the best brandy stirred in after it is strained and sweetened, and a little grated nutmeg; if corn meal is used, stir the dry corn meal into the boiling water;

two large spoonfuls to a pint of boiling water, and a half new milk; season as the other.

Vegetable Soup.

Take two white potatoes, one onion, a piece of well-baked bread. Put these into a clean stewpan, in one quart of water; boil then down to a pint; throw into the vessel some parsley or celery; cover the vessel closely; remove it from the fire, and allow the herbs to steep, while the liquor is cooling, under cover; season to the taste.

Castillon's Powders.

Take of Powdered tragacanth
Powdered sago
Powdered salep
Sugar, each, one ounce;
Prepared oyster-shell, two drachms.

Mix them thoroughly, and fold into papers containing each one drachm.

Directions.—Mix a powder with four tablespoonsful of cold milk in a bowl. Then transfer it to a milk-pan, and, while stirring, pour upon it gradually one pint of boiling milk, and boil for a quarter of an hour. Sugar may be added to the taste.

RECIPES FOR SOME OF THE MORE IMPORTANT PATENT MEDICINES.

Dalby's Carminative.

The published recipes for this, as found in the formularies, are not those used generally by druggists. Some of the ingredients in the original recipes are procurable with difficulty, and add so much to the expense of the preparation, that by common consent they are left out. The formula, as given by the College of Pharmacy, is nearly identical with that which I have used for a number of years, and I give it below.

Take of Carbonate of magnesia . . .	℥vj	75.
Carbonate of potassa	ʒij	3.125
Sugar	℥xvj	200.
Tincture of opium	f℥iij	op. 37.5.
Water	Ov	1000.
Oils of caraway,		
Fennel, and peppermint, of each . .	♏x.	
(To the above may be added,		
French brandy	f℥iv.	
Prepared chalk	℥ij.)	

Triturate together the essential oils, sugar, magnesia (and prepared chalk, if added), then add the water, and afterwards the remainder.

Dalby's carminative contains one grain of opium to about an ounce.

Dewees' Carminative.

Take of Carbonate of magnesia	℥jss.
Sugar	℥iij.
Tincture of assafœtida	f℥iij.
Tincture of opium	f℥j.
Water	Oiss.

Triturate together until they are mixed.

Bateman's Pectoral Drops.

		Parts.
Take of Diluted alcohol	Cong. j	1000.
[1]Red sanders, rasped	℥ss	31.25.

Digest for 24 hours, filter, and add

Opium, in powder	℥ss	31.25.
Catechu, in powder	℥ss	31.25.
Camphor	℥ss	31.25.
Oil of anise	f℥j	7.81.

Digest for 10 days.

This preparation contains about one grain each of opium, catechu, and camphor, to the f℥ss, corresponding in strength with tinctura opii camphorata, U. S.

Godfrey's Cordial.

			Parts.
Take of Tincture of opium	f℥vj	op. 34.5	
Molasses (sugar-house)	Oiv	367.8	1000.
Alcohol	f℥viij	46.	
Water	Ovjss	551.7	
Carbonate of potassa	℥v		57.5.
Oil of sassafras	f℥j		11.

Dissolve the carbonate of potassa in the water, add the molasses, and heat over a gentle fire till they simmer, remove the scum which rises, and add the laudanum and oil of sassafras, having previously mixed them well together.

This preparation contains a little over one grain of opium to the ounce, and is about half the strength of the foregoing.

Balsam of Honey.

Take of Balsam tolu	℥j.
Benzoic acid	℥iss.
Honey	℥vj.
Opium (powd.)	℥ij.
Cochineal	℥j.
French brandy	Oiij.

Mix, and digest together for a few days, then filter.

Composition Powders. (*Thompsonian.*)

Take of Powd. bayberry root	℔j.
" ginger	℔ss.
" cayenne	℥j.
" cloves	℥j.

Mix, by passing through a sieve.

[1] Substituted by Caramel ℥iij.

No. 6. Hot Drops. (Thompsonian.)

Take of Capsicum (powd.)	℥j.	
Myrrh (contus.)	℥iv.	
Alcohol	Oij.	Macerate and filter.

Or thus,

Take of Tincture of capsicum	Oj.	
" of myrrh	Oiss.	

Mix them.

Turlington's Balsam of Life.

The officinal tinctura benzoini composita is sold under this name, but the druggists who put it up in the peculiar and very odd shaped vials, in which it was originally vended in wrappers descriptive of its virtues, use various recipes for making it. The following is that published by the Philadelphia College of Pharmacy, and used in many of the best establishments. The original recipe for this, as filed in the office of rolls in London, contained 28 ingredients.

Take of Alcohol	Oiv.
Benzoin	℥vj.
Liquid storax	℥ij.
Socotrine aloes	℥ss.
Peruvian balsam	℥j.
Myrrh	℥ss.
Angelica	ʒij.
Balsam tolu	℥ij.
Extract of liquorice	℥ij.

Digest for 10 days and strain.

British Oil.

Take of Oil of turpentine	f℥iv.
" flaxseed	Oiij.
" amber	Oj.
" juniper	f℥ss.
Petroleum (Barbadoes)	℥ij.
" (American)	℥ij.

Mix them well together.

Hooper's Female Pills.

Take of Aloes	℥viij	400 parts.
Dried sulphate of iron	℥ij, ʒiss	200 "
or Crystallized sulphate of iron	℥iv	
Extract of black hellebore	℥ij	100 "
Myrrh	℥ij	100 "
Soap	℥ij	100 "
Powd. canella	℥j	50 "
" ginger	℥j	50 "
		1000 parts.

Beat them well together into a mass with syrup, and divide into pills, each containing two and a half grains.

Anderson's Scots' Pills.

Take of Aloes	℥xxiv	787.
Soap	℥iv	131.
Colocynth	℥j	33.
Gamboge	℥j	33.
Oil of anise	f℥ss	16.
		1000 parts.

Let the aloes, colocynth, and gamboge, be reduced to a very fine powder, then beat them and the soap with water into a mass of a proper consistence, to divide into pills, each containing three grains.

Worm Tea.

Take of Senna,	
Manna,	
Spigelia, of each	℥ss.
Fennel seed	℥j.
Worm seed	℥ss.
Savine	ʒij.
Bitartrate of potassa	℥ij.

Make into one package.

Directions.—Pour into this a quart of boiling water, and let it digest for ten or fifteen minutes; of the clear liquid sweetened, give to childrem two years old and upwards, a small teacupful *warm*, morning, noon, and night, on an empty stomach. It may be given three or four days successively, if necessary.

The fluid extract of pink root and senna, *U. S. P.*, may be substituted for this, and has the advantage of being ready for use without the trouble of extemporaneous preparation.

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