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VETERINARY MEDICINES

THEIR

ACTIONS AND USES.

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VETERINARY MEDICINES

THEIR

ACTIONS AND USES:

WITH A

COPIOUS APPENDIX ON THE DISEASES OF THE DOMESTICATED ANIMALS.

BY FINLAY DUN,

FORMERLY LECTURER ON MATERIA MEDICA AND DIETETICS AT THE EDINBURGH VETERINARY COLLEGE.

THIRD EDITION.

EDINBURGH:
EDMONSTON AND DOUGLAS.
1864.

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PREFACE TO THE THIRD EDITION.

The first edition of "Veterinary Medicines" I published ten years ago, whilst Lecturer on Materia Medica and Dietetics at the Edinburgh Veterinary College. A second edition, published in 1859, has been some time out of print; and as the work is still retained by my successor, Dr Allen Dalzell, as his Materia Medica text-book at the Edinburgh Veterinary College, and as it has, moreover, proved serviceable both to veterinarians and agriculturists, I have thought it desirable to prepare a third edition.

Besides carefully revising every portion of the book, and making alterations, and, I trust, improvements, on almost every page, I have introduced in this edition articles on Alteratives, Areca-nut, Arnica, Carbolic Acid, Gamboge, Glycerine, Male-shield Fern, and Podophyllin; and also included in the Appendix notices of Typhoid Fever in Horses, Splenic Apoplexy in Cattle, and Small-pox in Sheep. These new articles, with the other necessary additions, have enlarged the volume to the extent of seventy pages.

Such increase in the bulk of a text-book seldom finds favour with the student, who may, however, be somewhat reconciled to the amplification when assured that the additions mainly consist in fuller practical details regarding the uses and administration of the several medicines, and in a more copious collection of useful prescriptions.

As in previous editions, the general actions and uses of veterinary medicines, and the most important pharmaceutic preparations, are treated of in the Introduction. The bulk of the volume is occupied with the consideration of the medicines used in veterinary practice, the points chiefly dwelt upon being their natural history, preparation, properties, and most common impurities and adulterations; their general action on the various domesticated animals; and their uses, doses, and medicinal forms. The several drugs are discussed in alphabetical order according to their English names—an arrangement which I have adopted as the most simple and convenient, especially in a work of reference.

As in the preceding edition, I have introduced a copious Appendix, containing short notices of the nature, causes, symptoms, treatment, and prevention of the more common diseases of the domestic animals,—an addition which enhances the practical value of the work, especially to students, young practitioners, and amateurs.

Dr Murray Thomson, now Professor of Chemistry at the Thomason College, Roorkee, has been kind enough to revise for me, as he did on a former occasion, the chemical and pharmaceutical portions of the volume. Mr Thomas A. Dollar, V.S., of New Bond Street, London, has obligingly supplied me with information regarding the uses of arnica, has made for me some important experiments with podophyllin, and has, besides, furnished me with some valuable prescriptions.

WESTON PARK, SHIPSTON-ON-STOUR,
November 1864.

VETERINARY MEDICINES:

THEIR

ACTIONS AND USES.

INTRODUCTION.

VETERINARY MATERIA MEDICA, in the extended sense of the term, treats of every agent, material or immaterial, which is used for the cure of disease or injury, or for the preservation of health, among the domesticated animals. A subject of such scope would evidently require for its full consideration a treatise far exceeding the limits of the present work; and it is my intention, therefore, to confine my observations to that branch of Veterinary Materia Medica which is sometimes styled Veterinary Pharmacology, or the description of the medicines or drugs used in the cure of disease among the domesticated animals.

As the different medicines thus used possess many actions in common, and are prepared by the same pharmaceutical processes, I purpose making, in two preliminary sections, a few remarks on the general actions of medicines, and on the more important operations of pharmacy. The body of the volume will treat of the medicines themselves; and an Appendix is added, containing a brief and popular notice of the Nature, Symptoms, Causes, and Treatment of the more common diseases of the domesticated animals,—an addition which will, I believe, be specially serviceable to agriculturists and amateurs, as well as to junior students of Veterinary Medicine.

SECTION I.

ON THE GENERAL ACTIONS AND USES OF MEDICINES.

Every medicine is endowed with certain inherent characteristic actions, which distinguish it as decidedly as its physical and chemical properties. Thus, some medicines act on the bowels, causing purgation; others on the kidneys, stimulating the secretion of urine; and others on the brain and nervous system, causing insensibility: in fact, there is no part or organ of the body, except perhaps the spleen and pancreas, which is not influenced, and that often in several different ways, by some medicinal agent. It is impossible, however, to explain why a medicine should act in one way rather than in another; why, for example, aloes is purgative, and not diuretic, narcotic, or anæsthetic; or why chloroform is anæsthetic, and not caustic, diuretic, or purgative. The student must therefore endeavour to conceive of these actions, or dynamical effects of medicines, in the same manner as he does of their more familiar properties of colour, odour, taste, or density.

In order to facilitate the discussion of the general actions and uses of medicines, I shall divide this section into the following heads:—

I. The manner in which medicines establish their actions.

II. The manner in which medicines are believed to cure disease.

III. The arrangement of medicines according to their physiological actions.

IV. The circumstances which modify the actions of medicines.

I.—THE MANNER IN WHICH MEDICINES ESTABLISH THEIR ACTIONS.

Some medicines, as demulcents, caustics, and astringents, have merely a local or topical action—soothing, irritating, corroding, or altering the animal tissues, but not extending their influence beyond the part to which they are first applied. Others, either with or without such a local effect, have a remote or indirect action on organs at a distance from the part with which they are first brought in contact. Medicines which act thus remotely or indirectly are thought to produce their effects in either or both of the two following ways:—(*a*) They are absorbed into the circulation, and carried by the blood to remote organs; or, (*b*) The impression which they produce on the parts with which they are brought in contact, is transmitted along the nerves to other parts. This latter mode of operation is sometimes called action by sympathy.

(*a*.) The great majority of those medicines capable of solution appear to act in the former of these two ways, being taken up by the blood-vessels from the surface of the mucous membranes, skin, or other part to which they have been applied. Thus, most medicines given by the mouth, after having, if solid, undergone solution in the acid gastric juice, alkaline bile, or intestinal secretions, pass, by a process of endosmose, into the capillary veins which ramify on the surface of the stomach and intestines, enter the general circulation by the mesenteric and portal vessels, and are thus carried to all parts of the body, altering, it may be, the nutritive processes of various organs and tissues, and being at length expelled through some of the excretory channels, as the skin, kidneys, or bowels. The rapidity with which most substances are thus absorbed and make the round of the circulation is almost incredible. Professor Hering, of the Veterinary College, Stuttgardt, found that yellow prussiate of potash injected into one of the jugular veins of a horse appeared in the other in twenty-five seconds, and was exhaled from the mucous and serous membranes in a few minutes; and also that chloride of barium injected into the jugular vein of a dog reached the carotid artery in seven seconds. Dr Blake observed that chloride of barium and nitrate of barytes traversed the whole circulation of a dog in nine seconds, and that of a horse in twenty seconds; and a similar rapidity of distribution doubtless obtains with substances which cannot easily be detected in the blood.

(*b.*) The other hypothesis regarding the action of medicines, is, that they owe the development of their effects to the production of some nervous impression on the part to which they are first applied, and its subsequent transmission to remote organs by means of the nervous system. A recent modification of this theory, advanced by Messrs Morgan and Addison, assumes that the nervous impression is produced, not upon the part with which the medicine is first brought in contact, but on the interior of the blood-vessels after partial absorption. Part of the evidence in support of those hypotheses is derived from the fact that some poisons operate with such extreme rapidity as to render it doubtful whether there could be time for their being absorbed and making the round of the circulation. Thus, anhydrous prussic acid, conia the alkaloid of hemlock, and aconita the alkaloid of aconite, when injected into the veins, applied to the cellular tissue, or given by the mouth, produce almost instantaneous effects, and death in a few seconds. It appears, however, that the strongest evidence in favour of the theories under consideration consists in the effects of local injuries in producing constitutional disturbance. For example, a blow on the region of the stomach sometimes causes fatal swooning; distension of the stomach often produces hiccough; the presence of worms in the intestines sometimes induces epilepsy; and a local injury frequently causes fever and constitutional disturbance of all the more important organs of the body. In such cases the connection between cause and effect obviously depends on the transmission of nervous impressions only. And if topical causes are thus productive of remote effects, it is surely fair to infer that medicines and poisons may operate in a similar manner.

In fine, although it would appear that most medicines are absorbed, and actually conveyed to the parts on which they act, and that such absorption and actual contact are essential to their action, yet it is highly probable (though not yet positively ascertained) that some substances, especially the more active poisons, astringents, and emetics, owe their effects to the production of a nervous impression, and its propagation to remote organs. Nor is it at all improbable, that, under different modifying influences, certain substances will operate sometimes in one, and sometimes in the other of these two ways.

II.—THE MANNER IN WHICH MEDICINES ARE BELIEVED TO CURE DISEASE.

Every medicine, as already stated, is possessed of certain inherent and distinctive dynamical effects, which are exerted both in health and disease, and are termed its *physiological* actions. When, however, appropriate medicines are administered for the treatment of any curable disease, they are said to call forth another and secondary series of actions, more variable, uncertain, and limited than the physiological, but springing from them, and leading directly to the mitigation or cure of the malady. These are usually called *therapeutic* or *curative* actions, and may perhaps be better understood from the following illustrations:—A dose of aloes, or of any other purgative, administered during a simple febrile attack caused by the presence of irritating matters in the intestines, induces, first, its usual physiological effect, namely, purgation; this removes the cause of irritation, or excites the so-called therapeutic action, and is hence succeeded by restoration to health. Again, a diuretic given in a case of simple anasarca, or watery effusion in dependent parts, usually establishes, in virtue of its primary or physiological effect of increasing the secretion of urine, a secondary or therapeutic action, namely, the draining away of the effused fluid, and the consequent cure of the case. With some medicines it is not difficult to trace the cure, first to the therapeutic, and then to the physiological action, and to note each stage distinctly; with many others, however, it appears impossible, even with the utmost care and ingenuity, to discover any properly marked difference between the physiological and therapeutic actions on the one hand, and the therapeutic actions and the cure on the other. Indeed, there appears little use for complicating our ideas of the actions of medicines by regarding them as two-fold; for a physiological action, more or less obvious, is the source and origin of every cure, while the so-called therapeutic action is merely the physiological action exercised in or modified by disease, and specially applied to its alleviation or removal.

Many hypotheses have been propounded in explanation of the manner in which medicines cure disease. Two centuries ago, before chemistry and physiology were studied, it was thought that the diverse actions of medicines resulted from their variously-shaped particles producing diverse mechanical effects on the body. Since the times of the alchemists the action of medicines has frequently been ascribed to purely chemical agency; but this, although perfectly adequate to account for some of the effects of such medicines, as caustics and astringents, cannot alone explain the general effects of most remedies. The living animal body is much more than a machine or a laboratory; and mechanical and chemical laws are here modified by those more complex and less understood vital principles, which must be taken into account in any satisfactory explanation of the actions of the majority of medicines.

But even with our present comparatively advanced knowledge of vital principles, we are unable, as has been lucidly remarked by Professor Headland, to discover any single rule or formula which can account for the actions of all medicines. "The only general explanation we can give of the *modus operandi* of medicines in the cure of diseases, is to say that they operate by *various counter-actions*."—(Actions of Medicines, Third Edition.) Two of these systems of counter-action, most deserving of credit, and which together appear sufficient to account for the actions of the majority of medicines, are,—1st, The *antipathic;* and 2d, The *allopathic* mode of cure.

1st. Medicines act antipathically (*ἀντί*, *anti*, opposite; and *πάθος*, *pathos*, a disease), or, in other words, they produce a condition diametrically opposed to the disease in which they are administered. It is thus that astringents are effectual in diarrhœa; purgatives in torpidity of the bowels; and stimulants in depressed states of the system. In these, and in all other cases where an antipathic cure is effected, the physiological action of the medicine overcomes the morbid condition, because it counteracts it by a superior and directly antagonistic force. This mode of cure is specially adapted to the treatment of symptoms and local diseases.

2d. Medicines act allopathically (ἄλλος, *allos*, another; and πάθος, *pathos*), or produce an effect which, though itself unnatural, overcomes the disease to be cured; or, in other words, they occasion a short, simple, and manageable disease, which subdues that which originally existed. Nature herself frequently removes maladies in this way. Thus a spontaneous diarrhœa often relieves internal congestions; and copious perspiration, febrile attacks. In a similar manner blisters relieve pleurisy, purgatives alleviate local inflammation, and diuretics remove œdema or dropsy. By this allopathic system we also endeavour to explain the treatment of those diseases which result from the introduction into, or maturation within, the system of a blood poison, which we strive to remove by rousing to increased activity those natural purifying emunctories—the skin, bowels, and kidneys. Where these poisons cannot be counteracted or destroyed by any direct antidote, they must generally be thus eliminated from the system.

But about sixty years ago another method of cure was propounded by the German physician Hahnemann, who taught that the cure of a disease is effected by small infinitesimal doses of such medicines as would induce, if given to a healthy subject in large quantity, symptoms similar to the disease. This is the doctrine of homœopathy (ὅμοιος, *homoios*, like or similar; and πάθος, *pathos*), the principles of which are enunciated in the aphorism, *similia similibus curantur.* According to this doctrine, cinchona cures ague and intermittents, because it produces such febrile symptoms when given to healthy individuals in considerable doses; aconite is the appropriate remedy for reducing inflammatory fever, because in large doses it produces symptoms which are thought to resemble inflammation; and strychnia is the best remedy for palsy, because in large doses it appears to produce paralytic symptoms. This doctrine certainly appears strange and unnatural, and if sound, would stamp most disorders as hopelessly incurable; for it is only in a few exceptional cases that any similarity can be detected between the symptoms produced by large doses of the remedy, and those of the disease for which it is given. No known medicines, for example, are capable of developing symptoms such as those of thick-wind, roaring, pleurisy, strangles, distemper or hydrophobia, yet fifteen or twenty remedies are prescribed for each of these diseases. Glanders, farcy, and consumption, are treated by aurum, arsenicum, and bromine; but none of these medicines develop symptoms similar to the diseases for which they are used. Again, the disciples of Hahnemann treat diseases the most dissimilar in their nature and symptoms by the same remedy. Thus Mr Haycock, in his "Elements of Homœopathy," employs arsenic as the appropriate remedy in mange, bronchitis, enteritis, diabetes, strangles, tetanus, rheumatism, ophthalmia, poll-evil, glanders, and thirty other diseases; whilst he prescribes aconite in thirty-two diseases, beginning with papular eruptions, including most affections of the respiratory and digestive organs, and ending with ophthalmia and glanders. An "accurate similarity" between the symptoms of the disease and those of the remedy is, however, regarded as essential to the success of the homœopathic treatment; but where is the similarity between the effects of arsenic and these forty diseases for which it is prescribed, or between those of aconite and the thirty-two diseases in which it is considered so efficacious. These and many other such instances cannot be established without straining similarities which, to ordinary eyes, are imperceptible, or at best but very remote.

Hahnemann, in his "Organon of Medicine," translated by Mr Dudgeon of London, and accepted by English homœopathists as their standard authority, states, that "the symptoms of each individual case of disease must be the sole indication—the sole guide to direct us in the choice of a curative remedy" (p. 120). Now symptoms, although sometimes requiring special treatment, are but the visible signs and results of derangement and disease; whilst their removal, which is all that is aimed at in homœopathic treatment, does not always ensure the removal of the conditions on which they depend. Thus, rheumatism, pleurisy, enteritis, worms, and many other disorders, frequently remain unchecked after their symptoms have been relieved. Instead of thus vainly attempting the removal of symptoms, it were therefore more rational at once to remove, as is attempted by allopathists, the morbid condition—the source of the evil. *Causâ sublatâ, tollitur effectus.* No curative system, directing its efforts, as homœopathy does, merely against the symptoms of disease, can ever rest upon a safe or scientific basis; for it is notorious that, under varying modifying influences, the same diseases sometimes induce very dissimilar symptoms, and would consequently, according to this new system, require dissimilar treatment. On the other hand, diseases essentially different sometimes manifest similar symptoms. Thus, stupor and vertigo result sometimes from an excessive and sometimes from a deficient quantity of blood sent to the brain; difficulty of breathing from too much as well as from too little blood circulating through the lungs; vomiting from irritation of the stomach, or from direct derangement of the functions of the vagus nerve; diarrhœa from crudities in the alimentary canal, or irritant matters in the blood. Now, in these cases, similar symptoms, although depending upon unlike morbid conditions, must, according to homœopathy, be combated by the same remedies; for, it is written: "Diseases are cured by such medicines as have the power of producing, in healthy individuals, symptoms similar to those which characterize the diseases themselves" (Haycock's Elements, p. 20). No provision, let it be remarked, is here made for cases in which the same symptoms result from different or opposite conditions; and yet we not only find the same symptoms produced by very different diseases, but also by the most opposite remedies. Strychnia and prussic acid, for example, although totally dissimilar in their *modus operandi* and general action, both induce convulsions, and should therefore, according to the tenets of homœopathy, be equally suitable for the cure of convulsive diseases.

If the principles or foundations of homœopathy be false and imperfect, as I have endeavoured to show, the superstructure based on such a foundation cannot be otherwise than weak and tottering. The following important facts and doctrines of homœopathy exhibit, perhaps more clearly than any arguments, the extravagances and inconsistencies of the system:—The homœopathic doses are so small, that they are often incapable of detection, either by the microscope or by chemical analysis, and are sometimes so inconceivably minute, that the mind can form no idea of them. It is admitted, even by homœopathists, that millions of such doses may be swallowed by a healthy individual without inconvenience; but in disease, the system, according to homœopathists, is believed to become so susceptible of their action, that much risk is incurred by their insufficient dilution. Medicines, such as charcoal, sand, and carbonate of lime, which, in ordinary doses of several scruples or drachms, have only a slight mechanical effect, when given in fractional parts of a grain, are thought to produce very powerful effects, and cause many hundred symptoms. Charcoal, for example, is said, when given to man in very minute doses, to produce 930 distinct symptoms; oyster shell, 1090 symptoms; and the ink of the cuttle-fish, 1242 symptoms. The extraordinary powers supposed to be conferred on these and other medicines, even when given in doses of inconceivable minuteness, are chiefly ascribed to the magic influence of careful and continued triturations and often-repeated shakings, performed according to most precise directions. Some homœopathic authorities declare, that there is little difference of activity between different dilutions of the same medicine; and it is said, that if the medicine be well selected, it matters little whether the tenth, hundredth, or thousandth of a grain be used (Gunther and Haycock). There is probably some truth in this observation; for, with most medicines, especially when administered to the lower animals, all the dilutions mentioned would be equally harmless. The admixture of different medicines with one another, is said to neutralize the effect of all; but if this be the case, homœopathic drugs must always be without effect (which is very probable); for all medicines contain adulterations and impurities which, though small in amount, must of course acquire great potency by the triturations above mentioned.

But homœopathists assert that, in spite of the errors which their opponents discover in the system, it is nevertheless very successful in the cure of disease. In judging, however, of homœopathy as a system of practical medicine, it must ever be regarded as made up of two distinct parts,—1st, The original and peculiar part of the system, consisting in the use of medicines selected in accordance with a law embodied in the axiom *similia similibus curantur*, and administered in infinitesimal doses, usually varying from one grain to one-millionth of a grain, and carefully prepared according to certain precise directions; and 2d, Attention to diet and regimen—the only effectual and rational part of homœopathy—the true source of all its boasted cures—and that very department of medical treatment which has been insisted upon from the most ancient times by all scientific and successful practitioners, both of human and veterinary medicine. The value of the first part of the treatment, viz., of medicines given homœopathically, has never been satisfactorily shown, and never can be so, until two series of cases, as nearly as possible alike, be treated, the one in the usual homœopathic fashion, the other with the same attention to diet and regimen, but without the globules. If, in a sufficient number of well-regulated experiments, the former method proves itself superior to the latter, then of course it would be fair to infer that the medicine had some real curative effect. But no such superiority has been observed where impartial observations have been made. In experiments made at the Edinburgh Veterinary College, as to the treatment of pleuro-pneumonia and other diseases according to these two modes of cure, it appeared that those cases which were treated by diet and regimen alone, were as speedily and effectually cured as those treated with the globules in addition, so long as these globules were given in homœopathic doses. I say, so long as the doses given were homœopathic; and this, I think, is an important fact; for many of the medicines which are used homœopathically, are, in ordinary medicinal doses, capable of producing prompt, and often powerful effects, and become effectual means of cure in virtue of their physiological properties, but not in virtue of any homœopathic actions.

But though the principles of homœopathy are unsound, and though its practice among the lower animals has not been more successful than that of many more modest modes of treatment, still it has done some service to the cause of practical medicine, by showing more forcibly than before the great power of the *vis medicatrix naturæ*, and the inestimable importance of regimen and diet as auxiliaries to the medical treatment of disease. Further, it has aided in the advancement of a more rational system of veterinary practice, by discountenancing those copious and repeated bleedings, and large and reiterated physickings, which were often indiscriminately prescribed for all patients; and it has also acted beneficially in elucidating various subjects connected with therapeutics, and in inducing the opponents as well as the supporters of homœopathy to institute numerous and careful observations on the actions of remedies both on man and the lower animals.

III.—THE ARRANGEMENT OF MEDICINES ACCORDING TO THEIR PHYSIOLOGICAL ACTIONS.

"For the proper perfection of medicine as a rational science, two things are in the main needed: the first is a right understanding of the causes and symptoms of disease; the second, a correct knowledge of the action of medicines."—(Headland.) The latter of these two branches of medicine is still, however, so incomplete, that it is difficult to arrange remedial agents in satisfactory groups. From amongst many classifications we subjoin an excellent and comprehensive system by Professor Headland, who includes the articles of the materia medica under the four following heads:—

I. Hæmatics, or medicines acting on the blood. They restore some of its wanting or deficient constituents, destroy morbid matters circulating in it, are most valuable in constitutional disorders, are tolerably permanent in their action, and include all true tonics and alteratives.

II. Neurotics are medicines acting upon the nervous system, exciting, depressing, or otherwise altering its tone, usually prompt but temporary in their effects, and useful in remedying symptoms. They include most stimulants, narcotics, and sedatives.

III. Astringents cause the contraction of both voluntary and involuntary muscular fibre, and especially of the latter, and thus arrest secretion and bleeding.

IV. Eliminatives are irritant medicines, unnatural to the blood, which are expelled from it through the various excreting organs, and in their passage heighten their activity, increase their discharges, and thus carry noxious matters out of the system. Purgatives, diuretics, and diaphoretics, are examples of this class.

Although classifications of the articles of the materia medica are confessedly imperfect, owing to our present defective knowledge of therapeutics, they are nevertheless of much practical utility. I have therefore subjoined a tabular view of a classification which I have sometimes adopted in my lectures, and in which I have grouped medicines, classed and denominated according to their physiological actions, into three great divisions of mechanical, chemical, and vital agents—a plan followed by Dr A. T. Thomson and several other authors.

TABLE OF THE DIFFERENT CLASSES OF MEDICINES, ARRANGED ACCORDING TO THEIR PHYSIOLOGICAL ACTIONS.

I.—MEDICINES WHICH ACT CHIEFLY AS MECHANICAL AGENTS.

		Examples:—
Demulcents.	Protect the tissues from the action of irritants.	Solutions of gum, albumen, and gelatine.
Diluents.	Dilute the fluids.	Water, and mild watery fluids.

II.—MEDICINES WHICH ACT CHIEFLY AS CHEMICAL AGENTS.

		Examples:—
Antiseptics.	Prevent or arrest putrefaction.	Common salt, spirits, tannin.
Disinfectants.	Absorb, alter, or destroy contagious matters.	Chlorine, sulphurous acid, ozone.
Antidotes.	Counteract poisons.	Dilute alkalies for acids. Hydrated sesquioxide of iron for arsenic, etc.
Caustics.	Destroy the animal solids, and decompose the fluids.	Strong acids, metallic salts, as nitrate of silver, butter of antimony.
Acids.	Counteract alkalinity.	Sulphuric, nitric, and hydrochloric acids.
Antacids.	Counteract acidity.	Alkalies, with their carbonates, and alkaline earths.

III.—MEDICINES WHICH ACT CHIEFLY AS VITAL AGENTS.

			Examples:—
Agents which increase local action.	Rubefacients.	Cause redness of the skin.	Alcohol, turpentine.
	Vesicants.	Cause discharge of serum from the skin.	Cantharides, boiling water.
	Suppurants.	Cause discharge of pus from the skin.	Croton oil, Tartarized antimony.
	Errhines.	Irritate the mucous membrane of the nostrils.	Veratrum album, euphorbium.
	Stomachics.	Promote digestion.	Ginger, cardamoms, volatile oils.
	Emetics.	Cause vomiting.	Tartarized antimony, sulphates of zinc and copper, common salt.
	Ecbolics.	Induce contractions of the uterus, and expulsion of its contents.	Ergot of rye, savin, cantharides.
	Aphrodisiacs.	Stimulate the generative organs and the venereal appetite.	Phosphorus, cantharides, peppers.

Agents which increase local action and secretion.	Purgatives.	Evacuate the bowels.	Aloes, croton, oils, jalap.
	Expectorants.	Increase the seeretions of the respiratory mucous membrane.	Ipeeacuan, balsams, gum-resins.
	Diaphoretics.	Increaso the perspiration.	Warm elothing, acetate of ammonia, ethers.
	Diuretics.	Increase the secretion of urine.	Turpentiue, rcsin, nitre.
	Sialogogues.	Increaso the salivary secretions.	Mercurials, iodine, pungent-tasted bodies.
Agents which increase general action.	Tonics.	Gradually but permanently improve the appetite and incrcasc the gencral vigour.	Cinchoua, quinine, sulphates of iron and copper.
	Stimulants.	Promptly bnt temporarily increase ncrvous energy, and thus cxalt the action of the heart and tho othcr animal functions.	Volatile oils, ammonia, alcohol, ethcrs.
Agents which improve state of blood.	Alteratives.	Neutralizo or eounteract morbid materials or processes in thc blood.	Mercury, iodiue, arsenic, salines, and alkalies.
Agents wh. corrugate muscular fibre.	Astringents.	Constrict muscular fibre.	Oak bark, tannin, alum.
Agents which dim. local action.	Emollicnts.	Softcn the tissucs.	Poultices, fomcntations. moistened spongiopiline.
	Refrigcrants.	Lower auimal heat.	Cold air, cold water, ice, saline, and etherous matters.
Agents which diminish gcneral action.	Sedatives.	Depress both the eirculatory and nervous systcms.	Aconite, prussic acid, digitalis.
	Narcotics.	Pass from tho blood to thc ncrvcs and norvous ccntres, and act so as first to exalt ncrvous forco and thcn to depress it; and havc also a special aetion on tho intellectual part of tho brain. (Headland.)	Opium, Indian hcmp, bclladonna.
	Anæsthetics.	Diminish sensibility to pain, and to external impressions.	Chloroform, ethcr, naphtha, coal gas.

To familiarize the student with the names, general actions, and therapeutic applications of these different classes of medicines, I shall briefly notice them in the order in which they occur in the above table.

DEMULCENTS.

Demulcents (*demulceo*, I soften) sheath and protect the tissues from irritants. Gums, mucilage, sugar, starchy matters, gelatine, albumen, fats, and oils, as well as cotton, thin leaves of gutta percha, and oiled silk, are familiar examples of this class of remedies. They are chiefly used to take the place of the natural demulcents, as the tears, mucus, or skin, where these are defective or wanting; to defend external sores from the injurious action of the air, or of acrid secretions; and to lubricate the mucous membranes, and protect them from irritating and poisonous matters.

DILUENTS.

Diluents (*diluo*, I dilute) are a very simple class of medicaments, consisting of bland watery fluids which (as the name indicates) dilute the blood and the watery secretions. They include all simple drinks, and owe their action to the water which they contain. They are prescribed in febrile attacks, to promote the action of the various secretions; in inflammation of the urinary organs, to dilute the urine, and lessen its irritant effects; and in innumerable cases, to facilitate and expedite the action of purgatives, diuretics, and other evacuants.

ANTISEPTICS—ANTIPUTRESCENTS.

Antiseptics (ἀντί, *anti*, against; and σηπτικός, *septikos*, putrifying) prevent or arrest putrefaction. This class of medicines includes chlorine and its compounds, sulphurous acid, and sulphite of soda, the mineral acids, arsenious acid, common salt, astringent metallic salts, vegetable substances rich in tannin, sugar, spirits, creasote, and pitch oil. Antiseptics check that slow breaking up of organized bodies, which is termed putrefaction, by removing some or all of its causes. Most of them abstract water and combine with the tissues, forming compounds whieh are insoluble, and eonsequently little liable to deeay. Of these the most effeetive are ereasote and earbolie aeid. Ammonia, apparently by eatalysis, suspends the union of oxygen even with the most oxidizable bodies; whilst sulphurous aeid and sulphite of soda remove the oxygen, whieh is essential to the establishment of putrefaetive ehange. Condy's patent solution of the permanganates of soda and potash aets in this way. The unpleasant smell and taste of tainted meat is readily removed if it be steeped for ten minutes in a mixture of one part of Condy's fluid to forty of water. A few drops of the fluid stirred into a gallon or two of water loaded with organie impurities, eauses their rapid neutralization and subsidenee, and thus proves not only an exeellent test for the purity of water, but a eheap and convenient means for its purifieation. Antisepties are used for preserving meats and anatomieal preparations, and oeeasionally for arresting caries and gangrene. They were at one time given internally, in the belief that they eounteraeted general putreseency of the solids and fluids. But they are not now administered for sueh purposes, as it is well known that putrefaetion never oeeurs exeept in sueh organized matter as has passed beyond the pale of vitality.

DISINFECTANTS.

Disinfectants (*dis*, signifying separation; and *inficio*, I infeet), as above defined, are agents whieh absorb, alter, or destroy eontagious miasmata. Their *modus operandi* is neeessarily somewhat obseure and unsatisfaetory, for it is not as yet known in what the matter of eontagion eonsists. Air from fever wards, and other plaees filled with men and animals suffering from diseases of a notoriously eontagious kind, has been carefully examined; but the poisonous material, which sueh air undoubtedly contains, has hitherto entirely escaped detection. It is not as yet definitely aseertained whether it oeeurs in a gaseous, fluid, or solid eondition. Until reeently, the eurrent opinion was favourable to the view of its being a gas; and aeeordingly many gases were singled out as the essential eauses of contagious disorders,—as, for example, carbonic acid, sulphuretted hydrogen, hydrosulphuret of ammonia, seleniuretted hydrogen, and light carburetted hydrogen. But these gases have not been found in undue amount in the atmosphere in which patients affected by contagious diseases have been kept, and may, moreover, when mixed with air, be breathed in sensible, and sometimes even considerable quantities, without producing such diseases. One of the most recent hypotheses regarding the production of these diseases, ascribes them to a peculiar principle called ozone, discovered by Professor Schönbein, and believed to be an oxide of hydrogen. But contagious disorders do not appear to be developed by thunderstorms or other electrical disturbances of the air, during which, however, ozone is abundantly evolved; nor do they specially attack those employed in working friction or hydro-electric machines, even when these are of large size, and are worked for several days with constant evolution of large quantities of ozone distinctly perceptible to the nostrils. Indeed, ozone, so far from being a cause of disease, has been suggested by the late Professor George Wilson, as being a most valuable preventive of disease,—as being, in fact, the natural disinfectant which keeps the air pure, and, to a great extent, free from poisonous matters. And the probability of this opinion is greatly strengthened by the fact that ozone has the power of destroying organic colouring matters, arresting putrefaction, and removing disagreeable effluvia—properties closely allied to those of disinfectants.

The majority of competent authorities have, however, entirely abandoned the idea of the matter of contagion being gaseous, and now believe it to be a finely divided solid, which, like the pollen of flowers, or the volatile odorous principles of plants and animals, occurs in a state of such fine tenuity as to be incapable of detection by chemical or microscopical examination, and maintains its characteristic activity though carried for considerable distances through the air, or retained for a long time in clothes or other organized substances.[1] These contagious matters find access to the healthy body either through the pulmonary or the alimentary mucous membrane,—in the former case suspended in air, in the

[1] Graham's Elements of Chemistry, p. 336.

latter usually suspended in water. It is interesting to remark, as helping to explain the way in which disinfectants operate, that the matters of contagion, like all other organic products, must, as the late Professor George Wilson has suggested,[1] consist of "carbon, hydrogen, oxygen, and nitrogen, or at least of two (if not always of three) of these elements; and that, like all such compounds, they are readily decomposed by chemical re-agents, especially oxidizing ones. There is no reason to imagine that infectious matters are difficult to decompose, *provided we can reach them.* The difficulty lies in reaching them. Assuming, then, that contagious matters are not volatile, and that they contain (to take the most complex case) carbon, hydrogen, oxygen, and nitrogen, the principles which are to guide us in the application of chemical disinfectants will not be far to seek. Oxidizing agents will plainly be of great value, as they can readily convert hydrogen into water, and carbon into carbonic acid, and thus disintegrate and destroy the morbific matter. Substances having a great affinity for hydrogen, such as chlorine and its class, will plainly also be of great service. Substances having an affinity for oxygen will also be applicable to the destruction of organic poisons; and finally, all re-agents, which by contact with organic matter, can determine a new arrangement of its ultimate elements. All the powerful chemical disinfectants act in one or other or all of those ways." Heat also appears to disturb or destroy the complex and unstable constitution of contagious poisons. Thus Dr Henry of Manchester found that vaccine lymph was rendered totally inert by exposure to a temperature of 140°; jackets worn by scarlet fever patients were used with impunity by four children, after being exposed during two to four hours to dry heat about 200°; whilst the clothes of typhous patients were, after similar exposure, worn by himself without any bad effects. Extremely low temperatures possibly exert a similar disinfectant influence.

The most common disinfectants in use in veterinary practice are chlorine, with its several compounds, as chlorides of lime

[1] Pharmaceutical Journal, December 1852. "On some of the more important Chemical Disinfectants," by Dr George Wilson, Lecturer on Chemistry, Edinburgh.

and soda; nitric, nitrous, and hydrochloric acids; sulphurous acid, sulphite of soda, potash, soda, lime, and charcoal. The last two are mechanical rather than chemical in their action, and are chiefly useful in virtue of their absorbing the poison in the same manner as they do colouring and odorous matters. Chlorine and its compounds alter the composition of the contagious poison, and so deprive it of its injurious effects, probably by uniting with its hydrogen; while acids induce a similar effect either by oxidizing or deoxidizing. Macdougal's disinfectant has now come into extensive use, and is deservedly prized both as a disinfectant and deodorizer. It consists of sulphites of lime and magnesia, and carbolate of lime, the sulphites decomposing the noxious emanations by abstracting oxygen, whilst the carbolates coagulate the albuminous substances: the compounds produced are valuable manures. In many well-managed stables it is regularly used to fix the ammoniacal and other noxious gases, and thus preserve a pure and wholesome atmosphere. Condy's fluid has also been recently much used. It is a solution of the permanganates of soda and potash, destroys putridity alike of air or water, acts by its great affinity for oxygen, and in the quantities recommended for use has no injurious influence on plants or animals, and no caustic effect on wearing fabrics. A few ounces of the strong solution may be placed in flat vessels in the places to be disinfected, and the fluid diluted with forty or fifty parts of water sprinkled over the floors. Sir William Burnett's disinfecting and antiseptic fluid contains in every fluid drachm twenty-five grains of chloride of zinc, is used diluted with forty parts of water, and was once much employed in the public services. Ellerman's deodorizing fluid is said to owe its efficacy to a persalt of iron. But besides these, ozone, the body above referred to, must now be added to our list of disinfectants, for it has already been found a powerful antiseptic and deodorizer; and, being devoid of irritating or injurious properties, could be freely used in a building without the removal of the inmates. Experiments, however, are still wanting to establish its exact disinfectant value, and as yet no convenient process has been found for its preparation. All these disinfectant bodies are very effectual both as antiseptics and deodorizers; indeed, their efficacy for the two latter purposes affords one of the chief means of estimating their disinfectant value.

In practice, it is found best to use several disinfectants conjunctly. Chlorine, nitrous or sulphurous acid, may be set free in large quantity within the building to be disinfected, and the walls washed with lime-water or alkaline ley; whilst throughout the progress of the complaint, as well as after the patients are removed, the walls, floors, and fittings should be every day freely sprinkled with Condy's or Macdougal's disinfectant, or with bleaching powder. Air in abundance should be allowed free access, in order to dilute the miasmata, and so deprive them of their morbid power. Cleanliness must also be strictly enjoined, as filth and litter are very apt to absorb the miasmata, and so become fomites, favouring the continuance and spread of the disease. Such measures should be especially adopted in the case of contagious disorders, as glanders and farcy in horses, and pleuro-pneumonia in cattle; but are also of utility in other diseases, particularly those of an epizootic character.

ANTIDOTES.

Antidotes (*ἀντί*, *anti*, against; and *δίδωμι*, *didōmi*, I give) mitigate or arrest the action of poisons. A poison, in the popular acceptation of the term, is a substance which, in inconsiderable amount, destroys health and life; but, in reality, it differs from a medicine only in the degree or intensity of its effects. Indeed, it is found that, whilst many valuable medicines, when given injudiciously or in large doses, become active poisons, many poisons, when properly administered, become valuable medicines. True chemical antidotes unite with the poison, forming either a mild, innocuous compound, or an insoluble one. Thus alkaline solutions are antidotes for poisoning with the mineral acids, on account of their forming with them mild laxative salts; albuminous matters for poisoning with corrosive sublimate, on account of their forming with it the harmless albuminate of mercury; and the mixed oxides of iron for poisoning with prussic acid, on account of their forming with it insoluble Prussian blue. Some antidotes counteract or relieve the symptoms produced by the poison; ammonia, for example, is useful in overcoming the sedative effects of poisoning by prussic acid; and opium in lessening the unpleasant consequences of irritants. In all cases of poisoning, it is of importance at once to evacuate the stomach, in order to get rid of any poison still remaining there. This may be effected by the stomach pump, or more effectually in carnivorous animals by emetics. The early administration of such absorbent substances as charcoal, and even of clay, lard, or glycerine, frequently helps to prevent the poison coming freely into contact with the walls of the stomach, and thus retards its absorption. Such measures are very serviceable in poisoning either of horses or cattle, and have proved so effectual in some cases of poisoning, both of men and dogs, that various authorities recommend their prompt adoption, even before any emetic is given. In the case of corrosive and irritant poisons, demulcents may be given to sheath and protect the mucous surface of the canal; but large quantities of fluid should not in general be given until the stomach is evacuated, as they are apt to facilitate the solution and absorption of the poison. After poisons have got access to the blood, the judicious administration of purgatives and diuretics is often effectual in expediting their excretion and promoting restoration to health.

CAUSTICS—ESCHAROTICS.

Caustics (καίω, *kaiō*, I burn; καυστικός, *kaustikos*, burning) decompose both the solid and fluid animal tissues. They act in the first instance chemically, separating water from the tissues, and combining with their albumen fibrine and other organic constituents. This chemical action, which is true combustion, destroys the vitality of the part, and produces an increased vital action in the surrounding tissues. The caustics in common use in veterinary practice are salts of alumina, zinc, lead, copper, mercury, and arsenic, nitrate of silver, caustic potash, and concentrated acids. These differ chiefly in the intensity of their action, some being so mild that they have no effect on the sound skin, and scarcely any on the mucous surfaces; and others so active as to cause extensive sloughing and purulent discharge. Those possessing the latter action sometimes receive the special title of escharotics (ἐσχάρα, *eschara*, an eschar, scar, or scab). The difference between solid and fluid caustics is not great. The effects of the latter are more rapid and powerful, but more difficult to localize, than those of the former. The firing iron, or actual cautery, when used at any temperature above a full red heat, acts in exactly the same manner as caustics, producing first a chemical action, and then a highly exalted vital action. Besides being used as a caustic, it is also much employed as a counter-irritant (p. 28).

Caustics are used for many different purposes—for repressing soft, spongy, and exuberant granulations; for removing warts and other sorts of tumours, especially when so deep-seated and vascular that they cannot be safely extirpated by the knife; for altering morbid actions of the skin or of wounds; for exciting adhesive action in the walls of fistulæ; for preventing the effects of poisoned wounds, in which case fluid caustics are often preferable to solid ones, on account of their readily penetrating to all parts of the cavity; for opening abscesses and forming issues; for expediting and completing the destruction of sloughing textures; and for arresting hæmorrhage from accidental or surgical wounds. Caustics employed for the last-mentioned purpose usually receive the special title of *styptics* (στύφω, *stüphō*, I constringe; στυπτικός, *stüptikos*, astringent). In using them, the blood should be removed by a sponge, and the part lightly pressed, so that the blood-vessels may be more readily seen, and the caustic applied to them with greater precision, and with as little destruction as possible of the surrounding textures.

ACIDS.

Acids (ἀκίς, *akis*, a point) are defined by the chemist as substances which are sour to the taste, redden vegetable blues, and unite with bases to form salts. Those commonly used in veterinary practice are the three mineral acids, sulphuric, nitric, and hydrochloric, with acetic acid. In large doses and concentrated form they act as chemical corrosives, decomposing the tissues by uniting with their watery, albuminous, and saline parts. They are therefore all included under the head of caustics. They are useful antidotes in poisoning by alkalies. When given internally, they should be sufficiently diluted to prevent their exerting any corrosive action. They appear to be absorbed without previous neutralization, as seems evident from their acting so differently from their various salts. In the blood, they seem to neutralize any excess of alkali—probably of ammonia, which has been found to be unduly abundant in fevers and other such cases. Or, according to Professor Headland, they may promote the formation or temporarily supply the place of lactic acid, which appears to be deficient in low fevers, and is regarded as the natural blood fuel of the system. But whatever be the explanation of their action, whether it be chemical or vital, we are usually able to recognise from their employment certain well-marked results, and especially improvement of the appetite and strength, and a general astringent effect. Where the gastric secretions are faulty, as in some cases of indigestion, acids given medicinally, either directly supply the deficient acid, or more probably become absorbed into the blood, where they favour the natural production of lactic acid, which is now regarded as the true stomach acid. Possibly, in a somewhat similar manner, they counteract some of those chronic cases of diarrhœa, where the excretions are strongly alkaline, usually from the presence of carbonate of soda. Vegetable acids are generally decomposed within the system; but the mineral varieties appear to be excreted, usually imperfectly neutralized, and mainly by the kidneys. Hence they correct undue alkalinity of the urine, and any tendency to phosphatic deposits.

Acids and acid salts are said to act as refrigerants, or, in other words, to reduce the animal heat and lower the pulse. This, however, is not sufficiently established. Indeed, a practical physician and high therapeutic authority remarks:—“We have often endeavoured to observe whether they ever do produce any real diminution of the animal heat, and whether therefore their title, refrigerant, is really merited. We have not been able to satisfy ourselves of this; but we know, both from active and passive experience, that they give for the moment a *sense* of coolness which renders them truly delicious, either under a fever or a hot sun."[1] The so-called refrigerant effect which acids and various other substances are thought to produce when given internally, consists, therefore, in the gratefully cooling, though very temporary, impression which they make on the nerves of the throat and stomach; whilst the obvious good which often follows their exhibition depends on some of their known physiological effects. Acids will again be noticed under the heads of Tonics and Astringents.

ANTACIDS—ALKALIES.

Antacids (ἀντί, *anti*, against; and ἀκίς, *akis*, a point) include the alkalies, potash, soda, and ammonia; the alkaline earths, lime and magnesia; the carbonates and bicarbonates of these bases, and the neutral salts which they form with vegetable acids, which last are converted into carbonic acid in their passage through the body. As an antacid, ammonia, on account of its volatility, is less permanently effectual than the fixed alkalies. Potash seldom exists, either free or carbonated, in the blood; but is effectual in increasing its alkalinity, by setting at liberty soda and ammonia. Lime and magnesia, with their several salts, although effectual for counteracting acidity in the alimentary canal, are difficult of absorption, and hence less valuable as blood medicines. Antacids, and especially the most active of them, as the alkalies, are in large quantity corrosive, dissolving albuminous matter, and saponifying fat. They are prescribed as antidotes against acids of all kinds, and wherever occurring. Thus they are administered for the purpose of neutralizing either mineral or vegetable acids, which may have been given as poisons; and for removing acidity of the alimentary secretions, with the indigestion and diarrhœa to which such acidity often

[1] Monthly Journal of Medical Science, March 1853, p. 259.

gives rise. Whilst remaining in the blood they probably increase its alkalinity, and assist in maintaining the normal amount and solubility of its fibrine. This probably explains the value of alkalies in rheumatic disorders, eczema, and some other skin diseases, as well as in many inflammatory and febrile cases. In large quantities, some of these antacids are proved to pass rapidly out of the system by the bowels; but in smaller doses they are excreted in the urine, increasing its alkalinity, and counteracting any tendency to lithic acid deposits, which, however, are exceedingly rare either in horses or cattle. Alkalies will again be noticed under the head of Alteratives.

RUBEFACIENTS—VESICANTS—SUPPURANTS.

These three varieties of irritants agree in so far as they induce inflammation of the skin, but differ considerably in the degree and intensity of their action. *Rubefacients* (*ruber*, red; and *facio*, I make) include substances which slightly inflame and redden the surface of the skin, as alcohol, liniment of ammonia, mustard, and mild preparations of cantharides. Smart friction and moderate heat must also be included in this class. In the lower animals, however, the colour of the skin and the abundance of the hair render the reddening action of these agents considerably less obvious than in man. *Vesicants* (*vesica*, a bladder) have a more active and deep-seated effect, causing inflammation of the true skin, with effusion of serum between it and the cuticle. The serous effusion filling these vesicles or blisters consists, according to M. Magueron (quoted by Dr A. T. Thomson), of about seventy-eight parts of water, eighteen of albumen, and four of salts. The quantity and rapidity of the effusion vary much according to the substance used, but are especially great in the case of steam and boiling water. After some days, the blisters either dry up, or, when the inflammation has been considerable, secrete a muco-purulent fluid, which hardens over the parts, protecting them until the new skin appears. Cantharides, turpentine, ammonia, and boiling water, are the vesicants in most common use in veterinary practice.

Suppurants (*sub*, under; and *pus*, pus) are still more powerful than either rubefacients or vesicants, and actively inflame the deep-seated tissues of the skin, causing a crop of pustules and a purulent discharge. This is the effect of croton oil and tartar emetic, and also of cantharides, mustard, and other active vesicants, when applied to the same spot repeatedly or in large quantity.

Most of these agents act with tolerable certainty on the skin both of horses and dogs, but very imperfectly on the thick and insensible hides of cattle. On these, alcohol, turpentine, and even cantharides, have but slight effect; and for them the only counter-irritants which are convenient, prompt, and effective, are mustard made up with equal parts of turpentine and ammonia, and scalding hot water, which latter is certainly the simplest, cheapest, and probably the best blister that can be used. In the case of dogs, blisters require to be cautiously applied, as the skin is often so irritable and sensitive that the animals bite and rub the blistered parts, and thus induce sloughing. There is a curious and inexplicable anomaly in regard to the action of turpentine on the skin of the horse. If applied over a considerable surface, it produces such intense itching irritation, that the animal sometimes becomes for a short time quite frantic and unmanageable, which is the more remarkable, as turpentine acts but slightly on the more delicate human skin.

Setons are sometimes substituted for blisters or firing, and are often preferred to the latter on account of their being less liable to cause blemishing. The seton consists of a piece of tape or cord, passed by means of a seton needle underneath the skin. To prevent it slipping out, the ends of the tape are tied together or knotted. It is moved daily, and if a severe effect is desired, it is smeared with blistering ointment. Setons act chiefly on the comparatively insensible sub-cutaneous cellular tissue, and are, consequently, neither very rapid nor very powerful in their effects. They are serviceable where long-continued counter-irritation is to be maintained, and are especially useful in combating chronic inflammation of joints, in relieving the lameness of tedious cases of bone spavin, and in strangles in well-bred horses, where they appear to prevent that atrophy of the muscles of the larynx which is known as roaring, and which so frequently follows these attacks of strangles. Placed in the dewlap, they also prove a tolerably certain preventive for black-leg in calves and young cattle, probably in virtue of their continued irritation, which, although insufficient to interfere with health, is yet adequate to promote the formation in the blood of the fibrine which is found to be so deficient in this fatal disease. An issue or rowel acts in much the same manner as a seton, and consists in a wound made in the skin with a bistoury or rowel scissors, and kept open by the insertion of a pledget of tow, lint, or leather, which, to increase the counter-irritation and discharge, is sometimes smeared with irritant ointments.

The hot iron or actual cautery is still much used in veterinary practice as a counter-irritant. It is generally applied at a full red heat, and the higher the temperature the less is the pain attending its application. Besides being applicable to the same uses as active vesicants, it is employed for many of the purposes of caustics; and when used at a sufficiently elevated temperature, resembles these in abstracting water from the tissues, and in inducing, in the first instance, an active chemical effect. Its beneficial application in cases of diseased joints, ligaments, and tendons, in which it is so often used, depends on its exciting a superficial inflammation, and not, as was once currently believed, on its forming a permanent bandage around the parts. Indeed, though the skin, for a short time after the operation, is corrugated and tightened, it soon resumes its natural elasticity, and does not embrace the subjacent parts more firmly than in health. The firing of healthy limbs, with the popular idea of strengthening and bracing them up, is now deservedly discountenanced; for the apparent benefits resulting from the firing are now well known to result, not from the operation, but from the rest which it necessitates. It is a prevalent idea, that the efficacy of counter-irritants may be measured by the amount of the discharge which they induce. But this is by no means a general rule, for the amount of the counter-irritation and of the discharge do not bear a constant relation to each other; and the only accurate method of judging of the power or value of any counter-irritant, is by the intensity and continuance of the inflammation which it excites.

The uses of rubefacients, vesicants, and suppurants, are very analogous. They are applied as topical stimulants to indolent sores and ulcers, and occasionally to inveterate cases of mange, scab, and other scaly skin affections. The substances mentioned as vesicants are best adapted for these purposes. They are all of them in common use for producing counter-irritation in inflammation of the joints and surrounding tissues, and of the eye, lungs, and intestines, with their investing membranes. Inflammation, according to the scientific hypothesis lately propounded by Mr Lister, depends upon a depraved and debilitated state of the affected parts; and blisters accordingly are of service, not by withdrawing, as was wont to be taught, blood and nervous influence from the inflamed spot, but by attracting to it more blood and more nervous influence. By withdrawing from the blood liquor sanguinis, and with it the white corpuscles or their rudiments, they remove organizable materials, and establish this drain without diminishing the amount of the red globules which are so essential for maintaining nervous and vital power. Counter-irritants, though very serviceable in subacute or chronic inflammation, are useless, and often injurious, in acute inflammation, especially if it be accompanied by much constitutional fever. In the latter case, they either have no effect at all, or only aggravate the inflammation which they are intended to cure. Counter-irritants should be applied as near the seat of the disease as possible, but not directly to tissues of the same kind as those inflamed, or immediately continuous with them. Before the application, the skin should be well washed with soap and water, and the hair, when long or thick, removed with a pair of scissors or a razor. The effect of the application may also be further expedited and increased by subjecting the part to smart friction, or the action of boiling water, and by rubbing the agent well in, taking care to spread it over an amount of surface bearing some proportion to that diseased.

ERRHINES.

Errhines (ἐν, *en*, in; and ῥίν, *rhin*, the nose) are a small and unimportant class of topical irritants, which act on the nasal mucous membrane, causing discharge of nasal mucus, and sometimes sneezing. This latter consists in a forcible expulsion of air through the nostrils, and is a reflex action excited for the purpose of removing any irritant lodged about the nasal passages. Almost all irritant and acrid substances, when directly applied to the Schneiderian mucous membrane, act as Errhines; but those chiefly used are muriate of ammonia, subsulphate and iodide of mercury, tobacco, euphorbium, veratrum album, and its alkaloid veratria. Errhines, although now disused, were formerly prescribed to cause counter-irritation in affections of the eyes and head, and to expel, by inducing sneezing, foreign substances lodged in the nostrils, nasal sinuses, or respiratory passages.

STOMACHICS—CARMINATIVES.

Stomachics (στόμαχος, *stomachos*, the stomach) are substances which promote digestion. They include most spices and condiments, as ginger, carraway, and anise, with various other seeds from the natural family *umbelliferæ*, and several volatile oils, as peppermint and rosemary, from the *labiatæ*. On account of their gently stimulating the stomach, they are given to relieve simple indigestion, and to remove flatulence and slight colic pains, in which case they usually receive the special title of *carminatives*. They are also used to expedite and facilitate the action of purgatives, and to impart an agreeable flavour to many sorts of medicines.

EMETICS.

Emetics (ἐμετικά, from ἐμέω, *emeō*, I vomit) induce an antiperistaltic motion of the œsophagus and stomach, and, in severe cases, of the anterior portions of the small intestines, with increased secretion from all these parts. They have no obvious effect on horses; indeed, vomiting only occurs in these animals from extreme distension and spasm of the stomach, from dilatation of the lower part of the gullet, from rupture of the stomach or intestines, or from the effects of aconite and a few other poisons. This insusceptibilty to the action of emetics appears to result chiefly from the lesser irritability of the vagus nerve, and also to some extent from the smallness of the stomach, the acute angle at which the œsophagus enters it, and the impossibility of its being compressed between the diaphragm and the abdominal muscles. The position and length of the velum palati, even supposing the contents of the stomach to get so far in their upward progress, would cause them to pass out by the nostrils, and not by the mouth, as in true vomiting. It might reasonably be presumed, that as cattle naturally ruminate, they might also readily perform the analogous act of vomiting; but none of the substances which cause vomiting in other animals have any such effect on cattle. This is probably due to their large, subdivided, and comparatively insensible stomach, and to the lesser irritability of the vagus nerve. The dog and pig, however, can be made to vomit very easily and speedily; indeed, the former often purposely brings on vomition, by eating the *triticum repens* and other emetic grasses, which his instinct readily enables him to discover. In the dog, the act is so natural, and so readily induced, as to be capable of being caused by almost all disagreeably tasted, nauseous, or acrid substances. The emetics in common use are—mustard, tobacco, ipecacuan, common salt, sulphates of zinc and copper, tartarized antimony, and tepid solutions of many salts. These emetics differ somewhat from each other in their effects. Sulphates of zinc and copper act with great rapidity, whilst tartarized antimony and tobacco are somewhat more tardy in their action. The former two cause a greatly increased mucous secretion, but have not such a marked sedative effect as the latter. Some emetics, as mustard and most metallic salts, act chiefly in virtue of the local irritation which they produce, and have consequently little effect, unless when placed in contact with the mucous membrane of the stomach. Others, however, as tartar emetic, ipecacuanha, and tobacco, appear to owe their effects chiefly to their being absorbed, and operating on the nervous centres connected with the stomach. These, consequently, act with nearly equal certainty by whatever channel they enter the body. When an emetic is given, it first causes nausea, and then, in from two minutes to half an hour, vomiting, which continues for a variable length of time. In the meanwhile, the animal heat is raised, the pulse is somewhat quickened, the respiration disturbed, and, when the straining is excessive, fæces and urine are sometimes passed involuntarily. The matter vomited usually consists of a portion of the emetic and the contents of the stomach, together with mucus, which is secreted in large quantity, and occasionally a small amount of blood, which generally comes from the pharynx. After the vomiting has entirely ceased, the pulse and respiration fall below their natural standard, and hence the value which emetics possess as sedatives. Where the action has been violent or long continued, it is usually succeeded by considerable prostration of strength. The act of vomiting is a good illustration of what is termed a reflex spinal action. In the majority of cases where, for example, a dose of common salt is swallowed, the impression which the medicine makes on the mucous membrane of the stomach is conveyed by the appropriate nerves (the pneumogastric, and occasionally the splanchnic) to the medulla oblongata, whence the influence which produces the several motions, together constituting the act of vomiting, arises, and is distributed by the motor nerves. Tartarized antimony and other emetics which operate by whatever channel they enter the blood, probably either act directly on the medulla oblongata and other nervous centres, which preside over the movements of the stomach; or, according to Mr Headland, they owe their effects to the derangement which they produce in the functions of the vagus nerve. Dr Marshall Hall has shown that the several motions constituting vomition occur as follows:—A quick, deep inspiration is taken, the larynx is spasmodically closed, the pyloric orifice of the stomach is also closed; whilst the cardiac is opened, all the muscles of expiration are called into action, the diaphragm alone remaining a fixed surface, against which the stomach is pressed; and finally, as the lungs are full, and expiration is prevented by the closure of the larynx, the whole force of the effort is concentrated in emptying the stomach.

Amongst dogs and pigs, emetics are chiefly used for evacuating the stomach, in order to expel crude undigested food, poisons, or other foreign bodies; for clearing away obstructions from the throat or œsophagus; and for depressing the circulatory and nervous systems. In virtue of this sedative effect, they are serviceable in canine practice for the arrestment of distemper and other febrile attacks, and for the antiphlogistic treatment of all sorts of internal inflammation, except that of the alimentary canal. They were formerly sometimes used to cause relaxation of muscular fibre, and thus aid in the reduction of dislocations. But for these purposes chloroform has now entirely superseded all other remedies. For a medium-sized dog a safe and convenient emetic consists of a teaspoonful of common salt, with about half that quantity of mustard dissolved in a teacupful of tepid water. Where a prompt and certain effect is desired, two or three grains of sulphate of zinc should be given, dissolved in the salt and water, rolled up in a piece of meat, or mingled with some other food. Where a more permanent sedative result is sought, two grains of tartar emetic may be given either alone or with the salt and tepid water.

ECBOLICS—PARTURIENTS.

Ecbolics (ἐκ, *ek*, out of; and βάλλω, *ballō*, I throw) are medicines which are believed to cause contractions of the uterus, and expulsion of its contents. They are represented by such substances as ergot of rye, savin, rue, cantharides, and gamboge. They have, however, in reality, no special action on the uterus, but owe their effects to their violently exciting such neighbouring parts as the intestines or kidneys. They cannot produce abortion or hasten the period of parturition, without causing such constitutional irritation as render their employment dangerous to life. Some of them, especially ergot of rye, are occasionally given during the act of parturition, to increase the uterine contractions, and expedite the expulsion of the fœtus. Even in such cases their utility has been greatly over-estimated. Indeed, veterinarians have little occasion for the use of such agents, since, with a little time and patience, parturition in the lower animals is usually effected easily and safely, and without much interference or assistance.

APHRODISIACS.

Aphrodisiacs (ἀφροδίσια, *aphrodisia*, venery) are substances which have, or are supposed to have, the power of exciting the venereal appetites. They include such articles as phosphorus, cantharides, peppers, and turpentines. On the Continent they still appear to be frequently given to various of the domesticated animals, especially to cattle; but their employment is unnatural and unscientific, and further fails to produce the desired effect. When the powers of procreation are defective, instead of employing any of these drugs, the cause occasioning the loss of power should be sought for and removed. If it consist, as it often does, in general debility, the appropriate treatment will consist in a generous diet and tonic medicine.

PURGATIVES—CATHARTICS.

Purgatives (*purgo*, I purge), or cathartics (καθαίρω, *kathairō*, I cleanse or purge), augment the intestinal secretions, and quicken and increase the evacuation of fæces. Some of them, like errhines or vesicants, produce topical irritation of the alimentary mucous membrane, succeeded by increased secretion and peristaltic motion. The husks of grain, vegetable fibres, and other indigestible substances, probably act in this way, as also many resinous and comparatively insoluble purgatives previous to their absorption. All active purgatives, however, become absorbed. When given in the usual way by the mouth, they are first taken up by the capillary veins of the stomach and small intestines, and thence enter the general circulation. Being unfit for remaining in the blood or becoming assimilated, they are speedily returned to the intestinal mucous membrane, where they are separated from the blood by innumerable active secretory glands, and poured into the intestinal tube along with the increased secretion to which they give rise. During both their absorption and excretion, they cause irritation of the mucous membrane, and consequently increase the peristaltic motions, which, when excessive, occasion the pain and spasms accompanying the action of violent purgatives. Different purgatives appear to be excreted from different parts of the alimentary canal. Jalap is believed to be chiefly separated from the surface of the small intestines; aloes from the large intestines; and croton and saline purgatives from both. Excretion, however, from *some* part of the alimentary mucous membrane, appears to be essential to the full effect of all active purgatives; for aloes, salts, and the like, lose their purgative effect when administered in combination with articles which prevent their excretion, or cause them to be removed by the kidneys or other emunctories. In corroboration of this, Dr Ward records the interesting case of a woman, in whom castor-oil did not produce purgation, but was exuded from the skin, and acted as a diaphoretic.

Purgatives vary much in the intensity of their action. When mild, they are *laxatives;* when they induce copious watery discharges, they are termed *hydragogue* cathartics; when they induce griping, they are styled *drastic;* and when accompanied by profuse discharge of bile, they are known as *cholagogues.* Given injudiciously, or in excessive doses, cathartics cause much weakness, and occasionally lead to paralysis of the hind limbs; sometimes they induce fatal superpurgation, and sometimes enteritis; and these untoward effects are especially apt to ensue in irritation or inflammation of the skin or mucous membrane of the air-passages, particularly in the horse. And the reason of this is obvious; for such irritation or inflammation is very apt to extend to the intestinal mucous membrane, on account of the direct continuity and structural resemblance which exists between all these parts. I have seen a horse affected by bronchitis die from superpurgation, induced by only three drachms of aloes; and an almost equal degree of susceptibility to the action of very moderate doses is also observable in typhoid fever, purpura-hæmorrhagica, and laminitis.

The intestines of man have a superficial extent of about 1400 square inches (Meckel). Those of the horse being three times the length, and having at least three times the calibre of the human intestines, must consequently have a surface of about ninety square feet. The whole extent of this surface is covered by a highly vascular mucous membrane, packed full of actively secreting glands, and abundantly supplied with nervous influence. Such an immense extent of intestinal mucous membrane in such a vascular and sensitive state, necessitates great caution in the administration of purgatives to the horse. If possible, the animal should be restricted, for at least a day previous to the exhibition of the dose, to mash diet or green food. The dose should be small, as its effect may be accelerated and increased by administering it while the animal is fasting, by occasional exercise, until it begins to operate, and by the repeated use of clysters. This last auxiliary, when employed with sufficient perseverance, is indeed so effectual in promoting the action of the bowels, that one most successful army surgeon with whom I am acquainted, trusts almost entirely to its use, seldom giving, except in extraordinary cases, any purgative medicine whatever. For horses, aloes is probably the best of all cathartics. The fixed oils are tolerably good, but less certain; while croton is much too drastic, unless in small amount, and largely mixed with other less potent medicines. Saline cathartics are irregular, and sometimes act with unexpected violence. Senna, colocynth, buckthorn, and various other substances of much value as purgatives for men and dogs, have scarcely any such effect on horses. Purgation may be produced in the horse in from eighteen to twenty-four hours, and sometimes in a shorter period, if the auxiliary treatment above mentioned be adopted, as it invariably should be. A horse should never have purgative medicine when his strength is reduced and his pulse small and weak, or when he is in the advanced stages of inflammatory disease of the air-passages, and never without extreme caution in influenza and other debilitating epizootics.

In cattle and sheep, the magnitude of the *quadrisected* stomach, the large proportion of food which it always contains, and the comparatively low vascularity and sensibility of the whole alimentary canal, render the action of many purgatives far less certain than in most other animals. For these ruminants saline purgatives are preferable to any others, and their action may always be materially expedited by encouraging the animals to drink water, which may be rendered more palatable by sweetening it with treacle. In obstinate constipation, or torpidity of the bowels, gamboge, croton, and calomel, are often useful. In ordinary circumstances, purgation may be produced among cattle in from twelve to sixteen hours; but cases frequently occur where, in spite of all treatment, the bowels remain unmoved for several days. The best purgatives for sheep are common and Epsom salts and castor-oil, in doses of about one-fourth of those given to cattle. Calomel and croton are apt to act too violently. As sheep drink sparingly, their medicine should be given with a liberal quantity of fluid.

On account of the small size of his stomach and alimentary tube, and the less bulky nature of his food, the dog is peculiarly susceptible to the action of purgatives. In him they generally operate in from five to eight hours. Jalap, with a little calomel, or a mixture of equal parts of linseed and castor oils, are most generally approved of. Aloes acts more slowly and uncertainly, while saline medicines are too apt to cause vomiting, or, if retained, to act with undue violence. Indeed, all purgatives must be given to dogs in a well-prepared condition; for, when unpalatable, acrid, nauseous, or bulky, they are very apt to be expelled by vomiting. The action of cathartics on the pig is closely analogous to their effects on the human subject and dog; and he is best physicked by dropping on his tongue, from a shallow spoon or bottle, about an ounce of Epsom salts, dissolved in water, or a like amount of linseed or castor-oil. During the operation he must be held by the ears by an assistant, who will not be deterred by squealing.

No class of medicines is applied to so many important purposes as cathartics. They are the most certain and effective evacuants, and sometimes little inferior to blood-lettting.

1st. Purgatives are given to remove from the alimentary canal undigested food, feculent matters, poisonous substances, and worms. When employed for the destruction or expulsion of worms, they generally receive the special title of *anthelmintics* or *vermifuges*, and often owe their success simply to their causing such increased peristaltic motion and excessive secretion of fluid, as to unloose the hold which the parasites have on the intestinal walls, and wash them entirely away. Some anthelmintics, however, destroy the worms by poisoning them. Such are turpentine, and various pungent volatile oils, ethers and bitter substances, as jalap, gentian, and wormwood, with Areca nut, Indian pink, Kousso, pomegranate root bark, and the root-stalk, and lower leaves of the male shield fern. When a vermifuge is required, it is generally advisable to combine some of these agents with an ordinary purgative, to give the mixture while the animal is fasting, and to use clysters of soap and water, with a little turpentine, especially if there be reason to suppose that worms are lodged in the rectum. (See article on Worms, in Appendix.)

2d. Purgatives are exhibited in order to diminish the watery parts of the blood. This they effect very rapidly, owing to the large extent of actively secreting intestinal surface on which they act. From thus directing large quantities of blood to the intestinal mucous membrane, from robbing it of a great amount of its fluid parts, and also from determining to the same surfaces a large amount of nervous influence, purgatives are of much service in starving out and subduing inflammation of all internal parts, except the intestines themselves. When thus employed, they act on the principle of counter-irritation or derivation. In many cases of inflammation, accompanied by high fever, it is difficult, however, to establish purgation, on account of the fulness of the vascular system ; and in such cases much advantage results from combining the purgative with some sedative, as tartar emetic, calomel, or aconite. Purgatives are often effectual in causing the absorption of dropsical effusions; for when the proportion of its watery parts is diminished, the blood endeavours to regain its normal density, by absorbing fluid from whatever source it can be procured.

3d. Cathartics not only purge the intestines, but they generally purge the blood as well. By increasing the activity of the intestinal mucous surfaces, they accelerate the separation from the blood of effete matters produced by the disintegration of the tissues; of morbid matters which may have found their way into the blood, or been engendered there; and of excrementitious materials, the accumulation of which may have been induced by arrestment of the functions of the skin or kidneys. The accumulation in the blood of such noxious matters, even if they do not happen to be themselves a source of disease, always proves a serious aggravation to any complaint, and is especially prone to impair the functions of the nervous system. Nature herself sometimes endeavours to remove these deleterious matters by the establishment of spontaneous diarrhœa. Whether induced naturally or artificially, this depurative action is of especial service in removing febrile attacks, relieving nervous diseases, and accelerating the cure of most inflammatory disorders.

4th. Most active cathartics exert an indirect action on the liver, cause an increased secretion of bile, and hence are termed *cholagogues.* Several medicines appear, however, to act specially on the liver. Of these, the most important are calomel and other mercurials, which cause a marked increase in the biliary matters of the fæces. Orfila further noticed, that corrosive sublimate given to dogs produced abundant vomiting of biliary matter. Sulphate of manganese was found by Emelin to induce an extraordinary secretion of bile. Rhubarb and aloes are also considered to act upon the liver. Podophyllin is an amorphous resinoid powder—a concentrated preparation of an American plant, the Podophyllium Peltatum or May-apple. It has been introduced into human practice since 1847, is said to act specially on the liver, slowly developes its purgative action, occasionally with some pain and spasm, and in small doses proves an alterative. I am not aware of its having been used in veterinary practice.

From half a grain to two grains would be the dose for a medium-sized dog, about ten or twelve grains for a horse, and, to prevent griping, it should be given with some carminative, or with a little henbane. Cholagogues are prescribed in some cases of jaundice, and where torpidity of the liver is suspected. In many of these cases of torpidity, quinine and other bitter tonics prove serviceable. As they do not appear materially to increase the secretion of bile, they cannot, however, be considered as true cholagogues; and their beneficial effects depend, according to Professor Headland, on their striking analogy to the biliary matter taurine, and their taking its place in those cases where it is deficient from tardy action of the liver.

EXPECTORANTS.

Expectorants (*ex*, out of; and *pectus*, the breast) are substances which increase the natural secretions of the mucous membrane lining the trachea, bronchi, and other parts of the respiratory apparatus. Some of them exercise merely a topical effect, as chlorine, iodine, ether, tobacco smoke, and the vapour of water; whilst others, as ipecacuan, balsams, gum-resins, and probably antimonials, become absorbed, and, entering the circulation, exercise a special stimulant effect on the mucous glands of the respiratory mucous membrane, through which they are excreted. Expectorants are very uncertain in their action, even on man, and still more so on the lower animals, in which we have no evidence whatever of expectoration. They are not now used in veterinary practice.

DIAPHORETICS—SUDORIFICS.

Diaphoretics (διαφορέω, *diaphoreō*, I throw off by perspiration), and Sudorifics (*sudor*, sweat; and *facio*, I make), are similar in their nature, actions, and uses. Strictly speaking, the former increase the insensible, and the latter the sensible, perspiration. This is, however, a difference only in degree of action.

In all the higher animals the skin performs several very important functions. Besides protecting the sensitive parts alike from cold and external injury, and being intimately connected by vessels and nerves with all parts of the body, it also acts as a pneumatic apparatus, excreting carbonic acid from the system, and probably also absorbing oxygen. The excretion of carbonic acid is of such essential importance to life and health, that asphyxia soon occurs in any of the higher animals when the functions of the skin are arrested by covering it over with a thin varnish. The skin is further the channel through which the system ejects a very large, though variable, amount of refuse fluid matters, holding in solution various salts and effete organic matters. These latter are in much greater amount than is generally supposed. In man, it is estimated that 100 grains of azotized matter are excreted daily from the skin (Carpenter); and in horses and cattle the quantity must be at least three or four times greater. Sanctorius' experiments show that, of eight parts of food taken into the healthy body, three parts leave it in the fæces and urine, three by the lungs, and two by the skin. During those diseases in which the functions of the kidneys, lungs, or bowels are disturbed or arrested, this depurative action of the skin is of the greatest possible service in preventing the blood from being poisoned by the accumulation of deleterious matters. In such cases the skin takes on a vicarious action, and excretes those effete matters which are usually disposed of by other channels. Such considerations indicate the paramount importance of always preserving the skin in a clean and healthy state. In all animals cutaneous transpiration is the result of two actions—first, a physical process of evaporation, depending on the porosity of the tissues, and occurring alike in animate and inanimate objects; and, secondly, a vital process of transudation or secretion, analogous to that occurring in other parts of the body, and capable of being modified by external agencies. Diaphoretics accelerate the latter of these processes, either by exciting the general circulation, as is the case with active exercise, or more commonly by stimulating the cutaneous glands and vessels, as is the case with friction, warm clothing, and certain medicines.

In the lower animals, diaphoretics are less prompt and certain than in man, and this chiefly depends on the skins of quadrupeds being thicker and more plentifully covered with hair or wool, and on the fact that most medicines of this class are especially apt to pass off by the kidneys or bowels, rather than by the skin. Horses naturally perspire greatly more abundantly than cattle, and are more easily acted on by diaphoretics. Sweating can scarcely be said to occur at all either in the dog or cat. The waste fluids which pass from the bodies of men and horses in cutaneous transpiration appear to be got rid of in dogs by their frequent micturition, and by the evaporation from their open mouths and moist extended tongues. The wool-clad pelt of the sheep, and thick bristled hide of the pig, alike prevent free perspiration ; and in all these animals sweating medicines are mainly discharged by, and hence chiefly act upon, the kidneys. The best and simplest methods of causing diaphoresis in horses or cattle, is to administer diluents in large quantity, to apply smart friction over the surface of the body, and subsequently to keep the animal in a warm atmosphere, and well covered with horse-cloths. In conjunction with this treatment, small and repeated doses of some of the following medicines should also be given :— Acetate of ammonia, sweet spirits of nitre, sulphuric ether, ipecacuan, volatile oils, Dover's powder, and antimonials. These diaphoretic medicines, like other evacuants, become absorbed. Being foreign elements, however, they do not remain long in the blood ; but where the conditions already insisted on are duly attended to, they are attracted towards the skin, and produce there a stimulant effect, and an increased secretion, by which they are carried out of the body.

In connection with this subject, it may be remarked that warm and vapour baths have been used successfully in veterinary practice, and, like diaphoretics, prove beneficial chiefly by augmenting the healthy functions of the skin. The hydropathic method of sweating a patient has also been sometimes usefully employed in regular practice. The patient is enveloped in a sheet saturated with cold water. Over this are placed three or four or half a dozen large horse-cloths. The legs should be subjected to similar treatment, or rolled in warm bandages. After the patient has been thus clothed for half an hour or an hour, he will steam and perspire very freely. After from one to three hours, according to circumstances, the sheet and rugs should be removed, and the animal dried by hand-rubbing, and comfortably clothed. This mode of practice has been tried both with horses and cattle, and seems useful in many cases of rheumatism, and especially in gross subjects. It should not, however, be adopted unless with due consideration, and under competent superintendence.

Diaphoretics are applied to the following useful purposes:—

1st. They restore arrested action and secretion of the skin, and hence are of eminent service in equalizing irregularities of the circulation, and as preventives of serious disease. They are especially valuable in checking those chills which so frequently usher in febrile and inflammatory complaints. It would, indeed, be difficult to estimate how many serious colds and inflammations amongst horses have been opportunely nipped in the bud by the use of a couple of comfortable horse-rugs, bandages to the legs, and a warm, stimulating, diaphoretic drink.

2d. By the determination of blood and nervous influence, with consequent increase of secretion to the skin, they exert a species of counter-irritation, which is useful in overcoming internal congestions, and is often effectual in diminishing such excessive secretions of the kidneys or bowels as occur in diabetes, in chronic diarrhœa, or in the earlier stages of dysentery.

3d. Like other evacuants, they remove superfluous fluid and morbid matters from the blood, and hence are useful in relieving febrile, inflammatory, and rheumatic diseases. For these important purposes their value is greatly enhanced in cases where, from any cause, the evacuant and purifying functions of the bowels or kidneys are impaired or arrested.

DIURETICS.

Diuretics (διά, *dia*, through; οὐρέω, *oureō*, I make water) are remedies which increase the secretion of urine. This may be effected by giving either large quantities of fluid or certain saline, resinous, or other soluble substances which have a tendeney to pass out of the system in the urine. Hard work or bad food, such as heated oats or musty hay, also produee similar effeets. All diuretics, of whatever deseription they be, enter the blood; but not being required there, are speedily direeted towards the kidneys as the organs best adapted for their excretion. As is always the case with organs acted on by evaeuants, these glands beeome excited to increased aetivity, and henee a copious flow of urine, in which the irritant substanee—the eause of the aetion—is earried away. Although diureties greatly augment the watery parts of the urine, they do not increase, but, on the eontrary, usually diminish, the proportion of salts and organie matters expelled in it in a given time. Mr Bowman's view of the action of diuretics appears to afford a very satisfaetory explanation of this. He supposes that all sueh medicines stimulate the Malpighian bodies, whieh are intended for the seeretion of the watery parts of the urine, but have no such effeet on the uriniferous tubes or their capillary plexuses—the apparatus eonecrned in the secretion of the eharaeteristie solids of the urine. It may be that diuretics cause so much eongestion of this uriniferous apparatus as to arrest its funetions; indeed, when the doses are too large, similar eongestion and arrested function appear to extend to the Malpighian bodies, eompletely suspending the seeretion of urine.

The diuretics commonly used in veterinary praetiee are alkalies, with alkaline and neutral salts; turpentine with most resins and many volatile oils; sweet spirit of nitre and most etherous and aleoholie fluids; digitalis and eantharides. When used as diuretics, neutral salts must be given in moderate quantity, for in large doses they aet ehiefly on the bowels. A very useful diuretic ball for the horse may be made with half an ounee eaeh of nitre, resin, and soft soap. Six draehms eaeh of the three ingredients dissolved in water make a good diuretie drench for the cow. Stonehenge advises for a medium-sized dog about six grains of nitre, half a grain of digitalis, and three grains of ginger made into a pill, with linseed meal and water. A good and simple combination eonsists of thirty drops of sweet spirit of nitre, and five grains of saltpetre in a little water. Diureties usually act certainly and speedily on all classes of veterinary patients. Their actions are best ensured by giving small and repeated doses, by using several together, and by encouraging the animal to drink large quantities of water, thin gruel, or some other bland fluid—in short, by promoting as much as possible the excretion of the medicine by the kidneys, rather than by the skin or bowels.

In the treatment of disease, diuretics are used chiefly for the following important purposes:—1st. To restore the healthy action of the kidneys in diseases in which the secretion of urine is diminished. 2d. To promote the absorption of dropsical effusions by removing water from the blood, which, in order to recover its normal density, absorbs the anasarcous or dropsical swelling. 3d. To promote the elimination of poisonous agents from the blood—a purpose for which diuretics have been strongly recommended by Orfila and other toxicologists, who find that, in the case of arsenic and several other drugs, doses adequate to occasion poisoning may be given with impunity, provided active diuresis be speedily induced. 4th. To augment the proportion of water in the urine, and so to prevent the deposition of its solid parts in the bladder or other urinary passages. For this purpose, diuretics are frequently used in the human subject, occasionally in dogs, but very seldom either in horses or cattle, as these animals are little subject to gravel. 5th. To assist in removing inflammation by exciting counter-irritation; by diminishing the fluid parts of the blood; and also, in a more advanced stage, by carrying away the deleterious matters produced by the inflammation, or accumulated in the system, on account of the general arrestment of secretion.

SIALOGOGUES.

Sialogogues (*σίαλον*, *sialon*, saliva; and *ἀγωγός*, *agōgos*, evoking) increase the salivary and buccal secretions. They act in one of two ways—either producing a local irritant effect, or undergoing absorption and exercising a special action on the salivary glands and mucous follicles. Ginger, mustard, tobacco, and raddish act in the former; and mercury, and to a certain extent salts of gold and antimony, iodine, and almost all nauseants, in the latter of these two ways. In works on the materia medica published so lately as 1810, the list of sialogogues sometimes included upwards of a hundred substances; but in the present day remedies of this class are only used empirically.

TONICS.

Tonics (*τόνος*, *tonos*, tone) are agents which increase the general tone and vigour of the system. Royle defines them as medicines "possessing the power of gradually increasing the tone of the muscular fibre when relaxed, and the vigour of the body when weakened by disease." Dr Billing regards them as "substances which neither immediately nor sensibly call forth actions like stimulants, nor depress them like sedatives; but give power to the nervous system to generate or secrete the nervous influence by which the whole frame is strengthened."[1] Professor Headland considers that tonics act primarily and directly in the blood as restoratives, and certainly some of them appear to supply the blood with natural materials of which it may be temporarily deficient. Thus the different preparations of iron probably owe their virtue as tonics, in part at least, to their providing iron for the hematosin of the blood-globules; and cod-liver oil and other oleaginous tonics to their supplying the fatty materials necessary for the manufacture of healthy blood. But although it is impossible in all cases satisfactorily to trace the *modus operandi* of tonics, we do know that they all become absorbed. Many of them have been detected in the blood, and in various of the secretions. They appear to be retained in the system in larger amount, and for a longer period, than alteratives or stimulants; and in properly regulated doses they gradually induce a more healthy state, both of primary and secondary nutrition. In whatever manner they act, all tonics judiciously administered produce these obvious effects. They increase the appetite, the fulness and firmness of the pulse, the activity of all the bodily

[1] First Principles of Medicine. 4th ed., p. 92.

functions, the muscular power, and the capacity for endurance. These effects, though somewhat slowly developed, are usually very well marked, especially when tonics are given in cases where the appetite is deficient or capricious, the pulse weak and compressible, and the muscular system soft and flabby. When given to healthy animals in large and repeated doses, they do not, however, improve health; but, on the contrary, sometimes cause disorder of the digestive organs, and occasionally (in man and the dog) febrile symptoms. Similar effects sometimes also ensue from their injudicious administration to sick animals. Tonics, although bearing considerable resemblance to calefacients or general stimulants, are distinguished from them by the following well-marked characters. Their action is slowly and gradually induced, but tolerably permanent, and not succeeded by any subsequent depression; whilst the action of stimulants is speedily, and indeed almost immediately, developed, but proves very temporary, and is succeeded by a state of depression varying in proportion with the previous excitation. In short, tonics give strength, whilst stimulants merely call forth strength previously latent. Tonics also closely resemble astringents, but differ from them in acting more slowly, and possessing no obvious chemical influence, and no effect on animals except when alive.

Tonics are prescribed in indigestion and mal-assimilation, when these depend on debility; in most cases of a chronic and subacute character, when unaccompanied by acute fever; in scrofulous and other exhausting complaints; and during recovery from most debilitating diseases. In the human subject they have also a remarkable power of arresting agues and other periodic diseases, and that sometimes before many doses of the drug have been given, and before the development of any obvious physiological effect. Tonics should be withheld wherever there is active inflammation or acute fever; and they seldom do much good, unless the bowels be in a tolerably regular and normal state. To ensure their full effect, they should be given in moderate doses, at short intervals, and for a considerable period. With the absurd idea of making up for their being carelessly given at irregular and unduly long intervals, they are frequently prescribed in unnecessarily large doses, which are very apt to disorder digestion. In veterinary practice a good many mineral tonics, as salts of iron, zinc, and copper are employed; and also a few vegetable tonics, as gentian, quassia, rhubarb, and cinchona. Mineral are generally more active than vegetable tonics, and are hence better adapted for horses and cattle. Vegetable tonics usually contain an alkaloidal or neutral principle of remarkable bitterness. They are mild, and hence well suited for early convalescence, and for cases where more active medicines might be too stimulating. They are often also useful for dogs. Cod-liver oil is the only tonic of animal origin prescribed in veterinary practice. Its use, however, is very limited, being entirely confined to canine practice. In addition to these medical tonics, we must not omit to mention the natural tonic—cold, a most valuable and convenient agent for relieving laxness and irritability dependent on weakness, and one which possesses the singular advantage over other tonics of being suitable for local as well as general purposes, and being applicable in many different ways.

STIMULANTS, CALEFACIENTS, OR EXCITANTS.

Stimulants promptly but temporarily increase nervous energy, and thus exalt the action of the heart and the other animal functions. They include balsams, gum-resins, volatile oils, turpentines, phosphorus, ammonia, alcohol, and ethers. They all become absorbed, and may often be detected in the blood, and in various of the secretions and excretions. They usually excite the organs by which they are evacuated from the system, and on this account frequently possess various subordinate actions, some being diaphoretic, others diuretic. Although acting probably through the nervous system, stimulants produce their most prominent effects on the circulation, causing increased fulness and frequency of the pulse, accelerated respiration, and augmented temperature of all parts of the body. In properly regulated doses they do not, however, affect the functions of the brain.

Those which act with rapidity are termed *diffusible stimulants.* Such are ammonia, alcohol, and ethers. Their effects are, however, evanescent, and can be maintained only by frequently repeated doses.

Unlike tonics or alteratives, stimulants do not gradually counteract or remove disease, but their principal value results from their promptly increasing nervous force. Sustaining the action of the heart and the powers of life, they are thus of signal service in animals sinking from sudden shock, from loss of blood, or from poisoning by sedatives or narcotics. Rousing the vital powers, and increasing especially the action of the heart and the animal heat, they are valuable remedies in influenza, typhoid fever, and exhaustion. Equalizing the balance of the circulation where it has been disturbed, and thus relieving excessive determination of blood to any particular part, they prove very effectual in removing congestion of the lungs, caused by violent and continued over-exertion, and in controlling those shivering attacks which are so often the precursors of internal disease, and which depend upon the blood leaving the skin and collecting in undue quantity round the internal organs. When used for these purposes they are sometimes known under the special title of *cordials.* The general action of stimulants is often accompanied by special local effects: thus they frequently improve the appetite and promote digestion, or, in other words, act as *stomachics;* they prevent or remove flatus, or act as *carminatives;* or they counteract spasm, in which case they are termed *anti-spasmodics.* Alcoholic and etherous substances, volatile oils, and all other diffusible stimuli, are anti-spasmodic. This, like most other curative or therapeutic effects, depends on a physiological action. The diffusible stimulant, in virtue of its own characteristic and inherent power, exalts nervous force, and thus overcomes that perverted condition of the nervous centres on which spasm invariably depends. Some stimulants—like nux vomica, with its alkaloid strychnia and veratria, the active principle of white hellebore—appear to expend their stimulant action chiefly on the nervous system, without materially increasing the action of the heart, and hence have been sometimes separately classified as *nerve stimulants.*

From increasing the action of the heart and the general excitability of the system, stimulants are unsuitable in cases of active inflammation and acute fever among both horses and dogs. Amongst cattle, however, the existence of inflammation and fever must not always be regarded as sufficient to contra-indicate the use of calefacients; for in many diseases where such medicines would be destructive to other animals, they are of decided efficacy in cattle, removing irritability, subduing subacute inflammation, and inducing a healthy action of the various secretory organs.

ALTERATIVES.

A large and important class of diseases appear to depend upon some faulty or morbid materials or actions in the blood. Such are scrofulous affections and rheumatism, eruptive fevers, various skin diseases, and typhoid fevers in horses and cattle, with distemper and several nervous disorders in dogs. A very few of these blood diseases are readily removed by remedies which act with almost as much certainty as antidotes. Thus quinine promptly cuts short an attack of ague in man, whilst sulphur as readily cures itch. The very few medicines capable of thus producing with certainty special curative results are frequently termed *specifics.* As therapeutics become better understood, the present very limited number of specifics may possibly be increased, and particular blood poisons may in time have their appropriate antidotes.

The treatment of some of these blood diseases is, however, at present uncertain and unsatisfactory; but those of them which are under medical control are counteracted and annihilated by a large and useful class of medicines, termed alteratives, alterants, or catalytics. As their name indicates, they alter for the better the condition of the system. They include such remedies as mercury, antimony, iodine, arsenic, salts of silver, zinc, copper, and lead, sulphur, alkalies, and saline matters. They are mostly of inorganic origin, are soluble in some of the various secretions of the alimentary canal, are absorbed into the blood, and exert there their special influence, neutralizing or destroying morbid processes. In excessive or poisonous doses they impoverish the blood: thus mercury diminishes the plastic elements of the blood, and causes the development of fœtid matters; whilst salines induce solution of its fibrine, and increase of its watery portions. In medicinal doses their curative effects, although often only gradually established, are tolerably permanent. Being mostly unnatural to the blood, they do not long remain in it; and as they are expelled through the various excretory channels, and more especially through the kidneys, they increase their activity. Alteratives resemble tonics in producing permanent curative results; but tonics, being restoratives, have little effect during health, whilst alteratives, acting by counteraction, develop various of their effects almost as notably in health as during disease. Tonics supply certain materials to the blood, and may remain in it; but alteratives, on the other hand, being unnatural to it, are rapidly excreted from it.

Whilst we are well assured that these alteratives do counteract or annihilate disease, we cannot satisfactorily explain their modus operandi. Liebig and others have thought that many diseases, and especially those known as blood diseases, result from, and are propagated within, the body, by a species of fermentation. Alteratives may possibly owe their well-ascertained effects to their establishing a species of rival fermentation which checks that previously going on within the system. More probably still they may act by catalysis or contact, somewhat in the manner in which spongy platinum causes, without any change in itself, combination of oxygen and hydrogen, or the emulsine of the bitter almonds resolves the amygdaline into prussic acid and other compounds, or ptyaline and pepsine promote the change of starch into sugar. This ingenious hypothesis is propounded and rather favourably entertained by Professor Headland.

The practical uses of alteratives are numerous and important. They are employed in most inflammatory attacks, which they combat apparently by their diminishing the solid particles of the blood, maintaining a solvent power over the fibrine, and preventing that aggregation of the blood corpuscles which is so prone to occur in inflammation. Thus mercurials are found to deprive the blood of one-third of its fibrine, one-seventh of its albumen, and one-sixth of its globules. Alkalies dissolve fibrine, retard its formation and deposition, and cause its removal in the urine. Salines resemble alkalies in their effects, and, when used for some time, increase moreover the alkaline salts of the blood. Possessed of such powerful physiological effects, we need not be surprised at their remedial value in cases of inflammation and fever. In rheumatism also their judicious employment is usually very serviceable. In such nervous disorders as epilepsy and chorea, when unattended by nervous lesion, but depending upon a faulty state of the blood, alteratives are extremely useful, and none of them more so than arsenic and metallic salts. Scab, mange, and other skin diseases, are also benefited by alterative medicines, and particularly by arsenic, sulphur, and iodide of potassium. Whilst alteratives usually require to be given for some time before they develop their curative results, their striking tendency to impoverish the blood will indicate the propriety of discontinuing them so soon as their desired effects are produced, or any of their untoward symptoms are presented.

Many alterative prescriptions are used in veterinary practice. When acute febrile or inflammatory symptoms are to be subdued in horses or cattle, a scruple of calomel is given every three or four hours, conjoined with a drachm of opium, which prevents the mercury being carried out of the system too rapidly, and before its desired effects are produced in the blood. In the later stages of inflammation, during early convalescence, and in typhoid affections, mercury proves too lowering, and saline or alkaline alteratives are indicated. A common form consists of a drachm each of salammoniac and tartar emetic, with the same quantity of either chlorate of potash or nitre made into a ball with linseed meal. An ounce of sulphur, with a drachm each of nitre and salammoniac constitutes a useful alterative draught when mixed with a little oil, milk, or treacle-water, to ensure the proper admixture of the sulphur. A drachm each of nitre, salammoniac, ginger, and gentian, repeated thrice daily, either in bolus or draught, combine the advantages of an alterative stomachic and vegetable tonic. In rheumatism, a drachm each of iodide of potassium, nitre, and carbonate of soda, with or without sulphur, proves a useful alterative, especially if any acute symptoms have been previously counteracted by calomel and opium, or other more powerful remedies.

ASTRINGENTS.

Astringents (*ad*, to; and *stringo*, I bind) corrugate the softer animal solids and coagulate the fluids. They include the mineral acids, and almost all metallic salts, such as alum, acetates of zinc and lead, and sulphates of zinc, iron, and copper. Astringents of vegetable origin include tannic and gallic acids, oak bark, galls, catechu, and creasote; and owe their effects chiefly to the tannin which they contain. Almost all astringents produce, in the first instance, a chemical action on the parts with which they come in contact. Thus metallic substances unite with the elements of the tissues, diminishing their bulk and solubility; whilst most vegetable astringents tan them, causing their partial conversion into leather—the tough, insoluble tanno-gelatine of chemists. Thus far astringents have merely a chemical action, which they exert equally on dead and living tissues. When applied to the latter, however, their chemical constringing effect is speedily succeeded by a vital constringing effect. Albuminous, fibrinous, and gelatinous tissues exposed to this twofold action become lessened in volume, their blood-vessels diminished in calibre, and their exhalations and secretions decreased. But astringents have not a local action only: most of them, when properly administered, become absorbed, and exercise their characteristic effects, especially on voluntary and involuntary muscular tissues. They act on the unstripped muscular fibres of the arterial and capillary vessels, increasing the strength and firmness of the pulse, and on the same textures in the mucous membranes and glands, decreasing secretion, and often promoting digestion and improving general health. In producing these effects, astringents bear a close resemblance to tonics, and, in practice, may often be substituted for them, or combined with them. The most marked differenee between them probably eonsists in the aetion of astringents being preeeded by, and resulting from, a purely ehemieal effeet. The same substanees must, however, be frequently ineluded in both elasses.

In veterinary praetice astringents are used internally for arresting exeessive mueous secretion, especially when depending on defective tone; and for eounteraeting relaxed states of the digestive organs, with the morbid eonditions dependent on sueh relaxation. Their external uses are more numerous and important. They are applied to eounteraet relaxation and excessive seeretion both of serum and pus; to suppress pale flabby granulations; to hasten the formation of healthy eicatrices; to diminish the volume of protruded organs, in order to facilitate their return, as in cases of protrusion of the reetum or uterus; to eoagulate blood, and as styptics to stop the mouths of bleeding vessels; and to constringe the vessels of a part, and thus to remove inflammation—a mode of treatment specially applieable to slight eontusions, conjunctivitis, and other cases of eireumseribed and superfieial inflammation. The internal use of astringents should be avoided in serious and extensive inflammation and fever, and in undue irritability of the alimentary eanal. Their loeal applieation is usually eontra-indieated where the parts are abnormally hard or dry.

EMOLLIENTS.

Emollients (*mollio*, I soften) are somewhat analogous to demulcents; but in addition to the various substanees already mentioned as belonging to that elass, they include poultices, fomentations, moistened lint, and spongio-piline. On aceount of their physieal or meehanical action, they soften and swell the parts to which they are applied; and in virtue of their vital action soothe and relax them. Their effeets are diametrieally opposed to those of astringent tonics. They are serviceable in the earlier stages of inflammation for effecting resolution; in the more advanced stages for promoting suppuration; and in all stages for relieving the outward symptoms of heat, tension, and pain. They are much used for softening and cleansing wounds, but should never be applied to those which are likely to heal by adhesion or first intention.

REFRIGERANTS.

Refrigerants (*frigeo*, I am cold) reduce or moderate the excessive temperature of those parts of the body with which they come into actual contact. They are much used for the removal of superficial inflammation, especially in parts of low organization, and where the suppurative action is to be repressed. Cold air and cold water are amongst the best refrigerants that can be used; but the fact that all solid substances, in becoming fluid, absorb heat, suggests the expediency of dissolving in the water, immediately before application, some saline matters, as common salt and nitre, or common salt and nitrate of ammonia. Alcoholic, etherous, and other volatile fluids are also employed as cooling lotions, and are effectual on account of their abstracting heat during evaporation. Some refrigerants, especially saline ones, when given internally during fever and inflammation, are often useful in relieving thirst, and in some inexplicable manner expediting recovery; yet, as has been already mentioned (p. 24), there is no sufficient evidence of their reducing the general temperature. They appear to exert their characteristic effect only when topically applied.

The continuous application of cold, or *congelation*, as it is technically termed, is of the greatest service in controlling and subduing local inflammations. The most convenient mode of application is by ice broken small, and mixed with about half its weight of salt, the mixture being applied either in a gauze bag or a thin metallic vessel. A slight effect may be attained by immersing a piece of metal in the freezing mixture, and applying it to the part. Such treatment is of especial value in sprained tendons, open joints, chronic rheumatism, simple and deep-seated ophthalmia, and phrenitis, and also in relieving the irritation of ulcerating and other wounds. So entire is the removal of sensation, that abscesses have been opened, and other minor operations performed, without pain. The skin shortly beeomes bloodless, the subjaeent parts tense, firm, and numbed, eongestion disappears, and the inflamed struetures reeover their tone. The applieation, repeated several times daily, may be eontinued for ten or twenty minutes, and, to avoid undue reaetion, eold water should for some time after be applied to the parts. In the human subjeet eongelation has been sueeessfully used by Dr Arnott for the eure of erysipelas and other skin diseases; and in these and other eases it might, with great advantage, be used more extensively in veterinary praetiee.

SEDATIVES.

Sedatives (*sedo*, I ealm, or allay) depress nervous foree. They inelude blood-letting, aeonite, prussie aeid, tartar emetie, and digitalis. Applied to the mueous surfaees, to the skin, or to wounds, they find entranee into the blood, are eonveyed by it to the spinal eord and nervous eentres, derange and subdue the aetion of these parts, and eonsequently depress the funetions of most of the vital organs, espeeially redueing the foree and frequeney of the pulse, deereasing the number of the respirations, and often eausing nausea and general exhaustion. They are more uneertain in their effects than most other kinds of medieines, and more apt to be affeeted by modifying eireumstanees. They are exaetly opposed to stimulants; and although they bear some resemblanee to nareoties, they differ from them in eausing no preliminary exeitation and no direet effeet on the intelleetual parts of the brain. In exeessive doses most of them are dangerous poisons, usually destroying life by syneope or arrestment of the action of the heart. They are ehiefly useful in redueing or eontrolling inordinate or irregular action of the heart, as in febrile attaeks and inflammation of the lungs, intestines, and other important organs; and in subduing some spasmodie affeetions. For the horse the sedatives most to be relied on are ten drops of Fleming's tineture of aeonite, or a seruple of ealomel and a draehm of opium repeated every two hours, until the pulse beeomes more natural, or six or eight doses have been given. For eattle the same medicines are effectual in somewhat larger doses. For dogs and pigs there is a larger choice of reliable sedatives, and any of the following formulæ will prove serviceable :—Fifteen to twenty grains of Dover's powder ; two grains tartar emetic, and five grains of nitre ; two grains each of calomel and opium ; two drops of tincture of aconite ; or one grain of calomel, with a drachm each of mindererous spirit and tincture of arnica. Perhaps no remedies are so frequently abused as sedatives. They are often erroneously administered in cases of inflammation long after the acute stage, in which alone they are useful, has passed away ; and also very often in cases of weakness and irritability, where the small rapid pulse indicates the necessity of tonics and stimulants, rather than depletives or sedatives.

Sedatives vary considerably in their special effects, and their applicability for particular purposes. Aconite induces very rapid and general depression, is the most certain and effectual sedative for horses, cattle, and sheep, and possesses a curious local anæsthetic influence, which renders it useful as an anodyne in rheumatism and neuralgia. Hemlock, and its alkaloid conia, induce a series of symptoms allied to those produced by aconite, reduce the action of the heart, allay nervous irritablility, and, in large doses, develop swift-spreading paralysis of the motor nerves exactly antagonistic to the stimulating effects of strychnia. The woorara or ŭrari poison of Guiana, also destroys life by inducing general paralysis. The ordeal bean of Calabar resembles in many respects hemlock and woorara, and, like them, appears to derange and depress the functions of the spinal cord, and, according to Mr Nunneley, of the ganglia and nerves of the sympathetic system as well. It induces nausea and retching, discharge of saliva and tears, general muscular paralysis, and, in poisonous doses, destroys life, from the paralysis involving the muscles of respiration, and perhaps more especially those of the heart itself. It interferes little with consciousness, the special senses, or volition. Dr Frazer, who has diligently investigated the subject, has found it useful in rheumatic fever, bronchitis, delirium tremens, and tetanus. At present, however, it is chiefly valuable on account of its producing, when applied within the eyelids, rapid contraction of the pupil, an action diametrically opposed to that of belladonna and its alkaloid atropia, and likely to be of service in serious inflammation of the eye, by shutting out the undue stimulus of light, and by moving the iris, and thus preventing or breaking down adhesions. Like aconite, it will probably be also found useful when locally applied for the relief of rheumatic inflammation of joints, and of neuralgic pains. Hydrocyanic or prussic acid, in large doses, causes convulsions and fatal sinking; and in medicinal doses, acts more especially upon the vagus nerve, quieting cough and irritation of the stomach. Creasote somewhat resembles prussic acid in its anodyne uses, but besides, stimulates the mucous membranes, and thus shows some relationship with turpentine. Antimony, ipecacuan, and digitalis, are believed to derange or destroy the functions of the vagus nerve; in medicinal doses, especially in men and dogs, they produce nausea, with notable depression of the action of the heart, and act, besides, as eliminatives on the organs by which they are excreted from the system, antimony and ipecacuan proving diaphoretic, and digitalis diuretic.

Blood-letting is the most prompt and powerful of sedative remedies, but is also on that account the one most liable to abuse. It is chiefly serviceable in the earlier stages of acute inflammation of the lungs, pleura, brain, and feet, and in apoplectic affections—in fact, wherever there is high fever, with a tense, firm, incompressible pulse, or a full, slow, indistinct pulse. It lessens the quantity of the blood, reducing especially the proportion of the red globules, and by diminishing vascular tension, it weakens the force of the circulation. Hence it stays the progress of acute inflammation, favours absorption, and thus renders the system more amenable to subsequent treatment. In all cases where the operation is called for, either in horses or cattle, blood may generally be taken to the extent of five or six quarts. The exact quantity must, however, depend entirely upon the circumstances of the case; and blood should flow freely until its abstraction has made a decided effect upon the volume and strength of the pulse, or until the patient shows the earliest symptoms of nausea. Blood should be drawn rapidly from a large opening, as its effects are thus produced more rapidly and decidedly, and with less expenditure of the vital fluids. The jugular vein on either side is usually selected for the operation, and is safer and more convenient than any other vessel. Bleeding from arteries is more troublesome, and not more effectual than from veins. Topical blood-letting is rarely practised amongst the lower animals; but in cases of weed and acute founder, many successful practitioners still prefer to draw blood by carefully paring away the crust at the toe, laying open the minute vessels and immersing the foot in hot water or a warm poultice. Except in expert professional hands, fleams are much safer than the lancet, which occasionally in restive horses makes an ugly gash. If practicable, the horse should be bled with his head erect; for in this position the nauseating effects, which show that no more blood can be spared, are most noticeable. It is not very safe to bleed a horse when he is down, and never, in any case, to the extent of causing fainting. When enough blood has been taken, the edges of the wound must be brought accurately together, and secured by a pin, round which must be wound some thread, tow, or hair. Although blood-letting is assuredly the best remedy in the early stages of acute inflammation in vigorous animals, it must not be applied in all cases or in all stages of inflammation. It is always injurious in young weakly subjects, in the later stages of disease, in epizootic affections and eruptive fevers, and, indeed, whenever the pulse is small, quick, and weak. A horse or cow should never be bled if the pulse numbers seventy or upwards, for a quick pulse indicates weakness; and bleeding in all such cases increases exudation and effusion, instead of preventing them, whilst it unnecessarily debilitates the patient, retarding his recovery, and diminishing his capacity of coping with and throwing off the disease. In dogs blood-letting is rarely advisable. In all animals the finger should, during bleeding, be placed upon the pulse, so as to note the changes in the force and frequency of the circulation; and if, whilst the blood flows, the pulse gets quicker and weaker, and begins to flutter, be assured the treatment is erroneous: at once take away the blood-can, pin up the wound, and beware of prosecuting further the sedative treatment. Such a mischance should, however, never happen; for whenever there is the least question as to the propriety of blood-letting, give the animal the benefit of the doubt, and avoid a remedy, of which the reducing effects are so serious, and so slowly repaired.

NARCOTICS.

Narcotics (νάρκωσις, *narkōsis*, a benumbing) are mostly soothing and stupefying remedies. They are very accurately defined by Professor Headland as "medicines which pass from the blood to the nerves or nervous centres, which act so as first to exalt nervous force, and then to depress it; and have also a special action on the intellectual part of the brain." They include such medicines as opium, Indian hemp, belladonna, hyoscyamus, camphor, and tobacco. In large doses, they induce depression, preceded by comparatively little excitation, and usually cause death by coma. In small doses, however, they produce very obvious excitation; and those which chiefly exhibit this effect, as opium, Indian hemp, and tobacco, form the connecting links, as it were, between narcotics and stimulants, such as alcohol and ether. In these latter, however, the primary stimulation is much greater and of longer continuance than the secondary depression, whilst exactly the reverse obtains in the case of narcotics. Some narcotics, as belladonna and hyoscyamus, closely resemble sedatives, being preceded by but slight excitation, and having little action on the functions of the brain proper.

Among horses and cattle, narcotics require to be given in unusually large doses, and at best act far less certainly and perfectly than in the human subject or the dog. During the preliminary stage of excitation among animals, they appear to exalt chiefly the functions of the spinal cord, causing spasms and convulsions; whilst in the same stage in man they act more particularly on the mental powers, on the special senses, and on volition and sensation. During the succeeding stage of depression, drowsiness and stupor are also less obvious in the lower animals than in man; and death is more apt to occur from apnœa or syncope than from coma.

Narcotics are given to relieve inordinate nervous action. They are specially serviceable in removing the spasms of colic and chorea; in alleviating the irritability of chronic coughs, bronchitis, tetanus, gastrodynia, and chronic vomiting in dogs, diarrhœa and dysentery; and in blunting the pain of severe wounds, rheumatism, pleurisy, and other acute inflammations. When thus used for the relief of pain, they are usually termed *anodynes*; and when they cause sleep, *hypnotics*. To ensure their full effect, they should be given at intervals of every one or two hours; and since their effects are apt to diminish with their continued use, they should be administered in gradually augmented doses.

ANÆSTHETICS.

Anæsthetics (*α*, *a*, privative; and *αἴσθησις*, *aisthêsis*, sensation) are agents which produce insensibility to external impressions and to pain. They might be considered merely as a subdivision of narcotics, which they resemble in general action. As, however, they possess a peculiar distinctive power of extinguishing sensation, I shall briefly consider them under a separate paragraph.

In an excellent paper on anæsthesia and anæsthetic agents in the British and Foreign Medico-Chirurgical Review, Vol. IX., anæsthetics are classified as follows:—

1. Protoxide of azote, NO.
2. Carbonic oxide, CO; carbonic acid, CO_2.
3. Light carburetted hydrogen, CH_2; olefiant gas, $C_2\ H_2$; coal gas.
4. Ethyle series:—Alcohol, $C_4\ H_5\ O + HO$; ether or sulphuric ether, $C_4\ H_5\ O$; nitric ether, $C_4\ H_5\ O + NO_5$; acetic ether, $C_4\ H_5\ O + C_4\ H_3\ O_3$; hydrochloric ether, $C_4\ H_5\ Cl.$; hydrobromic ether, $C_4\ H_5\ Br.$; hydriodic ether, $C_4\ H_5\ I$; formic ether, $C_4\ H_5\ O + C_2\ H\ O_3$.
5. Acetyle series:—Aldehyde, $C_4\ H_3\ O + HO$; Dutch liquid,

$C_4 H_3 Cl. + Cl. H$; and doubtless the corresponding iodide and bromide.

6. Formyle series:—Chloroform, $C_2 H Cl._3$; bromoform, $C_2 H. Br._3$; iodoform, $C_2 H I_3$.

7. Compounds of methyle:—Pyroxylic spirit, or wood naphtha, $C_2 H_3 O + HO$; rock naphtha; coal naphtha; methylal, $C_2 H_2 O_2 + 2C_2 H_3 O$.

8. Turpentine, $C_{10} H_8$; benzoyle, $C_{14} H_5 O_2$; camphor, $C_{10} H_8 O$; creasote, $C_{16} H_{10} O_2$; amylene or valeryle, $C_{10} H_{10}$.

9. Bisulphuret of carbon, $C S_2$; acetone, $C_3 H_3 O$.

10. False anæsthetics, as sulphuretted hydrogen, prussic acid, coneine, etc.

11. Mixed bodies, as oleum ethereum, chloric ether, etc.

It is impossible at present to do more than advert very briefly to the most important of these. Mr Nunneley, who has made many careful and valuable observations on anæsthetics, considers nitrous oxide unsafe and uncertain. The substances of the second class, though extinguishing sensibility, are too poisonous to be of any practical value as anæsthetics. Light carburetted hydrogen is very feebly anæsthetic; olefiant gas is more powerful, though not very safe; but coal gas appears both safe and effectual, and in some experiments on horses, made a few years ago at the Edinburgh Veterinary College, it acted almost as well as chloroform, leaving, however, considerable nausea and depression. None of the ethers are so good as the sulphuric, to which we shall afterwards advert. Aldehyde is tolerably active, but objectionable on account of its irritant properties.[1] There seems much difference of opinion regarding the Dutch liquid. Mr Nunneley's experiments on animals lead to the inference that it is as effectual as chloroform; but Professor Simpson and Dr Snow regard it as a deleterious preparation. It is not likely, however, to come into common use, as it is very costly, and apt, when long inhaled, to leave much nausea. Among the bodies of the formyle series, none are equal to chloroform, which is, indeed, the best of all known anæsthetics, and will afterwards

[1] Anæsthesia in Surgery and Midwifery, by Professor Simpson. Philadelphia, 1849. P. 211.

be fully noticed in its proper place. Pyroxylic spirit is very feebly anæsthetic, resembling alcohol in this as in its other properties. Coal naphtha, also called Tennant's anæsthetic liquid, is much more effectual, and, besides being safe and manageable, is, I think, superior to all other anæsthetics except chloroform, and probably ether. Turpentine, and the other bodies associated with it, "possess the feeblest anæsthetic powers, or these are accompanied with such irritant qualities as render their use quite inadmissible." [1] Bisulphuret of carbon, though tolerably active, is very disagreeable to inhale, and not always very safe.[2] Acetone is unfit for use, on account of its acrid and irritating properties. The so-called false anæsthetics destroy sensibility only when they are given in poisonous doses. Some years ago the late Dr Snow attempted the substitution of amylene for chloroform, but only with indifferent success, as it has a very disagreeable odour, and is fully more expensive than chloroform. In 1861, kerosolene, a product of the destructive distillation of coal, was used in America. Four ounces are stated to have been inhaled with impunity, and patients kept for half an hour under its influence, which is recorded to be promptly produced, safe, and unaccompanied by any unpleasant results.[3]

Although the first employment of any of these substances in general practice is only of very recent date, still the possibility of inducing anæsthesia seems to have been thought of at a very early period. Mandrakes are spoken of by Dioscorides as having been used in his time for causing insensibility to pain. As early as the third century the Chinese are said to have used a preparation of hemp to induce anæsthesia during surgical operations; and, about the end of the seventeenth century, Augustus II., king of Poland, underwent an operation, which, on account of the use of some secret agent, is said to have been unaccompanied by pain.[4] In the beginning of the present century, Sir Humphry Davy proposed nitrous oxide as a means of causing insensibility.

[1] British and Foreign Medico-Chirurgical Review, Vol. IX., art. cit., p. 182.
[2] Anæsthesia in Surgery and Midwifery, by Professor Simpson, pp. 211–13.
[3] American Medical Times and Pharmaceutical Journal for October 1861.
[4] British and Foreign Medico-Chirurgical Review, Vol. IX., art. cit., p. 149.

About 1831, ether was known to have the power of causing insensibility among the lower animals, and relieving asthma in the human subject. It was first used to produce anæsthesia in man in America, on the 30th September 1846, by a Mr Morton, in the extraction of a tooth, and shortly afterwards became general in all kinds of surgical operations. On this side the Atlantic, it was first used in London on the 19th December by a dentist, and on the 21st by the celebrated Liston. In the succeeding February, it was first applied in midwifery by Professor Simpson of Edinburgh. Before, however, another year had elapsed, that gentleman had discovered another anæsthetic, more potent, safe, and convenient than any hitherto tried—this was chloroform. It had been previously known for some time as a chemical curiosity, and some of its effects on the lower animals had been observed by Dr Mortimer Glover in 1842, and by Flourens in March 1847. But its power of producing anæsthesia in man was first discovered on the night of the 4th November 1847, by Professor Simpson, in an experiment made with a small quantity on himself and some friends.[1] Since that date, its employment has spread over all parts of the habitable globe—it has relieved the sufferings of many thousands, and has saved the lives of hundreds, probably of more than ever have been saved by any single remedy, however ancient or valuable. Since the discovery of chloroform, many other anæsthetics have been tried, but none of them have come into general use.

The symptoms of anæsthesia in the lower animals do not materially differ from those in man. Indeed, Dr Marshall Hall thinks that their effects are more perfect in the lower animals. In the first stage, salivation and coughing often occur, the respirations are deep and somewhat hurried, the pulse quickened, the surface-heat raised, and the limbs moved about irregularly. During this stage in man, peculiar sensations and sounds are perceived, and incoherent expressions are uttered. In all animals, extreme slowness of the pulse, general insensibility, and muscular relaxation, gradually supervene. If the use of the anæsthetic be still continued, the breathing becomes stertorous, the pulse slow

[1] Miller's Principles of Surgery, Second Edition, pp. 757, 758.

and weak; and unless the inhalation be immediately stopped, death soon results. Irregular, and even untoward effects, sometimes take place, with certain anæsthetics, and in some subjects. Vomiting, and subsequently diarrhœa, convulsions, and relaxation of the various sphincters, are occasionally observed. In young animals the effect is usually very prompt and powerful, and sometimes accompanied by dangerous depression of the action of the heart. In dogs there is sometimes whining, as if the animal were uneasy or suffering pain; and in all animals there is apt, even during the full action of the agent, to be a quivering of the muscles, which renders the performance of delicate operations somewhat difficult. The effect varies in duration according to circumstances, but may be maintained for a very long time with perfect safety. Both in man and the lower animals, it has been kept up for many hours continuously. The degree of anæsthesia which it is advisable to produce, necessarily varies much in different circumstances. When a painful operation is to be performed, the agent should be given until the patient is quite unconscious and insensible, and a local anæsthetic effect if possible also obtained; but where merely relief of pain or of irritation is sought, a much less degree of effect is sufficient.

Anæsthetics appear to produce their effects in a tolerably regular order, in consequence of the different parts of the nervous system being progressively affected. At first there is exalted and perverted action of the intellectual faculties, the special senses, and volition, depending on a disturbed and excited state of the cerebrum and cerebellum. But the functions of these parts speedily become depressed, giving rise to drowsiness and suspension of special sense and motive power. After some time the functions of the thalami optici, and other sensory ganglia, and to some extent those of the spinal chord, are paralyzed, and the extinction of common sensation thereby induced. Thus far anæsthesia may be carried with safety and with decided advantage where insensibility to severe pain is required; but if it be still prolonged, the functions of the medulla oblongata become so much impaired that respiration ceases, and the action of the heart is also in consequence soon arrested. Death appears to depend on arrestment of the pulmonary circulation or of the action of the heart. The *post-mortem* appearances closely resemble those of drowning. The lungs and other parts of the pulmonary apparatus are much congested, the right side of the heart is filled with imperfectly purified blood, and the membranes of the brain are generally vascular.

The most certain, rapid, and safe way of administering anæsthetics is by inhalation. The chief precaution necessary is to secure their being mixed with a sufficiency of air; for, if breathed alone, they speedily cause asphyxia. Where they have produced an undue effect, the best restoratives are plenty of fresh air, stimulating clysters, pricking the throat with needles, especially over the track of the phrenic nerve, relieving the congestion of the right side of heart by a moderate bleeding from the jugular vein, and diligently persevering with artificial respiration. Until partial recovery takes place, the patient is unable to swallow, and hence any attempt to administer stimulants is dangerous. When injected into the rectum, the effects of anæsthetics are preceded by an inconvenient amount of excitement, are longer continued, and more difficult to subdue. This mode of administration appears, however, peculiarly suitable in irritable, spasmodic, or painful diseases of the intestinal or urinary organs. Local anæsthetics will probably become more used for all classes of patients. Lint saturated with chloroform, and its rapid evaporation prevented by a piece of oiled silk or gutta percha cloth, and the like application of tincture of aconite, also readily induce local insensibility. By the process of congelation (see page 55) it is possible, with a mixture of ice and salt, or other freezing mixture, greatly to reduce, if not entirely to remove, the sensation of any part, and thus, without pain, to remove superficial tumours, open abscesses, or perform such other operations. A thin flat piece of metal placed for a few minutes in a freezing mixture, and then firmly pressed upon the skin, also greatly dulls sensation.

It is difficult to explain the *modus operandi* of anæsthetics. They all of them enter the blood, and have a most remarkable power of penetrating the tissues. Some authorities consider that they add carbon to the blood; others, that they saturate it with chlorine, or some such substance, which robs it of its vitalizing oxygen; whilst others, again, believe that the anæsthetic vapours act caustically on the cell-walls of the blood corpuscles, shrivelling them up, and thus preventing the endosmose of oxygen. Whether this be the true explanation or no, the conversion of venous into arterial blood is certainly retarded during anæsthesia, and the vitiated blood appears inadequate properly to stimulate the nervous system. Hence the arrested sensibility and other well-marked symptoms. The anæsthethic state, though somewhat analogous to that of alcoholic intoxication, differs from it in many essential particulars. With alcohol, the disorder of the mental functions is always very great as compared with the slight loss of sensibility; and the effect is more decidedly marked when the agent is introduced into the stomach rather than into the lungs. Exactly the reverse obtains in the case of anæsthetics.

Anæsthetics are less used in surgical and other painful operations in the lower animals than in man, on account of the larger quantities required, the difficulty of administration, and the undue prolongation of the preliminary stage of excitement. They have been used in parturition, and afford, as in the human subject, immunity from pain, but without apparent interference with the force or frequency of the involuntary contractions of the uterus. Where the neck of the uterus in cows or ewes arrived at the full term of gestation, continues spasmodically closed in spite of regular labour pains, and where all manual efforts to expand the passages have been vainly persevered with for several hours, anæsthetics often prove very serviceable. They have further been used for relieving the irritability and pain of such diseases as peritonitis, pleurisy, and pneumonia; for obviating the spasms of tetanus, colic, and asthma; and for alleviating, by local application, the irritability of severe wounds. For all such purposes their use might, with advantage, be extended.

IV.—THE CIRCUMSTANCES WHICH MODIFY THE ACTIONS OF MEDICINES.

The actions of medicines are modified both in nature and degree by many circumstances. Of these modifying influences, some are dependent on the medicine itself, as its quantity, quality, and form of administration; and others dependent upon the species and age of the patient, and the channel by which he receives the medicine. To some of these modifying conditions we shall now briefly advert.

Quantity.—Variations in the quantity of the medicine, or, as it is technically called, the *dose*, evidently alter the degree, and occasionally, also, the kind of action. Small doses of turpentine cause diuresis; somewhat larger doses have a general stimulant effect; while those which are still larger act chiefly on the bowels. Small doses of most salts of potash, soda, and magnesia, are alterative and diuretic, while larger quantities are purgative. Aloes, in small quantity, is tonic, and in large, purgative. Alcohol, opium, and many other substances, afford striking examples of medicines in which a variation in dose produces a difference in the nature of the effect. An increase of the time during which the medicine is applied is generally equivalent, in the case of topical remedies, to an increase of dose, as with mustard, cantharides, and nitric acid. Where a uniform and continued effect is required, as in the case of tonics and stimulants, frequent small doses are greatly preferable to larger doses given at longer intervals. That the effects of medicines begin and terminate with their administration, may be regarded as a general rule,—subject, however, to occasional exceptions. Lead, mercury, and digitalis, for example, are often given for some time without any obvious result, but afterwards produce their effects suddenly and violently, as if from the combined or accumulated action of a series of doses, and frequently continue them for some time after the administration of the remedy has ceased. Medicines exhibiting these phenomena are said to be *cumulative* in their action.

Quality.—The quality of medicines must obviously affect their actions. Medicines that are impure, adulterated, or badly kept, cannot be expected to have such certain and powerful effects as those which are pure, carefully prepared, and well preserved. To protect medical men and the public against the falsification of drugs, the pharmacopœias, especially that of Edinburgh, have introduced a series of tests, by which the purity of all the simple substances in the Materia Medica may be ascertained.

Form of Administration.—The form in which a medicine is administered often modifies its effects. Thus, a state of fine division, by facilitating absorption, materially expedites and increases the action of medicines, which consequently present a variable and decreasing activity, according as they are given in the gaseous, fluid, or solid forms. Chemical combination, by altering the solubility of a medicine, frequently causes a variation in the degree of its action. It impairs, and often entirely neutralizes, the activity of medicines, which, like the mineral acids and alkalies, have only topical effects; whilst it alters but slightly those which become absorbed and exercise a more general action. Thus the combination of morphia, quinine, or oxides of lead, iron, or copper, with different acids, does not sensibly affect the action of these bases, or at most modifies only the degree of their action by increasing or diminishing their solubility.

Most vegetable substances are liable to be modified by soil, climate, cultivation, and many other circumstances. Such modifying influences will, however, be more conveniently noticed when discussing those medicines which they specially affect. Medicinal plants are usually most active when indigenous; but the opium-poppy, liquorice, and tobacco, are notable exceptions to this rule. Wild specimens are sometimes superior to cultivated ones, and should generally be preferred until the other be proved of equal efficacy. Selection should be made of vigorous, well-formed, dark-coloured, but not excessively luxuriant plants, growing on dry soils, and exposed to air, light, and sunshine, except in the case of plants which naturally seek situations of an opposite kind.

Species of Patient.—The different classes of veterinary patients are very differently affected by many medicines. A few grains of tartar emetic cause almost immediate vomiting in dogs, whereas the same medicine, even when given in doses of several ounces, has scarcely any physiological effect on horses or cattle. Aloes, the most uniform and convenient purgative for horses, is uncertain and irregular in its action on cattle, but purges dogs in doses of nearly a drachm, or eight times as much as is given to a man. Opium, strychnia, and ether also afford good illustrations of the different effects which the same medicine has on different classes of animals. In the present state of our knowledge, some of these anomalies cannot be very satisfactorily accounted for, but most of them depend on differences of organization and habit; and to a few of these we shall now briefly advert.

In the horse, the alimentary canal is very extensive, highly vascular, and abundantly supplied with nerves—provisions which, while they ensure the thorough absorption of nútriment from bulky and comparatively innutritious food, render the animal peculiarly liable to superpurgation, and unusually apt to suffer from inflammation of the bowels. In the horse, vegetable purgatives appear more suitable than mineral ones, and act chiefly on the large intestines, and only slightly on the stomach and small intestines. Except in disease, and under the influence of aconite and some few other poisons, horses never vomit; the act of vomition being prevented in them by the inaptitude of the vagus nerve to receive and convey the special irritation, the smallness of the stomach, its distance from the diaphragm and abdominal muscles, and the consequent difficulty with which it can be compressed betwixt the two. Most substances which act as emetics for men and dogs, produce a sedative effect when given to horses in sufficient doses. Sudorifics are less active and less useful than in man, and are very apt to act on the kidneys, unless the animal be well clothed. Opium and other narcotics operate less powerfully on horses, and, indeed, on all the lower animals, than on man.

The peculiarities of the action of medicines in cattle are chiefly referable to the construction of their alimentary canal, and to their phlegmatic temperaments. In these ruminants, the stomach is quadrisected, is much less vascular than in most other animals, is chiefly covered with cuticular mucous membrane, and (as regards its three first divisions) is almost mechanical in its action. The first and third compartments of the stomach always contain food, often in large quantity. These facts explain why cattle require such large doses of all medicines, why irritant and corrosive poisons can be given them with impunity, even in very considerable quantities, and why purgatives, unless in large doses and in solution, are so tardy and uncertain in their effects. Their kidneys and skin are somewhat less easily acted on than the corresponding organs in the horse; and their dull and phlegmatic disposition resists the action both of stimulants and tonics. It is a very prevalent notion, that medicines, when poured very slowly down a cow's throat, pass like the ruminated food direct to the fourth stomach. From a number of observations made at the slaughter-houses on both cattle and sheep, I find, however, that we cannot induce either animal to exert this voluntary effort in behalf of our medicines, which in all cases, no matter how slowly soever they be given, fall into the first and second stomachs, whence they shortly pass onwards through the third and fourth stomachs, especially if given, as they always ought to be, with a large quantity of fluid. Sheep closely resemble cattle in the way in which they are affected by most medicines; they usually require about one-fourth of the dose suitable for cattle; and are best drenched by being backed into a corner, and the head steadied between the operator's knees, whilst the medicine is cautiously poured over.

Medicines generally operate on dogs much in the same way as on man; but there are some remarkable exceptions to this rule. Dogs, for instance, take six or eight times the dose of aloes usually given to the human subject, but would be seriously injured by half as much calomel or oil of turpentine as are usually prescribed for a man. The opinion generally held, that medicines may be given to dogs in the same doses as to men, cannot therefore be safely entertained without a good many reservations. In dogs, the alimentary canal is short and straight; and purgatives consequently act with greater rapidity than in any other veterinary patients. Another peculiarity is the facility with which they can be made to vomit. Indeed, vomition in dogs is often naturally produced by their eating various sorts of grass, by their swallowing nauseous or unpalatable matters, or overloading the stomach. To prevent dogs vomiting their medicine, it is well to keep the head raised for an hour after its administration; and this may be easily effected by attaching a chain or cord to the collar, and fixing it to any object at the requisite elevation. The kidneys are excited with more difficulty than in horses or cattle, and diaphoresis can scarcely be said to occur at all—the skin not being adapted for cutaneous transpiration. The effects of medicines on pigs are somewhat similar to their action on men and dogs, but the practitioner is seldom required to prescribe for these animals.

Age.—The properties of medicines are modified, especially in degree, by the age of the animal. As a general rule, the younger the animal the more easily is it affected. Some authors have constructed tables showing the doses suitable for animals of different ages. Thus Bourgclât estimates that a one-year old colt requires one-third of the quantity of any medicine given to an adult horse; a two-year old, one-half; and a three-year old, two-thirds. A similar ratio is applicable to cattle. Such calculations are, however, merely approximative.

Size.—The size of the patient must obviously affect the action of all remedies, but the regulation of this modifying circumstance must be left to the judgment of the practitioner. In this work, the doses mentioned under the head of each substance are, unless otherwise stated, those suitable for adult animals of medium size.

Mode of Exhibition.—The channel by which medicines enter the body frequently modifies the degree of their action, for different organs and tissues vary much in their powers both of absorption and decomposition. Medicines are readily absorbed from the mucous and serous surfaces, from cellular tissue, and from wounds. They have also sometimes been injected into the veins, when they act with remarkable rapidity and effect; but this method of exhibition is attended with too much trouble and risk to be of much practical utility. When given by the mouth, most medicines are taken up from the surfaces of the stomach and first part of the small intestine,—parts which afford great facilities for speedy and complete absorption, and are, moreover, very sensitive, and intimately connected, both by vessels and nerves, with all the important organs in the body. The surface of the rectum is less sensitive and vascular than that of the stomach, and hence most medicines may be given *per ano* in doses two or three times as large as those administered by the mouth. The pulmonary mucous membrane is very actively absorbent, and well adapted for conveying medicines into the system. This method of administration, now in everyday use with such substances as chloroform and ether, might probably be advantageously extended to many active non-volatile medicines, which could be introduced into the lungs along with the vapour of water or of other fluids. Such a plan would be of great practical value; for medicines so introduced into the body, being speedily brought in a finely divided state into immediate contact with the blood, act with great rapidity and certainty. In most animals, the skin is capable of absorbing many medicinal substances. Thus, solutions of opium, tobacco, and corrosive sublimate, when ignorantly or carelessly applied for the cure of skin diseases or such other purposes, frequently become absorbed, and hence develop their poisonous action. Absorption is, however, greatly facilitated by removing the cuticle, by means of a small blister, and applying the medicine directly to the true skin. This constitutes the *endermic* method of exhibition, and has been tried with quinine, strychnia, morphia, and other expensive medicines, which, when so used, are said to operate with great certainty, and in unusually small doses. By the subcutaneous injection of these concentrated medicines similar advantages are also obtained; but these ingenious methods of administration have hitherto been little practised amongst the lower animals.

Habit.—The continued use of a medicine alters the degree of its action, and affects organic rather than inorganic medicines. Arsenic is, however, a notable example of an inorganic medicine, of which both men and animals become wonderfully tolerant by use. Thus, arsenic-eaters sometimes use with perfect impunity twelve or fifteen grains daily,—a quantity sufficient to poison three or four persons unaccustomed to the poison. A like tolerance is observable amongst horses which have been accustomed to receive arsenic. Opium, and most general stimulants, when administered for some time, gradually lose their effects; while caustics and irritants, which exercise only a topical action, exhibit, on their repeated application, a gradually increasing activity.

Idiosyncracies, which in the human subject render some poisons almost innocuous, and some simple medicines deadly poisons, are much less frequent and notable among the lower animals. Those of most frequent occurrence among veterinary patients, are either an increased or a diminished susceptibility to the action of purgatives and diuretics. Most medicines act with greater certainty and effect upon well-bred animals, whether amongst horses or dogs, than upon coarsely-bred mongrels.

Diseases.—The existence of disease alters the susceptibility of the system to the action of many medicines. Influenza, low fevers, and most extensive inflammations of mucous or cutaneous surfaces, withstand antiphlogistics badly, and require for their successful treatment the early exhibition of unusually large doses of tonics and stimulants. Copious blood-letting and large doses of sedative medicines induce less depression in inflammatory fevers than in health; immense quantities of opium have scarcely any effect in tetanus, hydrophobia, or enteritis; and excessive doses, both of purgatives and stimulants, are tolerated in the apoplectic form of puerperal fever among cattle, and in all other cases in which there is depression of nervous force.

External Circumstances.—The circumstances in which patients are placed, have often a material influence in altering the actions of medicines. Thus, it is notorious that diseases, whether in horses, cattle, or dogs, when occurring in large towns, and in filthy, overcrowded, and badly ventilated houses, are unusually unmanageable, are particularly apt to assume chronic, typhoid, and untoward forms, and are especially difficult of treatment. Owing to the altered and perverted state of the vital functions, induced by continuous disregard of the laws of health, medicines in such cases act very slowly and imperfectly, and will operate effectually only when used conjointly with improved sanitary arrangements. Inflammatory disorders usually bear more prompt and actively depleting treatment in winter than summer.

SECTION II.

ON VETERINARY PHARMACY.

In the present section I shall briefly notice the more important pharmaceutical compounds used in veterinary practice, as powders, boluses, tinctures, extracts, etc., adverting chiefly to the best methods of making, preserving, and administering them. I shall conclude these general observations with a few remarks on weights and measures.

POWDERS.

Most medicines may be coarsely powdered in a common hand mill, such as that in ordinary use for grinding coffee or pepper, or in an iron mortar (which should be fixed into a block of wood), with a large, heavy iron pestle, which ought to be suspended from one end of a flexible rod running along the roof, and fixed into the opposite wall. When the powder is to be finely divided, it must be transferred to smaller mortars, which may be made of wood, marble, or wedgewood-ware. Those of the latter material are the most convenient, being cheap, easily kept clean, and little affected by acids. They should be kept of several different sizes. The most easy and expeditious way of reducing a substance to powder, is to put only a small quantity of it into the mortar at a time. When a fine state of division is required, the powder is sometimes put through a sieve, and the coarser particles returned to the mortar. The laboratory should always contain sieves of different sizes and degrees of fineness, some of wire-gauze, and others of horse-hair. For light pungent or irritant powders compound sieves are sometimes useful. They are merely common sieves entirely closed in with a lid both above and below. If it can be at all avoided, medicines, especially the more expensive vegetable preparations, should not be purchased in powder; for in that state they are very apt to contain adulterations and impurities, which are then, for the most part, unusually difficult of detection. Medicine is occasionally administered in the state of powder scattered over, or mixed with, the food; but this method of administration is only admissible in the case of very simple and tasteless remedies, and should not be relied on where a decided or speedy effect is desired.

BALLS—BOLUSES.

Balls correspond in veterinary practice with the pills used in human medicine. They are of a cylindrical form, and usually contain, besides the active ingredients, certain subordinate constituents, termed *excipients*, which are added to give the bolus cohesion and consistence. The most common excipients are linseed meal and water, oil, lard, soap, liquorice powder, treacle, syrup, glycerine, and conserve of roses. In the selection of suitable excipients, the choice must be determined entirely by the nature of the active ingredients. The first four excipients above mentioned are chiefly used when the bolus or mass is intended for immediate use; but when it is to be kept for any considerable time, some of the others are more suitable. In order to keep a mass long soft and moist, it is often advisable to add to it a small quantity of some diliquescent alkaline salt—as acetate of potash, which serves especially well for most diuretic masses. When the active principles are resinous, a little alcohol or oil of turpentine is a useful addition, as, for example, in making the aloetic mass. In preparing a ball mass, the various ingredients are sometimes mixed together in a mortar or on a slab; but the aid of heat is sometimes necessary, as when any of the materials are of a waxy or resinous nature. A good ball mass is often troublesome to make; for it must be soft, and yet possessed of a proper consistence and cohesion, must retain these properties although kept for a considerable time, and must further be so prepared that each dose shall make a properly sized ball. It should be preserved in jars covered with moistened bladder and stout paper, and should be made up into doses only as required; for when balls are long kept they are apt to get hard, and in this state act tardily and uncertainly, sometimes passing unchanged through the whole extent of the alimentary canal. For cleanliness and facility of administration, balls are given either rolled up in soft paper, or covered with a coating of gelatine, which is a very neat and convenient method of exhibition. For horses the bolus is the most common and convenient method of administration; and for dogs it is also often used. It is given to horses either with the balling iron or with the fingers; and the latter method is the better, except in animals with very small, narrow mouths, or in which the mouth cannot be sufficiently opened. The operation, with a little practice and dexterity, may be easily performed. The ball is held by one end between the thumb (which supports it below) and fingers of the right hand, which is drawn together and rounded as much as possible. The patient's tongue is gently drawn out a little way by the left hand, and the ball passed rapidly along the roof of the mouth, and dropped on the back of the tongue, which is at once let loose and the mouth closed.

DRAUGHTS—DRENCHES—DRINKS.

Drenches are usually extempore preparations. They are occasionally given to horses, especially when a speedy effect is desired, as in colic; are frequently prescribed for dogs; and are almost the only form in which physic is ever given to cattle or sheep. In these ruminants, medicines in the solid state act very tardily and imperfectly, for they get mixed up with the immense bulk of food always found in the rumen, and thus remain unabsorbed often for a long time. Some medicines, too, from prolonged contact with this mass of vegetable matter, probably undergo changes which materially interfere with their action. Medicine in a liquid form, however, comes immediately into intimate contact with a large absorbing surface of mucous membrane, and passes on more speedily towards the second and fourth stomachs. In preparing drenches, care must be taken that the different ingredients are not incompatible, decomposing or injuriously reacting on each other; and further, that their quantity be not too great, as the trouble of administration is thereby much increased. For dogs, from two to six ounces, according to the size of the animal, is an average amount; for horses, one or two pints; for sheep, from four to six ounces; but for cattle it is not so necessary to limit the proportion of fluid. In giving the medicine the head should be slightly raised, which in horses may be conveniently done with the aid of a twitch, the noose of which is placed over the animal's upper jaw within the incisor teeth, and the stick held by an assistant, standing on the left side of the patient. In cattle, the head should also be steadied by an assistant, who holds either the horns or ears; and in dogs, the jaws may be kept sufficiently apart by getting some one to put a loop of stout tape or string, or a towel folded repeatedly, over each jaw, and gently separating them, when the medicine may be readily poured over. Small dogs are most conveniently dosed when placed on their hind quarters on a table or bench; but larger dogs should be backed into a corner, and their head held between the operator's knees. In all animals, the nostrils must be left unobstructed, and the tongue loose, or only gently held down, so as to prevent its interfering with the medicine passing from the mouth of the bottle. Glass bottles are fragile, and when they break waste the medicine, and may besides injure the mouth of the patient or the hands of the operator. Veterinarians, and even agriculturists, should therefore have a few stout tin bottles of two sizes, capable of holding a pint and a quart, made either round or flat, for more convenient conveyance in the pocket, and closed by a screw at the nozzle. Drenches should always be carefully and slowly given; and if coughing occurs, the operation should be stopped, and the animal set free for a few minutes.

DECOCTIONS.

Decoctions are prepared by *boiling* solid substances, especially of vegetable origin, in water. To ensure perfect solution, the medicine should be bruised or cut into small pieces, and the fluid allowed to stand on it for some time; but excessive heat and prolonged boiling should be carefully guarded against. The insoluble parts are separated by filtering the mixture through bibulous or unsized paper, straining it through muslin or calico, or allowing it to settle, and then pouring off the supernatant fluid. When decoctions are to be kept for some time, they should have a little spirit added to them, and be bottled and well corked *while hot.* Without these precautions, such preparations are very apt to ferment, or otherwise become spoilt. *Examples*—Decoction of barley, of camomile flowers, of aloes, etc.

INFUSIONS.

Infusions do not differ materially from decoctions. They are made by digesting the substance either in hot or cold water, and separating the insoluble parts by decanting, filtering, or straining. The process is often conducted in stoneware jugs, provided with a cup with perforated sides and bottom fitting into the top of the jug, extending about half-way down, and containing the solid matters to be infused. With such an apparatus, infusions are very easily and conveniently prepared; but, unless well bottled and corked up whilst hot, they do not usually keep well. An infusion which will keep better may be got by percolating cold water through the substance packed in an apparatus similar to that used for making tinctures. Various infusions used in human medicine are now concentrated by evaporation, and their keeping properties improved by the addition of alcohol. *Examples*—Infusion of catechu, gentian, aloes, etc.

TINCTURES.

Tinctures are solutions of animal, vegetable, or mineral substances, in any spirituous fluid. Alcohol, in some of its various degrees of concentration, pyroxylic spirit, and occasionally sulphuric ether, are the spirituous fluids generally used. The

Edinburgh Pharmacopœia gives the following excellent directions for making tinctures:—

"Tinctures are usually made by reducing the solid ingredients to small fragments, coarse powder, or fine powder, macerating them for seven days or upwards in proof-spirit or rectified spirit, straining the solution through linen or calico, and finally expressing the residuum strongly to obtain what fluid is still retained in the mass. A much superior method, however, has been lately introduced, which answers well for most tinctures, namely, the method of displacement by percolation. According to this process, the solid materials, usually in coarse or moderately fine powder, are moistened with a sufficiency of the solvent to form a thick pulp; in twelve hours, or frequently without any delay, the mass is put into a cylinder of glass, porcelain, or tinned iron, open at both ends, but obstructed at the lower end by a piece of calico or linen, tied tightly over it as a filter; and the pulp being packed by pressure, varying as to degree with various articles, the remainder of the solvent is poured into the upper part of the cylinder, and allowed gradually to percolate. In order to obtain the portion of the fluid which is kept in the residuum, an additional quantity of the solvent is poured into the cylinder, until the tincture which has passed through equals in amount the spirit originally prescribed; and the spirit employed for this purpose is then recovered, for the most part, by pouring over the residuum as much water as there is of spirit retained in it, which may be easily known by an obvious calculation in each case. The method by percolation, where applicable, will be found much more convenient and expeditious than the mode hitherto commonly followed, and it exhausts the solid materials in general much more completely. As considerable practice, however, is required for managing the details in different cases, more especially in regard to the degree of minuteness of division of the solids, and the degree of firmness with which they are to be packed in the cylinder, we have thought it right to direct that the method by maceration may be followed as an alternative. But the method of percolation is now preferred by all who have made sufficient trial of it to apply it correctly."

In this process of percolation the spirit passes gradually through the solid materials, in a state of moderately fine division, displaces and dissolves out their soluble parts, filters through the linen or calico at the lower part of the cylinder, and passes off by the stop-cock, which should be attached to the apparatus. Tinctures are very convenient preparations; they are usually tolerably concentrated, and are well adapted for long keeping. *Examples*—Tinctures of aloes, myrrh, opium, and cantharides.

EXTRACTS.

Extracts are the soft, semi-solid residues left by evaporating decoctions, infusions, tinctures, or the natural expressed juices of plants. What is chiefly necessary in their preparation is, to avoid exposing them to high temperatures, which are very apt to decompose or volatilize their active principles,—accidents which are especially apt to occur with narcotic plants, but which may be entirely prevented by first getting rid of a quantity of the fluid matters by evaporation in vacuo, and then transferring the residue to flat shallow pans, in which it is exposed to currents of air at ordinary temperatures, and continually stirred until it arrives at the desired consistence. Both alcohol and water are used in making the solutions from which extracts are subsequently prepared ; and the best solvent in each particular case, is that which removes the active principles without acting on the starch, gum, or other matters, which not only uselessly increase the bulk of the preparation, but also render it apt to spoil. When extracts are well made, they keep for a long time without undergoing change, especially if occasionally moistened with a little rectified spirit. *Examples*—Extracts of belladonna, hemlock, digitalis, liquorice, aloes, etc.

MIXTURES.

Mixtures are fluids containing two or more ingredients, either chemically combined or mechanically commingled. They usually are thick and drumly, deposit a sediment on standing, and are prepared extemporaneously. Camphor, chalk, and catechu mixtures, are examples of this sort of preparation.

ELECTUARIES.

Electuaries are generally made with sugar or mucilage ; are thick, viscid, and of the consistence of treacle ; and are chiefly used as vehicles for the administration of insoluble and disagreeably tasted drugs. They are usually regarded as synonymous with conserves and confections, and are rarely used in veterinary practice. *Examples*—Electuaries of catechu, senna, and opium.

SYRUPS.

Syrups are saccharine solutions, of a density varying between 1300 and 1400. In preparing them, care must be taken that they be of a proper consistence; for if too thin and weak, they become mouldy, and are apt to ferment; and if too thick and strong, the sugar crystallizes out. Simple syrup, the one most commonly used in veterinary practice, consists of two parts of sugar and one of water. Syrup of poppies and syrup of buckthorn are also occasionally used.

LOTIONS.

Lotions are fluid preparations intended for external use, and generally made up extemporaneously. Lotions for the eye are usually called *collyria.*

OINTMENTS.

Ointments are preparations for external use, containing oleaginous or waxy matters, and about the consistence of butter. When lard or oil are the excipients, the several ingredients may be mixed in a conveniently-sized mortar; but when wax or resin is used, it must be melted over a slow fire; the other constituents are then added, and the whole mass stirred until it has acquired a proper consistence. Ointments should be kept in well closed pots or jars, which (except when in daily use) should be covered with moistened bladder and strong paper. They are generally dispensed either in little wooden boxes, or in earthenware pots—both of which the practitioner should have of several different sizes. In dispensing these and other officinal preparations, spatulæ will be found essential articles of the laboratory furniture. They should be of different sorts, some being made of steel, and others of bone, wood, or horn. *Cerates* are ointments containing wax; and *liniments*, ointments containing oil, and of a mediate consistence between ointments and oils.

PLASTERS.

Plasters consist of waxy and resinous matters spread on calico, linen, leather, or some such substances. They are less useful in veterinary than in human practice; for in the lower animals they are difficult to apply, and, from the greater power of the panniculus carnosus, are very apt to be displaced. Where they are required to remain on for some time, the best way is to apply the melted ingredients of the plaster directly to the skin, covering them first with a little teased tow or lint, and then with a linen or leathern bandage. Plasters of this kind are popularly known as *charges*, and were once much used in all kinds of lameness. Their application is beneficial, partly from their stimulating properties, and partly from their ensuring the patient's being released from work for several weeks or months.

FOMENTATIONS.

Fomentations are watery applications used for bathing any part. They often consist of water alone; but vinegar, salt, and various other medicinal substances, are sometimes added. Unless otherwise specified, they are applied hot. Their exact temperature cannot, however, be regulated by any very definite rules, and must be modified by the nature and extent of the malady, and the part of the body to which they are applied. When for the eye, they may be about 100°; for strains, weed, and such cases, they should be as hot as the hand can bear; and for enteritis, pleuro-pneumonia, or other cases in which they are intended promptly to produce active counter-irritation, they must, to do much good, be scalding hot. In these latter cases, sacks, flannel, or horse-cloths should be dipped into boiling water, slightly wrung by a couple of men whose hands are protected from scalding by dry coarse towels, and then laid over a large extent of surface contiguous to the parts diseased; or, what is usually more effectual, the parts should be covered with several folds of thick woollen stuffs, and boiling water repeatedly poured in amongst the lower folds. In most ordinary cases, fomentations are made with a sponge or a soft piece of rug. They are chiefly useful for cleansing and softening wounds; for relieving external or superficial inflammation, with its attendant symptoms of heat, pain, and swelling; and also for reducing internal inflammation, such as that of the respiratory organs or the bowels, by speedily causing counter-irritation. The chief disadvantages in the use of fomentations are their aptness to be withdrawn before the heat and moisture have time to do much good, and the subsequent rapid cooling of the part by evaporation and contact with the cold external air. To obtain their full effects, they should be applied for several hours; fresh supplies of water, of the requisite temperature, being had in abundance. After the operation is finished, the parts should be rubbed dry, and well clothed, so as to prevent the rapid diminution of temperature which otherwise ensues from evaporation.

POULTICES—CATAPLASMS.

Poultices are external applications of a soft and pulpy consistence, and are usually intended to act locally. They are applied either hot or cold. Hot poultices are commonly made of linseed meal, bran, or oatmeal, with a sufficiency of boiling water to bring them to a suitable consistence; or of carrots or turnips, either steamed or boiled. Hot poultices are efficacious in allaying pain and irritation, in reducing circumscribed and superficial inflammation, and in promoting suppuration. They soften and relax the surfaces with which they come in contact, and increase the circulation of blood through them. But, as they are apt to hurry on the suppurative process, they are unsuitable for wounds which, if let alone, would heal by first intention or adhesion, and for cases of long-standing inflammation, where the parts have become relaxed and deficient in tone. In such cases, cold applications are indicated.

Cold poultices are made of the same materials and in the same way as hot poultices, and are then allowed to stand until they become cold. Their temperature is sometimes farther reduced by pouring over them vinegar and water, sour milk, solutions of equal parts of nitre and salammoniac, or of common salt and nitrate of ammonia, or some other of the various so-called "freezing mixtures." These cold poultices are especially adapted for sub-acute and chronic inflammation, particularly of joints, ligaments, tendons, and feet, and all other parts of comparatively low organization. They are even more useful in joint and feet diseases of cattle than those of horses; and are often of much benefit in cases which have for some time been ineffectually treated by hot applications. In veterinary practice it is very difficult to get poultices properly and securely applied, and it is only by much consideration, ingenuity, and mechanical dexterity, that this inconvenience can be overcome. Another difficulty is to keep the poultices at a uniform temperature, which may sometimes be done by pouring over them hot or cold solutions, but most effectually by getting fresh poultices as the old ones become dry and altered in temperature. These two difficulties, however, seriously interfere with the use of poultices in veterinary practice, and often cause them to be set aside in favour of either hot or cold fomentations.

CLYSTERS—GLYSTERS—ENEMA—ENEMATA—INJECTIONS.

Clysters are in frequent use for all the domesticated animals. Their composition varies, of course, with the purposes for which they are given: thus, in constipation, they usually consist of soap and water, with sometimes a little oil or turpentine, and occasionally tobacco smoke; in diarrhœa, of starch-gruel, with or without opium, etc. There are no remedies more safe and effectual for keeping the bowels in good order, whether in health or disease; and their diligent use will often safely and effectually fulfil all the purposes of purgative medicine. In tetanus, bronchitis, and other cases in which it is difficult to administer medicine in the usual way, it may often be advantageously given in a clyster, and the dose of the medicine so given may usually be two or three times greater than when administered in the ordinary way. Clysters, when intended to be retained and absorbed, should be limited in quantity, not exceeding two or three pints in the horse. Where intended to produce evacuation of the bowels their quantity may be doubled. Of the many kinds of apparatus for giving clysters, those in common use are—the old-fashioned bladder tied on a bit of leaden pipe; Reid's patent clyster syringe, improved by Mr Arnold, which has also the advantage of being available as a stomach pump; Mr Gamgee's block-tin tube and funnel, which fill the intestine by gravitation, and obviate the necessity of pumping; and the common barrel syringe, of which the best kinds are made of copper tinned over, and with a *nozzle* which screws out at pleasure, and can be carried in the interior of the instrument. In the horse the rectum is generally cleared out with the hand before any of these articles are used; and in all animals the part of the apparatus which enters the gut should be smeared with lard or oil, and introduced slowly and carefully.

WEIGHTS AND MEASURES.

Two systems of weights have been hitherto employed in purchasing and dispensing medicines—the avoirdupois and the apothecaries'. The avoirdupois or imperial weight has been used by wholesale druggists, and also by retailers when selling quantities amounting to or exceeding an ounce. Its divisions, with their appropriate abbreviations, are as follows:—

27 grains	= 1 drachm ʒj.
16 drachms	= 1 ounce, ℥j.
16 ounces	= 1 pound, lb. j.
14 pounds	= 1 stone, st. j.
112 pounds	= 1 hund. wt., cwt. j.
20 hundred weight	= 1 ton, ton j.

In the last edition of the Dublin Pharmacopœia this table of weights is altered in its lower denominations, so as to render it suitable for all pharmaceutical purposes. Throughout England and Scotland, however, apothecaries' weight—a slight modification of the old troy weight—has hitherto been used in making up prescriptions and dispensing medicines in quantities less than an ounce. Its several denominations, with their appropriate signs, are as follows :—

20 grains	= 1 scruple, ℈j.		
3 scruples	= 1 drachm, ʒj	=	60 grs.
8 drachms	= 1 ounce, ℥j	=	480 grs.
12 ounces	= 1 pound, lb. j	=	5760 grs.

In the new British Pharmacopœia the old apothecaries' weight is, however, to be abolished, and the avoirdupois, with a slight modification of its lower denominations, adopted in its stead. The avoirdupois ounce is to be the standard, and is divided into 437·5 grains, each of which will thus be one-eleventh less than the apothecaries' grain hitherto used. Between the grains and the ounce there will be no scruples, drachms, or any intermediate denomination.

In the British Pharmacopœia the measures undergo less alteration than the weights. The fluid ounce of distilled water, although weighing 437·5 grains, is divided into 480 minims. The old apothecaries' measure, given below, will therefore remain without any change, except that there will be no drachm or other denomination between the ounce and the minim.

60 minims	= 1 fluid drachm, fʒj.
8 fluid drachms	= 1 fluid ounce, f℥j.
20 fluid ounces	= 1 pint, O j.
2 pints	= 1 quart, Qt. j.
4 quarts	= 1 gallon, C. j.

It is often useful to recollect the weight of different measures. Of water, one minim (♏ j.) weighs rather less than a grain ; a fluid ounce at 60° weighs exactly an ounce avoirdupois ; hence a pint is equal to a pound and a quarter, and a gallon to ten pounds avoirdupois. Every practitioner must, of course, be provided with proper balances of different sizes, legibly marked weights of different denominations, and graduated measures, which, for the sake of cleanliness, should be made of glass or earthenware rather than of metal. It will often save much time, both to himself and his employers, to have the bottles in which he dispenses his medicines graduated to ounces and drachms; and such bottles may now be purchased at prices very little above those given for the ordinary sorts. To prevent mistakes, it is also well to send out medicines for external and internal use in differently shaped bottles.

When standard measures cannot be obtained, the practitioner has often occasion to use some of the ordinary domestic utensils, with the capacity of which he ought therefore to be familiar. Common tumblers contain from eight to ten fluid ounces; tea-cups, about five fluid ounces; wine-glasses, about two fluid ounces; table-spoons, half a fluid ounce; dessert-spoons, two fluid drachms; and tea-spoons, one fluid drachm of sixty minims. Such measurements, however, are merely approximative. The pint and quart bottles, subdivisions of the old wine measure now disused, contain respectively 13 and 26½ fluid ounces, and *not*, as their names might indicate, 20 and 40 fluid ounces. Medicines are sometimes measured by the drop, which varies, however, exceedingly with the density and viscidity of the fluid, and the form and size of the vessel from which it falls. A drop of water measures a minim, and weighs nearly a grain.

VETERINARY MEDICINES.

ACETIC ACID.

Acidum aceticum. $C_4 H_3 O_3 + HO$.

The pharmacopœias recognise acetic acid under the following varieties of strength and purity: acetic acid; pyroligneous acid, which is merely an impure acetic acid; and British, French, and distilled vinegars.

Acetic Acid is usually prepared by the distillation of vinegar or the decomposition of one of the acetates. The acetates of potash or soda are sometimes used, but that of lead is preferable, as yielding with less trouble a purer acid. The essential parts of the process, as fully detailed in the Edinburgh Pharmacopœia, consist in depriving the salt of its water of crystallization, heating it with the proper atomic proportions of sulphuric acid at a carefully regulated temperature, adding a little red oxide of lead to remove any trace of sulphurous acid, and then redistilling. When thus prepared, it is a mobile, colourless fluid, with an acetous odour, a pungent taste, a corrosive action upon organized tissues, and a density varying from 1063 to 1066. It rises in vapour at about 260°, is combustible, crystallizes at 50°, and is hence known as glacial acetic acid. It reddens litmus, gives white fumes with ammonia, dissolves volatile oils, resins, camphor, and vegetable alkaloids, and unites with bases to form crystallizable and soluble salts, called acetates. These produce a red-brown colour with perchloride of iron, are decomposed by sulphuric acid, and evolve acetic ether when heated with equal parts of alcohol and concentrated sulphuric acid. This strong acetic acid consists of one equivalent of water and one of anhydrous acid, which has the composition $C_4 H_3 O_3$. The preparation usually sold in Scotland as strong acetic acid has the properties of that just described, but is scarcely so strong, containing 11 per cent. less acid. The London and Dublin acids are both much weaker; that of the English College containing from 34 to 37 per cent., and that of the Irish about 50 per eent., of the hydrated acetic acid.

Pyroligneous Acid.—When any of the hard woods, as willow, oak, or beach, are exposed to destruetive distillation in capacious iron vessels, there comes over a dark brown empyreumatic liquid ealled pyroligneous vinegar. The portions soluble in water contain the acetic acid, methylic alcohol, creasote, and similar substances, to which this impure vinegar owes its value for the curing of meat. When its strength and purity are increased by redistillation, it constitutes the pyroligneous acid of the shops—a colourless or pale straw-coloured liquid, with a strong aeetous taste, and varying considerably in density and strength. That recognised by the Edinburgh College has the density 1034, and contains 25 per cent. of the hydrated acetic acid above described. ♏ 100 of it should neutralize at least grs. xxv. of crystallized carbonate of soda.

Vinegars.—Vinegar is diluted acetie acid, containing besides variable proportions of colouring matter, mucilage, alcohol, etherous principles, sulphuric acid, and sulphate of lime. There are two chief processes by which it may be got—by the destructive distillation of wood, as in the manufacture of pyroligneous acid, and the vinegars made from it; and by the oxidation of alcohol, by exposing it to the air, at a somewhat elevated temperature, and in contact with a ferment. In this latter way most British and continental vinegars are manufaetured from various substances containing alcohol; in this country, from weak spirits, malt liquors, or solutions of sugar; in France, by exposing some of the poorer wines in half-filled casks; and in

Germany (by what is often termed the quick or improved method of vinegar-making), from diluted alcohol, which is mixed with about one 1000th part of yeast, honey, vinegar, or other fermentescible body, and allowed slowly to trickle over a large surface of wood-shavings, at a temperature of from 75° to 80°. After twenty-four or thirty hours, the alcohol becomes oxidized at the expense of the oxygen of the air, and is thus converted into vinegar. The various changes which occur during this process are somewhat complex; but the ultimate change may be easily understood from the following formula:—

$$\text{Alcohol} + \text{Oxygen} = \text{Acetic acid} + \text{Water.}$$
$$C_4\,H_6\,O_2 + 4\,O = C_4\,H_3\,O_3 + 3\,HO.$$

The British vinegars are colourless, or nearly so, have an acid taste and reaction, and when of good quality, a refreshing acetous odour, owing to the presence of acetic ether. The finest vinegar is the French or Champagne, which is distinguished from British vinegar by its etherial acetous odour, dark colour, and high density, and by its yielding, when treated with ammonia, a purple colour and a purple flaky sediment, which indicate its being made from some of the red wines. Distilled vinegar does not materially differ from the better qualities of French vinegar. It is prepared by distilling French vinegar at a gentle heat, and rejecting the first and last portions that come over. It is colourless, entirely dissipated by heat, of an ethero-spirituous odour, and of the density 1005. Diluted pyroligneous acid is often sold in the shops, generally under the name of wood-vinegar. It consists of one part of pyroligneous acid to three of water, and is very suitable for all veterinary purposes, except for making the spirit of the acetate of ammonia.

Impurities.—The most common adulterations of vinegar are water and sulphuric acid. Water is discoverable by its diminishing the density and the power of neutralizing crystallized carbonate of soda. The British vinegars should have the density 1006 to 1019; the French, 1014 to 1022; and the distilled, 1005. ℳ 100 of the last neutralize eight grains of carbonate of soda. Dr Murray Thomson communicates to me the following ingenious and ready method of estimating the strength of any sample of vinegar or acetic acid. Take a measured quantity, say 100 ♏ of the vinegar, and a weighed amount, say 100 grains of prepared chalk, or any other convenient form of carbonate of lime. Add the chalk to the vinegar cautiously, until no more is dissolved. The equivalent of dry acetic acid and chalk being nearly alike, the number of grains of chalk taken up (which is, of course, easily discovered by weighing the quantity left) will therefore indicate almost exactly the number of grains of real acetic acid present in the sample. The addition to vinegar of one 1000th part of sulphuric acid is allowed by the excise laws, in the belief that it prevents spoiling. But the legal proportion is often greatly exceeded. All the sulphuric acid in four fluid ounces of vinegar should be precipitated by ♏ xxx. of solution of nitrate of baryta, of pharmaceutic strength. Copper and lead are sometimes present, and are detected by their precipitating sulphuretted hydrogen.

Actions and Uses.—Acetic acid, when in a state of concentration, is corrosive and irritant; and when diluted, is stimulant, diuretic, astringent, and refrigerant.

Its irritant effects are somewhat less energetic than those of the strong mineral acids; but it produces death with analogous symptoms, causing in dogs much uneasiness, vomiting and abdominal pain, weakness of the hinder extremities, and exhaustion. An ounce of the strong acid destroyed a medium-sized dog in an hour; a quarter of an ounce of pyroligneous acid in from five to nine hours; and four or five ounces of common vinegar in ten or fifteen hours (Christison on Poisons). Among the larger domesticated animals it is much less active, horses taking from six to twelve ounces of the commercial acid, and cattle doses of three or four pounds, without apparent bad effect (Hertwig). Neither acetic acid nor any of its solutions is much used internally. As stimulants, they have been displaced by the mineral acids, and as diuretics their efficacy is very doubtful. Vinegar was once in high repute as an antidote for almost every sort of poisoning; but is now employed only in the case of the alkalies and alkaline carbonates. In the human subject, when taken internally in small quantities, it stimulates digestion, but in large amount it retards both digestion and assimilation, and has hence been sometimes foolishly used to reduce corpulency. This it can only do at the sacrifice of health.

Applied externally, strong acetic acid is a powerful corrosive. Rubbed into the skin, it speedily causes redness, and the eruption of large blisters resembling those produced by scalding hot water. Dissolving albumen, fibrine, and gelatine, it is of much value in removing warts and such like excrescences, as well as corns in the human subject. It is applied as an astringent and styptic, and is useful as a stimulant, and a means of removing scurf in cases of ringworm, mallenders and sallenders, scab, and mange. In these cases, the impure pyroligneous acid is preferable to the purer acetic acid, probably from containing creasote and similar empyreumatic principles. Equal parts of glacial acetic acid and chloroform, mixed in a thin flask, produced a vapour which was found by M. Fournié to induce in five minutes local insensibility without pain. Vinegar, in its various forms, is used for refrigerant lotions in superficial inflammations and bruises; but for these purposes cold water is nearly as effectual, though it does not look quite so medicinal. When employed for fumigating stables or byres, it probably does more harm than good; for it disguises those noxious effluvia which it neither removes nor destroys, and thus prevents due attention to thorough ventilation, and the use of efficient deodorizers and disinfectants. It dissolves the active principles of many medicines, and enters into the composition of various pharmaceutical compounds, as vinegars of cantharides and colchicum, spirit of Mindererus, and oxymel. Oxymel is made by boiling together eleven ounces of vinegar and fourteen of sugar or honey. The antiseptic properties of vinegar recommend it for preserving various sorts of vegetables.

Doses, etc.—Acetic or pyroligneous acids, when used internally, are given in about the same doses as the common mineral acids, namely, f℥i. to f℥ij. for horses or cattle, and ♏ij. or ♏iij for dogs.

ACONITE.

Monkshood. Wolfsbane. Aconitum.—Tubers and leaves of *Aconitum Napellus*, *A. ferox*, and probably some other varieties.

Nat. Ord.—Ranunculaceæ. *Sex. Syst.*—Polyandria Trigynia.

Botanists have numbered twenty-two species, and upwards of a hundred varieties of aconite. Some species are inert, or nearly so; but others, as the Aconitum ferox, Sinense, and Napellus, are very active. The last of these, the common officinal species, is a doubtful native of Britain, but often grown in gardens and shrubberies, on account of its flowers. The cultivated, however, are said to be less active than the wild plants. Its several varieties are herbaceous plants, with tapering, carrot-shaped, black root-stocks, from which, after the first year's growth, are formed one or more oval-shaped tubers, which are at first nourished by the decaying parent-root; annual stems from two to five feet high; deeply divided, dark green leaves; long-stalked, helmet-shaped, blue or purple flowers, which form dense spikes, and usually appear in June or July; and dry, black, shrivelled seeds, which ripen about the end of August. The root, which, according to Professor Schroff of Vienna, is six times as active as the other parts, and is consequently most valued, should be taken up after the plant has flowered in autumn, or before the new stem rises in spring, cut into small pieces, and dried at a low temperature. The leaves are less active than the root, but more so than the flowers, fruit, or stem, and should be gathered for use early in July and before the flowering season is over, rapidly dried, and at once used for making the preparation desired. Any part of an active or poisonous aconite, when slowly chewed, produces a peculiar acridity, numbness, and tingling of the lips and tongue, unaccompanied by any irritation or inflammation. This, besides being a good test of aconite, also affords a very easy and accurate method of judging of the activity of any specimen or preparation of the drug; for it is most observable in those varieties and parts of the plant, and in those preparations which are most potent as medicines and poisons. When powdered, the root and leaves have a dirty grey colour, and a strong earthy odour. Their active principles are readily soluble in alcohol, but sparingly so in water, and hence watery preparations are not commendable. Aconite owes its activity as a poison, and its value as a medicine, to an alkaloid termed *aconita*,—a pale yellow, transparent, vitreous, acrid, bitter substance, crystallizable with some difficulty, insoluble in water, but soluble in alcohol, decomposable by heat, and capable of producing, when placed in the mouth, the same peculiar sensations as the crude drug. It is very expensive, costing, when pure, 3s. 6d. per grain.

Actions and Uses.—Aconite is a most active poison, paralyzing the nervous functions, and acting as a powerful general sedative. It is used medicinally as a sedative, antispasmodic, and anodyne. It proves poisonous to all animals, from infusory animalcules and earth-worms to man himself. Absorption into the blood-vessels appears essential to the development of its constitutional effects, which primarily and chiefly consist in depression of the functions of all parts of the nervous system. It is altogether devoid of irritant properties. The peculiar impression which it causes when chewed, or otherwise brought into contact with mucous or cutaneous surfaces, is purely nervous, and accompanied by no vascular excitement or visible alteration of structure; whilst the vomiting which it occasionally produces affords evidence, not of irritation, but of functional derangement of the vagus nerve. Its poisonous action on veterinary patients is well marked. In ordinary practice, I have repeatedly seen an over-dose cause horses to tremble violently, lose the power of supporting themselves, become slightly convulsed, and froth at the mouth, whilst their pulse and breathing became slower. Viborg mentions that a horse, after receiving eight ounces of the root and lower leaves of the aconitum Napellus, became very uneasy, breathed slowly and with difficulty, attempted to vomit, exhibited a depressed, irregular, and intermittent pulse, and looked round at his flanks, as if suffering pain; but that he gradually recovered in about six hours. Next day he got three quarters of a pound of aconite, which induced similar symptoms, and death in about twelve hours (Hertwig). Similar symptoms have been observed in the following experiments, made at the Edinburgh Veterinary College by my lamented friend Mr Barlow and myself:—

A black mare, 15½ hands high, previously used for slow work, and in good health, got, at 12.40 P.M. (27th September 1852), one fluid drachm of Fleming's tincture of aconite. At 1 she was nauseated, had eructations of frothy mucus, with attempts to vomit, which increased till 1.30, when she went down. The pulse, which was 35 before the administration of the poison, was now 60, and very weak. She continued down till 7 P.M., when she was destroyed in conseqence of being unable to stand.

On 24th September 1852, an aged chesnut cab horse, 16 hands high, and useless from a bad quittor, was tied up by the head for ten minutes, to ensure perfect quietude. The pulse was then found to be 56, and the respirations 12. The animal had a good appetite, and regular evacuations. At 10 o'clock he got ninety minims of Fleming's tincture of aconite in a linseed-meal ball, the head being still kept tied up for fifteen minutes. In half-an-hour he fed greedily on potatoes and beans, but no change was observable; and at 1 P.M. he got fifty minims of the same tincture in four ounces of water. At 1.15 he appeared to be making continual efforts to swallow something, his mouth was closed; and after such attempts at swallowing, air and fluid were regurgitated up the gullet, causing a rattling noise, as of air-bubbles mixed with water. At 1.20 the pulse was 50; symptoms of actual nausea appeared; the muscles on the side of the neck and throat were contracted; the muzzle brought near to the breast; the lips retracted; and the mouth slightly opened. Fits of retching came on every two minutes, and increased in violence during the next ten or fifteen minutes. 1.30.—During each paroxysm of retching, the mouth was opened, the lips widely retracted, and four or five ounces of frothy mucus discharged on the ground. The pulse had fallen to 40, and become weak. On account of the retching, the respirations could not be counted. Copious perspiration broke out all over the body, and increasing distress was shown in the quivering surface, and pallid mucous membrane of the mouth, nose, and eyes. 2 P.M.—Pulse 38, and weak; the respirations not easily counted, but probably about nine; in other respects no change. The animal passed fæces and urine freely; and shortly after getting a pint of cold water, lay down somewhat relieved, with the retching scarcely so frequent. At 2.30 the pulse was weaker than ever; the breathing irregular, interrupted, and sighing; and the animal unable to rise. The labial and nasal muscles were contracted, causing retraction of the lips, and disclosing the gums blanched, and the teeth covered with frothy mucus. Two bottles of strong ale were given, with half an ounce of spirit of ammonia. At 3 P.M. the pulse was 35, and still weaker than before; the respiration was somewhat accelerated, probably owing to the animal's being down; the perspiration continued to stream from every part; and the retching, though somewhat subsided, still came on about every ten minutes. The animal remained down without much change until about 6, when the nausea was somewhat diminished, but the pulse so weak as to be scarcely perceptible. He was raised with difficulty, and stood blowing much for fifteen minutes. At seven there was little change; the pulse remained imperceptible; the respirations about 20; and the patient unable to eat or drink. He was left with the expectation of finding him dead next morning; but at 7 A.M. (25th) he was up and eating. His pulse was 65; his respirations 10; and his appearance very haggard and reduced. October 1st.—Since last date he has never regained his former look or appetite; for two days has been unable to rise or stand; and has become much wasted. He was destroyed by six drachms of prussic acid; but, on *post-mortem* examination, every part except the lungs seemed quite healthy. These organs, more especially the right one, were extensively studded with patches of extravasated blood about the size of walnuts, which in those parts connected with the pulmonary tissue were more or less softened, and emitted an odour characteristic of heated decomposed blood. The rusty fluid produced from the softening had in various places passed into the bronchii, imparting to their frothy mucus a brown colour.

Among carnivorous animals a violent and speedy effect is readily produced by aconite, as is well shown in the two following experiments made at the Veterinary College in October 1852. A cat of average size got seven minims of Fleming's tincture of aconite. In two minutes severe retching came on, with a copious flow of saliva, probably arising from paralysis of the fauces; and in five minutes painful vomiting and involuntary muscular contractions of a most active kind, with perverted action of the voluntary muscles, causing the animal to leap up the wall and turn somersaults backwards. In this, as in most other cases, the pupil was dilated. The vomiting and muscular action continued till within two or three minutes of death, which took place twenty minutes after the administration of the poison. No morbid or peculiar *post-mortem* appearances were observable. An ordinary-sized Scotch terrier got thirty minims of Fleming's tincture. In five minutes painful and active vomiting came on, which must have effectually emptied the stomach. The retching and vomiting continued, however, for half-an-hour, when the animal was so exhausted and paralyzed in its hinder extremities as to be unable to walk except by supporting itself on its fore limbs, and dragging the hind ones after it. It gradually recovered, however, in about two hours. In some other cases a drachm has destroyed dogs with as much rapidity as an equal quantity of prussic acid.

Among ruminating animals the action of aconite, when introduced into the stomach, is less prompt and powerful than in other animals; and Dr Fleming found that the activity of aconite was sensibly diminished by digesting it with the gastric secretions either of rabbits or calves.[1] When, however, it is injected into the veins, or placed underneath the cellular tissue in these animals, it develops its poisonous effects as readily as in others, and with the same marked depression of the action of the heart.

According to the dose in which it is given, aconite appears to destroy life in one of these three ways,—1st, In very large amount it sometimes kills by communicating a sudden shock, possibly somewhat in the same manner as a blow on the stomach, or a flash of lightning; 2d, It paralyzes the muscles of respiration; and 3d, It paralyzes the action of the heart. In most cases, death appears to result from the concurrence of these two latter effects.

In poisoning by aconite, finely powdered animal charcoal, mixed with a little water, must be swallowed, in the hope of its absorbing the poison. Emetics or the stomach-pump must then be promptly used to get rid of any of the poison that may still remain unabsorbed. For a similar reason, cathartics are also useful. The only chemical antidote of any value is tannic acid, which owes its efficacy to its forming an insoluble compound with the aconita; but to be of any service it must be used very promptly. Nux vomica and strychnia are directly opposed to aconite in their effects, and have been successfully employed to rouse the failing action of the heart, and the slow and difficult breathing produced by considerable doses of aconite. The mortally sedative effects of the drug must also, if possible, be warded off by the use of diffusible stimulants; and it may further be recollected, that congestion of the lungs, which generally hastens death, may be much relieved by bleeding from the jugular.

Aconite is a most prompt and effectual sedative and antiphlogistic in febrile attacks and acute local inflammations. In these

[1] See Dr Fleming's admirable monograph on the physiological and medicinal properties of *Aconitum Napellus*.

cases it speedily moderates the action of the heart, and hence reduces the quantity of arterial blood which passes in a given time to any part. It thus acts much in the same way as blood-letting, but, besides being safer and more manageable, it is less apt to induce such extensive and continued depression of the vital energies. Aconite somewhat resembles opium in its sedative effects, and in its relieving pain and spasm; but acts less prominently on the brain, and more decidedly on the sympathetic or organic system of nerves; while its sedative action is not preceded by any obvious excitation. Though somewhat like digitalis, it differs from it in being anodyne and antispasmodic, whilst its sedative action is induced more speedily and certainly, and without risk of cumulative effect or undue intestinal irritation.

In pneumonia, pleurisy, and bronchitis, in many cases of influenza, in enteritis, peritonitis, laminitis, and weed,—in fact, in all cases of acute inflammation and fever, whether amongst horses or cattle,—aconite is a certain and successful sedative. By Mr Balfour, V.S., Kirkcaldy, it was, twelve years ago, freely used in the treatment of pleuro-pneumonia; and in his extensive practice, as well as in that of the Edinburgh Veterinary College, and of many private practitioners, it is still regarded as the best sedative for the earlier stages of this epizootic. Since the publication of the first edition of this work, in which it was strongly recommended, aconite has come into more extensive use amongst practitioners in all parts of the country, and is worthy of still more extended employment; for it is certainly more effectual than tartar emetic, calomel and opium, or any other sedative; and, when given sufficiently often, is quite equal to blood-letting in its power of reducing the pulse, relieving the respiration, and removing fever. Combined with a purgative, it is often serviceable in cases of colic resulting from the eating of hard rye, vetches, clover, or other such indigestible food. In rheumatism it usually relieves both the constitutional fever and the local inflammation, and is believed to prevent the malady from extending to the heart and its membranes. In frequently repeated doses, I have found it of benefit in both forms of puerperal fever in cattle; and Mr J. C. Adkins, of Milcote, Stratford-on-Avon, and other extensive flock-masters, now use it with success during the lambing seasons, giving it with gruel to all ewes which have had a hard time, and begun to blow, or show symptoms of fever. Moiroud and others speak highly of its utility in obstinate dropsies, and Stahl of its value in the removal of worms; but its efficacy in such cases is doubtful. Conjoined with chloroform, it has been used in the human subject with some success in traumatic tetanus, and deserves a further trial in such cases amongst the lower animals. From its action on the superficial sensory nerves, it is often useful as a local anodyne in neuralgic or rheumatic affections, painful wounds, or swellings of a chronic and non-inflammatory kind; and in such cases it not only allays pain, like opium, but also often removes its cause. Like other local anæsthetics, it is, however, of little avail in relieving pain depending on inflammation. Diluted with eight or ten parts of water, and used cautiously, it proves one of the best means of relieving the itching and hastening the cure of eczema either in horses or dogs. An excellent lotion for most of these purposes consists of an ounce each of tinctures of aconite and arnica dissolved in a quart of water.

Doses, etc.—Aconite is not usually employed in the crude state either of root or leaves. The *extract*, unless very carefully prepared from an alcoholic solution, is apt to be of defective or irregular strength. The *tincture*, although the simplest and best preparation, is frequently of irregular and defective strength; and in order to prevent disappointment, should be obtained only from the most reliable sources. According to Professor Fleming's directions, it is made as follows:—"Take of root of Aconitum Napellus, carefully dried and finely powdered, sixteen ounces troy; rectified spirit, sixteen fluid ounces; macerate for four days; then pack into a percolator, add rectified spirit until twenty-four ounces of tincture are obtained. It is beautifully transparent, of the colour of sherry wine, and the taste is slightly bitter." The dose of this tincture for horses is about ♏x.; for cattle, from ♏x. to ♏xx.; for sheep, ♏ij. or ♏iij.; and for dogs, from ♏j. to ♏ij. It should be given every second hour, and the animal will generally take it readily in water.

Aconita.—The alkaloid of aconite is one of the most active of poisons. Mr Headland mentions, in his "Prize Essay on the Action of Medicines," that $\frac{1}{300}$th of a grain in solution, in water, suffices to destroy a mouse; $\frac{1}{100}$th of a grain kills a small bird after a few minutes, and $\frac{1}{50}$th almost instantaneously; $\frac{1}{20}$th or $\frac{1}{10}$th kills cats, the latter quantity in twenty minutes or half-an-hour; $\frac{1}{2}$ of a grain given to a shepherd's dog, weighing 20 lbs., began to operate in three or four minutes, and proved fatal in sixty-five minutes; $\frac{1}{10}$th of a grain would probably be sufficient to cause the death of an adult man. The symptoms and post-mortem appearances are the same as in poisoning with the crude drug, the extract, or the tincture. The alkaloid has been sometimes used in human medicine, especially as an external application, in the forms of alcoholic solutions or of ointment, and is so uniform in its strength, that, but for its expense, it would probably supersede all other preparations of the drug.

ALCOHOL.

Spirit of wine. $C_4 H_5 O + HO$.

Alcohol is admitted into the pharmacopœias in three distinct forms—as absolute alcohol, rectified spirit, and proof spirit; and is, moreover, extensively used in the several forms of wines and spirits. The various alcoholic fluids are obtained, either directly or indirectly, from the fermentation of saccharine solutions; in this country, from infusions of malt; in most parts of the Continent, from the juice of the grape; in Germany, from potatoes; and in Jamaica, and other rum-producing countries, from molasses. In these, and all other processes for the preparation of alcohol, saccharine matter is dissolved, and exposed to the action of a ferment or albuminous body in a state of disturbance, which breaks it up into alcohol, carbonic acid, and water. The decomposition may be better understood from the following formulæ:—

$$\begin{array}{c} \text{1 Equiv. of Grape Sugar} \\ C_{12}\,H^{14}\,O_{14} = \end{array} \left\{ \begin{array}{l} 2\,(C_4\,H_6\,O_2)\ \text{Alcohol.} \\ 4\,(CO_2)\ \text{Carbonic Acid.} \\ 2\,(HO)\ \text{Water.} \end{array} \right.$$

From this it will be obvious that pure alcohol has the composition $C_4\,H_6\,O_2$; but as it is believed to be the hydrated oxide of a radicle ($C_4\,H_5$) called ethyle, it is more commonly represented as $C_4\,H_5\,O + HO$.

When a fermented saccharine solution is exposed to a high temperature, the alcohol distils over,—mixed, however, with water and various impurities; and if the distillation be several times repeated, the fluid will reach the density 825, which, according to the British excise law, constitutes alcohol or pure spirit. It is not, however, *absolute* alcohol, but still contains about 7 per cent. of water, which, though inseparable by any amount of distillation, may be removed by various hygroscopic or water-absorbing bodies. Dried chloride of calcium is recommended by the London and Dublin Colleges; but this only reduces the density to 815, still leaving 4 per cent. of water. The last traces of water may, however, be readily removed, and *absolute alcohol*, of the density 794–6, obtained, by allowing strong distilled spirit to remain for a short time in contact with quicklime. (Ed. Phar.) Absolute alcohol is a mobile, colourless fluid, with a spirituous odour, an intensely hot fiery taste, and a density of 794–6. It is very volatile, boils at 173°, and burns without producing smoke. It has never been frozen. It has a great affinity for water, absorbing it readily from the atmosphere, and mixing with it in all proportions. When oxidized, it forms acetic acid; and when decomposed by acids, produces ethers. It dissolves haloid better than amphide salts, and is also a good solvent for volatile oils, resins, vegetable acids, and bases.

Rectified Spirit is the generic term applied to alcohol varying in density from 835 to 840, and containing from 10 to 12 per cent. of water. Its properties are very similar to those of absolute alcohol. It has, however, less pungency and volatility, and a higher boiling-point.

Proof Spirit is diluted alcohol, having the density 912, according to the Edinburgh College, and 920, according to the London and Dublin Colleges, and the excise laws. It is very conveniently prepared, as directed by the Edinburgh College, by mixing one measure of water and two of commercial rectified spirit; and when thus made, is freer from impurity than the weak, imperfectly-rectified spirit of the shops.

A mixture of one part of wood naphtha or pyroxylic spirit and nine of excise alcohol is now sold, free of duty, in quantities of ten gallons and upwards. This is an immense boon to pharmaceutical chemists, and many other manufacturers; for the addition of the naphtha, although it prevents the mixture being used for drinking, does not interfere with its value in pharmacy or the arts.

The following alcoholic fluids, so much employed both dietetically and medicinally for man, are occasionally also prescribed for the lower animals:—*Wine*, the fermented juice of the grape, containing from 10 to 25 volumes in the hundred of excise alcohol (density 825), and owing its peculiar bouquet to œnanthic ether; *brandy*, prepared by the distillation of the weaker wines, and containing about 53 per cent. of excise alcohol; *rum*, a fluid of about the same strength, made by the distillation of a fermented solution of molasses; *whisky*, of similar strength, and obtained by distilling a thoroughly-fermented solution of malt; and *Hollands*, *Geneva*, or *gin*, a little weaker than these, and prepared from fermented malt, with a small quantity of juniper berries. *Ales* and *porter* are also useful stimulants in almost everyday use. They are made by infusing malt in water at about 180°; allowing it to stand for a few hours until the starch has been in great part converted into dextrine and sugar; boiling the solution with the requisite quantity of hops; and adding yeast to cause fermentation, which, however, must be carefully prevented from going too far. The dark colour of porter depends on a part of the malt used in its manufacture being roasted. Porter and ales are about the same strength, containing between 4 and 7 per cent. of excise alcohol (density 835).

Impurities.—Water is one of the most common impurities to which alcoholic fluids are liable, and is discoverable by its increasing the density of the spirit, which may be ascertained by testing it either with a hydrometer, or with marked beads. Commercial spirits, when prepared from malt, are always contaminated by an ill-flavoured, pungent volatile oil, called fusel or grain oil, which is apt to spoil the finer tinctures and liqueurs, and is discoverable from its causing the spirit to be blackened by sulphuric acid, or exposure to the action of nitrate of silver and light. To remove this impurity, the manufacturer mixes the spirit with water previous to each distillation, or digests it with animal charcoal; but neither of these processes is very effectual, whilst distillation off burnt alum, chloride of calcium, permanganate of potash, or the addition of nitrate of silver, though greatly better, are not available on the large scale.

Actions and Uses.—Alcohol acts locally as an irritant, sedative, astringent, and antiseptic, is a general stimulant, narcotic, and diuretic; and is besides a readily assimilable article of food.

When a few drops of strong spirit are put into the eye, or a small quantity introduced into the stomach of a dog, or other small animal, topical irritation, with increased vascularity and redness, is first observed; but this soon gives place to diminished vascularity and sensibility, usually corresponding with the previous excitation in continuance and degree. Alcohol has thus a primary irritant, and a secondary sedative effect. Its astringent and antiseptic actions depend on its coagulating albumen, and also, in the case of strong spirit, on its affinity for water. When given internally, it often produces some of the topical effects just noticed, but speedily becomes absorbed, and is detectible in the blood, where a large proportion of a moderate dose appears to be retained, and is utilized in the nutrition of most parts of the body, but especially of the nervous textures. What is not required in the system is shortly excreted, particularly by the lungs and kidneys. Alcohol acts directly on the nerves and nervous centres, and, in most animals, poisonous doses affect especially those parts which lie within the cranium. It induces, first, greatly increased action, and then, after a variable time, deranged and depressed action,—the relative amount and continuance of these two effects differing materially with the dose and state of concentration of the alcohol. In dogs, very large quantities of strong spirit sometimes produce rapid depression, coma, and death, within a few minutes, without any appreciable excitement; and several cases of this kind occurring in man are recorded by Professor Christison in his work on Poisons. Hertwig gave an old but sound horse eight ounces of alcohol (density about 825). He became much excited and uneasy, pranced, staggered, and after about two minutes fell, struck out vehemently with his feet, rolled his eyes, the pupils being at first contracted and latterly dilated, gradually became insensible, and died in about ten minutes. The pulse was little altered, and the heart continued to beat for ten minutes after death. Between four and six ounces produced similar symptoms, but did not prove fatal. From one to two ounces destroyed dogs in periods varying between a quarter and half an hour, with similar symptoms, and great inclination to vomit. From one to two drachms induced in dogs reeling and stupor, which continued for about half an hour. Cattle and sheep, and indeed all ruminants, are less susceptible of its influence than dogs or even horses; and Hertwig mentions, that when it is given in the form of brandy to sheep and goats, they soon become very fond of it, taking from six to ten ounces at a time, and gradually becoming less easily affected by it. Alcohol, when injected into the veins or serous cavities, causes speedy death, accompanied by the same symptoms as attend its administration by the mouth. When a large dose of alcohol speedily extinguishes life, the brain, lungs, and liver, are found, on post-mortem examination, to be congested with dark grumous blood, and an alcoholic odour is exhaled from the bowels and serous cavities; whilst, if life has been prolonged for some time after the exhibition of the poison, the stomach and alimentary canal are much reddened, and sometimes, it is said, considerably thickened.

Alcoholic fluids are advantageously employed where nervous power is defective, the surface heat low, and the pulse slow and soft, or quick and small, owing to irritability. In hoven, tympanitis, stomach staggers, and colic, alcoholic stimulants, in the form of ales or whisky, although often used empirically, are nevertheless very convenient, safe, and effectual remedies. In simple congestion of the lungs, caused by over-exertion, they are frequently useful in aiding the depressed nervous power to restore the lost balance of the circulation; whilst in debilitating diseases, and in the later stages of inflammatory complaints, as bronchitis, influenza, and even enteritis, they are also of much service in supporting the action of the heart, rousing the powers of life, and inducing that healthy reaction which is alone effectual in overcoming the consequences of previous disease. In the larger patients in the form of ale, and for the smaller in the shape of wine, alcoholic stimulants are most useful in promoting convalescence from all reducing disorders, sustaining especially the nervous power and the action of the heart, and aiding in some way, perhaps as yet not very well ascertained, in the healthy nourishment of the body. This combination of nutrient and stimulant properties appears to explain the great value of alcohol in the cure of disease, and its magical efficacy in increasing the appetite and vigour of the horse, worn out with long-continued or severe exertion. In all these cases, it is of importance to repeat the medicine frequently, so as to keep up the advantage gained by each single dose, and prevent that secondary depression which is otherwise apt to ensue. Spirituous fluids, in their removal from the body by the kidneys and skin, stimulate these secreting organs, causing diuresis, and also, though to a less extent, diaphoresis. In veterinary practice, however, they are not given expressly to induce either of these effects. When taken in moderate quantities, they appear to become oxidized into carbonic acid and water, and on this account are extensively used in the human subject as heat-producing articles of diet. Alcoholic stimulants, when given in undue amount whether in health or disease, increase abnormally the action of the heart, hinder the æration of the blood, impede general nutrition, retard the excretion of morbid matters, and cause dryness of the skin and mucous surfaces.

When alcohol, in a state of concentration, is applied to the more delicate parts of the skin, it acts as a rubefacient, but is seldom used for that purpose among the lower animals. In a more diluted form, it is used as a refrigerant, being sometimes mixed with an equal quantity of vinegar and muriate of ammonia, in the proportion of an ounce of the salt to a pint of the mixed fluids. When made into a mucilaginous consistence with albumen, it is used in the human subject to prevent excoriation of parts exposed to pressure. It is much used in pharmacy, especially for the preparation of tinctures and extracts.

Doses, etc.—The dose of rectified spirit for horses is from f ℥i. to f ℥iij.; for cattle, from f ℥iij. to f ℥vi.; and for dogs, about f ℥ij. The doses of whisky, brandy, ales, or wine, must be left to the judgment of the practitioner; but in exhausting disorders, these and other spirituous fluids should be given in moderate quantity, but at intervals of every one or two hours.

ALOES.

Aloe. Inspissated juice or extract of various species of *Aloë.*

Nat. Ord.—Liliaceæ. *Sex. Syst.*—Hexandria Monogynia.

The several species of *aloë*, which yield the various sorts of commercial aloes, are succulent plants, having short woody stems, strong, thick, fleshy, amplexicaul leaves, with sharp serrated edges, and a stout spine projecting at the apex. The bitter purgative juice is contained in cells lying immediately underneath the surface of the epidermis of the leaf, the rest of which is filled with a bland colourless sap. The mode of obtaining the juice differs somewhat in the different countries whence aloes is procured. It is sometimes allowed to exude spontaneously from incisions made in the leaf, or its flow is hastened by the application of a moderate heat. The aloes thus got is of the finest quality. A somewhat inferior sort is procured by exposing the leaves to pressure, which causes a mixture of the cathartic juice with the mucilaginous sap of the mass of the leaf; and a still more inferior sort is prepared from leaves that have already yielded most of their purgative juice, by cutting them into small pieees, boiling them with water, and evaporating the deeoetion.

Varieties.—Thc most important varieties of aloes met with in commerec and used in mcdieine are Barbadoes, East Indian, Socotrinc, Cape, and Caballine. Each of these varies in quality, frequently giving rise to several sub-varieties. In the following paragraphs, I shall deseribe the botanieal souree, mode of preparation, and more prominent properties of eaeh of the chief varieties of aloes, briefly notieing their more important sub-varieties.

Barbadoes Aloes (*aloë Barbadensis*) is the variety of aloes most extensively used in veterinary praetice. It is believed to be the produee chiefly of the *aloë vulgaris*, whieh has a short, eylindrical, woody stem; sword-shaped leaves, with hard, reddish spines, a tough and leathery euticlc, with a light brown-eoloured parenehyma; and tubular yellow flowers. The preparation of Barbadoes aloes is not eonfined, as the name might indieate, to the Island of Barbadoes, but is also carried on in Jamaica and most of the West Indian Islands. It is obtained from the leaves, oeeasionally by eutting them in pieees, and allowing the juiee to drain into tubs, but more eommonly by placing the ehopped leaves in bags or baskets, and immcrsing them for about tcn minutes in boiling water, whieh, when fully charged by the repeated immersions of frcsh portions of the leaves, is sct aside to cool. The sediment is earefully kcpt baek, and the clear fluid poured off, and eautiously evaporated to the required consistence, whieh is aseertained by taking out a few drops, and observing if they beeome brittle and eonerete on eooling. When suffieiently coneentrated, the juice is poured into gourd shells, and the opening elosed by a bit of shell let in, and secured in its plaee by a pieee of coarse cloth nailed over it. The gourds, when filled, usually weigh from 60 to 70 lbs.; and fully 2000 of these arc annually exportcd from Barbadoes alone. But aloes is also largely exported from that island in boxes and packages, holding generally about 56 lbs. eaeh; and of these the annual exportation has sometimes been above 2000. Barbadoes aloes has a dark or liver-brown colour; a brown, opaque, earthy fraeture; a disagreeable, bitter, persistent taste; and a strong and disagreeable odour, especially when breathed upon—an odour generally likened to that of the human axilla. It is tough, gummy, and difficult to pulverize; its powder is olive-green, and darker than that of any of the other commercial varieties. The dark colour, dulness, and opacity of Barbadoes aloes are generally stated to depend upon the presence of water, but may also be owing to the presence and condition of the aloine. When dissolved in weak spirits, it leaves an abundant flocculent residue.

East Indian Aloes (also called *hepatic* and *Bombay* aloes) is neither grown nor extracted in the country from which it derives its name, but is brought from Arabia, and the coasts of the Red Sea and Persian Gulf, to Bombay and other Indian ports, and is thence exported to Europe. It is supposed to be obtained from the *aloë Socotrina*, the same species as yields Socotrine aloes—a plant having a straight woody stem about a foot and a half high; green ensiform leaves, incurvated at the apex, with numerous small white marginal serratures, and a parenchyma abounding with a bright brown-yellow juice. Its flowers are scarlet at the base, and become green towards the top. The manner of extracting and purifying it is not well known. It comes to the London market in tinned boxes holding 56 lbs., or in skins, of which several are packed into casks or firkins. The quality and appearance of East Indian aloes are very variable. It is usually of a brown-red colour, dull, and rather opaque; but in small fragments is red, sparkling, and tolerably transparent. Its powder is brownish-yellow; its odour less disagreeable than that of either Barbadoes or Cape aloes; and its taste, like that of all the varieties, bitter and nauseous. Spirit of the density of Sherry does not fully dissolve in it, but leaves a fleecy residue. Aloes native to India are considered mostly of inferior quality, and are rarely exported. A variety termed *Mocha aloes* is occasionally met with in drug warehouses, is very variable and irregular in appearance and quality, and is considered an inferior sort of East Indian aloes.

Socotrine Aloes is of very fine quality, and is brought in quantities of a few tons annually from the islands of Socotra and Madagascar. It is believed to be the produce of the *aloë Socotrina*, which is also thought to yield most of the East Indian aloes. It is supposed to be prepared by allowing the juice of the leaves to exude spontaneously, and then evaporating it by exposure to the heat of the sun. But Professor Christison and others are of opinion that true Socotrine aloes is very rarely met with in the shops; and that by far the greater proportion of what is sold as such is not genuine, but consists either of selected portions of East Indian aloes, or of a purified extract of that variety. According to Christison and Pereira, Socotrine aloes occurs in reddish-brown pieces, of variable size, and of a garnet-red translucency when thin. It has a fracture generally smooth, glassy, and conchoidal, but occasionally rough, and resembling that of a tear of myrrh; and a fragrant agreeable odour, which is increased if the specimen be breathed upon or heated. It is brittle and easily reduced to powder, which is of a golden yellow colour, and almost entirely soluble in spirit of the density 950 (the strength of Sherry). It is distinguished from the East Indian aloes by its redder colour, and greater lustre, transparency, and solubility; and is believed by Pereira to differ from it on account of its being prepared by the aid of heat,—an inference which he considers substantiated by the fact, that East Indian aloes, when purified by heating and melting, acquires most of the characters of the Socotrine variety. The finer varieties of Socotrine aloes are sometimes called *aloes humida*, *lucida*, or *clear aloes*, which appear also to have been the names applied to varieties now extinct.

The late Professor Pereira described, in the Pharmaceutical Journal for April 1852, a soft semi-fluid sort of Socotrine aloes, recently imported in considerable quantity. He considered it to be the raw or unboiled juice of the plant, and proposed to call it Socotrine aloe juice. It is of the consistence of thin honey, of a deep orange colour, has the strong fragrant odour of Socotrine aloes, and deposits on standing a small quantity of minute prismatic crystals, identical with the aloine obtained by Messrs Smith from Barbadoes aloes.

Cape Aloes (*Aloë Capensis*) is brought from the Cape of Good Hope, and is chiefly got from the *aloë spicata*, which has a stem three or four feet high; long leaves, broad at the base, and gradually narrowing towards the point, marked with white spots, and containing a colourless sap; and campanulate and white flowers arranged on a tall spike. The extraction of the juice, as described by Mr Lyell, in Christison's Dispensatory, begins during September and October. The leaves, cut from the plant close to the stalk, are placed in piles, with the cut ends inwards, on sheep-skins or ox-hides spread in holes dug in the ground. The juice slowly drains out, is evaporated in large cauldrons, and exported either in chests or skins—the latter generally containing the better qualities. It is sold at the Cape at from 2¼d. to 3½d. per lb. Cape aloes is often of very inferior quality, being black, opaque, and vesicular in appearance, and of little activity. Those who have seen its preparation, are of opinion that its low quality is not owing to the species cultivated, to the climate, or other natural causes, but to carelessness in the extraction and evaporation of the juice, and especially to the commencement of operations before the termination of the wet season. But the better qualities of this variety are little inferior either to East Indian or Barbadoes aloes. They have a dark-brown or olive-green resinous appearance, a compact structure, a vitreous dark-green fracture, and a strong and rather disagreeable odour. They are very brittle, and easily reduced to a powder of a gamboge-yellow colour.

Caballine or Horse Aloes is inferior to all the varieties previously noticed, and is now deservedly discarded from veterinary practice. It generally consists of the residue or sediment left from the purification of the more valuable sorts. It varies considerably in colour, opacity, and general appearance; but is black, vesicular, and bituminous, and without the compact structure of the better sorts. It has a strong and disagreeably fetid odour, and always contains a quantity of such impurities as straw, bark, stones, and sand.

A knowledge of the more important distinctive characters of the chief varieties of aloes is best obtained by examination of actual specimens, but reference to the following tabular arrangement may occasionally assist the memory:—

	Barbadoes.	East Indian.	Socotrine.	Cape.
Colour,	Liver-brown.	Dark liver-brown.	Garnet-red.	Dark-brown, approaching to black.
Recent Fracture,	Granular, light liver-brown.	Smooth, dark-red.	Smooth and conchoidal, occasionally rough.	Shining olive-green.
Lustre,	Dull and earthy, and quite lustreless and opaque, even in small fragments.	Waxy. In small fragments slighly translucent.	Full resinous. In small fragments ruby-coloured, and translucent.	Vitreous. In small fragments yellowish-brown, and translucent.
Odour,	Strong, and rather disagreeable.	Agreeable.	Fragrant.	Strong, and disagreeable.
Solubility in alcohol of the strength of Sherry,	Leaves a very copious residue.	Leaves a considerable residue.	Almost entirely soluble.	Leaves a very copious residue.
Powder,	Dull olive-yellow.	Yellow, with a red tint.	Golden yellow.	Bright yellow, like gamboge.
Produced by	Aloë vulgaris.	Aloë Socotrina.	Aloë Socotrina.	Aloë spicata, and probably also other varieties.

Properties.—Aloes is the inspissated eonerete juiee of the leaves of eertain speeies of *aloë.* In mass it is a solid resinous-looking substanee, and is generally rather brittle. Its external surfaee is duller and darker than a freshly-made fraeture. It has an intensely bitter and persistent taste, and a strong and more or less disagreeable odour, whieh is always mueh inereased when the specimen is breathed on or heated. When held in the hand for some minutes, it softens and beeomes adhesive. At a low red heat, it beeomes partly fused, froths up, ehars, and burns. It is almost entirely soluble in boiling water, whieh, however, deposits, as it eools, a brown substance varying in quantity with the variety of the aloes. Most speeimens are entirely soluble in proof spirit, but in weaker solutions of spirit the degree of solubility varies mueh with the kind and quality of the speeimen. The eolour of both the watery and aleoholie solutions also varies somewhat in the several eommereial varieties; in general, the solutions of Cape aloes have the lightest eolour, and those of Barbadoes the darkest. The watery solution reddens litmus, owing to the presenee either of gallic or aloesic aeid. It is deepened in eolour by alkalies, yields an olive-brown eoloration with sesquiehloride of iron, and a yellow preeipitate with aeetate of lead. To ensure these reaetions, the solutions must be eold. Although aloes have been frequently analyzed, the results obtained are by no means uniform, and the subjeet still stands in need of fuller and more aeeurate investigations. I subjoin, as the best analysis I ean find, one of so-ealled Soeotrine aloes, made in 1846 by M. Edmond Robiquet, and quoted by Professor Christison in his Dispensatory:—

Pure aloes, aloesin (impure aloine),	85.
Ulmate of potash,	2.
Sulphate of lime, with traces of other salts,	2.
Gallic aeid (aloesic acid, Pereira),	0.25
Albumen,	8.
Loss,	2.75
	100.00

Aloesin, the bitter saponaceous, resinous, or extraetive principle of aloes, may be readily obtained by evaporating a watery solution of any of the varieties of aloes. It is brown, very bitter, and more soluble in water than spirit. Its properties undergo considerable alteration, and its purgative action is much impaired by exposure to high temperatures. It consists of a recently discovered principle called aloine, with about thirty per cent. of resin (Royle), and probably owes its medicinal properties to both these bodies. A brief notice of aloine will be found at the end of the article.

Impurities.—The adulteration of aloes is chiefly confined to the substitution of one variety for another, or to the mixture of an inferior variety with one of more value. Such frauds may in general be easily detected by a knowledge of the characters of the different varieties as above given, especially by noting their colour, lustre, odour, and solubility. The admixture of stones, earth, straw, and the like, must be detected by close inspection.

Actions and Uses.—Aloes is purgative and tonic; the former action being developed when it is used in considerable doses, the latter when it is given in repeated small doses, insufficient sensibly to increase the action of the bowels.

When aloes in the solid form is given by the mouth, it is probably acted on by the bile and pancreatic fluids, emulsified, saponified, and then in great part absorbed. The rapidity with which a properly compounded ball is reduced within the horse's stomach is shown by an interesting experiment made by Mr Joseph Gamgee, sen., at the New Veterinary College, in July 1862. Seven drachms of Cape aloes were made into a ball with sixty minims of glycerine, rolled in white tissue paper, and given to a horse, which, in thirty-three minutes after, was killed by dividing the carotid artery. When examination was made an hour later, the ball was entirely dissolved, a distinct odour of aloes was found in the stomach and duodenum, but had not extended to the large intestines. Aloes has not as yet been detected in the blood; but its disappearance from the part to which it is applied, and its frequently acting on the kidneys, are certain evidences of its entering the circulation. As, however, it cannot, when in any considerable quantity, remain there without harm, it must be excreted; and being generally in too large amount to be easily separable by the kidneys, and being insoluble in air, and hence not removable by the skin or lungs, no other channel of elimination is open to it except the bowels. It is accordingly absorbed into the glandular apparatus covering the intestinal mucous membrane, induces there a copious secretion of fluid, with which it is poured into the canal, and especially, it is believed, into its more posterior parts. The increased peristaltic motion so obvious during the operation of aloes, and which so much enhances its purgative effect, is a reflex action depending on the irritation excited during the solution and absorption, and subsequent excretion of the drug. The augmented secretions render the feces fluid, whilst the increased peristaltic motion accelerates their discharge.

As compared with some other purgatives, aloes is tardy in its action, and apt to be uncertain, unless when the bowels are in a tolerably regular and normal state. In ordinary circumstances, however, it is a safe and sure purgative for horses. Its effects, except within certain comparatively small limits, do not increase in proportion to the dose; and, unlike most other cathartics, it is not in large doses an irritant poison. It does not, except in very large doses, render the dejections so fluid as saline purgatives, but appears to accelerate the peristaltic motion in a greater degree. Aloes is generally thought to have a special effect in increasing the secretion of bile; but this has never been very satisfactorily established; indeed, though it usually relieves those symptoms which depend on defective action of the liver, bile has been sought for in vain in the feces of animals purged by aloes. It is said to produce evacuations which possess a peculiar disagreeable odour (Hertwig). The cathartic action of aloes, like that of all true purgatives, is produced with nearly equal facility by whatever channel it finds access to the blood. It may be produced by placing the aloes in sufficient quantity in the cellular tissue, applying it to any mucous membrane or other absorbing surface, or injecting it in solution into the veins. Six drachms of Barbadoes aloes, dissolved in twenty-four ounces of water, and injected at short intervals into the jugular vein of a horse, caused nausea, frequent straining and efforts to dung, colic, which, however, was only of short duration, and after twelve hours purgation. Sometimes, when injected into the veins, it acts on the kidneys rather than the bowels. Thus Moiroud injected four drachms, dissolved in diluted alcohol, into the veins of a horse, and next day eight drachms, dissolved in a similar manner; but, instead of any effect on the bowels, he observed only the evacuation of a large quantity of urine.

The different varieties of aloes differ somewhat in the degree of their action, Barbadoes being the most energetic, East Indian less so, and Cape the weakest. The Cape is generally considered as less active than the Barbadoes by nearly one-fourth, and further differs from it in being rather more apt to cause diuresis. In veterinary practice, preference has long been given to Barbadoes aloes—perhaps, however, without sufficient reason; for the other sorts, especially the East Indian, when given in slightly larger doses, are quite as effectual, and have the advantage of being considerably cheaper. The Caballine and other inferior kinds, being very uncertain and irregular in their effects, should not be used. Every sort of aloes is most active when freshly powdered; and hence, except for immediate use, should be kept in pieces, preserved from moisture in oiled silk or tin canisters. The purgative effect of aloes is materially accelerated and increased by giving it in solution, and by combining it with other substances, not in themselves purgative, such as sulphate of iron, and most vegetable tonics and bitters. Its irritant effect on the rectum, which is sometimes an objection to its use, especially in the dog, may be mitigated by giving it in solution, and entirely prevented by combining it with other purgatives.

In the horse, a cathartic dose of aloes generally causes in a few hours dryness and increased warmth of the mouth, a somewhat quickened pulse, and occasionally nausea, colic, and copious secretion of urine. This last effect, as above remarked, is more apt to be produced by Cape aloes than by any of the other sorts; but it occasionally occurs even with the Barbadoes, especially when the bowels have been previously much constipated, or otherwise out of order. Whenever, therefore, an ordinary dose of aloes fails to produce the desired purgative effect, the practitioner should always ascertain whether or not it has acted on the kidneys. To prevent this action, he should not repeat the aloes, giving an increased quantity, as some advise, but ought to diminish the dose of aloes, and administer it in combination with jalap, a little croton, or, best of all, with one or two scruples of calomel. The time required for the operation of aloes differs much in different horses, and is modified by various circumstances, especially by the diet upon which the animal has been previously kept. A dose of five or six drachms generally operates in from sixteen to twenty-four hours. The degree and continuance of the action are also liable to considerable variation. In some horses, the purging is over in two or three hours; in others, it extends over twenty-four hours.

In ruminants, aloes is neither a prompt nor a powerful purgative. When given to cattle even in the fluid state, and in doses of several ounces, it fails to produce copious evacuations, such as are obtained in the horse. Hertwig mentions that, in an experiment made at the Veterinary School of Lyons, a cow got six ounces of aloes, partly in solution, partly in electuary; but, although uneasiness and loss of appetite were observed, the bowels remained unmoved. Gilbert also gave six ounces, with an infusion of four ounces of senna leaves, without effect. Sheep and goats take doses varying from two drachms to an ounce, without being speedily or certainly purged. This tardiness and uncertainty in the purgative effect of aloes on ruminants, probably depends chiefly on its vegetable nature, and its consequent resemblance to the ordinary food of the animals; on the small effect which it has on the stomach, and other anterior parts of the alimentary canal; on its acting particularly on the great intestines, which in such animals are neither very sensitive nor vascular; and on its chiefly operating by increasing the peristaltic motions, which are especially difficult to excite in ruminants.

Aloes is frequently used as a purgative for the dog; but, when given alone, is neither so speedy nor so safe as calomel and jalap, or castor oil. It has also the disadvantage of occasionally producing irritation of the rectum; but this may in great part be overcome by giving it in the fluid state, or combining it with other purgatives. The quantity of aloes required to purge a dog is unusually large, as compared with the doses administered either to the human subject or to the horse. In the case of many medicines, the doses suitable for the dog and for man are very similar; but, in this instance, the dog requires eight or ten times the quantity given to man.—Aloes is a very good purge for swine, but usually takes about twelve or fifteen hours to operate.

The special cases in which aloes is administered, are very numerous, particularly in the horse. It is given in constipation, in colic, and for the expulsion from the intestines of concretions, foreign substances, and worms. As a vermifuge, it should be given after a long fast, in the fluid state, and with oil of turpentine; while, in addition to its exhibition by the mouth, a diluted solution ought to be injected into the rectum. In jaundice and congested states of the liver, it is usually selected in preference to other purgatives. In the treatment of febrile attacks, it is of the greatest advantage, often serving all the purposes of blood-letting without leaving debility, diminishing the fluid parts of the blood, and carrying away those deleterious matters which cause or aggravate the attack. It is a most valuable auxiliary in the treatment of inflammation of almost all parts and organs; as in inflammation of the brain, eye, lungs, pleura, and absorbents; and in all such cases its efficacy chiefly depends on some or all of these causes—on its drawing away blood and nervous influence from the inflamed part; on its diminishing the quantity of the blood; on its removing from that fluid many of those noxious matters which have been developed by disease, or accumulated there during its existence; and also on its clearing the intestines of undigested food and other crudities, which often occasion much uneasiness, and aggravate the original disease. Aloes is often effectual in removing œdematous enlargements and dropsies, when they do not depend on debility or disease of important internal organs. It is given in plethora to diminish the amount of superfluous blood and fat, and to promote condition; but for these purposes aloes, and indeed all purgatives, should be used with much caution, as the objects which they are intended to effect are far more safely and effectually secured by judicious feeding and well-regulated exercise. In similar diseases among cattle and sheep, aloes is occasionally given; but, as already stated, it cannot be so much depended on as in the horse. If used for ruminants, it should be combined with saline cathartics, gamboge, or croton, and given in the fluid form. For the dog, it may be used in the same sort of cases in which it is given to horses; but is generally superseded by calomel and jalap, or some of the oils, which have the advantage of acting more speedily and surely.

The administration of aloes should be avoided in cases of irritation or inflammation of any part of the alimentary canal, and in piles or hemorrhage from the rectum. In bronchitis and other inflammatory affections of the mucous membranes, and in inflammation of the kidneys, it must be used with great caution, and in very small doses; for in such cases the intestinal mucous membrane is unusually irritable, and superpurgation and inflammation are readily induced. During pregnancy, both in the mare and bitch, the violent operation of aloes must be carefully avoided. Some practitioners give it both to foals and calves, but for young animals linseed oil or castor oil is more suitable.

As a tonic, aloes is little used. Like other bitter medicines, it is occasionally prescribed in cases of weakness and relaxation of the digestive apparatus, where there is impaired secretion of bile, or tendency to the production of intestinal worms. It is sometimes applied externally as a gentle stimulant and desiccant, as to soft unhealthy granulations, which it speedily contracts and hardens. It also lessens the quantity, and improves the quality, of morbid pus.

Doses, etc.—The dose of aloes for the adult horse varies from ʒij. to ʒx., according as it is given as a mild laxative or an active cathartic. If used for the foal, the dose, until the animal is several months old, may always be readily ascertained by allowing grs. v. for every week of its age. For cattle, the dose is from ℥i. to ℥ij.; for sheep, ʒss. to ℥i.; for dogs, ℈j. to ʒi.; and for swine, about ʒiv.

As a gently stimulating tonic, the dose of aloes for any of the domesticated animals is an eighth or tenth part of that given as a purgative. The tonic doses should be given several times a-day, and in combination with aromatics and astringent bitters. A convenient laxative tonic for the horse is made with two drachms each of aloes, gentian, and ginger, rubbed into a ball with treacle. Another of less laxative tendency may be prepared with a drachm each of aloes and sulphate of iron, with half an ounce of ginger, made up with treacle and linseed meal. Either of these may be repeated daily, and prove useful in improving the tone of the digestive organs, and removing worms.

In veterinary practice, aloes is administered in only one or two forms. The most common and convenient is the bolus or ball, which may be made with any of the ordinary excipients. The requisite dose, freshly powdered, mixed with a drachm of ginger, made up with soft soap or lard, and the ball rolled in thin paper, is a formula answering well for immediate use. The ball-mass of the Edinburgh Veterinary College consists of equal weights of Barbadoes aloes and treacle, with two ounces of ginger to every pound of aloes. The addition of ginger, or some other aromatic, appears to render the action more speedy and easy. The ingredients are mixed over a slow fire, and constantly stirred until properly melted, great care being taken to prevent the temperature from rising too high. It should never exceed 120° Fahrenheit. The mass should be kept in air-tight jars, with closely fitting covers—the balls being made up as required. Another very good ball-mass, which keeps long without hardening, and is less bulky than the last, is prepared by adding to melted aloes about a fourth of its weight of rectified spirit or oil of turpentine, which is retained by the resinous matter of the aloes, and keeps the mass soft and moist. Aloetic balls made with lard, oils, or soap, are only suitable for immediate use, and, if kept for any considerable time, become dry and hard. This may, however, be temporarily prevented by adding a little glycerine and a few ounces of carbonate or acetate of potash to every pound of the combination. Fifteen grains each of powdered aloes, jalap, ginger, and soap, made into a pill with a little glycerine, is a good purge for a large dog, and will make two or three doses for smaller animals. Of the fluid preparations of aloes, the watery infusion is one of the best and most convenient. The aloes should be rubbed down in hot water, but on no account exposed to a boiling temperature. The solution should be used freshly prepared. Many practitioners employ a solution of aloes in diluted alcohol, which, though more expensive, keeps better than the watery infusion. It may be made of whatever strength is most convenient, and is best prepared by the old process of digestion.

ALOINE.—During the summer of 1850, Messrs Smith, the well-known pharmaceutic chemists, Duke Street, Edinburgh, discovered, first in Barbadoes aloes, and subsequently in the other varieties, a peculiar crystalline body, which they believed to be the active principle of the drug, and called aloine. They prepare it in the following manner.[1] Barbadoes aloes is powdered with sand to prevent agglutination, macerated in successive quantities of cold water, and the solutions thus obtained mixed and concentrated in vacuo to the consistence of a syrup. This, after being kept in a cool place for two or three days, becomes filled with minute brownish-yellow crystals of impure aloine, which is purified by drying between folds of bibulous paper, and by repeated solution in hot water, filtration, and crystallization. When pure, aloine is a pale-yellow crystalline substance, breaking when in mass with a dull short fracture. It is odourless; but its taste, at first slightly sweet, soon becomes intensely and permanently bitter, and distinctly aloetic. It is entirely combustible, burning with a yellow flame and much smoke. It yields by destructive distillation a somewhat aromatic volatile oil, and a resinous residue. It is neutral to test paper. It is soluble in rectified spirit, but less so in cold water —an ounce of which dissolves about a grain of aloine. The solvent power, both of water and alcohol, is greatly increased by heat. Aloine is also dissolved by acetic acid, and alkalies, forming with the latter orange-yellow solutions, which deepen in colour by oxidation. Sulphuric ether dissolves it sparingly, and oil of turpentine and chloroform have little effect upon it. Watery solutions rapidly darken in colour by exposure to air and light, and when heated above 150° F., the aloine is oxidized, decomposed, and converted into a resinous substance of little activity. Its actions with nitric acid and other chemical substances are very interesting, but cannot be discussed here. When anhydrous, its formula is $C_{34} H_{18} O_{14}$.

Aloine appears to be the tonic rather than the cathartic principle of aloes. When first discovered, it was thought to concentrate in itself all the activity of the crude drug, and was considered to be at least four times as powerful as a purgative. I have, however, on two different occasions, given two drachms to

[1] See Paper on Aloine, by Messrs Smith, in Monthly Journal of Medical Science. Feb. 1851.

healthy horses without any obvious effect; and have also repeatedly administered a scruple to dogs without observing any laxative action. In a small dog, two scruples acted moderately after ten hours.

ALUM.

ALUMEN. Sulphate of alumina and potash. $KO\ SO_3 + Al_2\ O_3, 3\ SO_3 + 24\ HO$.

Alum is found in limited quantity as an efflorescence on the surface of soils and rocks, especially in volcanic districts; and is prepared in large amount from aluminous clay, or schist, which consists of alumina, iron, and sulphur. This schist, when freely exposed to the action of the air, absorbs oxygen, by which its metallic iron is converted into oxide of iron, and its sulphur into sulphuric acid. After the addition of water to dissolve out the sulphates of iron and alumina, the solution is slightly concentrated, and treated with chloride of potassium, which, decomposing the salt of iron, forms chloride of iron and sulphate of potash—the former remaining in solution, and the latter uniting with the sulphate of alumina. The alum so formed crystallizes out, and is further purified by repeated solutions and crystallizations. It consists of one equivalent of sulphate of alumina, one of sulphate of potash, and twenty-four of water; and is expressed by the symbol $KO\ SO_3 + Al_2\ O_3, 3\ SO_3 + 24\ HO$.

Properties.—Alum occurs in transparent, colourless, crystalline masses, with a sweet, acidulous, astringent taste. It acts like an acid on colouring matter, effloresces when exposed to the air, and when heated, fuses, and parts with its water of crystallization. It is soluble in its own weight of water at 212°, and in eighteen times its own weight at 60°. It is best distinguished by its negative action on sulphuretted hydrogen; and its white precipitates with hydro-sulphuret of ammonia and with caustic potash. The precipitate with the latter is soluble in excess of the alkali, but reappears on the addition of chloride of ammonium.

Impurities.—It is apt to be contaminated by iron, which is discoverable by the yellow colour which it imparts to the salt, and by the blue precipitate it gives with solution of yellow prussiate of potash. But the presence of iron, though it renders alum unfit for the purposes of the dyer, does not interfere with its medicinal properties.

Actions and Uses.—Alum is irritant, astringent, and sedative. Doses of from one to two ounces given to dogs cause vomiting, unaccompanied, however, by any other symptoms. Orfila found that when the œsophagus was tied, so as to prevent vomiting, two ounces occasioned death in five hours, with symptoms of great exhaustion and diminished sensibility. On post-mortem examination, inflammation was observed throughout nearly the whole extent of the intestines. Devergie (quoted by Pereira) found that four drachms of burnt alum killed a dog when the gullet was tied, whereas in ordinary circumstances two ounces were required to produce that effect. An ounce introduced into the cellular tissue of a dog's thigh, caused excessive suppuration and death in fifteen hours. Moiroud says that large doses given for some time continuously exhaust the digestive organs, diminish the cutaneous transpiration, and appear capable of producing grave disorders. Bourgelat found it produce phthisis pulmonalis in horses. Doses of several ounces are occasionally given to cows to arrest the lacteal secretion, and although continued for some time, do not produce any obvious bad effects. In its medicinal actions and uses, alum closely resembles oxide and acetate of zinc, but is scarcely so active. Its astringent properties depend on its forming insoluble compounds with albumen, fibrine, and gelatine, and also in part on its affinity for moisture. By corrugating the soft animal tissues, it lessens the calibre of their blood-vessels, and so diminishes vascularity and arrests secretion. It is thus that its sedative action is established. Like other astringents, it becomes absorbed, and exercises a general constringing action, drying up excessive secretions, and causing thirst. It is administered in diarrhœa and dysentery, and is often advantageously combined with opium and vegetable astringents. It was at one time much used in diabetes, and is still occasionally prescribed in passive hemorrhages, in aneurisms and dilatation of the heart, and in slow poisoning by lead. It is much employed externally, as a mild stimulant and astringent, in chronic conjunctivitis, and in many simple injuries of the skin and mucous membranes. On account of its coagulating albumen, it is used by many practitioners in the treatment of open joints; being mixed with two or three parts of wheat flour, and the mixture dusted over the opening until synovia ceases to flow. It should not be used too freely, either for internal or external purposes; for although it coagulates albumen, the coagulum is re-dissolved by excess of the alum.

Doses, etc.—The dose for horses and cattle is from ʒij. to ʒiv.; and for dogs, between grs. x. and grs. xx. It may be given either as a bolus or in solution. The most convenient preparations for external use are the burnt alum, a simple watery solution, or an ointment made with one part of alum to three or four of lard.

AMMONIA AND ITS MEDICINAL COMPOUNDS.

AMMONIA. Caustic Ammonia. Hartshorn. Spirit of hartshorn. Aqua or liquor ammoniæ. $NH_4 O, HO$.

Liquid ammonia is generally prepared in large quantities by manufacturing chemists. It is made by triturating together equal parts of chloride of ammonium (sal-ammoniac) and slaked lime, transferring the mixture to large retorts, and applying a gradually increasing heat, until gas ceases to come off. In this process, the lime unites with the hydrochloric acid of the sal-ammoniac, and so liberates the ammonia, which is conducted into receivers containing water, in which it is freely soluble. Ammonia is evolved during the putrefaction and destructive distillation of organic matters, and also by passing electric sparks through a mixture of hydrogen and nitrogen.

Properties.—Aqua ammoniæ is a colourless fluid, with a pungent, penetrating odour, and a caustic alkaline taste. Its density varies with its strength, and is difficult to determine, on account of its volatility. The strong ammonia of the Edin. Phar. has the density 880, and contains, according to Dalton, 27 per cent. of gaseous ammonia, which is equal to no less than 670 times the volume of the water in which it is dissolved. But unless well kept in closely stoppered bottles, it very soon increases in density from the escape of ammoniacal gas. When exposed to the air, it also speedily absorbs carbonic acid. By a sort of catalytic action it prevents and arrests oxydation, and hence, as will be afterwards more fully noticed, it acts as a valuable antiseptic. It boils at about 100°. It unites with oils and fats, forming soaps and liniments. When heated in a small plain retort, it evolves ammonia, which is a colourless, irritant, irrespirable gas, with the same pungent odour and taste as the solution, and the composition NH_3. The strong ammonia, or aqua ammoniæ fortior, is too concentrated for most medicinal and pharmaceutical purposes, and a weaker solution, made by adding two and a half volumes of water to one of the stronger, is generally used. This diluted solution has the density 960, and contains 8.3 per cent. of gaseous ammonia (Dalton). Aqua ammoniæ seldom contains any serious impurities or adulterations. The presence of water, carbonate and muriate of ammonia respectively, may be discovered by the following tests:—Density 880; diluted nitric acid causing no effervescence; and solution of nitrate of silver causing no precipitation, when the suspected specimen is saturated with nitric acid. (Ed. Phar.)

Actions and Uses.—Liquid ammonia, in a state of concentration, and in large doses, is an irritant and peculiar narcotic poison; and in medicinal doses, is used as a diffusible stimulant, antispasmodic, antacid, resolvent, and diuretic, and also externally as an irritant and vesicant.

Hertwig found that half an ounce of the strong solution had no bad effects on horses, but that one ounce proved fatal in sixteen hours, and three ounces in fifty minutes; the latter quantity causing violent cramps and difficulty of breathing. Half a drachm introduced into the stomach, and secured by tying the œsophagus, destroyed a dog in twenty-four hours, causing much uneasiness, agitation, and stupor, and leaving after death slight redness of the villous coat of the stomach (Orfila). When injected into the veins, it causes spasms, convulsions, and death, which usually occurs within a few minutes, and depends, according to Mr Blake, on sudden arrestment of the action of the heart. The most effectual antidotes to ammonia, are vinegar and other diluted acids, with diluents and demulcents. On account of its volatility, and the rapidity with which it is absorbed, it probably enters the blood in a free state, or only very partially neutralized by the acid gastric juice. When administered in full medicinal doses, its action is speedily developed; it excites the action of the heart, and the activity of most of the secretions; but this stimulant action, although developed with especial rapidity, is very transient. Ammonia appears to affect chiefly the spinal chord and the ganglionic system of nerves; and does not, like alcoholic or etherous stimulants, owe its effects to its primary action on the brain proper. It is probably on this account that it acts with such unusual certainty and regularity on animals of all kinds, and of all degrees of *intellectuality*. Dr B. W. Richardson has found ammonia to be a normal constituent of the blood, and has endeavoured to show that its escape is the cause of the coagulation of blood withdrawn from the body. But Mr Lister, in his masterly Croonian Lecture, delivered before the Royal Society, 11th June 1863, proves very conclusively, that "the coagulation of the blood is in no degree connected with the evolution of ammonia, any more than with the influence of oxygen or of rest." Although somewhat foreign to my subject, I cannot refrain from introducing here Mr Lister's important conclusion, that "the real cause of the coagulation of the blood, when shed from the body, is the influence exerted upon it by ordinary matter, the contact of which, for a very brief period, effects a change in the blood, inducing a mutual reaction between its solid and fluid constituents, in which the corpuscles impart to the liquor sanguinis a disposition to coagulate."

In virtue of its activity as a diffusible stimulant, ammonia is a most effectual agent for removing spasm. On account of its alkaline properties, it is used as an antacid; but it is not so useful and effectual for this purpose as potash or soda. It is excreted from the body by several different channels, but particularly by the kidneys and skin, both of which it stimulates to increased activity. Its wonderful power of preventing oxydation probably explains its efficacy in staying or retarding the progress of those blood disorders accompanied by wasteful degeneration of the tissues. When applied externally, it produces redness, and even vesication; but its action as a counter-irritant, though rapidly induced, is not lasting.

In typhoid and debilitating diseases, as in influenza, scarlatina, purpura, chronic bronchitis, and pneumonia, when accompanied by a soft, weak pulse, and cold extremities, ammonia is of great benefit in rousing the vital powers, maintaining the fluidity of the blood, preventing exudations, or liquefying those already poured out, and retarding oxydation, and thus arresting undue disintegration and waste. It often relieves congestion of the lungs brought on by over-exertion, and effectually removes hoven and tympanitis. In indigestion its twofold action as a stimulant and antacid render it especially useful. It counteracts the spasms of colic and epilepsy, and should in the latter disease be given by the mouth, as well as cautiously inhaled. It is a valuable antidote in poisoning by prussic acid, and appears to operate beneficially by inducing a state of system directly opposed to that occasioned by the poison. For the same reason, it also proves useful in cases of poisoning by other sedatives. It is applied externally as a counter-irritant in sore throat and bronchitis, rheumatism, and other chronic affections occurring in the neighbourhood of joints, and for such purposes is especially valuable in cattle practice. Ammonia has been discovered by Dr Richardson effectually to prevent oxydation by a species of catalysis, and is hence a most powerful and useful antiseptic. In an atmosphere slightly impregnated with the penetrating ammonia, meat, milk, blood, morbid specimens, and indeed any sort of animal matter, may be kept for weeks without undergoing decomposition or any change, even in microscopical character. The only alterations occur with fatty matters, owing to their union with the ammonia to form a species of soap. The specimens to be preserved are either placed with about a drachm of ordinary liquor ammoniæ in bottles, with well-ground stoppers, or underneath bell jars along with lint, saturated with from ten to thirty minims of strong ammonia, the jars being secured from access of air by a luting of red lead and soap.

Doses, etc.—The dose of the strong ammonia, as a diffusible stimulant and antispasmodic, is from f℥ij. to f℥vi. for horses; from f℥ij. to f℥x. for cattle; and from ♏v. to ♏xii. for dogs. The ordinary medicinal solution contains one part of strong ammonia to two and a half of water. Ammoniacal preparations usually require to be given repeatedly; and, on account of their pungency, must be largely diluted with water, or, better still, with cold gruel or mucilage. For many stimulant purposes a good combination for horses and cattle may be made with an ounce each of medicinal ammonia, sweet spirit of nitre, and compound tincture of gentian. For colic and indigestion, a convenient draught is composed of an ounce of the medicinal ammonia, with four or five drachms of aloes rubbed down in water. For external application, ammonia is sometimes used alone, but more frequently along with turpentine or oils. A convenient liniment may be made with equal parts of ammonia, oil of turpentine, and linseed oil. *Spirit of Ammonia*—a solution of ammonia in rectified spirit—is occasionally used in human medicine, but for most veterinary cases is not so good as the cheaper watery solution. The Edinburgh College directs it to be prepared by conducting gaseous ammonia, obtained in the usual way from muriate of ammonia and quicklime, into a receiver containing rectified spirit, in which it readily dissolves. The spirit of ammonia of the London and Dublin Colleges contains carbonate of ammonia instead of ammonia itself, and is, consequently, less active than the Edinburgh preparation, which has a density of 845, and a strong ammoniacal odour, and does not effervesce with dilute acids. It is a useful stimulant and antispasmodic, and a convenient solvent for gum-resins. Its dose for the horse is from f℥i. to f℥ij.; for cattle, f℥ij. to f℥iv.; and for dogs, ♏xv. to ♏xxx.

Carbonate of Ammonia. Sesqui-carbonate of ammonia. Hartshorn salt. Sal volatile. Ammoniæ sesqui-carbonas. $2NH_4O, 3CO_2$.

Professor Rose of Berlin has described twelve different carbonates of ammonia, but the only one of these used in veterinary practice is the commercial sesqui-carbonate. It is best prepared by subliming together about two parts of finely powdered salammoniac, and three parts of chalk. Mutual decomposition occurs, but, from the escape of free ammonia, the carbonate which sublimes commonly contains only two parts of base to three of acid. It occurs in white, fibrous, translucent cakes, which have a pungent, alkaline taste, and an ammoniacal odour. According to Berzelius, it is soluble in two parts of temperate water and one of tepid water; alcohol dissolves it sparingly, and boiling water decomposes it with evolution of ammonia and carbonic acid. When heated, it sublimes; and when exposed to the air it becomes opaque and friable, and covered with a white powder owing to the formation of a bicarbonate. It is not liable to adulteration.

Actions and Uses.—The sesqui-carbonate closely resembles the alkali in its actions, but is somewhat less irritant. It is sufficiently active, however, to produce in small animals the same sort of narcotic poisioning as ammonia. Thus Orfila records that two and a half drachms given to a dog caused gastric inflammation, tetanic convulsions, and death. It is for all classes of patients the most convenient ammoniacal compound, and is employed in the same cases as those in which ammonia itself is recommended. In influenza, scarlatina, erysipelas, and other typhoid affections, in the advanced stages of all inflammatory complaints, and in convalescence from debilitating diseases, no remedy is of greater value as a general stimulant, and, in virtue of its special solvent action on the solid parts of the blood, as a means of preventing and removing exudations. For these purposes it is in every day use for cattle; and in cases of inflammation in these animals, it may be advantageously given earlier than it generally is, and earlier than would be advisable in similar cases amongst horses. When mixed with some aromatic oil, as that of bergamot or lavender, and a little aqua ammoniæ, it constitutes the familiar smelling salts.

The dose of carbonate of ammonia for horses is from ʒij. to ʒiv.; for cattle, from ʒiij. to ʒvj.; and for dogs, from grs. iij. to grs. v. It is best given either in a bolus with linseed meal, or with gruel, which must not, however, be used hot. Where a prompt stimulant effect is required, it is frequently conjoined with some variety of alcohol, with ether, or sweet spirit of nitre; whilst in chronic aliments it is advantageously united with gentian, ginger, oak-bark, or some other tonic.

Muriate or Hydrochlorate of Ammonia. Sal-ammoniac. Chloride of ammonium. Ammoniæ murias. NH_4 Cl.

This is the salt of ammonia from which all the others are commonly procured. It may be obtained from many different sources, but is now prepared chiefly from the ammoniacal liquor of the gas-works, which contains ammonia in various states of combination. This gas liquor is treated with diluted hydrochloric acid, or in some manufactories with common salt or impure chloride of calcium; and the solution, when slowly evaporated, yields brown crystals of muriate of ammonia. These are dried, and exposed for eight or nine days to a gentle heat in iron pots covered with leaden domes, in the interior of which the salt is sublimed in large hemispherical cakes. So prepared, the salt is colourless and translucent, and of a tough and fibrous structure. It is devoid of odour, and has a saline acid taste, and a slightly acid reaction on colouring matter. It is soluble in one part of boiling, and three of temperate water. During solution it abstracts much heat, and is consequently an ingredient of many freezing mixtures. When heated, it sublimes unchanged. If mixed with lime or potash, it evolves ammonia.

Actions and Uses.—In large doses it is an irritant poison, and, like other ammoniacal salts, produces peculiar remote symptoms, which are thought to depend on some special action on the spinal chord. Two ounces given to a horse caused muco-enteritis (Moiroud); and two drachms destroyed a little dog in an hour (Orfila). The symptoms described as occurring in dogs are "muscular weakness, slow breathing, violent action of the heart, and tetanic spasms" (Christison on Poisons). In medicinal doses it is, like other ammoniacal compounds, stimulant, resolvent, and diuretic. On account of its power of dissolving fibrine and stimulating the secreting organs, it is of much value in the secondary stages of inflammation; and being less actively stimulant, it may be used in cases where the liquor ammoniæ and carbonates are too powerful. For such purposes it deserves to be more extensively used, and may be given in the same doses as the carbonate. When dissolved in water or spirits, it is a favourite application for inflammatory swellings, bruises, and sprains; and a good discutient lotion may be made with equal parts of muriate of ammonia and nitre, dissolving the mixture when required for use in sixteen or twenty parts of water. Such a mixture will lower the thermometer from 50° to 10° F. (Pereira).

Acetate of Ammonia. Spirit of Mindererus. A diluted aqueous solution of the acetate of ammonia. Ammoniæ acetatis aqua.

Acetate of ammonia is so diliquescent that it cannot be kept in the solid state. The solution is thus prepared by the Edin. Pharmacopœia:—"Take of distilled vinegar (French vinegar in preference) twenty-four fluid ounces; carbonate of ammonia one ounce. Mix them and dissolve the salt. If the solution has any bitterness, add by degrees a little distilled vinegar till that taste be removed. The density of the distilled vinegar should be 1005, and that of the aqua acetatis ammoniæ 1011."

The solution of acetate of ammonia is clear and colourless, with a mawkish unpleasant taste, but nearly devoid of odour. It is easily distinguished by the ammoniacal odour developed by the admixture of caustic potash, and the acetous odour which it produces when heated with sulphuric acid.

Like other ammoniacal salts, it is stimulant, diaphoretic, and diuretic. The dose for horses and cattle is from f℥iij. to f℥iv.; and for dogs, from fʒij. to fʒiv. It is given diluted with water, or in wine, spirits, or ale. It is occasionally used in febrile and inflammatory diseases, but not so frequently among the lower animals as in man. In influenza, strangles, and other debilitating disorders, a convenient combination is made with two ounces each of the mindererus and sweet spirit of nitre, and half a drachm of extract of belladonna. The acetate, like the muriate, is applied externally as a discutient.

ANISE.

ANISUM. Fruit of the *Pimpinella Anisum.*

Nat. Ord.—Umbelliferæ. *Sex. Syst.*—Pentandria Digynia.

The natural family umbelliferæ yields many aromatic, carminative seeds, such as anise, caraway, coriander, and fennel.

Anise is grown in many islands of the Archipelago, and in Egypt; but the English market is chiefly supplied from Spain and Germany. The Spanish seeds are smaller, lighter coloured, and more esteemed than the German. The anise is a little yellow-brown fruit, about the size of a small oat seed, is covered by minute hairs, encircled with numerous little ridges, and possessed of an aromatic odour, and a sweet pungent taste. Like other seeds of this natural family, it may be separated into two symmetrical halves. It bears some resemblance to the fruit of the hemlock, for which it has sometimes been mistaken, but may be easily distinguished from it by its aromatic odour, and its smooth encircling ridges. Anise contains a considerable quantity of gummy matter, a little sugar and resin, with various salts, a fixed oil, and also a transparent, nearly colourless, volatile oil, which is the active ingredient of the seed, has a strong anise flavour, and solidifies at low temperatures, owing to the large proportion of stearoptin it contains.

Actions and Uses.—Anise is stomachic and carminative. It is used to relieve cases of indigestion and flatulence, to communicate an agreeable flavour to many medicines, and to diminish the nauseating and griping effects of purgatives. It was at one time frequently given to females while nursing, in the belief that it increased the quantity and improved the quality of their milk; and some veterinarians have thought that it exerts a similar action in cows.

Doses, etc.—The dose of powdered anise for the horse is about ℥i.; for cattle, from ℥i. to ℥ij.; for sheep and swine, from ʒij. to ʒiij.; and for dogs, from ℈i. to ℈iij. These doses may be repeated several times a day, are often conjoined with ginger or aromatics, and are conveniently administered in ale or in spirit and water. The oil of anise is rather too expensive for ordinary use as a carminative, but is much used as a flavouring ingredient, especially for ball masses, and is often useful for destroying lice, especially in pet dogs and other small animals.

Caraway, cardamoms, coriander, fennel, and fenugreec, resemble anise in their actions and uses, and may be given in similar doses. Small quantities of these seeds are much used in England amongst feeders of pigs, sheep, and cattle, and amongst waggoners and others, for improving the coat and condition of their horses. Fenugreec especially is highly prized for such purposes, enters into the composition of many "nourishing drinks," and, with ground peas, locust beans, and linseed cake, constitutes the bulk of several much vaunted patent "foods."

ANTIMONY AND ITS MEDICINAL COMPOUNDS.

Oxide or Teroxide of Antimony. Antimonii oxidum. $Sb\ O_3$.

The native oxide is found in small quantity in Saxony and Hungary, and is known as white antimony or flowers of antimony. There are many different ways of preparing the oxide used in medicine, but that generally followed consists in decomposing the chloride with water, and carefully washing the precipitated powder with water and a solution of an alkaline carbonate, to free it from adhering traces of chlorine and hydrochloric acid. The oxide thus purified is a white, tasteless, heavy powder, insoluble in water, but soluble in muriatic, tartaric, and acetic acids. It is permanent in air; it fuses at a red heat; and at higher temperatures sublimes and crystallizes in acicular prisms. Professor Christison considers it a sesqui-oxide ($Sb_2\ O_3$), but most chemists now regard it as a teroxide ($Sb\ O_3$).

Two oxides of antimony form the principal ingredients of the far-famed *James's powder*, which is a mixture chiefly of antimonious acid ($Sb\,O_4$) and phosphate of lime, with some oxide of antimony ($Sb\,O_3$), and a little antimoniate of lime ($Ca\,O,\ Sb\,O_5$). Edin. Phar. The mode of preparing the patent James's powder still remains a secret, but the three pharmacopœias have imitations of it, which, however, are considered inferior to the empirical medicine in activity and certainty.

Actions and Uses.—Oxide of antimony is chiefly important on account of its employment in the preparation of tartar emetic, which it closely resembles in its actions and uses. It is itself so little employed in veterinary practice, that it does not require special notice. Neither the true James's powder, nor its pharmaceutical imitations, are much used in veterinary medicine; nor would their introduction be of much advantage, since they are chiefly serviceable as diaphoretics, and appear amongst the lower animals in no way superior to tartar emetic.

SULPHURET OF ANTIMONY. Antimonii sulphuretum. $Sb\,S_3$.

This, the most valuable and abundant ore of antimony, is popularly known as grey or black antimony. When purified by fusion, it occurs in grey-coloured, metallic, heavy, brittle cakes, devoid of odour and taste, and known as crude antimony. Many modifications of the sulphuret have at various times been used in medicine. Some of the most important of these are—*Glass of Antimony*, "an irregular mixture of oxide of antimony with a definite compound of the oxide and sulphuret;" *liver of antimony*, "a double sulphuret of antimony and potassium;" *Kermes mineral*, believed to be a hydrated sulphuret, or, according to Rose, an amorphous sulphuret of antimony with sulphantimoniate of soda or potash; *golden sulphuret of antimony*, a "hydrated sulphuret with an admixture of oxide;" and *crocus of antimony*, "a definite compound of one equivalent of oxide and two of sulphuret." (See Christison's Dispensatory.)

Actions and Uses. — Being uncertain, irregular, and often violent remedies, the sulphurets of antimony are not now used in human medicine, and should also be discarded from veterinary practice. Their irregularity of action probably depends in great part on their being of very variable composition, and insoluble in water. All of them are considered alterative and anthelmintic, and are usually given to horses in doses of one to three drachms along with sulphur or nitre. They act as emetics for dogs, but are not now used as such.

CHLORIDE OR TERCHLORIDE OF ANTIMONY. Muriate of Antimony. Oil or butter of Antimony. Antimonii chloridum. $Sb\ Cl_3$.

This familiar caustic is prepared by digesting the native sulphuret with hydrochloric acid, and colouring the solution with pernitrate of iron. It is a transparent red-brown liquid, varying in hue according to the proportion of nitrate of iron which it contains. Its specific gravity ranges between 1200 and 1500. From containing excess of hydrochloric acid, it has an acid reaction, and fumes on exposure to air. The addition of water causes the separation of a white precipitate of subchloride, which if washed yields a pure oxide.

Actions and Uses.—It is now used only as a caustic, and that less often than formerly. It is still, however, employed in the treatment of fistulæ, thrushes, canker, and luxuriant granulations; and is besides an especial favourite with many practitioners in cases of foul in the feet of cattle, and foot-rot, the analogous complaint in sheep. In these cases many prefer it to other caustics as more effectual, and at the same time less apt to produce excessive pain, and corrosion of neighbouring parts. Except in cautious hands, it is, however, too energetic for general use; and as it cannot be diluted with water without undergoing decomposition, it should be mixed with an equal quantity of compound tincture of myrrh.

TARTARIZED ANTIMONY. Tartar emetic. Tartrate of potash and antimony. Antimonium tartarizatum. $KO,\ Sb\ O_3,\ \bar{T} + Aq$.

The simplest and best process for making tartar emetic is that pursued by the Edinburgh and Dublin Colleges, and briefly stated as follows:—"Take of sulphuret of antimony in fine powder, four ounces; muriatic acid (commercial), one pint; water, five pints. Dissolve the sulphuret in the acid with the aid of a gentle heat; boil for half an hour; filter, pour the liquid into the water; collect the precipitate on a calico filter, wash it with cold water till the water ceases to redden litmus paper; dry the precipitate over the vapour bath. Take of this precipitate three ounces; bitartrate of potash, four ounces and two drachms; water, twenty-seven fluid ounces. Mix the powders, add the water, boil for an hour, filter, and set the liquid aside to crystallize. The mother liquor, when concentrated, yields more crystals, but not so free of colour, and therefore requiring a second crystallization."—(Edin. Phar.) These directions scarcely require explanation. The chloride obtained from the native sulphuret is decomposed by the action of water. The impure oxide thus thrown down is purified by water, and boiled with bitartrate of potash, when the tartaric acid, being a bibasic acid, unites with the oxide of antimony to form a double tartrate of potash and antimony. This is tartar emetic.

Properties.—It is sold in the shops in two distinct forms; in a white powder, and in colourless transparent octohedral crystals, which become opaque when exposed to the air, and crepitate when heated. It is devoid of odour, but has a sweetish, styptic metallic taste. It is insoluble in strong alcohol, but soluble in weak spirituous fluids, as in wine and proof spirit. It is dissolved in about fifteen parts of temperate water and three of boiling water. The watery solution reddens litmus, and spoils if long kept. It is decomposed by strong acids, alkalies, alkaline earths, and their carbonates (and consequently by most spring waters), as also by decoctions of cinchona and galls, and other tannin-containing substances. Tartar emetic is easily identified by its giving with sulphuretted hydrogen an orange-red precipitate of hydrated sulphuret, which is soluble in excess of the precipitant, and forms, with hydrochloric acid, a yellow solution yielding, when diluted with water, a white precipitate of the oxide. When tartar emetic or other salts of antimony occur in coloured organic solutions, the best method of detecting them is to add to the solution zinc and sulphuric acid, which cause the evolution of antimonuretted hydrogen ($Sb\ H_3$), which may be ignited as it passes from a gas jet. If a bit of cold glass or porcelain be held in the flame, it becomes speedily coated with a deep black mirror of metallic antimony, which may be easily identified by its colour, by its insolubility in a solution of bleaching powder, and also by dissolving it in acidulated water, and treating the solution with sulphuretted hydrogen.

Impurities.—Tartar emetic is liable to only two common impurities, viz., oxide of iron and bitartrate of potash. The former readily discovers itself by the yellow or brown colour it imparts to the salt; while the latter, which is present in considerable quantity in many commercial specimens, diminishes its solubility. To lessen the chances of adulteration, purchasers should adopt Professor Christison's suggestion of procuring their tartar emetic in crystals, instead of powder, as any impurity would then be far more readily discoverable.

Actions and Uses.—The action of tartar emetic differs much in the different domesticated animals. Dogs, pigs, and men, are greatly more susceptible of its various actions than horses or cattle, which resist entirely its emetic action, and are brought under its irritant and cathartic effects only by the administration of doses of three or four ounces given in solution. Quantities of from one to eight drachms seldom have much effect on horses, even when given repeatedly. They do not, at least for a considerable time, induce nausea; they improve rather than injure the appetite; they neither augment nor diminish the evacuations, and disturb neither the circulation nor the respiration. These statements, although somewhat at variance with the generally received opinion, and with the results of various experiments made at Alfort, and reported in the "Veterinarian" for 1847, are fully borne out by a number of experiments made at the Edinburgh Veterinary College by the late Mr Barlow and myself. As these experiments are still unpublished, I shall notice one or two of them somewhat in detail.

Case I.—On 9th September 1852, about 10 A.M., a brown mare, unfit for work on account of lameness, with the pulse 38, and respirations 7, got three drachms of tartar emetic in a ball made up with treacle and linseed meal. In the evening the pulse was unaffected, and the dose was repeated.

10th.—The pulse was 40, the respirations 7, appetite good, bowels and kidneys regular. A dose of four drachms was given morning and evening.

11th.—At 10 A.M. the pulse was 42, respirations 7, appetite and bowels quite normal. Got an ounce in a ball as before. In the evening the pulse was 40, no perceptible nausea, appetite good, bowels and kidneys regular. Dose of an ounce repeated.

12th.—In the morning the pulse was 37½, somewhat weaker than yesterday, but still firm. The appetite was very good, and there was no change in the state of the kidneys or bowels. Got a dose of an ounce. In the evening the pulse was 40, and the patient in other respects as in the morning Gave an ounce, being seven ounces six drachms in four days.

13th.—At 10 A.M. the pulse was 35, the appetite good, and the bowels and kidneys normal. About 11 A.M. the animal had dropped or lain down, and while lying the pulse was somewhat irregular, varying between 60 and 70. The respirations were quiet. At 12 the animal was lifted, when the pulse fell in a few minutes to 55, and the respirations to 6. The appetite still remained very good. Gave ten drachms in the usual way. In the evening the pulse was 40, the same as in the morning, the respirations 6, the appetite and evacuations natural: gave fourteen drachms.

14th.—10 A.M. No change from last night. Got an ounce; but when having it put over, the animal ran back, and went down. At 1 she was raised, still continued to eat, and at 1.30 got another dose of an ounce. She remained down all day, and appeared nauseated. The pulse was not quite regular, probably owing to the occasional struggling, but reached about 60 when at its maximum. Respirations about 12. At 6.30 the animal was still eating and drinking, but only sparingly; was much nauseated, and lying pretty quiet, with the lips much retracted; and the pulse 75, and weak.

15th.—10 A.M. Found dead, having taken ten ounces and six drachms of tartar emetic in six days. Mr Barlow made the following notes of the post-mortem examination:—The muscular tissue in every part of the body was unusually flaccid, although the rigor mortis was well established. The right lung, which was the lowermost as the animal lay, was much congested in its deeper and central parts; the several margins were comparatively pale; at the anterior part of the anterior lobe there was much emphysema. The left lung was perfectly healthy, and not at all emphysematous. The bronchial tubes and smaller bronchii in both lungs contained frothy mucus. The pleura and pericardium were in every way healthy. The heart was very large in consequence of all its cavities being filled with firmly coagulated blood. At the junction of the villous and cuticular coats, the stomach was much contracted, and exhibited a slight blush, not amounting to redness. The cuticular coat was marked with several indentations, such as are produced by bots; but in all other respects the stomach was perfectly healthy. The intestines were also perfectly healthy, both within and without. The liver was in a state of cirrhosis, such as is often seen in old and worn-out horses. The organs of urination and generation were quite normal. The brain was healthy, but the sub-arachnoid spaces contained a considerable quantity of fluid.

CASE II.—A mare, about 16 hands high, and in good health and condition, got three drachms of tartar emetic daily, in the form of a bolus, for five days, and then four drachms daily for thirteen days, making in all ten ounces and three drachms in eighteen days; but without exhibiting any physiological effect. The animal was destroyed by cutting the carotid artery, but the post-mortem examination discovered nothing at all abnormal. It may be mentioned that, on the twelfth day of experiment, twenty ounces of urine were removed, and found to contain a perceptible, but not very large, quantity of antimony.

CASE III.—A black mare, of sound, healthy constitution, took ten ounces and a half of tartar emetic (in doses of four drachms, repeated twice and thrice a day) during the ten days from the 16th to the 24th of September 1852; yet she was in no way affected by it; her pulse and respiration were scarcely at all altered; her appetite throughout was voracious; her evacuations natural in appearance and quantity; and her condition considerably improved. She was poisoned by a fluid drachm of Fleming's tincture of aconite. On dissection, not a single morbid appearance referrible to the tartar emetic was observed. The stomach and intestines were carefully examined, and found "beautifully healthy."

CASE IV.—A healthy, well-bred horse got ten ounces of tartar emetic in solution, and after showing a good deal of nausea, uneasiness, and pain, died in about six hours. The only notable appearances on post-mortem examination, were softness and vascularity of the intestines, analogous to what is seen in patients that have died while affected by diarrhœa. Neither in this, nor in any of the other cases, were the lungs congested or inflamed, as is said to have occurred in Magendie's experiments.

These cases, with several others of a similar kind which might also have been adduced, clearly show that single doses of tartar emetic sufficient, if retained in the stomach, to destroy from thirty to forty men, or as many dogs, may be given to horses with impunity; that doses of from one to eight drachms may be administered to them in the solid form for days, or even weeks, without producing any very obvious physiological effects; and that doses of several drachms, even when given in the form of solution, in which the medicine is certainly far more active, failed to produce any marked depression of the action of the heart, or any diminution in the force and frequency of the respirations.

Cattle, like horses, can take very large doses of tartar emetic without suffering from any of the physiological actions of the drug. Hertwig and Viborg gave quantities varying from two to ten drachms, and Gilbert gave ten drachms in solution—all without effect.—(Hertwig's Arzneimittellehre.) I have repeatedly administered an ounce twice a day to cattle affected by pleuro-pneumonia, and, except in a few cases where purgation occurred, have watched in vain for any evidence of its action. Mr Balfour, V.S., Kirkealdy, informs me that he has given half a pound in solution without any very obvious effects. By doses proportion-ate to their size, sheep are acted on much in the same way as cattle. Viborg gave one drachm, and Gilbert three drachms in solution, and four in the solid state, without effect.—(Hertwig.) But Gilbert found that four drachms destroyed a one-year-old sheep.

The effects of tartar emetic on dogs are much the same as on man. Doses varying from six grains to half an ounce are speedly expelled by vomiting, if the animals be left to themselves; but if the gullet be tied so as to prevent vomiting, such doses cause nausea, accelerated and difficult respiration, fluid dejections, intestinal irritation, and death in a few hours. Hertwig mentions, that it is not so active in pigs as is generally believed; that from ten to twenty grains cause nausea and vomiting, but act neither very rapidly nor very certainly; that one drachm in solution, given to a boar nine months old, caused vomiting, dulness, and uneasiness, which continued for three days; and that two drachms given to a similar animal killed it within twenty-four hours.

Tartar emetic has much the same effect when placed in the cellular tissue, or injected into the veins, as when given in the usual way. In any case it becomes speedily absorbed, and is believed to diminish the plastic elements of the blood (Richardson); to exercise a deranging and depressing influence on the vagus nerve, thus inducing vomiting in man and carnivora; to produce a like sedative effect on the nerves of the heart and lungs, thus explaining the nausea, slower breathing, and increased bronchial secretion which follow its use in these animals (Headland); and to develop a pustular eruption of the skin, which, although observed by Lepelletier in man, has not, I think, been noticed in the lower animals. Tartar emetic has been detected in the blood and in most of the soft tissues, especially in the liver and kidneys, from the latter of which it is chiefly excreted. (Orfila.)

Tartar emetic is extensively used in a great variety of cases. It is generally considered a valuable antiphlogistic for horses and cattle, and is especially prescribed in febrile complaints, pneumonia, pleurisy, bronchitis, and most local inflammations, except those of the alimentary canal. In all such cases it is said to be very effectual, especially when the more acute symptoms are partially subdued by bleeding. But many of the more rational and observant veterinary practitioners, both in England and Scotland, have now entirely abandoned the use of tartar emetic for such cases amongst horses and cattle, and rightly consider it perfectly useless. Indeed, the principal evidence in favour of its possessing any curative action in such circumstances, is derivable from cases in which it is used in conjunction with medicinal and hygienic remedies, which are in themselves most effectual means of cure. Apart, however, from practical experience, it appears highly improbable that tartar emetic should have any active therapeutic effect either in horses or cattle, since in these animals it is, as already mentioned, altogether devoid of physiological action. Many regard tartar emetic as a useful vermifuge, and give it for this purpose to horses, along with Epsom salts or other purgatives. The mixture is sometimes really effectual; not, however, from any special anthelmintic action, but from the smart purgation which tartar emetic always induces when given along with a cathartic. When thus used in combination with other remedies, tartar emetic frequently expedites their effects; for it causes vascular relaxation, which hastens their absorption. This probably accounts for its value as an adjuvant purgative.

Among dogs, cats, and pigs, tartarized antimony is very useful as a nauseating emetic; and is advantageously used in most febrile and inflammatory complaints, relieving engorgement of the stomach and intestines, depressing the action of the heart, and causing a copious secretion from most of the mucous surfaces. It does not operate so speedily as sulphate of zinc or of copper, but is preferable to these in febrile cases, since its emetic action is of longer duration, and accompanied by a greater amount of nausea. On these accounts, however, it is less suitable for simply emptying the stomach of food or poisons.

When rubbed into the skin, tartar emetic causes much irritation, inflammation, and swelling, with an eruption of minute crowded vesicles, which soon become converted into pustules.

Unlike cantharides, it has no tendency to act on the kidneys; but is occasionally absorbed, and produces in dogs the same effects as follow its administration by the mouth. Unless used with considerable caution, it is apt to induce deep-seated inflammation, sloughing, and blemishing; and is consequently little employed in this way, either for horses or dogs. For cattle, however, it is a useful counter-irritant, being chiefly applied in chest diseases, and chronic rheumatism of the joints.

Doses, etc.—The usual dose for horses or cattle is from ʒi. to ʒiv., administered three or four times a day either in bolus or solution. As an emetic for dogs or cats, the dose varies from gr. i. to grs. iv. It may be given in a bolus or rolled up in a bit of meat, but is most effectual in solution. In quantities insufficient to produce vomiting, as in doses of one grain or less, it is used in these carnivora for inducing nausea in inflammatory and febrile complaints. For similar purposes in horses and cattle the dose is generally united with several drachms of nitre; two or three scruples of calomel; a few ounces of salts; or a few drachms of aloes—the last mixture being with some practitioners a favourite purgative in cases of acute febrile complaints. One to two grains, with about the same quantity of calomel, is often given to dogs to arrest inflammatory complaints. Such a mixture causes vomiting, and subsequently purgation, accompanied by much depression. Tartar emetic is used externally as a counter-irritant in the form either of solution or ointment, which latter is usually made with one part of tartar emetic and four of lard, and is sometimes added to ordinary blistering ointments to increase their activity.

ARECA-NUT.

Betel-nut. Seeds of *Areca Catechu.*

Nat. Ord.—Palmæ. *Sex. Syst.*—Monœcia Hexandria.

The catechu or betel-nut palm, is a straight, slender tree, forty or fifty feet high. Within a fatty, fibrous fruit lies the hard, roundish, red-brown seed, measuring about three-fourths of an inch in diameter. When ground, the powder is brown, astringent, and soluble in hot water and spirit. It consists chiefly of tannin, with a little gallic acid, a fixed oil, a red insoluble matter, etc. A portion of areca-nut rolled up with a little lime in the aromatic pungent leaf of the Piper betel, constitutes the celebrated betel or pan so extensively chewed in Eastern countries.

Actions and Uses.—Areca or betel-nut is a very effective vermifuge, especially for dogs, and proves destructive alike to round and to tape-worms. It is best given when the bowels have been cleared out on the previous day by any simple laxative, and when emptiness of the stomach is ensured by several hours' fasting. Half a nut, or about sixty grains of the powder, suffice for a dog of the size of a pointer. It is convenient to note Mr Mayhew's observation, that the dose of the powder is about two grains for every pound of the animal's weight. The nut is always given powdered, and the powder is either made into a bolus, or more commonly given in milk or soup. In a few hours worms are generally discharged. In the "Veterinarian" for May 1862, Mr Hanley states that he gave a bitch, which had fasted for twenty-four hours, two drachms of powdered areca-nut in milk. In fifteen minutes she passed a mass of tape-worms, varying in size from an inch to three feet, and numbering forty-three, each being stated to have a perfect head! Mr Hanley also records the case of a greyhound bitch, which passed, after the use of the nut, a tape-worm thirteen yards and two feet long. Such rapid riddance of the worms is not, however, always attainable; and where the symptoms indicating their presence remain after one or even two doses of the nut have been given, another may still be tried after the interval of a week; and if the patient be vigorous and the bowels not unduly relaxed, it is advisable, a day or two subsequent to the use of the areca-nut, to give a moderate dose of castor-oil and turpentine. By thus following up with another medicine the action of the areca-nut, worms that previously appeared immoveable, will sometimes be speedily and entirely evacuated.

ARNICA.

Leopards'-bane. Mountain Tobacco. Flowers, Leaves, and Root of *Arnica Montana.*

Nat. Ord.—Compositæ. *Sex. Syst.*—Syngenesia, Polygamia æqualis.

Arnica montana is a perennial plant, growing in meadows throughout the cooler parts of Europe, with a hairy stem reaching about one foot high, composite yellow flowers, obovate leaves, and a cylindrical brown root. All parts of the plant have a peculiar aromatic odour, an acrid nauseous taste, and contain a resinous matter, a volatile oil, and a bitter alkaloidal principle called *arnicina.* The flowers, leaves, and root are occasionally used powdered, especially for making poultices; an infusion is sometimes employed; but the most common preparation is the tincture, which is usually made with two and a half ounces of the powdered plant to a pint of proof spirit.

Actions and Uses.—Viborg gave a horse six drachms of the infusion of the flowers, and noticed quickening of the pulse and diuresis. In the human subject it is stated by Pereira "to exert a specific influence over the nervous system, causing headache, giddiness, and disturbed sleep." In infinitesimal doses it was a favourite homœopathic remedy before it was much used in ordinary veterinary practice. It appears to act as an alterative and stimulant, and amongst the lower animals has proved serviceable in rheumatism, the secondary stages of pleurisy, weakness of the loins, and muscular strains. Mr Dollar, V.S., of New Bond Street, London, uses it successfully in rheumatism in horses, and gives me the particulars of the following interesting case:—A four-year-old half-bred horse was, during the spring of 1863, affected with rheumatism, causing constant lameness, which was severe, and frequently shifted from limb to limb. Being in good condition, he was treated for ten days with calomel and opium, and for double that time with small doses of nitre, iodide of potassium and aloes, but without any appreciable improvement. Half-drachm doses of the tincture of arnica were then given night and morning in half a pint of water, amendment was obvious in a few days, and in less than a month the horse was perfectly cured and at work. Drachm doses, repeated twice or thrice daily, afford considerable relief in cases of rheumatic fever in cattle, and arnica deserves in such cases a more extended trial. In the various forms of rheumatic kennel lameness in dogs, and in stiffness produced from over-exertion, it is also usefully employed both externally and internally. Twenty minims of tincture arnica with two drops of Fleming's tincture of aconite given in a few ounces of water, and repeated night and morning, I find effectual in checking obstinate diarrhœa, and straining in lambs. These proportions are suitable for sheep six or eight months old.

The external uses of arnica are numerous and varied. It allays local irritability, and forms one of the best of healing and soothing remedies. In all animals it is useful in cases of strains, bruises, and wounds, and is specially commendable in expediting the healing of broken knees and sore shoulders. For such purposes an ounce of the tincture may be dissolved in from twelve to twenty ounces of cold water; but a still better lotion is made with a drachm each of tincture of arnica and Goulard's extract diluted with ten or twelve ounces of water. The Messrs Dollar use the following prescription:—

Tincture of arnica, ...	1 drachm.
Sulphate of zinc, ...	2 drachms.
Water, ...	10 ounces.

For painful or irritable wounds the tincture may be used with an equal quantity of chloroform, tincture of belladonna, or laudanum, and the mixture diluted with water according to circumstances. Along with liberal feeding and tonic treatment, a drop of tincture of arnica placed daily within the eyelids is one of the best remedies in those troublesome ulcerations of the cornea which affect weakly dogs recovering from distemper.

ARSENIC.

WHITE ARSENIC. Arsenious acid. Arsenicum album. $As\,O_3$.

Arsenious acid is rarely found native, but is often associated in considerable amount with ores of iron, tin, and cobalt. When these are roasted it is evolved, accumulates in an impure form in the furnace flues, and is then purified by one or two sublimations. In this way it is usually prepared from the tin ores of Cornwall.

Properties.—From its being sublimed in conical cast-iron kettles, it occurs in large brittle masses, which are of a concavo-convex form, and exhibit on their interior surface minute octohedral crystals, with triangular facets. It has a snow-white lustrous appearance, and a slightly sweetish taste, is rough and gritty when between the teeth, and if kept in the mouth for a short time causes irritation. It has no odour. When long kept it loses its transparency, and becomes quite opaque. The density of the transparent variety is 3.73, that of the opaque 3.69. It requires for solution nine times its weight of boiling water, and about 400 times its weight of temperate water. Its solubility is increased by the presence of acids, but diminished by that of organic matter.

Chemical Tests.—The special tests for the detection of arsenious acid are easy and distinctive.

1st, When heated in a common test tube to about 380°, it sublimes unchanged, and condenses again in the cool part of the tube in shining crystals, which, when examined with a pocket lens, are found to be regular octohedrons, or portions of such octohedrons, exhibiting faces which are equilateral triangles.

2d, A mixture of arsenious acid and carbonaceous matter, or still better, some cyanide of potassium, is introduced into one of those test tubes specially made for testing arsenic, and having a narrow neck and small bulb. The mixture being heated to redness, the acid is decomposed, and its oxygen withdrawn; while metallic arsenic volatilizes as a colourless gas with a strong odour of garlic, and condenses in the narrow part of the tube, forming a brilliant steel-grey incrustation. This is dark-coloured and smooth externally, and lighter and more crystalline, rough, and shining internally. When the narrow part of the tube is cut out, put into a common test tube, and heated, the metallic arsenic regains the oxygen which it previously lost, and a crust of arsenious acid, in beautiful octohedral crystals, forms in the cool part of the tube.

3d, When this white crust has been boiled with a little water acidulated with hydrochloric acid, or when white arsenic is otherwise in a state of solution, there are three other tests by which it may be readily identified—(*a*) Sulphuretted hydrogen gives a brilliant yellow precipitate of sulphuret of arsenic ($As\ S_3$) or orpiment. (*b*) Ammonio-nitrate of silver (prepared by adding ammonia to nitrate of silver, until the precipitate which first falls is almost wholly redissolved) gives a primrose-yellow precipitate of the arsenite of silver (2 Ag O, As O_5). (*c*) Ammonio-sulphate of copper (prepared in a similar manner to the ammonio-nitrate of silver) gives an apple-green precipitate of arsenite of copper (2 Cu O, As O_5), commonly known as Scheele's green. Although these liquid tests, when taken individually, are not quite free from fallacy, still all of them together afford adequate evidence of the presence of arsenic; and this evidence will of course be still further strengthened by obtaining the peculiar crystals of arsenious acid, and afterwards reducing them to the metallic state.

When arsenic is present in the contents of the stomach, the tissues of the body, or in any coloured organic mixture, the tests mentioned are quite inapplicable until the arsenic be isolated. To effect this, three different *processes* are in common use.

1st, The mixture is boiled, with the addition of water if necessary. It is then filtered, acidulated with hydrochloric or acetic acid, subjected to a stream of sulphuretted hydrogen, and again boiled. A yellow precipitate of sulphuret of arsenic will gradually appear, and its nature may be readily demonstrated by washing, drying, and heating it in a tube with cyanide of potassium, or with a mixture of charcoal and carbonate of soda, when metallic arsenic will volatilize, oxidize, and condense in the characteristic crystals of arsenious acid, which may further be reduced to the metallic state, or subjected to the liquid tests already mentioned.

2d, The mixture is acidulated with pure muriatic acid, and boiled for some time with a few copper clippings, on which there collects a dark crust, which was at one time regarded as metallic arsenic, but is now ascertained to be a mixture of an alloy of copper and arsenic, containing 68 of former to 32 of latter. The clippings are then put into a test tube, and cautiously heated until a ring of arsenious acid lines the cool part of the tube. Indubitable evidence of the nature of this sublimate may be had by dissolving it in acidulated water, and applying the tests for arsenic in solution. This is generally known as Reinsch's process, and is very simple, and so delicate that it will detect at least one 250,000th part of arsenic in solution. (Christison.)

3d, The mixture placed in a Wolf's bottle, a Döbereiner's lamp, or other convenient apparatus, is treated with zinc and sulphuric acid (which must themselves be free from any traces of arsenic, as ascertained by the hydrogen they evolve being uncontaminated by arseniuretted hydrogen). Hydrogen is set free from the decomposition of the water, and unites with the metallic arsenic of any arsenical compound present. The arseniuretted hydrogen ($As\ H_3$) so formed may be decomposed by heating the glass tube through which it passes off, and the crust of metallic arsenic which is thus deposited may be subjected to examination in the usual way. Or, if the end of the exit tube be narrowed, and the gas ignited, a bit of glass or porcelain held over the flame will soon become encrusted, either with metallic arsenic or arsenious acid, according to the distance at which it is kept from the flame. This elegant method of extracting arsenic from complex fluids is called Marsh's process. Mr Morton, lately of the London Veterinary College, has proposed a very delicate and ingenious method of evolving arseniuretted hydrogen from fluids containing arsenic, without the use of zinc and sulphuric acid, by passing a galvanic current through them. The gas thus evolved is subjected to the same examination as in Marsh's process.

Actions and Uses.—Arsenious acid is an irritant poison, an alterative, tonic, and antiseptic.

It acts on all animals as a destructive poison. It causes irritation, inflammation, and sloughing of any part with which it comes in contact; is readily absorbed; produces, while it remains in the system, loss of appetite, emaciation, various nervous disorders, and depression of the circulation; and appears to be excreted from the various mucous surfaces, but especially from that of the alimentary canal, producing as it passes through them violent and often fatal inflammation. It exerts its poisonous action with nearly equal certainty by whatever channel it enters the body. All its compounds are poisonous; and, as usual with other poisons, the most soluble are the most active. Arseniuretted hydrogen is probably the most deadly of all its compounds, having occasioned the death of three chemists who were so unfortunate as to inhale small quantities of it. Orfila found that the sulphurets, in doses of forty to seventy grains, destroyed dogs in from two to six days, and had much the same effect whether they were given in the usual way or applied to a wound. Metallic arsenic, although itself innocuous, unites so readily with hydrogen, oxygen, and salt radicles, that it speedily acquires a poisonous activity.

Arsenious acid, like all other mineral poisons, has been given to horses in very considerable doses with impunity. Berthe gave a mare affected with inveterate mange two, and afterwards three, drachms without injury.[1] Beissenhirz gave a horse one, four,

[1] Recueil de Médecine Vétérinaire, Oct. 1825. Quoted by Moiroud, p. 466.

three, two, and eight drachms, on different successive days; but death occurred on the ninth day after the last dose.[1] Hertwig gave it to eight different horses, first in doses of a scruple, but gradually increasing the quantity to a drachm. He continued the adminstration for thirty or forty days, but observed no bad consequences, either during the use of the poison or afterwards. The pulse became a little stronger and harder, and in some of the cases the condition improved.[2] Mr William Percivall, experimenting on a horse affected with glanders, began with one drachm daily, made into a bolus with linseed meal and treacle; increased that dose by a scruple per day, and continued the medicine for seventeen days. On the seventeenth day the animal got, in one dose, 380 grains, and had then taken seven ounces, 380 grains, or very nearly half a pound of arsenic. Yet no physiological effect was obvious, no loss of appetite, no uneasiness or pain, and no alteration of the pulse or respiration.[3]

But although such large doses have usually little or no effect, it is found that much smaller doses occasionally act with greater violence. Thus Gerlach saw twenty grains cause active diarrhœa; and Mr Percivall mentions that two glandered horses, getting five grains of arsenic daily in the form of bolus, were attacked, one on the eighth and the other on the ninth day, with shivering, loss of appetite, nausea, purging, and other symptoms of abdominal irritation, imperceptibility of the pulse, and prostration of strength. One died, the other recovered.[4] It is scarcely possible to explain why doses of five grains should act so powerfully in eight or nine days; whilst upwards of a drachm has been given daily without effect for a longer time. It may be that these different effects depend on variable degrees of susceptibility in the subjects experimented on; or, more probably perhaps, on the large doses producing such changes on the coats of the alimentary canal, as prevent in great part the absorption of the poison. And it is so far consistent with this view, that arsenic given in solution, as it always should be when used

1 Pereira's Elements of Materia Medica, third edition, vol. i., p. 606.
2 Praktische Arzneimittellehre für Thieraerzte. Berlin, 1847, p. 656.
3 Veterinarian for 1843, p. 317. 4 *Ibid.*, pp. 349-351.

medicinally, is greatly more certain, regular, and active, than when used in the solid state. Thirty grains given daily, dissolved in carbonate of potash, destroyed a horse in four days.[1]

Mr Baldwin, in the "Veterinarian" for January 1858, reports the case of six horses poisoned by drinking from a pail in which some arsenical sheep-dipping mixture had been made. Two died; and there was found on examination, inflammation of the mucous coat of the stomach, and patches of inflammation extending throughout the whole alimentary canal. The symptoms presented by the others were dulness succeeded by colicky pains, pulse 72 and wiry, extremities cold, visible mucous membranes highly injected, with active purging. One mare was ill for three or four days. The treatment consisted of opiates and lime water.

It requires somewhat larger quantities of arsenious acid to destroy cattle than horses, probably because their stomachs are generally filled with food, which interferes with the action of the poison. An ounce of arsenic given with a handful of salt to a strong sheep caused most of the symptoms above mentioned as occurring in horses, and death after five days.[2] Hertwig, quoting from a report of the French Academy, mentions that from five to ten grains given to sound sheep produced the usual symptoms of poisoning; that a second dose of from ten to twenty grains given twenty-four hours after caused death; and that, on examination, the poison was found in the blood, urine, lungs, liver, and muscles. The carcases of sheep poisoned by arsenic have been eaten by dogs with impunity.[3] A chronic form of arsenical poisoning, with symptoms of indigestion, thirst, gradual sinking, and chronic diseases of the joints and bones, is sometimes met with among both cattle and horses in the neighbourhood of the tin and copper smelting furnaces of Cornwall and Wales. Mr W. H. Michael, of Swansea, one of the witnesses examined before the Select Committee of the House of Lords on injurious effects of noxious vapours, stated: "I have known rabbits poisoned, and sheep to have died; and especially two or three horses I

[1] Veterinarian for 1843, pp. 350–1.
[2] *Ibid.*, p. 345.
[3] *Ibid.*, p. 345.

know to have died. I have seen a great amount of injury done to ponies. The gentleman who occupied the farm of which I am speaking kept several hundred ponies, which he bought very young generally, and fattened them for sale; he was obliged to give up keeping them, owing to the peculiarly starved and shaggy appearance those animals acquired. The knee joints began to swell, they got lame and hide bound, the hair fell off, the teeth became black and fell out, and necrosis of the bone occurred, and the result was that he gave up grazing on a large tract of land" (Report, 1st August 1862).

Arsenic is greatly more active in dogs and cats than it is in horses or cattle. I have found that doses varying from a quarter of a grain to a grain, given twice daily, and continued during periods varying from eight to fourteen days, caused in these small animals gradually diminished appetite and vomiting. From the sixth to the tenth day, diarrhœa, rapid emaciation, and painful cough ensued, and death occurred in from twenty to thirty days. Quantities of from three to ten grains, mixed with water, and administered to dogs, caused in a few minutes nausea, vomiting, short moaning, difficult breathing, a wiry rapid pulse of 120 or upwards, and black evacuations made with considerable pain. These symptoms were accompanied by a look of extreme anguish; blunted perception; and death with convulsions followed in from six to thirty hours. Arsenic produces similar effects both on pigs and poultry.

The post-mortem appearances of poisoning by arsenic are very similar in all animals, but differ a good deal with the severity and duration of the case. The carcase, when opened, generally evolves large quantities of fœtid gas. In the horse the cuticular part of the stomach is not usually much altered, but the villous is reddened, softened, thickened, and disorganized by patches of inflammation and extravasation of blood, which extend into the duodenum, and are also observable in the colon and cecum. The lungs are usually congested, and their mucous membrane, with that of the urino-genital organs, is red and vascular. These appearances present themselves, not only when the poison has been swallowed, but also when it has been absorbed from the surface of the skin.[1] The bodies of animals poisoned by arsenic do not undergo the usual form of putrefaction, but become dry and mummified, the cellular tissue, brain, lungs, and some other parts becoming greasy and tallow-like.

In the treatment of cases of arsenical poisoning, the first object must be to get rid of any poison still remaining unabsorbed, by the administration of emetics; or, where these are ineffectual, as in horses or cattle, by the use of the stomach-pump. The hydrated sesqui-oxide of iron is the best of the various antidotes hitherto proposed, and is most active when prepared by precipitating a sesquisalt of iron with ammonia, washing the precipitate with warm water, and administering it moist. It should be given as soon as possible, and in a quantity at least twelve times greater than that of the poison. It appears to act by uniting with the arsenious acid to form an insoluble arsenite. Magnesia is another antidote which appears, like the last, to render arsenious acid insoluble. It is most effectual when given in the gelatinous form, prepared by precipitating a solution of Epsom salt with caustic potash. Certain insoluble powders, as charcoal and clay, act as mechanical antidotes, enveloping the particles of the poison, and protecting the coats of the stomach from its action; but such antidotes, to be of any use, must be given before, along with, or immediately after, the poison. Lard, glycerine, and even milk, also exercise a similar mechanical influence, and with other fatty bodies are said to diminish the solubility of arsenic. The most useful means for removing the remote effects produced by poisonous doses of arsenic are blood-letting and large doses of opium and demulcents, where the inflammatory symptoms are high; oleaginous laxatives and clysters, where there is constipation and griping; and in all cases plenty of good and easily digested food, with occasional diuretics, which are highly recommended by Orfila, and are further indicated by the fact that the kidneys appear to be one of the chief channels by which arsenic is excreted from the system.

Arsenious acid is an alterative, a tonic, and an anti-periodic, but this latter action is not well observed amongst the lower

[1] Veterinarian for 1843, p. 680.

animals. It is chiefly serviceable in chronic rheumatism, paralysis, epilepsy, and chorea, with mange, and other scaly skin diseases, in which in all animals it ought to be used both externally and internally. No remedy is more effectual in obstinate cases of farey. It is generally of more advantage in the nervous diseases of dogs than of other veterinary patients. From its influence in reducing the amount of the red globules, a course of arsenic might probably be useful in counteracting the tendency to splenic apoplexy, congestive fever in calves, and other such apoplectic disorders. In some countries it is eaten by the peasantry, in the belief that it improves the complexion, prevents breathlessness in running or ascending hills, and increases the general vigour. In some parts of continental Europe, as well as in some of the midland counties of England, it is regularly given to horses in small doses, and is said to be effectual in maintaining condition, and imparting strength and endurance. Indeed, so long as it is given cautiously and regularly, the animals appear to be in excellent health, and have fine sleek coats; but when, after being used to it for several months or years, it is withdrawn, they fall off in appearance, and for some months are more difficult to keep in condition. A small portion of arsenic in a thin bag is sometimes attached to the bit, to produce the frothy muzzles which seem to be admired in high-stepping carriage horses. These practices are, however, attended with so much risk of poisoning, and are, moreover, so likely to injure the horse's constitution, that they should not be tolerated. Arsenic is used externally for stimulating unhealthy ulcers, curing scab, mange, and other cutaneous diseases, destroying vermin in the skin, eradicating warts, and producing the sloughing and removal of malignant tumours. For such purposes it must, however, be used cautiously, for animals have been destroyed by its injudicious application, both to wounds and to the skin; and many more have been permanently blemished by the excessive sloughing which it produces when applied to the surface in any considerable quantity. In virtue of its antiseptic properties, it has been sometimes used to preserve subjects for dissection.

Arsenic enters into the composition of many sheep-dipping mixtures, and appears to be more effectual for the destruction of the ticks, and other vermin infesting the sheep, than the solutions of tobacco, spirits of tar, and other substances sometimes employed. It is safer and more effectual than the mercurial baths or ointments sometimes recommended; and is still used more extensively than M'Dougall's non-poisonous dipping mixture, which has lately been deservedly rising in favour both in England and the Colonies. On inquiry in various parts of the country, I find that the usual allowance for a hundred sheep is two pounds of arsenic dissolved in a hundred gallons of water; but that three, four, and even five pounds dissolved in the same quantity of water are used without any bad effects. A safe and convenient sheep-dipping mixture may be made with three pounds each of arsenic, soda ash, or impure carbonate of soda, soft soap, and sulphur. In many parts of England pearl ash or impure carbonate of potash is substituted for the soda ash. Some farmers double or quadruple the quantity of the soap, which, with the alkaline carbonate, aids in dissolving the arsenic, whilst the sulphur appears to whiten and soften the fleece, and also for a considerable time prevents the attacks of flies. For this end a pint or two of naphtha, or a little impure carbolic acid, is also sometimes added The ingredients are best dissolved in from ten to twenty gallons of boiling water, and cold water added to make up a hundred gallons, which, with careful dripping, will dip fully a hundred sheep. The head must of course be kept out of the bathing-tub, and the wool well squeezed before the animal is liberated; for if the head be rubbed against the wool saturated with the solution, the lips and nostrils may suffer from an eruption, and remain sore for several weeks.

But arsenical dipping-mixtures sometimes produce more serious, and even fatal consequences. A correspondent in Lincolnshire informed me several years ago, that after dipping 150 half-bred Leicester hogs, 11 of them died in twenty hours, and several after some days. But a greatly more serious case occurred at Burton, in Northumberland, during the summer of 1858, and created so much interest amongst chemists and veterinarians as well as amongst agriculturists, that I subjoin a short account of it. Mr Black of Burton purchased from Mr J. Elliot, chemist, Berwick-on-Tweed, 15 packets of dipping mixture. Each packet contained 20 ounces each of arsenic and soda ash, and 2 ounces of suphur, and was directed to be dissolved with 4 pounds of soft soap in three or four gallons of boiling water. With 45 gallons of cold water subsequently added, this made quantity sufficient for 50 sheep. On 14th August, Mr Black had 869 sheep dipped in the usual manner; the apparatus and arrangements were good, and the dripping and other work performed with great care. In two days, however, the sheep began to die; they were seized much in the same order in which they had been dipped, and within a month 850 had perished. The symptoms frequently came on very suddenly, and Mr Bird, the veterinary surgeon in attendance, records that several died in twenty minutes after he had observed them eating or ruminating, and apparently well. The usual symptoms were dulness and nausea, frothing at the mouth, blood-shot eyes, pain in the bowels, the passage of black and bloody urine, laboured breathing, blackening of the skin, with falling off of the wool in patches, especially about the back and loins. On post-mortem examination, the bowels were found to be inflamed, and were covered with black blood, the lungs blackened and inflamed, the liver black, soft, and friable, the spleen congested, the bladder empty. Arsenic was found, on analysis, in the stomachs and bowels.

The case came to trial at Newcastle in February 1859, and the jury found a verdict for Mr Black, with damages amounting to L.1400. Mr Black's case rested mainly on the fact that his sheep had been carefully dipped in the usual manner, and according to the printed instructions sent out with each packet of the dipping-mixture. It was sought to be proved that the mixture might in some way have been improperly made up, and was of such poisonous strength that it had become absorbed through the skin. The poisoning of a donkey which had carried the skins of the dead sheep, some sores and patches of mortification on the hands and arms of some of the men employed in the dipping, were also adduced as evidence of the undue strength of the mixture.

On the other hand, in defence of Mr Elliot, it was shown that thousands of sheep had with impunity been dipped in mixtures of the same strength as that sold to Mr Black; that, indeed, on the same day as the Burton sheep were dipped, another gentleman in the neighbourhood used, without any bad effect whatever, eight packages of the same mixture made in the same way and at the same time. Mr John Gamgee and Dr Macadam made various experiments on the subject, using, in two instances, arsenic in the proportion of 28 and 68 ounces for 50 sheep, instead of the 20 ounces present in Mr Elliot's dip. Mr Browning, a professional sheep-dipper in Oxfordshire, who annually passes through his hands several thousands of sheep without losing one, has for years employed $2\frac{1}{2}$ lbs. of arsenic for 50 sheep, which is exactly double the strength of Elliot's mixture. I made in 1859, and have repeated and verified them since, several experiments with dips three and four times the strength of Elliot's; some of the sheep I kept immersed for several minutes, and had these concentrated solutions well rubbed into the skin. I abstained in several instances from pressing or drying the wool, dipped the same sheep twice within two hours, and several times within a week, and yet failed in destroying or injuring in the smallest degree any one of the sheep subjected to these severe trials.

It seems therefore fair to infer, that arsenical sheep-dipping mixtures are little liable to be absorbed through the healthy skin. The risk of using such dips depends, not on their being absorbed by the skin, but on a certain quantity of the poisonous fluid being retained by the fleece, from which it drips on the grass or other food over which the animal strays. This we believe explains the serious mortality at Burton. The sheep were rapidly dipped at the rate of 80 per hour; and according to the usual calculation, each sheep carries away in its fleece, even after it has been reasonably drained, about a gallon of the fluid, which, of Elliot's strength, would contain 176 grains of arsenic,—a quantity quite sufficient, if swallowed, to destroy eight or ten sheep. The sheep are turned out hungry, and at once begin to eat; and the drippings falling the while, contaminate the grass, which in the Burton case appears to have been still further impregnated, owing to a shower falling during the night, and thus washing a larger quantity of the poisonous solution out of the fleeces on to the pastures. Here it was found in three sods taken up ten days after, and examined by Dr Maclagan, who failed, however, to find any arsenic in sods brought from an adjoining pasture, where no dipped sheep had grazed. We can thus understand how the donkey, the two oxen, and the horses which died suddenly about the same time, shared the fate of the sheep; whilst the drippings left in the yards before the flocks were turned out, would account for the mortality which was stated to have also taken place amongst the poultry.

It is a popular error to suppose that sheep, pigs, or other animals, will refuse to eat food over which an arsenical dipping-mixture with its nauseous soft soap and alkali have fallen. I have seen sheep eat grass watered for the purpose of experiment with such solutions, and afterwards die from their poisoned meal. I have known pigs and poultry die from getting access to yards where recently dipped sheep have been confined; and I some years ago knew of two colts which were poisoned by eating a few vetches which were carelessly left in a yard where some sheep had been placed to drip.

The following important practical conclusions are deducible from this and other such cases. Yards into which newly dipped sheep are to be turned should be previously cleared of all green food, hay, and even fresh litter; if perfectly empty, they are still safer. When the dipping is finished, they should be cleaned, washed, and swept, and any of the unused dipping solution at once poured down the drains. Dipped sheep should remain, if possible, in an open, exposed place, as on a dry road, or in a large open yard. Over-crowding should be avoided, and every facility given for rapid drying, which is greatly expedited by selecting for the operation fine clear drying weather. On no account should sheep be returned to their grazings until they are dry, and all risk of dripping over.

Doses, etc.—The dose of arsenic for horses and cattle is from grs. v. to grs. x.; and for dogs, from gr. $\frac{1}{15}$ to gr. $\frac{1}{10}$. To obtain its curative effects, it is necessary to give it for some time; and when it causes any physiological action, as acceleration or hardness of the pulse, tenderness of the conjunctiva, indigestion, or diarrhœa, its administration must be carefully watched, and the doses somewhat diminished or remitted for a few days. It must be remembered that, with all animals, and in all doses, it is most active when administered in solution. Hence, it is best given in acidulated water, or in the form of the *liquor arsenicalis* or Fowler's solution, which consists of arsenious acid and a little arsenite of potash dissolved in a solution of carbonate of potash, and coloured with tincture of lavender. Every ounce of this solution contains four grains of arsenious acid. The London and Edinburgh Colleges direct it to be thus made:—"Take of white arsenic in powder, and carbonate of potash, of each four scruples; compound tincture of lavender, five fluid drachms; and water, one pint: dissolve the oxide and carbonate together in half the water, with the aid of heat; filter if necessary; add the tincture to the liquid when cold, and then dilute it with water till the whole measure one pint."—(Ed. Phar.) Fowler's solution is suitable for external as well as internal use; but where a solution is inconvenient, an ointment made with six grains to an ounce of lard may be used. It cannot, however, be too often repeated, that all arsenical preparations, whether for internal or external purposes, must be used with great circumspection.

ASSAFŒTIDA.

Gummy resinous exudation of *Narthex Assafœtida*, and probably of other species.

Nat. Ord.—Umbelliferæ. *Sex. Syst.*—Pentandria Digynia.

Most of the best assafœtida brought to this country is the produce of the *Narthex Assafœtida*,—a plant with a disagreeable fœtid odour, a long black perennial root, large pæony-like annual leaves, and a tall, fleshy, flowering stem, terminating in a cluster of flowers. The plant grows luxuriantly in Persia and India, and several fine specimens may be seen in the Edinburgh Botanic Garden. When the plants are four years old, the leaves and stem are removed, and some time after a slice is cut from the upper part of the root. The fœtid milky juice exudes from the freshly-cut surface, and as it concretes is scraped off. Fresh slices of the root are removed at short intervals, until the plant is entirely exhausted. The little tears first collected are usually agglutinated into irregular lumps, which have externally a red-brown colour, and within a white waxy surface, which, however, becomes gradually red on exposure to the air. Assafœtida has a disagreeable, penetrating odour of garlic, and an intensely bitter acrid taste. It is pulverized with difficulty, forms an emulsion with water, and is dissolved in rectified spirit, and also in potash and ammonia. It contains 48.8 per cent. of resin; 25.8 of gum; 4.6 of volatile oil; 10.5 of salts; besides water and impurities.

Actions and Uses.—Assafœtida is a mild diffusible stimulant, carminative, and vermifuge. It is speedily absorbed, and by its disagreeable odour soon renders its presence appreciable in the breath, perspiration, matter of abscesses, and even in the muscles. Hertwig, however, could not recognise it in the milk or urine of cows or horses getting five ounces daily. It acts very mildly both on horses and cattle; and is little used except occasionally in cases of colic, in chronic cough, and in chorea in dogs. It is also, however, like other substances containing odorous volatile oils, a vermifuge; and for this purpose may be given either by the mouth or rectum. The two gum-resins, *ammoniac* and *galbanum*, are closely analagous to assafœtida, but scarcely so active. They are occasionally used for the same purposes, and as constituents of charges and plasters.

Doses, etc.—The dose of assafœtida for horses is about ℥ij.; for cattle, about ℥iv.; and for dogs, grs. x. to grs. xx. As its stimulant effects are very transient, it requires to be given repeatedly; and is most conveniently administered in a watery or alcoholic solution of ammonia. It is often conjoined with camphor and carbonate of ammonia.

AXUNGE, OR HOG'S LARD.

Most parts of the fat of the pig are used for making lard; but that about the internal organs and loins is chiefly preferred, on account of its greater firmness and density. To get rid of the cellular and vascular tissue mixed with it, the fat is sometimes first beat up in a mortar with cold water, is melted over a slow fire with constant stirring, filtered through coarse cheese-cloth, and, while liquid, poured into pots or bladders. When pure, it is a white, or yellowish-white, granular-looking substance, having no odour, but a sweetish taste. It melts at about 90°, forming a clear transparent fluid, which is a good solvent for wax and resins, and when boiled with alkalies forms soap. Like other fats and oils, lard is insoluble in water, slightly soluble in alcohol, but quite soluble in ethers and oils. If exposed to the air it becomes rancid, and in this state is unfit for emollient purposes. It contains about 62 per cent. of oleine, and 38 per cent. of stearine and margarine. *Suet*—the fat around the kidneys of the sheep or ox—is sometimes used instead of axunge, and differs from it chiefly in being firmer, harder, and less easily melted. Horses' fat is more easily melted, and firmer than that of swine. Goose grease, much used as a popular remedy for sprains and bruises, is more oily.

Actions and Uses.—Fats, and mild fixed oils, which are merely fluid fats, when given without other sorts of food, are quite inadequate to support life; thus dogs, receiving only butter and olive oil, with distilled water to drink, died in about thirty-six days. In a well-regulated system of diet, they serve, however, various important purposes; they are employed along with flesh or other nitrogenous matters in the formation of cells; they build up the nervous structures, which are so largely composed of fatty matters; are consumed in the body for the support of animal heat; or are stored away in different parts for investing and protecting important organs. Although small doses are easy of digestion, large quantities disorder the digestive functions, and cause diarrhœa. Hog's lard is occasionally used as an internal demulcent, as an antidote for poisoning with alkalies, and as a laxative clyster. It is also applied externally as a simple dressing for ulcers and blistered surfaces, softening and protecting them from the action of the air, and of acrid discharges. It is sometimes effectual in removing mange, scab, and similar complaints, and appears to act simply by preventing access of air to the minute acarus on which these diseases depend. It is much used for making ointments and liniments.

BARLEY.

Nat. Ord.—Graminaceæ. *Sex. Syst.*—Triandria Digynia.

Barley is used as an article of food for most of the domesticated animals; and when stripped of its outer husk, is also recognised by the pharmacopœias as pearl barley. When ground to meal, it is used for making poultices and infusions. When moistened and exposed to a temperature of about 100°, it begins to germinate; and if the process of germination be arrested by drying, the altered barley is converted into *malt*,—a sweet mucilaginous substance, which is more easily digested, but rather less nutritive than barley, forms a palatable and useful article of diet for sick or convalescent horses, and is used for making poultices and mild laxative drinks. When a solution of malt is fermented, as in the preparation of beer, ales, or porter, there rises to the surface of the liquor a yellowish-brown frothy scum, known as *yeast* or *barm*, which readily putrifies when moist, but when dry remains for a long time unchanged. It contains water, alcohol, carbonic, acetic, and mucic acids, potash and lime, a mucilaginous saccharine extract, with minute vegetable cells, which constitute, it is believed, its active principle. Yeast is not now used internally, but is frequently employed for making antiseptic and deodorizing poultices, which may be conveniently prepared with bran or linseed meal, an equal weight of yeast, and a sufficiency of boiling water.

BELLADONNA.

Deadly Nightshade. Leaves of *Atropa Belladonna.*

Nat. Ord.—Solanaceæ. *Sex. Syst.*—Pentandria Monogynia.

Belladonna is found growing in most parts of the country, especially about old walls, edges of plantations, and ruinous shady places; but so great is the demand for its preparations, that the plant is now largely cultivated at Hitchin and elsewhere, and the cultivated are found as active as the wild specimens. It has a straight, round, hairy, annual stem, several feet in height; large, smooth, ovate, acuminated leaves, which are supported on short leaf stalks, and are of a sombre-green colour, and of a faint bitter taste; dark-purple, bell-shaped flowers; a brownish-black berried fruit, with a mawkish taste; and a fleshy, branching, perennial root. The plant is in greatest perfection when flowering is over and the seeds fully developed, which is usually about the end of June or early in July. It is then cut down and speedily dried; and so liable is it to deterioration from heating and moulding, that it is advised to use it at once for the making of the medicinal preparations. Besides water, lignine, gum, gummy extractive matter, starch, albumen, and colouring matter, the plant contains a colourless crystalline poisonous alkaloid called *atropia* or *atropine*, which exists combined with malic acid, and is said to constitute $\frac{1}{15,000}$th part of the leaves, and $\frac{1}{200}$th of the root. When pure, it is in colourless silky crystals, which are devoid of odour, but have a nauseous bitter taste. It is volatile, sparingly soluble in water, but readily dissolved in alcohol, and possessed in a concentrated form of all the properties of belladonna. Its composition, according to Von Planta, is $O_{34}\ H_{23}\ N\ O_6$.

Actions and Uses.—Belladonna, in large doses, is a narcotico-acrid poison, but its irritant effects are seldom very violent or long-continued. In small doses, it is anodyne and antispasmodic; and it causes in all doses, and by whatever channel it enters the body, dilatation of the pupil.

Like most other narcotics, it has less effect on herbivora and graminivora than on omnivora or carnivora. A horse is mentioned by Moiroud as having consumed upwards of six pounds of the leaves without any bad effects. A donkey ate a pound of the berries with equal impunity. Münch says that goats and sheep devour it with apparent satisfaction, and without any obvious harm. On the other hand, Hertwig experimented on upwards of twenty horses, and observed tolerably decided effects. He gave the dry pulverized herb in quantities varying from four to six ounces, with meal and water, in four separate doses, and within a period varying from four to eight hours. In four or five hours, and still more on the succeeding day, he observed dulness, languor, expansion of the pupils, an uneasy look, and a feverish mouth. The appetite was gone, and digestion impaired, gas being abundantly evolved in the stomach and intestines. The pulse numbered about 90, was small, hard, and scarcely perceptible. The breathing was short, quick, and accompanied by flapping of the nostrils. The sensibility was slightly diminished, but there was no appearance of drowsiness. In some of the cases there was much abdominal pain; in others, imperfect power of moving the hinder extremities; and in others, a fatal termination in from thirty to fifty hours after the exhibition of the first dose. In most of the cases the symptoms gradually retrograded, and after thirty-six or forty-eight hours the animals were perfectly well. From two to three ounces of the dried root acted on horses in a similar manner; and six ounces usually proved fatal. Hertwig considers that belladonna is rather more active in cattle than horses; and records that doses of the root varying from two to four ounces caused in cows violent symptoms lasting forty-eight hours, and that larger doses were dangerous. In dogs, from thirty to fifty grains of the dried herb or root caused, in from fifteen to thirty minutes, whining and continuous moaning. In thirty minutes the iris had contracted so much as to be quite out of view, and had also become insensible to the brightest light. Though sight was gone, hearing and sensibility remained unimpaired. Vomiting sometimes occurred, the nose got dry and hot, and the gait tottering from inability to move the hinder extremities. After some time the animals became rather drowsy. In from one to three hours the symptoms began to abate, but contraction and diminished irritability of the iris still remained, even after twenty-four hours. (Hertwig.) Half an ounce of the ordinary watery extract is fatal to dogs in about thirty hours, when given by the mouth; half that quantity in twenty-four hours when introduced into a wound; and even smaller doses than these are more speedily fatal when injected into the jugular vein. (Christison.) In animals poisoned by belladonna, death results partly from paralysis, partly from coma; the blood remains fluid, and pùtrefaction sets in very early; the lungs, and somctimes also the brain and its membranes, are congested; but no inflammatory appearances can in general be detected. When excessive doses have been given, the best remedies are those prescribed in cases of poisoning by opium, which must itself be freely given, as it appears to counteract many of the symptoms and fatal tendencies of the belladonna.

Belladonna is anodyne and antispasmodic, and is used for many of the same purposes as opium, from which, however, it differs, in the absence of soporific and constipating effects, and in the possession of a peculiar power of dilating the pupil of the eye. It has been prescribed for all the domesticated animals in colic, acute and chronic rheumatism, and in inflammatory diseases of the respiratory organs, and is of especial service in those cases of cough and sore throat which frequently accompany or succeed influenza. In the early stages of such cases, forty grains of extract of belladonna may be given to horses or cattle, at intervals of three or four hours, along with half an ounce of nitre, or ten drops of tincture of aconite. When the more acute fever is subdued, leaving weakness and irritability, a drachm each of extract of belladonna, carbonate of ammonia, and camphor, will prove serviceable. Another good but more stimulating combination, adapted especially for bronchitis and influenza, consists of an ounce each of medicinal ammonia and sweet spirit of nitre, with a drachm of extract of belladonna, given in a pint of ale or of water, and repeated two or three times a-day. It appears superior to all other remedies in removing the irritation and spasm of tetanus, and, when used along with active purgatives and quiet, has been very effectual in many of the cases of that intractable disease which have of late years been treated at the Edinburgh Veterinary College. Some practitioners use it in hydrophobia, epilepsy, and such other nervous diseases; but without much success. Two grains of the extract of belladonna, with thirty drops of ether, or with two grains each of camphor and carbonate of ammonia, will greatly relieve the distressed breathing and coughing which occur in distemper in dogs. Used externally, it is a valuable dressing for painful and irritable tumours, for tender enlarged glands, for cases of garget and sore throat, and, in the form of an injection, for allaying irritation of the bladder or rectum, and counteracting spasmodic contractions of the uterus.

It possesses, in common with hyosciamus and stramonium, the power of contracting the iris, and thus enlarging the pupil; and produces this effect whether it be applied round the eye or given internally. When used internally, it causes more or less temporary impairment of vision, but seldom has any such injurious effect when applied locally. This peculiar action on the iris is usually apparent within an hour after the use of the medicine, but often in a much shorter time; generally continues for several hours, especially when developed by giving the belladonna internally; and is believed by Müller and other physiologists to depend on temporary paralysis of the ciliary nerves. A remarkably increased sufferance of light and other stimuli accompanies this paralyzing effect on the muscular fibres of the iris. These actions of belladonna are of much practical utility in preventing or breaking up adhesions between the iris and lens; in expanding the pupil, and thus facilitating the discovery and examination of cataracts; and in performing operations on the eye. These effects of belladonna and its alkaloid atropia are directly antagonistic to those of the ordeal bean of Calabar, which has recently been discovered rapidly to contract the pupil.

Doses, etc.—The dose of the dried powdered leaves for horses and cattle is about ℥ij.; for dogs, from grs. ij. to grs. v. The leaves, however, are seldom used in this crude state, but, along with the young stalks, flowers, and fruit, are made into an extract or tincture. The *extract* is very apt to vary in strength, and, from exposure to undue heat, is sometimes quite useless. An active preparation may, however, be made by the following process of the Edin. Phar.:—"Take of Belladonna fresh, any convenient quantity; bruise it in a marble mortar into a uniform pulp; express the juice; moisten the residuum with water, and express again. Unite the expressed fluids, filter them, and evaporate the filtered liquid in the vapour bath to the consistence of firm extract, stirring constantly towards the close." The dose of this extract is from half a drachm to a drachm for horses and cattle, and from one to three grains for dogs. A *tincture* may be conveniently made with ten ounces of the bruised belladonna, and a pint and a half of rectified spirit, flavoured with tincture of cardamoms. It may be got by digestion, or in the same way as tincture of hemlock.

Atropia is sometimes used, but, on account of its activity, must be employed with caution. The sulphate being more soluble, is preferable to the alkaloid. The dose of either for the horse is gr. i. or grs. ij.; and for the dog, about gr. $\frac{1}{20}$. A solution made with grs. ij. of atropia, f℥i. of water, and a few drops of acetic acid, is much used in medical practice for developing the peculiar action of belladonna on the iris. A single drop of this solution, applied to the conjunctiva, produces the desired effect in a few minutes. The use of a weak solution of $\frac{1}{500}$th of a grain, injected with a nævous syringe underneath the skin along the course of the pneumo-gastric nerves, has been successfully tried for the cure of asthma in man, and similar local injections also greatly relieve the pain of rheumatism.

BENZOIN.

Gum Benjamin. Benzoinum. Concrete balsamic exudation of *Styrax Benzoin.* (Ed Phar.)

Nat. Ord.—Styraceæ. *Sex. Syst.*—Decandria Monogynia.

Benzoin is a concrete balsamic exudation yielded by a tree growing in the Islands of Borneo and Sumatra. When incisions are made through the bark, the juice exudes, concreting in tears, which are subsequently made into larger masses. These are red-brown externally, and yellowish-white within, are brittle and easily pulverized, slightly heavier than water, of a sweet resinous taste, and an agreeable balsamic odour, which is much increased when the masses are rubbed or burned. Benzoin is dissolved by alcohol, alkalies, and acids, but is only partially soluble in water. When of inferior quality, it is dark-brown or nearly black, and devoid of amigdaloid structure. Besides traces of volatile oil, moisture, and impurities, it contains about eighty per cent. of resin, and nearly twenty of benzoic acid, which is exceedingly irritant, especially in vapour, and may be prepared either by subliming benzoin, or decomposing an alkaline solution of it.

Actions and Uses.—Benzoin belongs to a class of mild stimulants, once much used in veterinary practice, and including styrax and balsams of Peru and Tolu. It was once in high repute as a remedy for coughs, all kinds of pectoral complaints, and consumption; but is now scarcely ever used internally. Some practitioners, however, still apply it externally in the treatment of contusions and wounds, generally making use of the Friar's Balsam, or of its pharmaceutical imitation, the *compound tincture of benzoin*, which is thus prepared:—"Take of Benzoin, in coarse powder, four ounces; Peru balsam, two ounces and a half; East Indian aloes, half an ounce; rectified spirit, two pints. Digest for seven days, pour off the clear liquor, and filter it."—(Ed. Phar.)

BUCKTHORN.

Rhamnus. Fruit of the *Rhamnus Catharticus.* (Ed. Phar.)

Nat. Ord.—Rhamnaceæ. *Sex. Syst.*—Pentandria Monogynia.

Buckthorn is a shrubby, thorny-looking tree, which reaches eight or ten feet in height, and grows in the woods in most parts of this country. The berries, which are the only officinal part, are black, globular, about the size of peas, and contain an acrid, bitter, nauseous juice, which is at first green, but soon becomes red from the production of acetic acid. This juice is usually clarified; and, to remove its nauseous and irritating effects, boiled with sugar or treacle, and flavoured with ginger or other spices. Its active principle is unknown. The syrup, the only form in which buckthorn is used medicinally, is thus prepared:—"Take of the fresh juice of buckthorn-berries four pints; ginger sliced, and pimento bruised, of each six drachms; pure sugar, four pounds. Let the juice rest three days; pour off the clear liquor, and strain it. Digest the pimento and ginger in a pint of the strained liquor at a gentle heat for four hours, and filter. Boil down the rest of the juice to a pint and a half; mix the two liquors; add the sugar, and dissolve it with heat." (Ed. and Lond. Phars.)

Actions and Uses.—Syrup of buckthorn is a cathartic; but so mild as to be useless either for horses or cattle. Even in dogs or cats its effects are not powerful, and its use is chiefly confined to young or delicate animals, and to cases of distemper. The dose for the dog is about f℥i., and for the cat about f℥iv. A tolerably prompt and certain effect may be obtained by combining with an ounce of the syrup, two or three drachms of confection of senna, ten or fifteen grains of jalap, or an ounce of castor oil. Any of these formulæ will prove a convenient laxative for medium-sized dogs. Half the quantities will suffice for cats.

CALCIUM AND ITS MEDICINAL COMPOUNDS.

LIME. Quicklime. Oxide of Calcium. Calx. CaO.

When limestone or carbonate of lime ($Ca\ O,\ CO_2$) is burned, its carbonic acid is driven off, and the metallic oxide ($Ca\ O$) or quicklime is left. It is commonly seen in greyish-white, irregular masses, has an astringent, alkaline, caustic taste, and a great power of absorbing water, with which it forms *slaked lime*, a hydrated oxide ($Ca\ O,\ HO$). Lime is soluble in 700 parts of cold, and 1200 of boiling, water. The solution known as *lime water* is prepared by slaking a small quantity of freshly burned lime, agitating it briskly with a large quantity of water, allowing the undissolved matter to subside, and pouring off the clear solution, which, when saturated, contains, at the temperature of 60°, $11\frac{1}{2}$ grains of lime. It is a colourless fluid, has an alkaline taste and reaction, and unites with oils to form soaps. As it is apt to absorb carbonic acid, it should be kept in closely stoppered bottles. Lime and its compounds are readily detectible in solution by their yielding no precipitate with sulphuretted hydrogen or hydro-sulphuret of ammonia, but an immediate and abundant white precipitate with oxalic acid.

Actions and Uses.—Lime is irritant, corrosive, desiccant, and antacid.

Its irritant and corrosive properties depend on its affinity for water, and its solvent action on the soft animal tissues. They speedily succeed the application of the powder to any of the mucous surfaces or to the skin. Orfila mentions that a drachm and a half administered to a little dog caused vomiting, and considerable irritation, which lasted for about a day; and that three drachms caused vomiting, pain, languor, and death in five days. Lime resembles the alkalies in many of its actions, but differs from them in diminishing rather than increasing secretion. In this respect it is somewhat analogous to preparations of zinc and alumina; but its desiccant action is mechanical, and unaccompanied by any true astringency. It is used as an antacid in indigestion, diarrhœa, and hoven, especially among cattle; and occasionally as an antidote in poisoning by arsenic and the mineral acids. It is applied externally for many of the purposes of a desiccant; and in the form of lime water, mixed with an equal quantity of linseed oil, is used under the name of *Carron oil* (so called from the extensive ironworks of that name in Stirlingshire) in the treatment of scalds and burns. In such cases, however, the present approved mode of cure consists in immediately protecting the parts from air and moisture by layers of cotton wadding, applied with gentle and equable pressure. It is often used both in powder and solution for cleansing and deodorizing foul stables and byres.

Doses, etc.—The dose of quicklime for horses or cattle is ʒi. or ʒij.; and for dogs, grs. v. to grs. x. The dose of lime water for the former is f℥iv. or f℥v.; and for the latter, from fʒi. to fʒiv.: it may be given alone, or, as in the human subject, with milk. Two ounces each of lime water and infusion of gentian with three or four drops of tincture of aconite, make a good mixture, when repeated twice or thrice daily, for checking diarrhœa amongst feeble calves; half the doses will answer for sheep. For calves and dogs, *saccharated lime* may be tried as an antacid and stomachic. It is made by slaking eight ounces of quicklime, rubbing it up with five ounces of white sugar, adding a pint of water, stirring and filtering. It is given diluted according to convenience.

CARBONATE OF LIME. Chalk. Calcis Carbonas. $Ca\ O, CO_2$.

Carbonate of lime occurs in the several forms of calcareous spar, limestone, marble, and chalk. The last, the only variety of much medical importance, abounds in the south of England in beds mixed with silica, alumina, and oxide of iron. These impurities are removed by triturating it with a little water, agitating it with a larger quantity of water, allowing the coarser fragments and foreign matters to subside, and pouring off the clear liquid, which slowly deposits a fine impalpable powder, which, when dried, constitutes prepared chalk, the *creta præparata* of the pharmacopœia. Its properties are so familiar as scarcely to require description. It is of a dull white colour and earthy appearance, is tasteless, and adheres to the tongue owing to its porosity and its affinity for water. It requires for solution about 1600 times its own weight of water, and its solubility is increased by the presence of carbonic acid.

Actions and Uses.—Chalk is the cheapest and most convenient of antacids; and is much used amongst all the domesticated animals in the treatment of indigestion, chronic diarrhœa, and dysentery. In such cases it proves effectual by neutralizing the acid matters which cause or keep up the complaint, by absorbing irritant substances, and by protecting the intestinal surfaces. It is a good antidote for oxalic and the mineral acids. In a dry and finely divided state, it is used as a desiccant for external wounds, absorbing their irritating discharges, and protecting them from the action of the air.

Doses, etc.—The dose for horses is from ℥i. to ℥ij.; for cattle, ℥ij. to ℥iv.; for sheep, ʒij. to ʒiv.; and for dogs, grs. viij. to grs. xij. It is conveniently given in a bolus, or suspended in milk, gruel, or mucilage. When administered in large or frequently repeated doses, the bowels should be kept open, so as to prevent its accumulation in the intestines. It is frequently conjoined with catechu and other vegetable astringents; with ginger and other carminatives, as in indigestion and diarrhœa; and with opium or belladonna, where there is much irritability or pain. The following formulæ will prove serviceable as antacids and mild astringents. For the horse, an ounce each of chalk, gentian, and ginger, made up in the usual way with linseed meal and treacle; or chalk ℥i., opium ʒi., creasote ♏xx., made up as before; or again, chalk, catechu, and ginger, of each an ounce, opium ʒi. For either horses or cattle these prescriptions may be given dissolved in a bottle of sound ale; for sheep, similar combinations may be used in about half the doses mentioned; for dogs, a convenient pill may be made with chalk and ginger, of each grs. v., with opium grs. ij., and aromatic confection, q.s. A draught for similar purposes is made with chalk, grs. v., laudanum and ether, of each ♏xv., given in a little milk or soup.

Chloride of Lime. Bleaching Powder. Chlorinated Lime. Hypochlorite of Lime. Calx Chlorinata.

Large quantities of this valuable bleaching agent are made in Glasgow, where it was first prepared by Messrs Tennant and Mackintosh in 1798. The process adopted is as follows:—Chlorine gas (produced by the action of sulphuric acid on common salt and black oxide of manganese) is transmitted into close chambers, where slaked lime, moistened with water, is spread on piles of wooden trays. The changes occurring are not well understood; but the lime, after being exposed to the chlorine gas for about four days, is found to have absorbed from thirty to forty per cent. of it, and has become the familiar bleaching powder.

Properties.—It is a soft, greyish-white powder, with a feeble odour of chlorine, or rather of hypochlorous acid, and an astringent, acrid, bitter taste. When exposed to the air it deliquesces, absorbs oxygen, and evolves hypochlorous acid. When heated, it gives off chlorine, and afterwards oxygen gas. It is only partially soluble in water, for a part of the lime remains undissolved. The watery solution is colourless, or of a faint yellow tint, and has at first an alkaline, and subsequently a bleaching, action on vegetable colouring matters. This bleaching action is especially rapid on the addition of an acid. The exact composition of the substance is still undetermined, but the majority of chemists now regard it as a mixture or compound of hypochlorite of lime and chloride of calcium. Its ordinary name of chloride of lime is therefore not strictly accurate. From careless preparation or bad keeping, bleaching powder is apt to be of inferior quality. The intensity of its odour, and the degree of its solubility, are simple approximative tests of its strength and purity, and a good specimen should contain thirty-five per cent. of chlorine.

Actions and Uses.—Chloride of lime is irritant, stimulant, alterative, and astringent; and is besides used as an antiseptic, deodorizer, and disinfectant.

Its irritant, stimulant, and astringent properties shew themselves when it is applied to any mucous surface, either in powder or strong solution, and depend in part on the free lime it contains. Hertwig states that he has given it in variable quantity to all the domesticated animals; to horses and cattle in doses of from one ounce to two pounds; to sheep and goats in from one to eight drachms; and among dogs, from half a drachm to four drachms. The smaller quantities produced scarcely any effect; the larger caused acceleration of the pulse, difficult breathing, increased warmth in the mouth, weeping eyes, an abundant secretion of urine, having a curious odour of chlorine or prussic acid, and a white sediment, frequent copious alvine discharges, and in dogs, vomiting. In horses the effects usually began in about twenty or thirty minutes, and lasted from two to five hours. Considerable doses, when given repeatedly, did not impair the appetite, but caused thirst and gradual emaciation. It is seldom used internally. The late Mr Youatt recommended it as a remedy for hoven in cattle, and tympanitis in horses, in doses varying from two to four drachms, and ingeniously ascribed its supposed good effects to its decomposing the gases evolved in the alimentary canal. But from repeated and careful trials, made at the Edinburgh Veterinary College, the conclusion has been arrived at, that it is of little, if any, service in the majority of cases of hoven or tympanitis, whether in cattle or horses. Two drachms each of bleaching powder and extract of belladonna, with an ounce of solution of ammonia and ten drops of tincture of aconite, form a good combination for cases of dysentery in cattle. Half the quantity may be used for sheep. Some practitioners consider bleaching powder to be possessed of deobstruent virtues; but this has not been sufficiently proved. It is a valuable stimulant, antiseptic, and deodorizer for unhealthy ulcers, fistulæ, thrush, canker, and grease; is one of the approved remedies for mange and other skin diseases, attended by scurfiness and itching; and is recommended in diluted solutions for checking conjunctival ophthalmia, and other circumscribed and superficial inflammations. It is used to arrest putrefaction, and to destroy the fetid odours of gangrenous wounds, unhealthy excretions, and all kinds of decomposing animal matter; and, from its undoubted efficacy as an antiseptic and deodorizer, it is reasonably inferred to be a disinfectant. Where contagious diseases prevail, it should be spread in powder over the floor of the building, and applied in solution to the walls. (See Disinfectants, p. 17). Scattered about the stables or cowhouses it keeps away flies; whilst neither rats nor mice will frequent places where it is sprinkled, especially when mixed with sulphur.

Doses, etc.—Horses and cattle take from ʒi. to ʒij.; dogs, from grs. ii. to grs. v. It may be given either in a bolus, or with mucilage or milk.

CAMPHOR.

A peculiar concretion, from *Camphora Officinarum.* $C_{10}\ H_8\ O$.

Nat. Ord.—Lauraceæ. *Sex. Syst.*—Enneandria Monogynia.

The *Camphora Officinarum*, or *Laurus Camphora*, is a tall, handsome evergreen, cultivated in Japan and China, and in many European conservatories. Its wood and leaves evolve a camphoraceous odour when bruised. From some experiments made by Professor Christison, it probably yields about 1-500th of its weight of camphor, which is extracted by exposing the wood to dry distillation; or, according to some, by boiling it with water. The camphor which distils over is condensed in cones, lined with straw; the masses are broken down and sublimed; and, on their importation to this country, are again subjected to a similar purification.

Properties. — Camphor occurs in concavo-convex masses, which derive their form from the vessels into which they have been sublimed. It is white, translucent, and crystalline, with a bitter, pungent, cooling taste, and a strong, peculiar, aromatic odour. It floats on water, and has a density varying from 985 to 996. When exposed to the air it slowly evaporates; when heated, it takes fire, and burns with a sooty flame. It is tough and difficult to powder, unless with the addition of a little spirit. It dissolves readily in ethers, acids, and oils, in about its own weight of alcohol, in eight times its weight of milk, and in 1000 times its weight of water. It is considered to be an oxide of camphine or camphogen ($C_{10}\ H_8$)—a radicle which is also present in oil of turpentine, and various other organic substances.

The substance known as *Borneo Camphor*, from its being obtained in the island of that name, is found in minute crystals in cavities in the wood of the *Dryobalanops Camphora*, and is distinguished from true camphor by its softness and friability, its high density, and its alliaceous odour. It consists of ninety-four per cent. of a colourless mobile volatile oil, and six per cent. of resinous matter, and closely resembles cajuput oil in its composition and properties.

Actions and Uses.—Camphor, in excessive doses, is irritant and narcotic; and, in medicinal doses, slightly stimulant, sedative, calmative, and antispasmodic.

It is somewhat irregular in its poisonous action. When given in the form of coarse powder, it acts chiefly topically, causing inflammation and ulceration of the alimentary canal; but when finely powdered, or in solution, it is absorbed, inducing derangement and depression of the nervous centres, with symptoms of giddiness, delirium, convulsions, and stupor. Moiroud states that doses of two ounces produced in horses convulsive movements, and acceleration of the pulse, unaccompanied, however, by any fatal results. Hertwig mentions that, when doses, varying from two to four ounces, are given to horses and cattle, two to four drachms to sheep, or one to three drachms to dogs, the respiration and pulsation are accelerated, the breath acquires a camphoraceous odour, the sensibility appears to be heightened, and convulsions supervene. In dogs there is also imperfect power of controlling the movements of the limbs; and when the doses amount to three or four drachms, insensibility and death ensue. The vapour of camphor is speedily destructive to frogs and insects, inducing difficulty of breathing, trembling, stupor, and death. All parts of the bodies of animals poisoned by camphor evolve a strong odour of the drug. When the doses have been in the solid form, the stomach and intestines exhibit inflammation, and sometimes spots of ulceration. When camphor has been given in solution, besides vascularity of the alimentary mucous surface, the membranes of the brain are much injected, the pelvic viscera inflamed, and the heart filled with florid blood, indicating death from syncope.

In medicinal doses, camphor exercises a slight stimulant action, speedily succeeded by a depressing and calmative effect, which is of service in allaying nervous irritability. It is chiefly used in chronic cough, and other sorts of pulmonary irritation, in spasmodic diseases, and in typhoid fevers; and in such cases is especially useful when conjoined with opium and stimulants. In typhoid cases, either in horses or cattle, a convenient combination consists of half an ounce of camphor, a drachm of tincture of the chloride of iron, and an ounce of ether, or of sweet spirit of nitre. A drachm each of camphor and extract of belladonna, dissolved in an ounce of sweet spirit of nitre, is a good formula in cases of bronchial irritation of horses and cattle, and may be repeated several times a day. Five grains each of camphor and extract of belladonna, with ♏ xx. of tincture of arnica, in a few ounces of water, often quiet the cough and bronchial irritation accompanying distemper in dogs. Camphor appears to be excreted chiefly by the mucous membranes and skin; and, like other stimulants, exalts the activity of the excreting organs. Occasionally also it is in part removed by the kidneys, and hence sometimes produces diuresis. Various other properties have been ascribed to camphor, many of them on very insufficient grounds. It has been thought to possess the power of repelling the secretion of milk in women and animals that carried fragments of it about with them; has been frequently lauded as an anthelmintic; and has even been considered capable of arresting the propagation of contagious diseases. Some veterinarians combine it with cantharides, under the impression that it lessens the irritant action which that substance has on the kidneys. It is sometimes used externally to allay the irritation of skin diseases, painful ulcerations, and articular rheumatism, as well as chilblains in man.

Doses, etc.—The dose for horses and cattle is from ʒi. to ʒiv.; and for dogs, from grs. iij. to grs. x. As it is required for the development of calmative, and not of irritant effects, it is best given made into an emulsion with eggs, or dissolved in milk or oil. For external use, it may be conveniently dissolved in six or eight parts of alcohol, in acetic acid, linseed oil, or oil of turpentine.

CANTHARIDES.

Blistering or Spanish Fly. Lytta Vesicatoria. Cantharis Vesicatoria.

Class.—Insecta. *Order.*—Coleoptera.

Cantharides flies are found in most parts of Southern Europe, Germany, and Russia, and occasionally along the south coast of England. They settle in large numbers on certain trees and shrubs, as the lilac, ash, rose, honeysuckle, and privet. They are collected in May and June, by men who, with their faces protected by masks and their hands by gloves, sally forth after night-fall, or before dawn, to the shrubberies frequented by the insects, and shake the trees on which they feed. They fall in numbers, and are received in towels or sheets placed under and about the trees, are turned into sieves, and killed by exposure to the fumes of boiling vinegar or oil of turpentine, or by being placed in a vessel exhausted of air. They are then quickly dried, either in the sun or by exposure to artificial heat. At one time most of the flies used in this country were brought from Spain (and hence their vernacular name of Spanish flies), but they are now chiefly imported from St Petersburg and Messina. They are usually packed in barrels or cases containing from 100 to 200 lbs.

Properties.—The insect measures from six to ten lines in length, and weighs about one grain and a half. It has a little furrow running along the head, neck, and body, and dividing the animal into two symmetrical halves; a pair of fine, gauze-like, membranous wings; and investing these a pair of shining wing coverings, called *elytræ*, which are of a green, or greenish-yellow colour, and so indestructible that they have been recognised by

Orfila in the human stomach nine months after interment. The body, especially along its under surface, is covered with greyish-white hairs; the head is large; the antennæ or horns are black and thread-like, and project beyond the head. The insect is said to live from eight to ten days. It deposits its larvæ in the earth, leaving them to be hatched by the heat of the sun. Cantharides has a resinous acrid taste, and a disagreeable penetrating fœtid odour, which is especially strong while the animal is alive. When powdered, it is freely soluble in boiling water, alcohol of all strengths, acetic acid, and fixed and volatile oils. The active principle is volatile, and hence no cantharidine preparation should be heated beyond 200°. When exposed to moisture, cantharides becomes spoilt, and should therefore be kept in tightly fitting drawers lined with paper, or in closely stoppered bottles. The vesicant action of the cantharides, and the brilliant green appearance of the wing coverings, are the best tests by which it can be identified.

Cantharides, as analyzed by Robiquet, consists of:—A green fluid fatty oil, probably giving colour to the elytræ, but devoid of any vesicant effect; a bland yellow viscous matter, soluble in water and alcohol, and also without vesicant action; a black matter, soluble in water, insoluble in alcohol, and also without vesicant action; a principle resembling ozmazone; acetic and lithic acids, with phosphates of lime and magnesia derived from the osseous structure of the animal; and an acrid, volatile, crystalline principle, of a white micaceous appearance, possessing most energetic vesicant properties, and called *cantharidine*. It appears to be confined to the soft parts of the body of the insect, and does not exist in the head, wings, or limbs. The posterior parts of the body, particularly the sexual organs, and especially those of the female, contain the largest amount of this principle. It may be prepared by concentrating the tincture, from which it slowly crystallizes; and may be afterwards purified by washing with alcohol, and boiling with animal charcoal. When pure it is insoluble in water, but soluble in alcohol, acetic acid, ether, chloroform, and oils. It appears to be a solid volatile oil, and consists of $C_{10} H_6 O_4$. A principle exactly similar to cantharidine is found in the bodies of most other insects, which cause vesication when rubbed into the skin.

Impurities.—In this country cantharides may generally be obtained tolerably pure. The flies should be purchased entire, as the powdered cantharides sold in the shops sometimes contains euphorbium and various other substances. Attention to the characteristics of the cantharides fly will at once lead to the detection of adulteration by admixture of other insects. The causes which most seriously interfere with the efficacy of the blistering fly are long keeping, and the attacks of mites, moths, and other parasites. The most effectual way of preserving cantharides from such attacks is to keep them in closely stoppered bottles, with a few drops of acetic acid, or a few grains of camphor, or carbonate of ammonia.

Actions and Uses.—Cantharides, when given internally, is an irritant, general stimulant, and diuretic; and when applied externally, a rubefacient and vesicant.

When given in large doses, it acts on all animals as a powerful poison, causing intense gastro-enteritis, inflammation of the bladder, and frequently coma, convulsions, and death. According to Orfila, cantharides causes violent inflammation of any part with which it comes in contact, and seems also in these excessive doses to exercise a powerful influence on the nervous system, and especially on the spinal chord. He found that in a dog "three drachms of the tincture, with eight grains of powder suspended in it, caused death in twenty-four hours, if retained in the stomach by a ligature on the gullet, insensibility being the chief symptom; and that forty grains of the powder killed another dog in four hours and a half, although he was allowed to vomit. In all the instances in which it was administered by the stomach, that organ was found much inflamed after death; and generally fragments of the poison were discernible if it was given in the form of powder. When applied to a wound, the powder excites surrounding inflammation; and a drachm will in this way prove fatal in thirty-two hours, without any constitutional symptom except langour." (Christison on Poisons.) An ounce administered to a horse caused death in eighteen hours;

and fatal effects are reported to have occurred where only one drachm was given. (Morton.) In cases of poisoning by cantharides the post-mortem appearances are congestion and inflammation of the alimentary canal and urinary apparatus, the latter being usually most affected when the animal survives some days after the administration of the poison. In most cases there is congestion of the brain, and effusion into its cavities.

When cantharides has been given in an excessive dose, or has caused undue irritation of the urinary organs from being absorbed from the surface of the skin, mucilaginous substances should be given in large quantity, both by the mouth and rectum, and in the horse fresh sheep skins should be laid over the loins. When the pain and inflammation are great, blood-letting, followed by opiates, may be necessary.

Except in very large doses, the acrid principle of the cantharides appears to be dissolved by the alkaline matters it meets with in the intestines, and thus enters the blood. But whilst combined with the alkali, it is in great part deprived of its irritant properties, which are, however, recovered as it passes through the kidneys, where the excess of acid neutralizes the alkali, and the liberated cantharidine acts as a powerful diuretic. (Headland.) In small and repeated doses, cantharides is a stimulating tonic; but its use requires caution, as it is very apt to produce diuresis, and occasionally much irritation of the urino-genital organs. When given for some time continuously, little vesicles usually appear on the skin. It is popularly believed to possess the power of stimulating the sexual appetites; but this action, if it occurs at all, only shows itself where it is given in poisonous doses. The chief cases in which it is given internally are weakness and impaired action of the digestive and urinary organs. In man it is sometimes useful in relieving dropsies, and arresting chronic mucous discharges.

Cantharides, when applied to the skin of animals, causes first irritation, pain, and swelling, with some redness; and by and by effusion of serum in circumscribed spots betwixt the true skin and the epidermis, constituting vesicles or blisters. These usually appear in from three to twelve hours, according to the strength of the preparation and the state of the part to which it is applied. They vary much in size, and, after a variable but usually short time, they burst, discharging a yellow serous fluid, which soon becomes sticky and pus-like, and dries into a scurfy cicatrix. In a fortnight or three weeks the blistered part is usually healed, and all mark nearly obliterated. Sometimes, however, when the inflammation has affected the deep-seated tissues of the skin, the hair is removed, and does not readily grow again. This most commonly results from the excessive strength of the preparation, from its containing corrosive mineral substances, or from the injudicious application of blisters to parts in a state of undue irritability. The blistering action of cantharides differs somewhat in the different domesticated animals, being most powerful in horses, rather weaker in sheep and dogs, and still weaker in cattle and swine. It is more prompt and efficient in young, well bred, and thin-skinned animals, than in old, coarsely bred, and hard-hided subjects. When applied to wounds, ulcers, or parts in a state of acute inflammation, it causes excessive irritation, and sometimes extensive sloughing. But, on the other hand, when there is much vital depression or active inflammation near the blistered part, the action of the cantharides is slow and imperfect. Cantharides possesses several characters which distinguish it from other vesicants; it acts slowly and gradually, but its effects continue for a long time; it causes an unusual amount of serous effusion, but seldom, when used judiciously, produces any untoward results; and it is occasionally absorbed, causing diuresis, strangury, and other constitutional symptoms—effects which occur especially when it is applied in large quantity over an extensive surface, when the skin has been abraded, or when the local action is slow and imperfect.

There is no vesicant more extensively employed than cantharides. Acting beneficially by determining to the inflamed parts a more healthy and abundant supply of blood and nervous influence, it is applied among the different domesticated animals in inflammation of all internal organs, except the kidneys and bladder. Like other vesicants, it is most effectual after the more acute inflammation has been subdued: indeed, whilst inflammation is at its height, blisters, if they act at all, often do more harm than good. Cantharidine applications being especially useful in chronic and sub-acute inflammation, are in consequence more effectual in the internal diseases of cattle than of horses. They are often serviceable in rheumatic affections, particularly those of long standing. They are frequently prescribed in cases of paralysis and tetanus, being in the latter disease sometimes rubbed in all the way along the spine from the occiput to the tail. Such a mode of application is, however, exceedingly injurious, and is directly contra-indicated by the nature of the disease, which, to be treated successfully, requires soothing remedies and quiet. Cantharidine blisters are largely used as stimulants and vesicants in inflammation and swelling of joints, bursæ, ligaments, tendons, and bones; and in such cases act beneficially by inducing an increased activity in the circulation of the parts, and a greater activity of absorption. In small quantity, they are often used to promote adhesion of old and unhealthy wounds and fistulæ, to stimulate weak and callous ulcers, and to induce a more healthy state of the skin, as in mallenders, ring-worm, and sometimes in inveterate mange. In using cantharides as a blister, care must be taken not to apply it to any part in a state of highly exalted vascularity and sensibility, as during active inflammation. The tendency of cantharides to become absorbed and stimulate the urinary organs must also be borne in mind, and its use avoided in all cases in which these organs are in a morbidly irritable state.

Doses etc.—The dose of cantharides for horses is grs. iv. to grs. xx.; for cattle, ℈i. to ℈ij.; for sheep and swine, grs. ij. to grs. viij.; and for dogs, gr. $\frac{1}{2}$ to grs. iij. These doses should be repeated once or twice a day, care being taken to watch their effects, and to suspend their administration should any untoward effects occur. They are usually given in the form of a bolus, with aromatics and bitters; and occasionally in that of a tincture.

Cantharides is used externally in many different forms, but chiefly in those of powder, tincture, ointment, liniment, or plaster.

Powdered Cantharides, which should be carefully preserved from moisture, is principally used for keeping up discharges, and for scattering over mustard poultices and other stimulant applications to increase their activity.

Tinctures of Cantharides, vulgarly termed sweating blisters, may be made of any strength. Those used in human medicine are too weak for most veterinary purposes. One part of powdered flies to fifteen or twenty of proof spirit forms a useful tincture of medium strength. This may be prepared by digestion for several days, or more speedily by percolation. Some practitioners augment the activity of such preparations by the addition of a small quantity of euphorbium, liquor ammoniæ, or oil of turpentine. The tinctures of cantharides in common use act more speedily than the ointments, but their effects are less powerful, and of shorter duration. Though they produce considerable irritation, they seldom cause blistering, unless used repeatedly at short intervals. In using them, it is not essential that the hair be removed, nor even that the animal be kept idle. They may be applied repeatedly to the same spot without fear of blemishing.

Acetum Cantharides, a solution of flies in acetic acid, is often used in human medicine, and is equally applicable to veterinary practice. One part of powdered cantharides to ten or twelve of commercial pyroligneous acid forms a prompt and powerful counter-irritant.

Ointments of Cantharides are much used in veterinary practice, as their oleaginous constituents render them easy of application, and ensure their efficiency by dissolving the active principles of the fly. There is scarcely any limit to their number and variety. Many of them contain a great number of ingredients, but the simplest are usually the best. A useful ointment of medium strength consists of one part of powdered cantharides to four or five of hog's lard, resinous ointment, or such other excipient. Such an ointment, when well made and applied with smart friction, acts very efficiently, is little apt to blemish, and hence is preferable to more complex preparations. One part each of powdered cantharides, Venice turpentine, and resin, with three parts of palm oil or lard, makes an excellent ointment. Amongst the many irritant substances which needlessly enter into the composition of the blistering ointments of the shops, are euphorbium sulphuric acid, and occasionally even corrosive sublimate and arsenic. The two former of these are present in the following common preparation:—Powdered cantharides, one ounce; powdered euphorbium, one ounce; oil of thyme, two drachms; sulphuric acid, two drachms; resinous ointment, four ounces. For horses such a preparation must be used with much caution; for, besides enough of cantharides alone to render it an active blister, it contains a very unwarrantable amount of euphorbium and sulphuric acid, each of which ingredients, if used at all, should never exceed in quantity one-eighth part of the active principles of a blister. In larger amount they are very apt to cause unnecessary pain, sloughing of the integuments, and permanent blemishing. In cattle practice counter irritation is generally produced with boiling water or mustard; but some powder or strong ointment of cantharides, mixed with the mustard, greatly increases its effects. For dogs a convenient ointment is made with six drachms of powdered cantharides, an ounce of oil of turpentine, and four ounces of lard. In preparing cantharidine ointments, the oleaginous and resinous substances are melted together over a slow fire, and when liquified are removed from the heat, and the powdered cantharides stirred in, along with any euphorbium or volatile oils. The stirring should be continued until the mixture has acquired a proper consistence. To ensure the full vesicant effect of cantharidine ointments, the hair should be removed from the part to which they are to be applied. The skin should also be washed with soap and water, and subjected to hot fomentations or smart friction. The ointment should then be spread over the part, and well rubbed in. The size of the surface to be covered must depend of course upon the nature, seat, and extent of the malady. Where the ointment is too liberally applied, it sometimes spreads beyond the desired limits; this, however, may be easily prevented by surrounding the blistered spot with an edging of resinous ointment. While rising, the blister causes much irritation, and the animal, if permitted, will rub or bite the blistered part. In the horse, this should be prevented by tying the head to the rack, or putting on the beads; in the dog, by the use of the muzzle. The day after the blister has been applied, the part should be fomented with warm water, and dressed with oil, lard, or any simple ointment; but if a sufficiently powerful effect has not been produced, a little more of the blister may be applied.

Liniments of Cantharides are merely liquified ointments, and, in respect of activity, occupy a mediate place between ointments and tinctures. They generally consist of one part of cantharides, and from six to ten parts of linseed oil. Oil of turpentine is sometimes also added. Some practitioners use a liniment of one part of cantharides and four of tar—a preparation not very commendable, and not easily rubbed in.

Plasters of Cantharides are not much used in veterinary practice, being difficult of application, and very apt to be displaced by the powerfully corrugating action of the panniculus carnosus. They are made in the same manner as ointments, but rendered more strongly adhesive by the addition of a large amount of resin or pitch. They are usually applied in the melted state, immediately covered by a little tow or teased lint, and enveloped in a woollen, cotton, or linen bandage.

CARBOLIC ACID.

Carbolic or Phenic acid closely resembles creasote in its properties and uses, and is one of the many interesting products of late years obtained from coal tar. In an impure state it is a black oily treacle-like liquid, with a disagreeable smoky taste and smell. When purified it is an oily and nearly colourless fluid, neutral to test paper, and of the specific gravity 1062. When deprived of its water, carefully distilled and exposed to a gradually lowered temperature, it occurs in colourless needle-like crystals. In its several forms it exhibits a smoky creasote flavour, and a warm, burning taste, is sparingly soluble in water, but readily dissolved in alcohol, ether, and strong acetic acid. It consists of $C_{12} H_5 O + H O$. It is the principal constituent of M'Dougall's disinfecting powder, which conjoins the antiseptic and deodorizing virtues of carbolic and sulphurous acids; and of M'Dougall's disinfecting fluid, which is made with carbolic acid and lime water. For medicinal and surgical, as well as for sanitary purposes, these and several others of Mr M'Dougall's preparations are often conveniently substituted for the pure carbolic acid.

Actions and Uses.—Carbolic acid is a sedative, anodyne, and astringent; and an antiseptic, deodorizer, and disinfectant.

Like creasote it acts in large doses as a narcotico-irritant poison, and appears to destroy life by interfering with the action of the heart. In the human subject, in doses of three minims, it has proved very serviceable in checking obstinate vomiting, indigestion with flatulence, and diarrhœa, especially when depending upon bad drainage or noxious effluvia. I have found it very serviceable in protracted cases of diarrhœa amongst cattle and sheep, and it will doubtless soon be more generally used for allaying stomachic irritation and vomiting in dogs. It is an admirable dressing for unhealthy wounds and indolent ulcers, for foul in the feet of cattle, and foot rot in sheep, promptly lessening irritability, improving the tone and condition of the adjoining healthy textures, and at once destroying all smell. A diluted solution, containing half a drachm of acid to a pint of water, forms a good wash for the mouth, feet, and udder of animals affected with aphthous epizootic. It speedily removes the itching of skin diseases, and is especially adapted for the treatment of eczema, grease, mange, and scab. In the form of M'Dougall's sheep-dipping composition, it has been favourably reported on by the Australian Government Commissioners appointed to investigate the spread and cure of scab in that colony. The Commissioners state that it has proved very successful, perfectly restoring the diseased skin to a healthy state, and causing the growth of wool on the parts previously scabbed. Carbolic acid is likewise the principal active constituent of M'Dougall's "dipping composition" for sheep and lambs, possesses the several advantages of freedom from poisonous properties, readily destroys ticks, and prevents, for a considerable period, the attacks of flies. Similar solutions prove serviceable in all animals for the destruction of lice and fleas.

Carbolic acid prevents oxydation and coagulates albuminous matters, and is hence a most valuable antiseptic. A few drops mixed with fresh urine, prevents its undergoing any change for several months; meat washed with a diluted solution keeps unchanged for weeks; whilst skins, solutions of gelatine, starch size, and other such substances, prone to decay, are readily preserved when moistened with it. A minute quantity, mixed with recent manure, prevents or arrests putrefaction, obviates all smell, and by retaining and permanently fixing the ammonia and other volatile matters, it greatly enhances the value of the manure so treated. For most of these purposes M'Dougall's disinfecting powder and fluid are now largely used, and especially for the healthful purification of stables, cow-houses, piggeries, and poultry pens. In some of the extensive omnibus and carrying establishments of London, Manchester, and other large towns, it is employed daily at an annual cost of 5s. for each horse. It is also employed for the cleansing and purifying of railway horse boxes and cattle trucks; and for these and similar uses, its cheapness and efficacy recommend its more general adoption.

Doses, etc.—As an internal remedy, pure carbolic acid, in the form either of the clear fluid or the crystalline solid, is preferable. For horses and cattle, the dose varies from ♏xv. to ♏xl.; for sheep, from ♏v. to ♏viij.; and for dogs, from ♏i. to ♏ij. Where the crystalline form is used, grains instead of minims will be given. It is conveniently administered either in a bolus with linseed meal, or dissolved in a little diluted spirit. Where there is extreme irritability of the bowels, carbolic acid may be conjoined with half a dose of laudanum, or a little chalk, carbonate of soda, or other antacid. As a dressing for wounds, a solution may be made with one part of the acid, and from fifty to eighty parts of water; a few drops may be added to the sugar of lead or other healing lotion; or mixed with oxide of zinc, or such other astringent ointment. M'Dougall's fluid, foot rot ointment, and other preparations, are well adapted for the purposes for which they are intended.

CASCARILLA.

Bark of *Croton Eleuteria*, and probably of other allied species.

Nat. Ord.—Euphorbiaceæ. *Sex. Syst.*—Monœcia Monadelphia.

Cascarilla bark is principally imported from the Bahama Islands in quilled pieces about the size of a pencil, and varying from two to four inches in length. Its structure is dense and brittle; its outer surface fissured, and usually covered with a light-coloured lichen; and its inner surface smooth and light brown. Its powder has the same colour, with a strong, pungent, but not disagreeable taste, and a peculiar aromatic odour, which is much increased by heat. From its fragrance it is frequently used as a constituent of fumigatory pastilles. Cascarilla bark, besides woody fibre, contains 15 per cent. of a bitter resin, 18·7 of a bitter gummy extract, 1·6 of a pungent volatile oil; with a small quantity of a neutral, odourless, bitter, non-azotised, crystalline body, called *cascarilline.* The two latter constituents appear to be the active ingredients of the bark, and are soluble in spirit, and also, though less readily, in water.

Actions and Uses.—Cascarilla is a bitter tonic. It resembles cinchona in its general effects, but is considerably less active. Many practitioners use it for all the domesticated animals in indigestion, diarrhœa, chronic typhus affections, and convalescence from exhausting diseases. But for such cases, especially amongst horses and cattle, there are many more efficacious remedies.

Doses, etc.—The dose for horses and cattle is from ℥i. to ℥ij.; and for sheep and dogs, ʒi. to ʒiv. It is given in the form of bolus, decoction, or tincture.

CASTOR OIL.

Ricini Oleum. Expressed Oil of the seeds of *Ricinus Communis.* —(Ed. Phar.)

Nat. Ord.—Euphorbiaceæ. *Sex. Syst.*—Monæcia Monadelphia.

The castor oil plant, or *palma christi*, generally considered to be Jonah's gourd, is indigenous to various parts of the world, but its development varies in different countries and climates. When cultivated in the colder parts of Europe, it is an annual shrub about three or four feet high. In Spain and Sicily it reaches a height of about twenty feet, and in still more southern latitudes, as in India, Central Africa, and various parts of North and South America, it becomes a large tree.

The officinal part of the tree are the seeds, three of which are contained in each capsule. Two varieties are met with, the one the size of beans; the other and commoner, somewhat smaller. Both are of a yellowish-white colour, and mottled with red-brown spots. The investing coat, which forms about 24 per cent. of the whole seed, consists chiefly of lignine. The nucleus, comprising nearly 70 per cent. of the seed, contains 46·2 per cent. of a fixed oil—the castor oil—associated with 21 per cent. of albumen, 2·4 of gum, and, according to some, a small quantity of an acrid purgative principle, which remains after the expression of the oil. The seeds further contain about 8 per cent. of moisture.

Castor oil, besides being manufactured in London, is largely imported from the East Indies and America, and occasionally in small quantities from the West Indies and Australia. Various modes are adopted for extracting and purifying the different varieties of castor oil. It is manufactured in London by crushing the seeds in a screw or hydraulic press, purifying the oil by rest and filtration, and bleaching it by exposure on the house-tops to sun and light: in the East Indies, by expressing the oil as above, heating it with boiling water, and then straining it through flannel: in America, by heating the seeds, expressing, and then boiling the oil with water: and in Jamaica, by boiling the bruised seeds with water, and skimming off the oil as it rises to the surface—a process which, however, yields a very inferior and dark-coloured specimen. In various parts of Continental Europe, the oil is prepared by the agency of alcohol; but this is an expensive and inconvenient plan. The oil obtained by these various methods differs slightly in its activity, but considerably in colour, flavour, solubility, and the property of keeping. That prepared without the application of heat, and known as cold-drawn castor oil, is generally preferred, for when a high temperature is employed, either in roasting the seeds or boiling the oil, the purgative principle appears to be injured.

Properties.—Castor oil, when well prepared, is almost colourless, but the inferior qualities are yellow and occasionally brown. It has an unpleasant oily odour, and a disagreeable greasy taste. It is lighter than water, but is one of the heaviest of the fixed oils, its specific gravity at 60° being 964. When its temperature is reduced below 32°, it becomes dense and opalescent, and deposits a small quantity of margarine. No deposit, however, is obtained from oil which has been previously raised to the boiling point of water. When long exposed to the air, it becomes rancid; and if in a thin layer it thickens, and after a time entirely dries up. It is soluble in hot and cold alcohol, and in ether, but not in water; is easily miscible with other oils; saponifies with alkalies; and, with one-twentieth of its weight of hyponitrous acid, is converted in about seven hours into a yellow substance termed *palmine.* Much doubt still prevails as to the exact composition of castor oil. It is believed to consist of glycerine (the sweet basic principle present in all oils and fats) united with two fatty acids, margaritic and ricinolic acids—the former a crystalline body, the latter a liquid. (Gregory.) Soubeiran, many years ago, found in castor oil a soft resinous oil, to which he ascribed its purgative properties; but his researches have not been verified. From its belonging to the same natural family as croton, and from its having similar properties, it might naturally be expected that it should, like croton, contain an active, acrid, volatile acid; but as yet no such substance has been found in castor oil.

Impurities.—Castor oil is seldom adulterated. The inferior sorts are distinguished by their dark colour, and disagreeable acrid taste and colour. Any rancid odour or dark colour may be removed by the addition of water and equal parts of calcined magnesia and coarse animal charcoal, and agitating the mixture at intervals during two or three days. The dark colour may also be removed by exposure to sun-light, and filtration through animal charcoal. "Pure castor oil is entirely dissolved in its own weight of alcohol."—(Ed. Phar.)

Actions and Uses.—Castor oil seeds are irritant and purgative; and have repeatedly caused fatal gastro-enteritis ~~in~~ man. They appear to be more powerfully irritant than the oil extracted from them. When crushed, they form an Indian cure for mange.

The oil is a mild purgative, closely resembling linseed and the other fixed oils in its action. It causes increased activity of the bowels, but without the frequent and watery discharges induced by some cathartics. Its action seems to depend rather on its increasing the peristaltic motion, than the secretions of the intestines. After its administration it may usually be observed, in oily-looking flakes, amongst the dejections, giving them a glazed appearance. When injected into the veins of man it causes laxative effects, and produces in the mouth the same disagreeable oily taste, as when taken in the usual way. In the horse, castor oil, like other oleaginous substances, is not very certain or prompt in its effects, and is seldom to be recommended where a speedy or full purgative effect is desired. In cattle and sheep its action is more to be depended upon; but in these animals, especially in cattle, it is generally superseded by linseed oil, which is similar in its action, and less expensive. In the dog it seems more active than in man, and, for delicate subjects, a mixture of equal quantities of castor oil and olive oils is preferable to the castor oil alone. Its occasional action as an emetic in dogs, does not result from any specific emetic action, but depends merely upon the nauseous taste and oleaginous nature of the fluid, and in most cases may be entirely obviated by giving the oil with mucilage, a little spirit, or some aromatic, and making sure of its being free of all rancidity.

In properly regulated doses, castor oil produces purgation without irritation or griping, and hence is useful, in young animals, in irritation and inflammation of the digestive organs, as in dysentery, enteritis, and peritonitis; in hernia; advanced pregnancy; affections of the kidneys and bladder; and in other cases where more drastic purgatives might induce undue irritation. Its anthelmintic action has sometimes been over-estimated, and is in reality very slight, and entirely dependent upon its purgative action. In cattle practice it is not very active when given alone, but proves useful in diarrhœa and inflammation of the digestive organs. United with Epsom salts, in doses of half or three-quarters of a pound of each, it produces prompt and certain effects. For external use as a demulcent, castor oil is unsuitable on account of its great tendency to become rancid. The bruised seeds are much used by the native Indian farriers for the cure of mange; and Mr Thomas Pritchard, V.S., of Madras, informs me that two or three dressings usually suffice to remove the disease. It is sometimes employed as a clyster; but for this purpose, amongst veterinary patients, it is generally superseded by linseed oil.

Doses, etc.—The castor oil seeds might be conveniently given to the dog or pig to the number of six or eight, triturated with linseed meal, and made into a bolus, or rolled up in a piece of meat or such other food. The dose of castor oil for the larger quadrupeds is about a pint; for sheep, f℥iij.; and for dogs, f℥i. or f℥ij. It is generally given alone, but is sometimes mixed with linseed oil, or with gruel and aromatics; whilst, to increase its efficiency, it is combined with small quantities of oil of turpentine or of croton.

CATECHU.

Extraet of wood of *Acacia Catechu;* of the kernels of *Areca Catechu;* and of the leaves of *Uncaria Gambir;* probably too from other plants.—(Ed. Phar.)

The Acacia Catechu belongs to the *Nat. Ord.*—Leguminosæ. *Sex. Syst.*—Monadelphia Polyandria.

Cateehu, also ealled kuteh, gambeer or terra japoniea, is an extraet prepared from the wood, leaves, or kernels of various speeies of eateehu, and also of other plants. It derived its old name of terra japoniea from its being imported from Japan, and from the opinion that it was an earth. Its more reeent and eorreet name of eateehu is more in aeeordanee with its true nature, being derived from *cate*, a tree, and *chu*, juiee. Mr Morton, in adopting the nomenelature and sourees of eateehu, as given by the London College, falls into the very common error of aseribing it to the wood of the aeacia eateehu alone; whereas it is now eertain that the eatechu in common use, is obtained from various parts of the plant besides the wood, and is also derived from various other plants besides the one mentioned by the London College. There are at least three different plants whieh yield the cateehus of commeree—the *Acacia Catechu*, an Indian shrub, twelve or fourteen feet high—the *Areca Catechu*, or betel-nut tree, a tall, beautiful palm, with large leaves, numerous flowers, and a thiek, fibrous fruit, containing the betel-nut, whieh is an astringent seed, about the size of a plum (See p. 145)—and the *Uncaria Gambir*, a low shrub, belonging to the natural family Rubiaceæ, and inhabiting the Islands of the Indian Archipelago. The processes followed for the extraction of the eatechu from these different sources are very similar. The wood is cut into chips, and the leaves or seeds are bruised, and boiled with water; the liquor thus proeured is eoneentrated; and, when of sufficient consistence, is poured into square or round moulds, usually made of clay. Whilst the title of catechu is applied to these prepared extraets, the term *kino* is generally given to various natural exudations, possessed of very similar astringent properties.

Varieties.—Catechu is chiefly imported to this country from Bombay, Calcutta, and other parts of the Indian Peninsula. It varies much in appearance and quality; but the many different kinds used in tanning, dyeing, and medicine, are included under the three classes—brown, yellow, and grey catechus.

The Brown Catechu is of several kinds. The best occurs in round, irregular, and somewhat flattened masses, weighing from two to four ounces, and is known as *ball* catechu. Its surface is generally covered with the glaumes or husks of rice. Its fresh fracture is smooth, of a dark chocolate-brown colour, and occasionally marked with a red marbling. It has a strong astringent taste, followed by a sensation of sweetness, but without any bitterness. It communicates a red colour to the saliva. *Lump* catechu differs from ball catechu chiefly in form, being made into large masses weighing eighty pounds, and upwards. Both these varieties are probably obtained from the wood of the *Acacia Catechu.* *Colombo* catechu has only recently found its way into British commerce. It is believed to be obtained from the *Areca Catechu.* It is in small, hard cakes, has a resinous, red-brown fracture, an astringent taste, and is of superior quality, some specimens containing 53 per cent. of tannin. (Christison.)

The Yellow Catechus are distinguished from the other sorts by their greyish-yellow colour, their loose, brittle structure, lighter density, and duller fracture. When chewed, they communicate a yellow colour to the saliva. The most highly prized of the yellow catechus is the *dark Gambeer*, which is imported from Singapore, and is believed to be prepared from the leaves of the *Uncaria Gambir.*

The Grey Catechus are of less importance than either the brown or the yellow. They are less astringent, more apt to be adulterated with starch and other impurities; and although used for tanning and dyeing, are rarely employed in medicine.

Properties.—All the catechus have an agreeable astringent taste, and leave, when chewed, an impression of sweetness. They have no odour. When heated, they soften, froth up, and char. They are soluble in alcohol and in water, and their solubility in the latter medium is a tolerably correct indication of their quality, for the inferior are considerably less soluble than the superior sorts. The infusion is generally prepared with hot water. When strong, it is slightly acid, and deposits a reddish substance as it cools. When diluted, it changes from red to yellow, is deepened in colour by alkalies, and precipitated by gelatine and salts of lead, copper, and peroxide of iron. As these metallic salts form insoluble compounds with catechu, they should not be given along with it. With chemical tests it comports itself in the same manner as any other tannin-containing substance. The proportion of tannin contained in the different sorts of catechu, varies, according to Professor Christison, from 28 to 54 per cent. The extractive matter of Davy, also known as resinoid matter, catechine, or catechuic acid, is insoluble in cold, but soluble in hot water; and is, when pure, a white, silky, crystalline powder, represented by the formula $C_{20}\,H_9\,O_8$, HO.

Impurities.—Catechu is liable to various adulterations. Sand and other inorganic matters, which are the most common impurities, are readily discovered by chewing the specimen, which, when pure, should be free of grittiness; or by burning it, and observing the amount of residue. The best test, however, alike for the purity and goodness of catechu, is the proportion of tannin it contains.

Actions and Uses.—Catechu is astringent and antiseptic. Like other tannin-containing substances, it combines with the gelatine and albumen of the tissues, and so lessens their calibre, and renders them insoluble and capable of resisting putrefaction. On account of these properties, it is much used by the tanner in the preparation of tanno-gelatine or leather. Catechu is less astringent than oak-bark or galls, and is, therefore, more suitable for internal administration. It is given to all the domesticated animals in general atony and relaxation, and in excessive mucous discharges, especially from the alimentary canal. In such cases it is often advantageously combined with aromatics, to remove flatulence; with opium, to relieve irritability; and with magnesia or an alkali, to counteract acidity. A convenient formula for diarrhœa may be made with three ounces each of catechu, magnesia, and ginger, and six drachms of opium, made into a mass with treacle and linseed flour. This will make six doses for a horse, three for a cow, and eight or nine for a calf or sheep. For these ruminants the dose is conveniently given suspended in a little starch gruel. Catechu is used as an application for sluggish sores and ulcerations, for excoriations on the udder of cattle, and for all the ordinary purposes of a vegetable astringent.

Doses, etc.—The dose of catechu for horses is from ʒij. to ʒv.; for cattle, from ʒiij. to ʒviij.; for sheep and swine, from ʒi. to ʒiij.; and for dogs, from grs. x. to grs. xl. These doses may be administered three or four times a day, with a sufficiency of mucilage or gruel to cover their astringent taste. The chief officinal preparations are the infusion and the tincture. The *infusion* may be readily prepared for veterinary purposes by pouring boiling water over any convenient quantity of catechu, allowing the mixture to stand by the fire for a few hours, and straining. Flavouring ingredients may be added if required. A good *tincture* may be made by the following process of the Edin. Phar.:—"Take of catechu, in moderately fine powder, three ounces and a half; cinnamon in fine powder, two ounces and a half; proof spirit, two pints; digest for seven days, strain and express strongly the residuum; filter the liquors. This tincture may also be prepared by the process of percolation, the mixed powders being put into the percolator without being previously moistened with the spirit." For external purposes the powder or infusion is commonly used, and occasionally an ointment.

CHAMOMILE.

Anthemis. Simple flowers of the *Anthemis nobilis*.—(Ed. Phar.)

Nat. Ord.—Compositæ. *Sex. Syst.*—Syngenesia, Polygamia superflua.

Chamomile flowers are extensively cultivated in the warmer parts of England; are gathered during dry weather; exposed for a short time on trays in a shady place; and are afterwards carefully stored and kept very dry. Two sorts are met with in the shops—the single or Seotch, and the double, or English. The former is universally preferred, and is the only variety acknowledged by the Pharmacopœias.

Chamomile flowers have a hot, bitter taste, and a strong aromatic odour. They contain a bitter extraetive matter, soluble both in water and alcohol; a small quantity of tannin, easily discoverable in the watery solution by its precipitation with gelatine or sesqui-chloride of iron; and a volatile oil, which when first distilled, is of a beautiful blue eolour, and is the chief active principle of the plant.

Actions and Uses.—Chamomile flowers are stomachie, carminative, and mildly tonic. Their stomachic and carminative virtues depend upon the volatile oil, and their tonic properties on the extractive matter and tannin. They are occasionally given to horses and cattle in doses of one to two ounces, as a domestic remedy in indigestion; and, in the form of fomentations and poultices, are sometimes used to soothe inflammatory pain, and swelling. For this purpose, however, they are seareely, if at all, superior to linseed or oatmeal.

CHARCOAL.

Two varieties of charcoal, or carbon, are used in medieine and pharmacy, namely, wood charcoal, or *carbo ligni*, and animal charcoal, or *carbo animalis*. The former is prepared by piling some of the harder woods into heaps, covering them with turf and sand, and leaving a few apertures for the admission of air. The pile is then ignited; and, after the flame has risen through the whole mass, the openings are closed, and the eombustion proeeeds slowly without access of air. The moisture of the wood, its oxygen, hydrogen, and nitrogen, are dissipated, leaving carbon and mineral matters. The charcoal varies in eomposition with the wood from which it is prepared, but eontains, on an average, about 87 per cent. of chemically pure earbon, 2 of ashes, and 11 of volatile matters. (Berthier).

Animal charcoal, also known as bone or ivory black, is chiefly prepared from bones, which are first boiled to separate fatty matters, and then heated in close vessels until vapours cease to be disengaged. The fixed residue contains carbon, with about ten times its weight of phosphate of lime (Graham), which exists in a state of very fine division, separates the particles of the charcoal from each other, and greatly enhances its value as an agent for the removal either of colours or odours.

Vegetable and animal charcoal differ considerably in their characters. They are both of a brownish-black colour, are insoluble, inodorous, and tasteless. They readily absorb moisture, all the liquifiable gases, and most vegetable colouring matters. Animal charcoal, the more valuable of the two, may be distinguished by its density, its incombustibility, its bitter taste, and its containing a large proportion of phosphates.

Actions and Uses.—From its insolubility both in water and acids, charcoal has no physiological effects; and its few medicinal actions are dependent chiefly on its desiccant, antiseptic, and deodorising properties. It is occasionally given in chronic diarrhœa and dysentery, especially in cattle; and is very useful in these complaints in lessening the fœtor and acrimony of the feces. Although once much used as an anthelmintic, it is now superseded by more certain and potent remedies. It acts mechanically as an antidote for arsenious acid, nux vomica, aconite, and other active poisons; and, like other insoluble powders, appears to envelope their particles, and thus diminishes and retards their effects. It is only effectual, however, when given promptly, and in cases where the poison has been in moderate amount, and in the solid form. Charcoal is much used as an external remedy. It is frequently applied to unhealthy wounds and ulcers, especially when accompanied by irritating and offensive discharges; and appears to act beneficially by keeping the parts dry, diminishing the irritating effects of the discharge, and removing its noisome odour. In cases of mange, scab, and grease, it is sometimes sprinkled over the unhealthy surface, or applied along with simple poultices. Charcoal is much used for decolorising and otherwise purifying organic solutions; and the convenience and success of the process usually compensates for the loss of a small quantity of the preparation which the charcoal is apt to retain. Charcoal is a powerful antiseptic and deodoriser, and is in every-day use for preventing or arresting the putrefaction of water and many sorts of meat. It attracts odorous and colouring matters, condensing them within its pores; and as there is every reason to believe that it exerts a similar effect upon contagious miasmata, it is hence entitled to be considered a disinfectant.

Doses, etc.—The dose of charcoal for the horse is between ʒiv. and ℥i.; for cattle, about ℥i.; for sheep, from ʒi. to ʒiij; and for dogs, from ℈i. to ℈iij. It is most conveniently given suspended in gruel or any other mucilaginous fluid; and for all purposes its effects may be materially increased by raising it to a low red heat shortly before it is used.

CHLORINE.

Chlorine is prepared by heating sulphuric acid with common salt and black oxide of manganese. For fumigating the Millbank Penitentiary, Dr Faraday used one part of salt intimately mixed with one part of black oxide of manganese, and two parts of oil of vitriol previously diluted with two measures of water. All the ingredients were stirred together in shallow earthenware vessels, and where only a slow evolution of gas was desired, heat was not used.

Chlorine is a greenish-yellow coloured gas, with a peculiar suffocating odour, an astringent taste, and a density of 2470. It is extensively used as a bleaching agent. When applied to the skin it causes redness and eruption, and produces similar effects on the alimentary canal when swallowed in solution. It is so irritating, that it can only be respired in a very diluted state. Its irritant effects are, however, considerably diminished by the force of habit, and are relieved by inhaling ether or the vapour of warm water or alcohol. In veterinary practice chlorine is not used medicinally; but in human medicine it is occasionally inhaled in cases of chronic cough, bronchitis, and phthisis, and also as an antidote in poisoning by prussic acid and sulphuretted hydrogen. Chlorine is much used as a deodorizer and disinfectant; and appears to owe these properties to its readily uniting with hydrogen, and thus altering the composition of noxious matters exposed to its influence. For deodorizing and disinfecting purposes it may be obtained, either as above directed, or by the addition of an acid to bleaching powder. It should be freely used both in the gaseous and fluid states—large volumes of gas being liberated in the place to be disinfected, and the walls, wood-work, etc., washed with a strong solution. Light must be freely admitted, for without it the action of chlorine is very imperfect; and thorough ventilation is also to be subsequently adopted. When large quantities of the gas are being used, all animals must be removed beyond the influence of its irritant action; but where only small quantities are employed this is unnecessary. Although it appears highly probable that chlorine, when efficiently used, is of considerable service in arresting the progress of such diseases as glanders and farcy, pleuro-pneumonia, and the aphthous epizootic, and of maintaining in a pure and healthful state the atmosphere of the habitations of animals, still it must in fairness be mentioned, that cholera and erysipelas in the human subject are stated to propagate themselves readily even when the patients are kept almost constantly surrounded with the fumes of chlorine. (Pereira's Materia Medica.) Such statements, however, are insufficient to shake the strong presumptive evidence in favour of the disinfectant value of chlorine in various contagious diseases affecting the lower animals.

CHLOROFORM.

Terchloride of formyle. $C_2 H, Cl_3$, or $Fo Cl_3$.

Chloroform was discovered in 1832, nearly about the same time, by Soubeiran and Liebig. Its effects on the lower animals were first observed by Dr Glover, in 1842; while its valuable anæsthetic properties were first discovered and applied by Professor Simpson in November 1847. Since then it has been largely and successfully used for the alleviation of human suffering during surgical operations, parturition, and various diseases, and has also been occasionally applied to similar purposes in veterinary practice.

Preparation.—The cheapest and best way of making chloroform is with one part by measure of alcohol, or of the cheaper methylated spirit, and twelve parts by weight of bleaching powder. These ingredients are made up with water into the consistence of cream, and distilled in a roomy retort, with refrigerator and receiver attached. The chloroform comes rapidly over during the first part of the process, and, collecting in the receiver, forms two strata—the upper consisting of weak spirit, which may be preserved for the next operation ; and the lower of crude chloroform, about the density 1220. In order to char and destroy the deleterious oily matters which this impure chloroform contains, it is agitated with about half its volume of sulphuric acid, which must be carefully freed from nitric acid. Prolonged or repeated contact with the sulphuric acid must, however, be avoided, as it prevents the preparation from keeping well. All trace of acid is then removed by distilling the chloroform, mixing it with quicklime, decanting it off, and again distilling. The late Professor George Wilson also showed that it may be still further purified by washing it with water, and once more distilling it.

Properties.—Chloroform is a transparent, colourless, oily-looking, mobile fluid, with a density of 1500, a strong sweet taste, and a fragrant etherial and apple-like odour. It volatilizes readily, and boils at 140°. Though not spontaneously inflammable, it can be burned around a wick saturated with alcohol. In burning it forms a dull sooty flame, and evolves hydrochloric acid. Alcohol and ethers dissolve it readily, but water scarcely takes up more than 1-2000th part. A pint of water only holds sixty minims in solution—a further addition of water rendering the mixture opalescent with precipitation of the chloroform. It is an active solvent for volatile oils, wax, and resins. The various effects which acids and alkalies have in altering the appearance of a drop of chloroform have been carefully investigated by the late Professor George Wilson. On dropping chloroform into a saucer, or other shallow vessel containing water, and adding an alkali, he observed that the small, compact, and well-defined drop, so characteristic of pure chloroform, immediately became collapsed and flattened, and sank to the bottom of the vessel; but that, when the alkali was neutralized, by the cautious addition of acid, the flattened globule immediately regained its spherical form, and rose nearly to the surface of the water. This flattening and restoration of the globular form may be repeated again and again, as the water is rendered alkaline or acid. Chloroform consists of one equivalent of the basyle formyle (Fo or C_2H), and three of chlorine (Cl_3); is consequently termed terchloride of formyle; and is represented by the symbol C_2H, Cl_3, or Fo Cl_3.

Impurities.—Chloroform sometimes contains impurities which are apt to render its effects tardy and irregular, and to expose those who inhale it to headache and nausea; but such impurities are now much less common than they once were, and have never been so serious in Scotch as in English chloroform. When quite free from water, it remains transparent if exposed to a temperature of 32°. The presence of alcohol renders the drops opaline when added to pure water. Sulphuric acid discovers itself by its reddening litmus; whilst chlorine and hydrochloric acid, the most common of its irritating impurities, are easily identified by their action on nitrate of silver, or by their disagreeable acridity, which is occasionally so great as to prevent the chloroform from being respired. Many specimens contain volatile oils, which may be recognised by their blackening sulphuric acid, or evolving an unpleasant pungent odour when a small quantity of the drug contaminated by them is evaporated from the back of the hand. In judging of the purity of chloroform, it is chiefly necessary to note its odour, its behaviour when agitated with sulphuric acid, its reaction on litmus, and its density, which is invariably lowered by the presence of adulterations.

Actions and Uses.—Chloroform is a narcotic poison, an anæsthetic, stimulant, and antispasmodic.

The poisonous narcotic effect of chloroform is very analogous to that of alcohol or ether; and is readily produced by large doses introduced into the stomach, or rapidly inhaled without sufficient admixture of air. It is merely a higher degree of its valuable anæsthetic action. This latter action, as already mentioned, was discovered by Professor Simpson in November 1847, and appears to be produced in the following manner. The volatile chloroform rapidly enters the blood; its effects, according to the late Dr Snow, are readily observed so soon as the blood takes up 1·56th part of the amount it is capable of dissolving; and it acts directly on the nervous centres, first perverting and then gradually extinguishing their several functions. It seems to affect these centres in a tolerably regular order; involving first those presiding over special sense and volition; next those of common sensation and motion; and lastly, where the influence is unduly prolonged, those which sustain the respiratory and circulatory movements. The symptoms which occur as the agent successively involves these several parts, have been already fully noticed under the head of Anæsthetics. It may be sufficient here to mention that there is at first temporary excitement, with many of the symptoms of inebriation, succeeded by gradually diminishing consciousness of all external objects, weaker and slower respiration, diminution of the animal temperature, muscular relaxation, and insensibility to pain. In animals destroyed by the inhalation of chloroform, the *post-mortem* appearances are variable. The lungs are usually congested; the heart continues to beat for a considerable time after respiration has ceased, its left side being nearly empty, but its right filled with semi-solid, dark-coloured blood. The veins of the head, neck, and chest are distended with black fluid venous blood; and the membranes of the brain are sometimes congested.

Chloroform bears favourable comparison with all other known anæsthetics, being more pleasant to inhale, more powerful and regular in its action, and less apt to cause preliminary excitement, or leave unpleasant effects. Dr Simpson considers that it saves the lives of six persons in every hundred subjected to surgical operations. Nor, with proper precaution, is it an unsafe remedy. It is stated to have been used 9000 times at St Bartholomew's Hospital without causing a single death; and M. Flourens says, that during the Crimean War 25,000 French soldiers inhaled it without a single casualty. It cannot, however, be used so conveniently or safely in the lower animals as in man. In horses, its anæsthetic action is often preceded by considerable excitement; and if, to prevent this, it be given rapidly and in large amount, it occasionally proves fatal. These untoward results are even still more observable among dogs and rabbits. The author has had little experience of its effects on either cattle or sheep. Bees exposed to it speedily become insensible, and while under its influence, may be safely removed from full hives. Plants exposed to its vapour lose their irritability.

The stimulant action of chloroform is exhibited in the preliminary excitement which it produces, either when inhaled or swallowed. This may be readily kept up for a considerable time, by giving the medicine in small quantities at short intervals. When chloroform is dropped upon the intestines or bladder, it excites violent peristaltic motion—another evidence of its stimulant action. But when "dropped on the heart, as that organ was contracting, it caused a cessation of the pulsations until it had all evaporated, having a temporary paralysing effect on that organ." (*Monthly Medical Journal* for May 1853.) It is partly from its stimulant, and partly from its anæsthetic action, that it is so effectual in overcoming spasm. Mixed with solutions of aconite, atropia, morphia, strychnia, and other such active poisons, it expedites their absorption and their poisonous action on rats, guinea pigs, and other small animals, whose feet were immersed in solutions of the poison.

In veterinary practice, the uses of chloroform are as yet comparatively limited. It is occasionally given to horses to procure insensibility during castration, firing, and other painful operations; but should probably not be used without warning the owner of the possible risk attending its administration, and having at hand an ample supply of the drug in good condition. Among the lower animals, parturition is performed so easily, and with so little apparent pain, that the administration of chloroform, in the great majority of cases, is quite unnecessary. It is, however, occasionally useful in bitches, when the pups have to be reduced in size before they can be extracted. A few cases also occur in cows and ewes, where the neck of the uterus is so firmly closed that the matured fœtus cannot be extracted. The mother strains violently; preparations for parturition appear to be otherwise complete; but the neck of the uterus continues closed, and sometimes remains so for hours in spite of medicines and manipulation. Chloroform in such cases often proves very effectual. Under its influence the rigid muscle gradually relaxes, and delivery is safely accomplished usually within an hour after the administration of the anæsthetic. The inhalation of chloroform has been highly recommended in cases of tetanus; but the spasms are relaxed only so long as the anæsthesia continues, and return with all their wonted severity whenever it ceases; while the benefit derived from the temporary relief is usually more than counterbalanced by the disturbed and excited state into which the animal is apt to be thrown during the administration of the chloroform. In diseases accompanied by violent and long-continued pain, as enteritis, peritonitis, and acute rheumatism, as also in the spasms or after-pains of parturition or abortion, a slight degree of anæsthesia is of service in all animals in blunting pain, and allowing time for the beneficial operation either of medicines or of the conservative powers of nature. In such cases, it may either be inhaled or given in solution by the mouth or rectum. In the form of clysters it is probably entitled to more extended use as a means of relieving the pain of serious internal diseases. Its inhalation three or four times a-day, in quantities sufficient to cause slight anæsthesia, has little, if any, curative effect in cases of pleuro-pneumonia. It has a marked effect in arresting epileptic fits in dogs, and is of service in all animals as an antispasmodic in cases of colic and asthma, especially when swallowed in a state of dilution, and in doses insufficient to produce any anæsthetic effect. Rubbed into the skin, it is a convenient and cleanly method of removing lice and fleas.

Doses, etc.—It is somewhat difficult to fix the precise quantity of chloroform necessary to produce anæsthesia. Two or three ounces will generally be effectual in horses or cattle, and from one to two drachms in dogs. The exhibition is most simply and safely effected by placing a sponge saturated with chloroform in a nosebag, perforated with holes to admit a sufficiency of air, and attached to the head. Care should be taken to secure the animal, lest he become unmanageable during the early stages of excitement; to supply fresh quantities of chloroform by a tube or other means; and to ensure the entrance into the lungs of an adequate supply of air along with the chloroform. Where the chloroform vapour is insufficiently diluted, there is much risk of its causing sudden death by arrestment of the action of the heart, and the proportion of vapour should therefore never exceed five per cent. of the air inspired. Whilst the anæsthesia continues, the respiration and the pulse must be carefully watched; and if an undue effect be produced, the inhalation must be immediately stopped, fresh air allowed to flow in currents about the face, water thrown over the head and neck, and artificial respiration adopted, if necessary. When partial recovery takes place, the inhalation and exhibition of stimulants will also be useful. As a stimulant and antispasmodic, the dose for horses or cattle is from f℥i. to f℥ij.; and for dogs, from ♏v. to ♏x. These doses are best given in weak spirit, at intervals of an hour or two. A solution of chloroform in spirit, adapted for these stimulant purposes, may now be had ready prepared, under the name of *chloric ether*, and may be applied to the same uses as sulphuric ether, or the more familiar sweet spirit of nitre. Chloroform is sometimes used as a solvent for gutta percha, and the solution is occasionally employed as a substitute for collodion. It is also an excellent solvent for many gum-resins, these solutions constituting very fine though expensive varnishes.

CINCHONA.

Bark of different species of Cinchona.

Nat. Ord.—Cinchonaceæ. *Sex. Syst.*—Pentandria Digynia.

Cinchona appears to have been first known in Europe about 1640. For a long time it was used only by the Jesuits (and hence the name it still occasionally bears of Jesuit's bark); but about 1670 its virtues were discovered by an Englishman, named Talbot, who sold his secret to the French Government for L.1600, an annuity of L.80, a ten years' monopoly, and the honour of knighthood.

Natural History.—The various plants yielding the different varieties of cinchona bark were long entirely unknown. Many distinguished naturalists have investigated the subject, and within the last few years it has been greatly elucidated by Dr Weddell, who has published his observations in a splendid monograph.[1] He admits nineteen different species, but considers only eight of them valuable for obtaining the active principles quinine and cinchonine. The *Cinchonaceæ* are trees, or tall shrubs, with fine, usually evergreen foliage, and beautiful fragrant flowers. They abound on the slopes and valleys of the Andes; extend in a comparatively narrow zone from about 10° N. latitude to 19° S. lat.; occur chiefly in groups or solitary trees; and thrive best with a good deal of moisture, a mean temperature of about 60°, and an elevation of between 4000 and 10,000 feet above the level of the sea. The bark is collected from May to November, being removed from the trees sometimes while they stand, but more commonly after they have been felled. It is then carefully dried, the thick pieces from the trunk remaining flat, and the thinner portions from the branches curling into quill-like forms. It is packed in chests or in cerones, which are formed of hides or coarse cloth, and contain from 70 to 150 pounds of the bark, and is exported from Bolivia and other places along the coast of

[1] Histoire Naturelle des Quinquinas. Fol. Paris, 1849.

Peru, whence its vernacular name of Peruvian bark. The im provident destruction of the American cinchona forests has diminished the supplies of bark, enhanced the price of quinine, and directed attention to the introduction of the plants into other regions, and especially into India, where the undertaking promises to be most successful.

Varieties.—There are from forty to fifty different sorts of bark met with in commerce, but those in common use have, for convenience of description, been divided into pale, yellow, and red barks.

The Pale Cinchonas are usually in thin fibrous rolls or quills, and are stripped from branches or young trees, which, as they grow older, often yield the darker barks. Their powder is light coloured, astringent rather than bitter, and contains cinchonine, but little or no quinine. *Crown bark*—a well-known and esteemed variety of the pale cinchonas, and interesting as being the bark first used, is the produce of the *C. condaminea*, occurs in quills from six to fifteen inches long, and about the size of the finger, and is invested with a grey or tawny epidermis, which is always entire, marked with longitudinal furrows and transverse cracks, and covered with lichens. The inner surface of the bark is red or cinnamon-brown ; and the powder, which is lighter than that of either the red or yellow barks, has the same colour. The *grey* or *silver bark* is another of the pale cinchonas. It is of fine quality, but is less used than crown bark.

The Yellow Cinchonas (*Cinchonæ flavæ*) include a great variety of barks, but by far the most important is that receiving the specific title of *yellow cinchona* or *C. regia*. It is very highly prized, on account of its containing a large quantity of quinine. It occurs both in quills and flat pieces, the latter being the most esteemed. Its epidermis is brown, rough, fissured, and often covered by white or yellow lichens; its inner surface is smooth and yellow ; its structure, fibrous ; and its powder, yellow-orange. It has an aromatic odour, and a bitter taste, without much astringency. When infused in water, it yields, with a strong solution of sulphate of soda, a precipitate of sulphate of lime. Dr Weddell has shown that it is obtained from the *C. Calisaya*—a tall tree, found in the warm climates of Bolivia and South Peru, and distinguished by its stout naked stem and leafy summit overtopping the rest of the forest.

The Red Cinchonas (*Cinchonæ rubræ*) include several commercial varieties, are the produce of different species, and owe their distinctive colour chiefly to the manner in which they are procured and dried. They usually occur in flat pieces, which vary in length and thickness, and have a red, rough, wrinkled epidermis, a fibrous red-brown interior, a feeble agreeable odour, and a strong astringent taste. They are of excellent quality, and yield a considerable proportion both of quinine and cinchonine.

Besides these superior varieties of pale yellow and red barks, there are various others of inferior quality, which are much used to adulterate the more valuable sorts. Such are the ash, rusty, and the various kinds of Carthagena bark.

Properties.—All the cinchonas have certain common characters. They occur either in quills or flat pieces, and have a slightly aromatic odour, and an astringent and somewhat bitter taste. Their colour varies considerably, but is always deepened by exposure to moisture. They are soluble in cold and hot water, and in alcohol of all densities; but their best solvents are proof spirit and diluted acids. When solutions of cinchona are exposed to a high or prolonged heat, the colouring matter unites with the alkaloids, forming insoluble compounds, and on this account, decoctions and extracts are ineligible preparations. When infused in four parts of boiling water for twenty-four hours, and then filtered, the superior qualities of bark are precipitated by solution of nut-galls, potash, and ammonia. The precipitates thus produced are chiefly the alkaloids of the bark. Owing to the presence of tannin, solutions of gelatine and tartar-emetic, when added to infusions of cinchona, produce white or grey precipitates, and persalts of iron, dark-green precipitates.

Cinchona contains the following constituents:—

Quinine or *Quina*, an alkaloid, found most abundantly in the yellow bark, and used as a tonic and antiperiodic, chiefly in the form of a sulphate. When a solution of the sulphate is treated with ammonia, the alkaloid is precipitated as an amorphous, white, odourless powder. It may also be got in delicate, needle-like crystals, by slowly evaporating a concentrated solution. It has an intensely bitter taste; and dissolves sparingly in water, but readily in diluted acids, with which it forms crystallisable, moderately soluble salts, having all the virtues of the pure alkaloid. Quinine, according to Liebig, consists of C_{40} H_{24} N_2 O_4.

Cinchonine is chiefly present in the grey barks, and may be obtained by subjecting them to the process for sulphate of quinine (p. 214). The alkaloid occurs in colourless, quadrilateral, insoluble crystals, having a feebly bitter taste, and consistingof C_{40} H_{24} N_2 O_2. Like quinine, it is a powerful tonic, but is scarcely ever used medicinally. When quinine and cinchonine are subjected to heat, new alkaloids, isomeric with them, are produced.

Cinchondine, isomeric with cinchona, occurring only in certain varieties of bark, and obtained, by evaporation of an alcoholic solution, in bright, hard, striated, rhomboidal prisms.

Aricine, a fourth alkaloid, analogous to cinchonine, discoverable in only some varieties of bark, and of less importance than the alkaloids already mentioned.

Cinchonic or *Kinic* and *Kinotannic* acids exist in combination with the alkaloids, and with lime, are acid to the taste, crystallisable with difficulty, undergo decomposition when heated, and comport themselves in most respects like acetic acid.

Tannin, resembling that of catechu, and easily recognised by its precipitating gelatine, tartar-emetic, and persalts of iron.

Cinchonic Yellow and *Cinchonic Red*, two colouring matters, uncrystallisable, partially soluble in water, readily dissolved by alcohol and diluted acids, and, when heated, readily forming, with the alkaloids, insoluble and nearly inert compounds. Besides these more characteristic constituents, cinchona further contains a concrete oil, a trace of volatile oil, starch, gum, resin, lignine, and salts of lime.

Impurities.—Inferior and spurious cinchonas are apt to be substituted for the better varieties. This may be discovered by noting carefully the general appearance, fracture, colour, odour, and taste of any suspected specimen ; and likewise especially the proportion of alkaloids which it contains. 1000 parts of good yellow bark yield from 11·7 to 23·4 parts of quinine.

Actions and Uses.—Cinchona bark is, in large doses, slightly irritant ; and, in medical doses, astringent, antiseptic, tonic, and antiperiodic.

Large quantities, in the state of powder, cause irritation of the alimentary mucous membrane, increased force and frequency of the pulse, and, in the dog, vomiting. In rabbits, thirty grains caused debility, and sixty grains death (Christison). An ounce and a half of a strong decoction injected into the jugular vein of a dog, caused, after the lapse of about fifteen minutes, vomiting, violent palpitations, and spasms ; and, on half an ounce more being injeeted, tetanus and death. Its astringent properties depend upon the presence of tannin, and are exerted alike on dead and living tissues. A strong solution increases the eohesion of portions of the intestines, blood-vessels, or other parts steeped in it; and in living animals counteraets relaxation, arrests exeessive secretion, and when given for some time eauses pereeptible thiekening and contraetion of the intestines. It also improves the appetite, promotes healthy digestion, strengthens the pulse without quiekening it, and augments the general power and vigour. Henee it is a valuable tonie. It unites the various properties of a tonie, bitter, and astringent; but, in properly regulated doses, is devoid of any very obvious stimulant aetion, or any irritant effeet on the alimentary eanal. It possesses a remarkable power of arresting those diseases in whieh the symptoms oceur at regular intervals, as ague in man, and some sorts of fevers and nervous diseases. This antiperiodie aetion of einehona bark is owing to the alkaloids present in it, and is possessed by no other known medicines exeept arsenic and salts of bebeerine. It appears to oceur quite independently of any tonic effeet, being sometimes developed in a few hours, and by one or two doses, and results, as some think, from a peeuliar stimulant aetion on the nervous system. M. Briquet, however, eonsiders that small repeated doses of einehona or quinine allay irritation in virtue of a sedative effeet, and that, like opium and ethers, it exhibits a twofold aetion—first increasing and then diminishing vital aetion.

Cinehona is of mueh service in all diseases characterized by impaired appetite, weak pulse, and general atony; as in ehronie diarrhœa, and other inordinate mucous diseharges depending on defective tone; in passive hemorrhages; typhoid affeetions; eonvaleseenee from debilitating complaints; consumption, and other forms of serofula; diabetes; glanders; and sheep-rot. In these two last diseases it is, like other tonics, a valuable palliative, but not, as some have eonsidered, a perfect or eertain eure. As an antiperiodie it is used advantageously in intermittent fevers in all animals, in chorea in dogs, and in periodie ophthalmia or moon blindness in horses, in the treatment of which it is highly extolled by French veterinarians. It has sometimes been given with benefit in rheumatic affections both of horses and cattle. It is contra-indicated in acute inflammation or fever, except of an intermittent or typhoid type; and should also be avoided when there is much irritability of the alimentary canal. It is occasionally used externally as an astringent and antiseptic; but for these purposes it may be advantageously replaced by more efficient and cheaper remedies.

Doses, etc.—The doses for horses or cattle are from ℥i. to ℥iij.; and for dogs, ʒi. to ʒiij.; repeated twice or thrice a day for several days continuously. If nausea or vomiting supervene, as occasionally happens in dogs, the dose should be considerably reduced. It is usually administered in the form of a bolus, and is often conjoined with camphor, gentian, or ginger. Infusions and tinctures are occasionally used. The *infusion* is made by infusing for some hours in a covered vessel one part of powder, and ten or twelve parts of boiling water, and then straining. The *tincture* is conveniently prepared by the following process of the Edin. Phar.:—"Take of yellow bark in fine powder (or of any other species of cinchona, according to prescription) eight ounces; proof spirit, two pints; percolate the bark with the spirit, the bark being previously moistened with a very little spirit, left thus for ten or twelve hours, and then firmly packed in the cylinder. This tincture may also be prepared, though much less expeditiously, and with much greater loss, by the usual process of digestion, the bark being in that case reduced to coarse powder only."

Sulphate or Disulphate of Quinine.

Sulphate of Quinine (*Quinæ Sulphas*) possesses in a concentrated form all the properties of cinchona bark. As it is always procured from the manufacturing chemist, it is unnecessary to enter into minute details regarding its preparation. Excellent directions for making it will be found in the Pharmacopœias. The yellow bark, being more productive than any of the other varieties, is chiefly used for its preparation. The colouring matters and acids of the bark are first removed by decoction with water and carbonate of soda, and the residuum boiled with water acidulated with sulphuric acid. The solution is concentrated, and some carbonate of soda added to separate the alkaloid, which is then converted into a sulphate by the addition of a small quantity of very diluted sulphuric acid. The salt is purified and rendered colourless by one or two crystallizations. The proportion of sulphate of quinine yielded by the different sorts of bark varies from one to four per cent.

Properties.—Sulphate of quinine occurs in fine, silky, colourless, odourless crystals, which adhere together in little tufts, and have an intensely bitter taste. When exposed to the air it effloresces, giving off three-fourths of its water of crystallization. It is soluble in 740 parts of cold water, and about 30 of boiling water; and its solubility is greatly increased by the addition of a few drops of sulphuric acid. Its acidulated watery solution has a faint blue tint, exhibits on its surface a peculiar fluorescence, which is a characteristic test of quinine, and is noticeable even when it is diluted with a thousand times its weight of water. With alkalies and alkaline carbonates it yields white precipitates of quina; and, with infusion of galls, a white precipitate of tannate of quina. When treated first with chlorine water, and then with ammonia, a green-coloured solution is produced, from which a green precipitate shortly separates. Another test has been proposed by M. Vogel, junior: A drop of chlorine water, and then a concentrated solution of ferrocyanide of potassium, produces a bright red colour, passing, after some time, into green.

Impurities.—Sulphate of quinine is liable to various adulterations. The most common are sulphate of lime, detectable by incineration; and sugar, discoverable by the sweetness of the residuum left on evaporating a solution. When sugar, starch, or other organic matters, are present, the salt forms, with cold concentrated sulphuric acid, a coloured, instead of a colourless, solution. The simplest tests for its purity are its being entirely dissipated by heat, and entirely dissolved in acidulated water.

If the mother liquor from which quinine has been crystallized be treated with an alkali, a precipitate is formed which, when washed and fused, is a dark-brown, brittle, uncrystallizable substance, now well known as *amorphous quinine* or *quinodine.* It is also obtainable when salts of quinine are exposed in solution to a strong light, or are treated with excess of acid. It is a mixture of all the alkaloids and basic principles of the bark. It appears to be formed at the expense of the more valuable crystallizable alkaloids, and its proportion is believed to be greatly increased in all specimens of bark by its being carelessly dried, and exposed during drying to strong direct sunlight. Quinoidine, although scarcely so powerful, is identical in its action with quinine, and is considerably cheaper.

Actions and Uses.—The actions and uses of sulphate of quinine are very similar to those of cinchona. It is, however, devoid of astringency, and is less apt to cause nausea. Dr Headland thinks it possible that the tonic effects of quinine mainly depend upon its stimulating the functions of the liver; and, in support of this view, he points out its analogy in composition with taurine, and further states, that in all cases where quinine is serviceable, there is failure in the secretion of bile. Like many other medicines of vegetable origin, its effects are more observable in omnivora or carnivora than in herbivora or graminivora; and, like other tonics, its actions are more apparent during weakness and disease than during health. It is beyond all comparison the most powerful and certain of vegetable tonics, and is an active antiperiodic. Its expense alone precludes its more extensive use in veterinary practice. It is of much value in loss of appetite, and weak digestion depending on debility; in convalescence from acute complaints; and in chronic exhausting diseases. There is no tonic better adapted for dogs, especially when suffering from distemper. It allays irritation, and counteracts excessive nervous action; but owing to the rarity of periodic diseases among the lower animals, veterinarians have little opportunity of observing its antiperiodic virtues. They are, however, believed to be sometimes exerted in chorea in dogs, and in constitutional or deep-seated ophthalmia in horses. Sulphate of quinine, when given with cathartics, is believed to increase their activity; but its actions in combination have as yet been imperfectly studied.

Doses, etc.—The dose for horses and cattle is from grs. xx. to grs. xl.; for sheep, about grs. x.; and for dogs and cats, from grs. ij. to grs. x. These doses should be repeated thrice a day; and when the medicine is given as a tonic, it should be persevered in for some days, and occasionally alternated with other remedies of the same class.

It may be given in the form of a pill, which is conveniently administered to the dog in a spoonful of gruel or a bit of meat. The solution in water, acidulated with a few drops of sulphuric acid, is often used, and is the form preferred in human medicine. It is frequently conjoined with ginger, gentian, camphor, valerian, or iron, and medical men endeavour to combine the good results of the best mineral and best vegetable tonic, by administering the citrate of iron and quinine. Sulphate of quinine is one of those remedies which have been applied by the endermic method. A small blister is applied, the vesicles formed are laid open, and the medicine in powder scattered over the exposed surface of the true skin, from whence it is readily absorbed, and produces its effects in the same manner as if given in the usual way. The desired effect, however, is said to be produced by a lesser quantity of the remedy.

Other salts of quinine besides the sulphate have at various times been proposed for use; but as the quinine is the important element alike in all the salts, and retains its properties unchanged in all its ordinary forms of combination, it is obviously of little importance which salt is employed. The sulphate, however, is probably one of the most convenient, on account of its being easily and cheaply prepared. The alkaloid itself has sometimes been used, but has nothing specially to recommend it. The amorphous quinine should not, however, be forgotten, as it appears to be quite as effectual, and is considerably cheaper than any other preparation.

COD-LIVER OIL.

Morrhuæ Oleum. Oleum Jecoris Aselli.

Cod-liver oil is usually prepared by boiling the livers of cod, and occasionally of other fish, with water, allowing them to digest for some time, and then skimming off the oil, and purifying it by filtration and expression through a cloth. It has a pale yellow colour, and an oily, fishy taste, which, however, becomes less obvious to those long accustomed to take it. It consists of oleic and margaric acids, united with glycerine or an analogous principle; and contains, besides, small quantities of resinous biliary matters, phosphorus, iodine, bromine, and salts. The undoubted curative influence of the oil, especially in the human subject, probably depends on the combination of its several properties—the unusually assimilable state of the animal fatty matters, the alterative effects of the iodine and bromine, and the stimulant action of the phosphorous, exerted perhaps especially on the nervous system. From careless preparation, cod-liver oil is occasionally dark coloured and exceedingly nauseous.

Actions and Uses.—Like other fixed oils, it causes, when given in large doses, derangement of the bowels and purgation; but in small and repeated doses it becomes assimilated, and increases the intercellular fat. Dr Pollock has published in the "Lancet" (5th November 1853) some interesting experiments, made by an Essex agriculturist, regarding the fattening action of cod-liver oil on pigs, sheep, and cattle. Twenty pigs, separated from a lot of three hundred, averaging in weight from five to fifteen stones, received two ounces of oil daily, with as much meal as they pleased. The rest of the lot were treated in exactly the same manner, but got no oil. Those receiving the oil are stated to have consumed less food, and when killed, "weighed the heaviest, and made the most money in the London market, the fat being firm and white." When the daily allowance of oil was increased to four ounces per day, the fat became yellow, and the flesh acquired a fishy taste. For small pigs, an ounce daily was found the most economical quantity. An ounce of oil given daily to sheep, induced a decided improvement in the quality both of the fat and flesh ; while cattle, receiving on an average about half a pint daily, are stated to have eaten less food, and paid better, than when treated in the usual way. The oil, it is mentioned, cost from 2s. 8d. to 3s. per gallon ; and in some comparative experiments, is said to have proved itself superior to sperm oil. We should be glad to see these experiments repeated. As they stand, they confirm the fact, now admitted by all scientific agriculturists, that a certain quantity of oleaginous material is of much service in the speedy and economical fattening of animals, in the saving of food, and in the improvement of the quality both of the fat and flesh. They do not, however, suffice to establish the individual superiority of cod-liver oil over other oleaginous matters. Equally satisfactory results might doubtless have been obtained from the use of rape, linseed, or any other mild fixed oil.

In the human subject cod-liver oil is, however, preferred to any other medicinal oleaginous matters, and is extensively prescribed in many debilitating and chronic complaints, accompanied by faulty nutrition, in all forms of scrofula, and in epilepsy, chorea, and various nervous disorders resulting from weakness. In such nervous cases its value probably depends upon its rapid assimilation, and its employment within the body for the building up of the badly nourished nervous textures, which consist in health of 50 per cent. of fatty matters. It may be advantageously given to dogs in all forms of scrofula, protracted cases of distemper, inveterate skin diseases, epilepsy, and chorea, and in chronic rheumatism, especially that variety known as kennel-lameness, and depending upon damp, bad feeding, and mismanagement. For the like disorders among cattle, sheep, and horses, it is usually superseded by linseed or oil-cakes. Dr Pollock's Essex correspondent mentions that it materially relieves broken-winded horses.

Doses, etc.—It may be given to dogs in doses of half an ounce twice a day, and persevered with for a considerable time. To lessen its naseous flavour, the dose may be beat up with an egg, or given in milk or gruel, with a small quantity of any ordinary aromatic.

COLCHICUM.

Meadow Saffron. Cormus or bulb and seeds of *Colchicum autumnale.*

Nat. Ord.—Colchicaceæ *Sex. Syst.*—Hexandria Trigynia.

The *Colchicum autumnale*, or autumn crocus, grows wild in the lawns and coarser wet pastures throughout many of the mild moist parts of the island, and is also cultivated in many gardens. It has an annual stem; a lilac or purple flower; numerous roundish, brown, bitter-tasted seeds, about the size of those of the millet; and a biennial root, which, towards the month of June, and when about a year of old, produces near its lower end a small bulb. This offshoot gradually increases in size, sends up in autumn a flowering stem, and in spring the familiar crocus leaves with the seed vessel. By July it attains its full growth, being about the size of a walnut, and beginning in its turn to form a young bulb. Meanwhile the parent bulb has been gradually wasting, until, during the second summer of its own existence, it becomes a dry, shrivelled, shapeless mass, attached to the lower surface of its full-grown progeny. Previous to this, however, generally during the spring months, it sometimes produces one or two small immature bulbs, which, after separation from the parent bulb, probably require several years to come to perfection. The corm or bulb, which is the chief officinal part of the plant, is usually taken up in June or July, when plump, rich in starch, and about a year old; but Professor Christison, who has investigated this subject with much care, considers that, although more shrivelled and watery, it probably continues equally active throughout the succeeding winter and spring. The bulbs, when dug up, are stripped of their brown integument and cut into slices, which are dried at a temperature not exceeding

150°, and should be of a greyish-white colour, dry, and firm, with a bitter, acrid taste. They yield their active principles to spirits and vinegar, the latter of which forms their cheapest and most convenient solvent. The bulbs contain water, starchy matter, lignine, gum, and a bitter, crystallisable, poisonous alkaloid called *colchicine*, similar to veratria, and present in other parts of the plant as well as in the bulb.

Actions and Uses.—Colchicum is, in large doses, an irritant poison; and in medicinal doses, cathartic, diuretic, emetic, and sedative.

When eaten, whether in the green or dried state, it is apt to cause serious consequences. Mr Broad of Bath, in "The Veterinarian" for 1856, records two cases of horses dying from eating in their hay the stalks, leaves, pods, and seeds of colchicum. Colic, tympanitis, and great dulness supervened, with death in twenty-four hours; and on post-mortem examination, "inflammation and patches of erosion" were found on the mucous membrane of the stomach. Mr Broad also mentions the poisoning of eight two-year-old in calf heifers, which suffered from tympanitis, purging, feeble pulse, and coma. Three died in about twenty hours, and the mucous membrane of the stomachs was affected with patches of inflammation and erosion." M. Barry, in the "Recueil de Médécine Vétérinaire" for December 1862, records the case of a cow and heifer at Aisne, which ate some cut grass containing a considerable amount of meadow saffron. In a few hours they had violent colic, profuse and bloody diarrhœa, tenderness of the abdomen, coldness of the surface, and prostration. The cow recovered; the heifer died from irritation and exhaustion in three days. A number of cows ate small quantities of pure colchicum, suffered from colic and diarrhœa, but recovered when treated with emollient drenches, and mild saline mixtures. In men and dogs colchicum is more active than in horses or cattle. Two drachms of the dried bulb caused in dogs vomiting, diarrhœa, diuresis, depression of the action of the heart, and death in five hours. A tenth of a grain of colchicine given to a cat occasioned salivation, vomiting, purging, staggering, extreme languor, colic, and death in twelve hours. (Christison on Poisons.) The emetic and cathartic effects of colchicum are violent and irregular; and its diuretic action is less certain than that of many more common remedies. It is only used on account of its sedative influence, which is best developed by the administration of small and frequently repeated doses. It has been highly recommended by Mr Hallen, lately veterinary surgeon of the 6th Dragoon Guards, and by Mr Phillips, of the 7th Hussars, in the treatment of rheumatism and rheumatic influenza; and appears most effectual in those subacute cases in which the inflammation flies from joint to joint. Other practitioners, both British and foreign, also speak favourably of it in deep-seated or constitutional ophthalmia. In the human subject it has the effect of producing, even after a very few doses, a marked increase in the urea and uric acid excreted by the kidneys.

Doses, etc.—The dose of the powdered corm or seeds is, for horses or cattle, ʒss. to ʒij.; and for dogs, grs. ij. to grs. viij. The powder, mixed with small doses of nitre, is commonly used, and a convenient solution may be made with one part of colchicum, six or eight of vinegar, and a little spirit.

COPPER AND ITS MEDICINAL COMPOUNDS.

Copper. Cuprum. Cu.

Copper is a brilliant red metal, deriving its name from the island of Cyprus; crystallising in regular octohedrons or cubes; and having a specific gravity of 8·8, a nauseous bitter astringent taste, and an unpleasant odour, especially when rubbed. It is malleable, ductile, and readily oxidised. Its principal ore is the sulphuret; and its chief officinal salts—the sulphate, iodide, and acetate. Its various salts, when hydrated, have a green or blue colour, and are distinguished in solution by the following tests: sulphuretted hydrogen, or hydrosulphuret of ammonia, gives a black precipitate of sulphuret of copper (Cu S); potash or soda, a greenish-blue precipitate of oxide (Cu O); ammonia, a similar precipitate, which redissolves on further addition of the precipitant, forming a deep blue liquid ($2NH_3$, CuO, NO_5); and ferrocyanide of potassium, a chocolate-brown precipitate of ferrocyanide of copper (Cu_2, $FeCy_3$). Another good test is to place in the solution a piece of polished iron or steel, which quickly becomes coated with a red crust of metallic copper. All the salts of copper closely resemble each other in their actions, being irritant and caustic in large doses, and astringent and tonic in medicinal doses. Copper, however, so long as it remains metallic, is devoid both of poisonous and medicinal effect. Drouard "gave as much as an ounce of finely divided copper to dogs of different ages and sizes; but none of them experienced any inconvenience therefrom." (Pereira.) As with other metals, however, copper acquires activity when converted either into an oxide or salt. Animals depastured in the neighbourhood of copper-smelting works are occasionally affected by loss of appetite, impaired digestion, falling off in condition, hectic fever, and various diseases of the bones—effects which, though usually ascribed to the ingestion of small quantities of copper, more probably depend upon the arsenious acid which these smelting furnaces evolve in considerable amount. (See p. 152.) It must not, however, be thence inferred that copper may be taken for an indefinite length of time with impunity. There is no doubt that injurious effects, such as have frequently taken place in the human subject, might occur in the lower animals, and especially in the dog, from the use of food or drink which has acquired a cuprous impregnation from being boiled in copper vessels, and allowed to remain in them while cooling. Acidulous and fatty matters are most apt to become thus contaminated, and especially if kept long in contact with copper, which is at the same time freely exposed to air and moisture.

Sulphate of Copper. Blue Vitriol. Blue Stone. Vitriol of Copper. Cupri Sulphas. $CuO, SO_3, +5HO$.

Sulphate of copper may be prepared by dissolving the black oxide in sulphuric acid; but more cheaply and conveniently by roasting the sulphuret of copper, or copper pyrites ($Cu\ S$), when both its copper and sulphur absorb oxygen, forming oxide of copper and sulphuric acid, which unite. The salt so procured is dissolved in water, and then crystallised. It usually contains a trace of iron, which does not, however, interfere with its medicinal uses. It occurs in azure-blue rhomboidal prisms, has a specific gravity of 2·2, and a strong styptic metallic taste. When exposed to the air it effloresces, and becomes covered with a greenish-white powder of the carbonate. It is soluble in about two parts of boiling water, and four of cold.

Actions and Uses.—In large doses, sulphate of copper causes irritation of the alimentary canal, various nervous disorders, and death. In medicinal doses, it is tonic and astringent; and, in virtue of its irritant action, is an emetic for the dog.

Hertwig mentions that large doses (as above twelve drachms for horses and cattle, one drachm for sheep or swine, and half a drachm for dogs) cause indigestion, impaired appetite, in carnivora vomiting, diarrhœa, inflammation of the stomach and intestines, and usually death. Drouard found that six grains of the sulphate, introduced into the stomach of a dog, killed it in half an hour; but left no appearance of inflammation. Mitscherlich further found that two drachms caused speedy death, but left no apparent inflammation, and no abnormal condition except "blueness of the villous coat of the stomach, mingled with brownness, the apparent effect of chemical action." (Christison on Poisons.) The same observer also mentions, that a drachm applied to a wound caused in dogs rapid prostration, and death in four hours. Injected into the jugular vein, it speedily reduces and arrests the action of the heart, fifteen grains proving fatal in twelve seconds. In poisoning by salts of copper, the appropriate remedies are plenty of mild diluents, with white of egg, milk, and other albuminous substances, which cause the formation of an insoluble innocuous albuminate of copper. The sulphate and other salts of copper, whether administered in poisonous or medicinal doses, become absorbed and have been detected by Professor Orfila and others in the blood and most of the internal organs.

Sulphate of copper is much used as an astringent and tonic in cases of atony and general feebleness. Although indubitably valuable for horses and dogs, it is still more so for cattle, in which the milder tonics are sometimes of comparatively little use. In scrofula, dysentery, glanders, and farey, it arrests abnormal secretion from the bowels, improves the appetite, increases the general vigour, and often wards off the fatal result for a considerable period. Given along with, or alternated with, spirituous or ammonial stimulants, it is serviceable in purpura, typhoid fever, and other reducing complaints; and like other active tonics, is very useful during recovery from exhausting disease. In many such cases, a convenient formula consists of a drachm each of sulphate of copper, nitre, and gentian, made into a ball with linseed meal and water. Where the bowels are much relaxed, as in dysentery, a drachm of opium will prove an excellent addition. It is applied externally as an astringent in cases of chronic ophthalmia, in morbid conditions of the Schneiderian and other mucous membranes, scurvy affections of the skin, fistulous wounds, farcy buds, exuberant granulations, and superficial hemorrhage from minute vessels. From its uniting with sulphuretted hydrogen and hydrosulphuret of ammonia, it is occasionally used as a deodorizer; but for this purpose it is not so convenient or effectual as chloride of lime, sulphurous acid, solutions of the permanganates, or preparations of carbolic acid.

Doses, etc.—As a tonic and astringent, the dose for horses is from ʒi. to ʒij.; for cattle, from ʒij. to ʒiv.; and for dogs, gr. i. to grs. iij. These doses should be repeated at least thrice a day, and administered either in a bolus or dissolved in some mucilaginous solution. As an emetic for the dog, the dose is from grs. viij. to grs. xv. dissolved in water. For external purposes, the salt is usually applied either in powder or solution. Mixed with equal weights of gunpowder and hog's lard, it constitutes an excellent ointment for foot rot in sheep.

AMMONIO-SULPHATE OF COPPER. Cuprum Ammoniatum. $NH_3\,CuO + NH_3\,SO_3, HO$. (Pereira.)

The ammonio-sulphate of copper is generally prepared by triturating sulphate of copper and sesqui-carbonate of ammonia until effervescence ceases, wrapping the mass in bibulous paper, drying it, and preserving it in closely stoppered bottles. It may be prepared in a hydrated state by adding ammonia to a solution of sulphate of copper until the precipitate first thrown down is nearly re-dissolved; and in this condition it is used as a test for arsenic. The dried salt has an azure-blue colour, a metallic, coppery taste, and a powerful ammoniacal odour. Unless carefully protected from the air, it speedily loses ammonia. There is still much difference of opinion regarding its composition. The formula above mentioned is that given by Pereira.

Actions and Uses.—Its actions and uses are closely analogous to those of the sulphate. Doses of several drachms destroy dogs with intestinal irritation, and symptoms of nervous derangement. Two to four drachms are administered with benefit to horses and cattle in influenza, pleuro-pneumonia, consumption, and all other complaints accompanied by atony and debility; and to dogs as a stimulating tonic in chorea and other nervous affections. In veterinary practice, however, it has not been used sufficiently long or extensively to enable us to form an accurate estimate of its value as compared with the common sulphate. It is administered in the same or somewhat lesser doses than the sulphate, and is also applied externally for similar purposes.

Iodide of Copper. Cupri Iodidum. Cu, I.

Iodide of copper, though not mentioned in any of the Pharmacopœias, is noticed by Mr Morton in his Veterinary Pharmacy; and is occasionally used in veterinary practice. It is the by-product remaining in the preparation of iodine, by mixing sulphate of copper with the familiar iodine ley. (See Iodine.) It is a fawn-coloured salt, has a disagreeably styptic, coppery taste, and evolves an odour of iodine, especially when rubbed. The chief excuse for its introduction into practice was the belief that it possessed the conjoined actions of its two constituents. But this is by no means established. Indeed, its effects in large doses, in which its characteristic actions should be most obvious, resemble those of other salts of copper, and bear no analogy to those of iodine. It has been chiefly recommended as a stimulating tonic, in glanders, farcy, "and chronic œdematous enlargements of the legs," and as an astringent in ill-conditioned ulcerations and inveterate grease. (Morton's Pharmacy.) As yet, however, there is no sufficient evidence of its superiority to the sulphate, which is preferable to all the other salts of copper, on account of its being cheap and easily obtained.

Subacetate of Copper. Verdigris. Blue Verdigris. Ærugo. $2\ CuO, \overline{A} + 6\ HO$. (Phillips.)

Chemists have described at least five several compounds of oxide of copper and acetic acid; but only one of these is of much medicinal importance, namely, the sub- or di-acetate. There are two varieties of this salt—one made in this country, and distinguished by its green colour; the other made abroad, especially in the south of France, and of an azure-blue colour. It is usually prepared by placing plates of copper in layers, alternated either with cloths saturated with acetic acid, or, according to the foreign process, with the moistened husks of the grape and the refuse of the wine process. The copper, being thus exposed for about a month to the conjoined action of air and acid, becomes oxidized, and subsequently unites with the acetic acid. The salt thus formed is scraped off, dissolved, and crystallized.

Properties.—It occurs either in amorphous masses or powder, is either blue or green, according to the mode of its preparation, and has the taste and odour of a salt of copper. It remains unchanged in air; but when heated, gives off water and acetic acid, leaving a residue of oxide and metal. When treated with hydrochloric acid, it should not leave more than 5 per cent. of residue or impurity undissolved.

Actions and Uses.—Verdigris, like the other salts of copper, is a peculiar irritant poison, an emetic, tonic, and astringent. Drouard exhibited twelve grains to a strong dog while fasting; and observed that it "caused aversion to food, efforts to vomit, diarrhœa, listlessness, and death in twenty-two hours." In some cases, paralysis of the hinder extremities was also observable, but in none was the stomach much inflamed. The neutral acetate ($Cu\ O, \overline{A}, HO$) appears more active; for Orfila found that from twelve to fifteen grains given to dogs, produced, besides the symptoms above mentioned, convulsions, tetanus, sometimes insensibility, and death within an hour. (Christison on Poisons.) Hertwig observed that one ounce, administered to a horse, caused colic, with acceleration of the pulse; and that two ounces, given some hours after, aggravated these symptoms, causing first acceleration and then depression of the pulse, debility, and, after six days, convulsions and death. The irritant properties of verdigris render it a prompt and effectual emetic for dogs and other carnivora; but its use is not to be commended, as it is liable to become absorbed, and act as a poison. It is employed both internally and externally for the same purposes as the sulphate, and in the same doses. For external application it is used in the several forms of powder, solution, and ointment, the last of which may be conveniently made with one part of verdigris and eight or ten of lard or of resinous ointment. The acetate or sulphate of copper, rubbed up with equal weights of gunpowder and lard, forms an effective dressing for foot-rot in sheep.

CREASOTE.

Kreasote. Creasotum. $C_{24}\ H_{16}\ O_4$.—(Gorup-Besanez.)

Creasote is one of the most interesting products of the distillation of wood; is present in wood-smoke, in pyroligneous acid, and in tar, whether of wood, coal, or peat; and confers on these substances their well-known antiseptic properties. It is usually obtained from wood-tar by a tedious and complex process, followed only on the large scale. A somewhat simpler process has been recently proposed; namely, distilling tar into a barrel half filled with water, removing the watery fluid which floats on the surface, adding sulphuric acid to the heavier residue, boiling the mixture, exposing it to the air for three days, with frequent stirring, and distilling it repeatedly. Tar of good quality is said to contain from 20 to 25 per cent. of creasote. (Gregory.)

Properties.—Creasote is a mobile, oily-like fluid, which is colourless and transparent when first prepared, but, unless very pure, soon becomes brown. It has a strong, persistent, smoky odour, and a pungent, acrid taste, with a sweet after-taste. It has a density of about 1065; burns readily, with a sooty flame; boils at 398°, and freezes at 16°. It readily dissolves in small quantities of acetic acid, alcohol, and volatile oils, and in from 80 to 100 parts of water. From its coagulating albumen, it corrodes the skin and other animal tissues, and unites with them, forming insoluble compounds, which resist putrefaction.

Impurities.—Much of the creasote of the shops is only carbolic (phenic) acid, and contains, besides, such impurities as colouring matters, with fixed and volatile oils—some of them produced, like itself, during the distillation of wood. When pure, it possesses the following characters:—Specific gravity 1065. "A slip of deal dipped into it, and afterwards into hydrochloric acid, and then allowed to dry in the air, acquires a greenish blue colour; dropped on white filtering paper, and exposed to a heat of 212°, it leaves no translucent stain." (British Phar.)

Actions and Uses.—Creasote is a narcotico-irritant poison, a sedative, anodyne, astringent, and antiseptic.

Doses of three drachms given to horses caused merely slight and temporary feverishness, and imparted to the breath a creasote odour (Hertwig). Dr Cormack,[1] whose treatise on creasote still remains the best authority on the subject, observed that, when given to dogs in doses of about thirty drops, it caused uneasiness, copious salivation, vertigo, twiching of the external muscles, convulsions, enfeebled and fluttering action of the heart, laboured breathing, diminished sensibility, dulness, and stupor. The symptoms came on within a few minutes, and continued for two or three hours. For a day or two, however, irritability of the stomach, occasional vomiting, and dulness, were still observable. Two dogs got each two drachms, and died within three hours, evincing, besides the symptoms above mentioned, violent convulsions and complete coma. A rabbit was thrown into convulsions, and died within a minute, from the effects of thirty

[1] Treatise on Creasote. By John Rose Cormack, M.D. Harveian Prize Dissertation for 1836.

drops. In all cases, the heart and lungs were much engorged with blood, and the heart, even when examined immediately after death, proved very insensible to the action of stimuli. This paralysis of the heart is especially observable when poisonous doses are injected into the veins. The stomach and intestines are slightly inflamed, particularly when the animals have survived for some hours. Creasote, whether in poisonous or medicinal doses, becomes rapidly absorbed, and appears to act especially on that part of the nervous system presiding over the action of the heart. It seems to pass from the body by almost all the excreting channels. In order to arrest the poisonous action of creasote, the stomach should be evacuated; ammonia and other diffusible stimuli administered to rouse the sinking action of the heart; and blood drawn from the jugular vein in order to relieve the congestion of the lungs and of the right side of the heart.

On account of its physiological action on the heart, creasote has been occasionally administered as a sedative in cases of irritation and inflammation. Several years ago, it was used at the Edinburgh Veterinary College in a good many cases of pleuro-pneumonia among cattle, in doses varying from twenty to eighty drops, dissolved in oil or acetic acid; but although of considerable temporary advantage in allaying irritability, it was, when judged by the proportion of cases cured, little, if at all, superior to other medicines. Like almost every other article of the materia medica, it has been tried in glanders, but without any very striking results. Cases of farcy, and nasal gleet with enlarged glands and fœtid discharge, are, however, often greatly benefited by giving daily a drachm of creasote with thirty minims of sulphuric acid, made into a ball with linseed meal. With chalk, catechu mixture, or a little laudanum and some aromatics, it is useful in checking diarrhœa, especially in dogs. A similar formula answers well in dysentery in all animals, and besides being given by the mouth, may also be used as an injection. It was at one time recommended in that form of diabetes insipidus common in horses, but usually does harm rather than good. In men and dogs it is a valuable remedy for allaying irritability and chronic vomiting—in this, as in other respects, bearing considerable resemblance to prussic acid. It is much used externally in the treatment of ulcers, caries, scrofulous tumours, fistulæ, canker, thrush, and foot-rot; as also in grease, mange, and such other cutaneous diseases. Indeed, in the treatment of mange and scab, no remedy is more efficacious. Gerlach in such cases advises an ounce of creasote, dissolved in fifteen ounces of spirit and forty of water. Its general actions and uses resemble those of carbolic acid (see p. 187), and, like it, it acts beneficially as a stimulant and astringent, an anti-putrescent, and a deodorizer. Like other astringents, it has been used in diluted solution for the cure of superficial and circumscribed inflammation, such as that of the conjunctiva. In the human subject it is a valuable anodyne in cases of toothache depending on caries; and when cautiously used, often affords speedy and lasting relief, probably by uniting with the albuminous matter in the hollow of the tooth, and thus protecting the nervous pulp from the action of air and other irritants. The antiseptic properties of creasote are exceedingly energetic. It is believed to have been the essential agent used in embalming the Egyptian mummies. It is employed in preserving various dried meats; and might be used for preparing subjects for dissection, by dissolving it in acetic acid, and injecting the solution into the veins.

Doses, etc.—The usual dose for horses or cattle is from ♏xx. to ♏xl.; and for dogs, from ♏i. to ♏iij. It is best given in a mass with syrup, or in a solution made with acetic acid, oils, or alcohol. For external purposes, it is used alone; as a solution, in spirit, acetic acid, oil, or water; and as an ointment, made with a drachm of creasote to an ounce of lard. For skin diseases, a drachm each of creasote and sulphur may be made into an ointment with lard, or a liniment with oil. A little creasote is sometimes added to the turpentine, hartshorn, or other embrocations used for sore throat.

CROTON SEEDS AND OIL.

Crotonis Semina. Seeds of *Croton Tiglium.*
Croton Oil. Crotonis Oleum. Expressed oil of the seeds of *Croton Tiglium.*

Nat. Ord.—Euphorbiaceæ. *Sex. Syst.*—Monœcia Monadelphia.

Croton seeds are obtained from various species of croton, but chiefly from the *Croton Tiglium*,—a tree from fifteen to twenty feet high, growing on the Indian continent, in Ceylon, and in many islands of the Indian Archipelago. The nut or fruit, which contains three seeds, is somewhat larger than a hazel-nut, and of an oval triangular form. The seeds are about the size of French beans, resemble the castor oil seeds in size and general appearance, and, when shelled, weigh on an average three grains each. They are of a brown colour, and odourless, with a taste at first mild and mucilaginous, but soon becoming hot and acrid. When heated, they yield irritating fumes. Their thin brittle external shell envelopes an oleaginous albumen, which contains about fifty per cent. of a fixed oil. This, when separated by expression and purified by straining, constitutes the *croton oil* of commerce. It is extracted in London, as well as imported from India. It is slightly viscid, and of a brownish yellow colour, with a faint peculiar nauseous odour, and the acrid taste of the seeds. It is nearly insoluble in pure cold alcohol, but completely soluble in boiling alcohol, sulphuric ether, and the fixed and volatile oils. The residuum from which the oil has been expressed is sometimes used in veterinary practice under the name of *croton cake;* but as the amount of oil which it retains is very variable, its effects are irregular and uncertain.

The important constituents of croton seeds are albumen, gum, a mild fixed oil, and a volatile acid termed the crotonic. Croton oil contains only the last two of these ingredients. *Crotonic acid* is the active constituent of croton, and is crystalline, highly volatile, and intensely acrid when tasted, inhaled into the nostrils, or applied to the skin.

Impurities.—Croton seeds are not liable to sophistication. They should be plump and well shaped, and not dry or shrivelled. The oil is sometimes of inferior quality, and dark-coloured, on account of the seeds from which it has been extracted being old or musty. It is occasionally adulterated with other oils, most commonly with castor oil. Its purity is thus established by the test of the British Phar.:—"Agitated with its own volume of alcohol, and gently heated, it forms a clear solution from which about three-fourths of the oil separate in cooling."

Actions and Uses.—Croton is an irritant poison; and is used internally as a cathartic, and externally as a counter-irritant.

Forty seeds are sufficient to destroy a horse in seven hours, with all the symptoms of gastro-intestinal inflammation; and I have frequently seen even full medicinal doses cause very unexpected and serious irritation. Orfila gave a dog three drachms, which proved fatal in three hours, the œsophagus being tied to prevent the expulsion of the poison by vomiting. Fatal effects are also said to have followed the administration of one drachm to the dog. The same quantity of the seed or oil which proves fatal when given to any animal internally, will have the like effect when placed underneath the cellular tissue, or applied to a wound. Moiroud says, that twelve drops injected into the veins of a horse produced, in a few minutes, alvine evacuations; and that thirty grains caused speedy death, and produced the same appearances as large doses given by the mouth, namely, redness and inflammation of the alimentary canal, especially of the stomach and lower intestines. Fifty drops in alcoholic solution, applied to the belly of a small horse, caused next day alvine evacuations of normal consistence, but three or four times more abundant than natural, and continuing so for two days. The irritant action of croton is often exerted on those employed in shelling the seeds previous to the expression of the oil, frequently inducing swelling and inflammation of the face and other parts exposed to the croton dust.

The cathartic action of croton is developed in all the higher animals. In the horse its effects are prompt and powerful; but the great extent and extreme vascularity of the intestinal mucous membrane, requires that in that animal it should be used with much caution. In cattle practice it is invaluable, operating with certainty when most other purgatives are quite ineffectual, and being rarely attended with undue irritation or other bad consequences. In dogs and pigs it is also prompt and effectual. In developing either its cathartic or poisonous action, which latter is but an exaggeration of the former, it probably induces a considerable amount of topical irritation wherever it comes in contact with the alimentary mucous membrane; but, speedily mixing with the biliary and pancreatic juices, it is emulcified, and perhaps saponified, and, like other fats and fixed oils, is probably absorbed through the villi into the lacteal vessels, and so carried by the thoracic duct into the general circulation, from which it is shortly excreted through the intestinal glandular apparatus in the same way as other purgatives. It acts on all parts of the alimentary canal, operating more speedily than aloes, and generally producing more fluid discharges. Youatt and some other veterinary authors state that croton is uncertain in its effects; but this is a mistake. They also object to it on account of its tendency to cause griping and debility. The griping is, however, generally the result of its injudicious administration, and may be prevented by combining it with other medicines; whilst the debility, although an occasional consequence in the human subject, rarely occurs, to any serious extent, in the lower animals, is only noticeable during the active operation of the dose, and is not greater than that produced by equally powerful purgatives.

Croton is used as an active cathartic for all the domesticated animals, commending itself chiefly by the full and speedy effects which it produces when administered in small quantity. It is given with great advantage in fardel-bound, and other forms of constipation in cattle; in torpidity of the bowels dependent on disordered states of the nervous system, as in tetanus in the horse, and congestive puerperal fever in cattle; and in cases where is it desirable to produce copious fluid evacuations, and to excite extensive counter-irritation, as in passive dropsies or local inflammation in parts remote from the alimentary canal. It is of much value where bulky medicines are inadmissible; where, for example, animals are restive, unmanageable, or unable to swallow bulky medicines from disease or injury, as in tetanus, and some affections of the throat. Croton is contra-indicated in all animals wherever any portion of the alimentary canal is in an unusually irritable or vascular state; is too active to be generally used for horses, ought to be reserved in them for special cases only, and is unsuitable for young or delicate subjects.

Croton oil is sometimes used externally as a counter-irritant; and, as such, resembles tartar emetic in its action, speedily producing a crop of minute crowded vesicles, which soon assume the character of pustules. The eruption is attended by much irritation, inflammation, and swelling of the surrounding parts. When applied over a considerable surface, especially if the skin is thin or abraded, the oil becomes absorbed, and produces its usual action on the bowels. On this account, and also from its liability to excite undue irritation, and to involve the more deep-seated tissues of the skin, it is not a very suitable vesicant either for horses or dogs. But it is often useful for cattle, in which it is much less apt either to purge or to blemish. To prevent the injurious effects that might otherwise attend its absorption, it should never be applied to the skin in quantities larger than those in which it can be safely given internally, and should always be used diluted with some less potent substance. It is occasionally used as a counter-irritant in bronchitis, pneumonia, pleurisy, and chronic glandular enlargements in most animals; and in chronic rheumatism amongst cattle, in which I have frequently seen the affected joints much benefited by its repeated application at short intervals.

Doses, etc.—The dose of croton seeds, as a cathartic for the horse, is from ten to twelve seeds; for cattle, from fifteen to twenty; for sheep, about four; for dogs, two; and for swine, from two to four. The recollection of the proper dose of croton for any animal is much aided by knowing that one drachm of Barbadoes aloes is equivalent to two croton beans, or six grains of ground croton. The dose of the oil for the horse is from eighteen to twenty-four drops; for cattle, about one-fifth part more; and for the dog, from three to four drops. The dose of the so-called croton cake is generally considered as double that of the fresh croton bean. The cake, however, as has been already stated, is not an eligible form of the medicine, on account of the uncertainty of its effects. The bruised seeds and the oil are generally administered made into a bolus with linseed meal, or dissolved in linseed oil. Though sometimes used alone, they are best conjoined with other purgatives. Thus, in obstinate constipation, or torpidity of the bowels, among cattle, they are often advantageously given with a few scruples of calomel, a pound of salts, or a pint of linseed oil; and few purgative mixtures are more effectual. Alcoholic solutions of croton, as usually made, are very faulty and unchemical preparations, for cold alcohol has little solvent action on pure oil of croton. Some practitioners, in using croton, drop it in an undiluted state on the tongue; but, except in extreme cases, this is not advisable, as the oil is apt to adhere to the tongue and fauces, causing irritation and inflammation. For external purposes, the bruised seeds or the oil may be dissolved in six or eight parts of oil of turpentine or soap liniment. Croton oil, added in small quantity to any of the ordinary blistering ointments, greatly increases their activity.

DIGITALIS.

Foxglove. Leaves of *Digitalis Purpurea.*

Nat. Ord.—Scrophulariaceæ. *Sex. Syst.*—Didynamia Angiospermia.

Digitalis or foxglove grows wild in this country and in many parts of the Continent. It is chiefly found on gravelly sandy soils, in young plantations, on hedge-sides, banks, and hill pastures. It is a herbaceous biennial plant, with numerous drooping, purple, spotted flowers, an erect stem several feet high, and large oval-shaped leaves with serrated edges, and covered with down, especially on their lower surfaces. The leaves are the officinal part of the plant, and are gathered in June and July, when about two-thirds of the flowers are expanded. The leaves of the second year's growth are generally more active than those of the first. They are best dried in darkness, over stoves, and are then of a dull-green colour, with little smell and a nauseous bitter taste. The seeds are small, round, and of a grey colour. Though the *Digitalis purpurea* is the variety generally used, other species, in all probability, possess similar properties. The active principles of digitalis are readily soluble in water, alcohol, ether, and weak acids. The infusion and tincture, when diluted, give precipitates of tannogallate of iron, with a solution of the sesquichloride of iron. The leaves, when triturated with lime, evolve ammonia.

Digitalis contains lignine, starch, gum, and sugar, albumen, tannin, extractive and fatty matters, salts, and an active crystalline principle termed *digitalin* or *digitalia* ($C_{20}\ H_{18}\ O_8$), which is neutral, colourless, bitter, and acrid, and present in the leaves in the proportion of somewhat less than one per cent.

Actions and Uses.—The physiological actions of digitalis are complex; but its uses are few and simple. It is a topical irritant, a sedative, and a diuretic.

Two ounces of the dried powdered leaves destroyed an adult horse in twelve hours. (Moiroud.) One ounce, and in some cases six drachms of the leaves, given to horses in a bolus, caused, in from three to ten hours, loss of appetite, frequent urination, fluid feces, sometimes tinged with blood, a pulse at first full and increased, but afterwards small, slow, and irregular, blunting of the special senses, contraction of the pupils, difficulty of breathing, languor, and, after about twelve or sixteen hours, death. (Hertwig.) Doses of about one or two drachms given to dogs cause nausea; and when vomiting is prevented, moaning and expression of abdominal pain, feebleness of the pulse, diarrhœa, general weakness, shivering, slight convulsions, contraction of the pupils, and diminution of common sensibility. As might be expected from such symptoms, inflammation and its consequences are found after death throughout most parts of the alimentary canal. Congestion of the lungs, a spotted appearance of the heart, occasionally injection of the membranes of the brain and spinal cord, and a fluid condition of the blood, are also observed. Digitalis produces its effects by whatever channel it enters the body, and appears to destroy life by depressing the action of the heart. Its effects on the circulation, however, are not very uniform, being modified by various circumstances, and especially by the dose employed. With large doses, the pulse becomes much accelerated, irregular, and intermittent. Thus, in one horse poisoned by digitalis, the pulse rose to 130 beats per minute (Moiroud), and in another to 140 (Hertwig). In dogs, large doses also raise the pulse to about 95, and often higher. But in all cases the action of the heart is weakened; and where the circulation is at first unduly excited it afterwards becomes depressed, the pulse getting soft, irregular, and so slow, that in dogs which had received poisonous doses, it numbered for some minutes before death only fourteen beats per minute.

Repeated small doses of digitalis are given in inflammatory diseases to reduce the action of the heart; but their efficacy has, I think, been considerably overrated. They are at best irregular and uncertain in their results; are apt to derange the digestive organs, producing much nausea, and destroying the appetite; whilst in not a few instances they cause dangerous irritation of the bowels. I have noticed such effects in cases where digitalis has been used medicinally, and have been led to similar conclusions by some experiments which I made with the drug upon healthy horses several years ago. I subjoin notes of three of these cases:—

In February 1856 I gave powdered digitalis to three horses in good health, and receiving daily 12 lbs. of hay, 5 lbs. of oats, and 5½ lbs. of bran. On the 20th they each received a drachm of the powder at 12 noon, and another drachm at 6 P.M.; on the 21st and 22d, one drachm at 6 A.M., at twelve noon, and 6 P.M. and on the 23d, a drachm at 6 A.M.,—in all, nine doses of a drachm each in three days.

No. 1. Brown Mare, 3 years old.

Feb.	20. 12 noon,	pulse 38,	respirations	8.
	21.	...	34,	...	6.
	22.	...	28,	...	7.
	23.	...	28,	...	7.

On the evening of the 22d she became dull, and refused her feed. 23d, 10 A.M.—Still dull, without appetite, pupil contracted, passing wind, with small quantities of fluid feces. 4.30 P.M.—Pulse 32, more distinct than at noon, pupil considerably contracted, rather less dulness. On the 25th, two days after the medicine was withdrawn, the mare was eating, and perfectly well again.

No. 2. Bay Gelding, 3 years old.

Feb.	20. 12 noon,	pulse 36,	respirations	7.
	21.	...	36,	...	8.
	22.	...	30,	...	6.
	23.	...	32,	...	6.

23d, 12 noon.—Pulse, both yesterday and to-day, slightly irregular; no appetite; very dull and stupid, with the pupil somewhat contracted. 4.30 P.M.—Pulse 34, tolerably firm, but unequal; eating a little, and scarcely so dull. No more digitalis being given, the animal recovered its appetite, and by the 26th was well again.

No. 3. Brown Mare, 3 years old.

Feb.	20. 12 noon,	pulse 38,	respirations	8.
	21.	...	33,	...	7.
	22.	...	34,	...	$7\frac{1}{2}$.
	23.	...	120,	...	20.

Towards the evening of the 22d the mare became dull, and would not feed. 23d, 10 A.M.—Very much nauseated; nose, mouth, and ears cold; abdomen tympanitic, with colicky pains, and occasional pawing; pupil somewhat contracted; pulse firm at axilla and heart, but not very perceptible at the jaw. Had four drachms of carbonate of ammonia and clysters occasionally, the stimulant being repeated at two o'clock and four. At 4.30 P.M. she was down, much pained, attempting to roll; pulse 82, but unequal. 24th, 12 noon.—Pulse imperceptible at jaw, about 120; respirations 25, and very much laboured; lips retracted, and saliva dripping from the mouth; enormous abdominal tympanitis and much pain; rapid sinking.

Died on 25th, at 11 A.M. Post-mortem examination made next morning at 9.30. Voluntary muscles unusually pale; spots of ecchymosis found in the areolar textures, between the muscular fibres, and in places underneath the skin. *Chest.*—Lungs and pluræ healthy; anterior extremities of lungs contained more blood than posterior; venæ cavæ contained the usual amount of dark non-coagulated blood; bronchial tubes inflamed for about six inches along their anterior ends; windpipe inflamed half-way up the neck, and containing flakes of greenish pus mixed with mucus; no froth here, or in bronchii. Heart pale, friable, containing a small clot of blood in its left ventricle, and about five ounces of non-coagulated blood in the right ventricle. *Abdomen.*—A rent of eight inches long was found in the inferior curvature of the stomach, through which food had passed into the omentum; the mucous membrane of the stomach was quite healthy; the organ itself very large, but collapsed, in consequence of the rupture; the intestines were pale and flaccid, and contained enormous quantities of food and gas, but their mucous membrane was quite healthy. The kidneys and generative organs, with the brain and spinal chord, were perfectly healthy.

On account of its uncertainty, its cumulative tendency, and its liability to irritate the intestines, digitalis is not a very safe sedative for horses, and has now generally given place to aconite or calomel and opium. Those who still adhere to its use employ it in the secondary stages of inflammatory complaints, in irritative fever, especially when depending on nervous disturbance, in functional diseases of the heart, and in chronic rheumatism. It has been given with some benefit for the relief of thick and broken wind, and enters into the composition of Professor Dick's famous recipe, which consists of a scruple each of digitalis, calomel, opium, and camphor. Half drachm doses of digitalis, dissolved in a pint of coloured water, with two drachms of nitre, constitute the ordinary cough and fever draughts used by many veterinarians in London and elsewhere. Digitalis has been prescribed, but without much success, in epilepsy, phthisis pulmonalis, and externally in ulcerations and chronic eruptions. It should be avoided, on account of its irritant action, in inflammation of the digestive organs. Some practitioners speak highly of it as a diuretic, especially for the cure of dropsies, and give it in small and repeated doses in combination with saline diuretics. In these dropsical cases it probably exerts a twofold action; it favours absorption by reducing the power of the heart and the vascular tension, whilst it withdraws fluid from the system by direct irritation of the kidneys. In using digitalis, whether as a sedative or a diuretic, care must be taken to watch its action, and to diminish its dose gradually whenever its constitutional effects appear, otherwise its cumulative properties may lead to the development of poisonous symptoms. Should these unfortunately occur, they are best subdued by stopping the administration of the medicine, and giving diluents, with opium, and if necessary, stimulants.

Doses, etc.—The dose of powdered digitalis for horses is about a scruple; for cattle, a drachm; and for dogs, from two to four grains. As a diuretic for a medium-sized dog, Stonehenge advises digitalis gr.$\frac{1}{2}$, nitre grs. v., ginger grs. iij., made into a bolus with liquorice powder and syrup, or linseed flour and water. When used as a sedative, digitalis should be given at least three times a day, and as a diuretic at least twice. The powdered leaves are sometimes used, but the *extract* is more convenient. It may be easily prepared by taking any convenient quantity of sound, freshly gathered leaves, reducing them to a pulp in a mortar, expressing the juice, filtering and evaporating it to the consistence of an extract, either in a vacuum or in shallow vessels exposed to a current of air. The dose of this extract is about one-fourth of that of the powdered leaves.

Digitalin, if procurable at a moderate price, would probably prove a more certain and convenient medicine than the crude drug, the infusion or tincture sometimes used, or even the extract. Its cost, however, at present precludes its use. It is an active poison, and is said to destroy life by gradually stopping the pulse and the respiration. (Leray.)

ERGOT OF RYE.

Ergot. Spurred Rye. Ergota. The grain of the common Rye (*Secale cereale*), diseased by the presence of an imperfect fungus. (Brit. Phar.)

Nat. Ord.—Graminaceæ. *Sex. Syst.* Triandria Digynia.

There is still some difference of opinion regarding the nature and cause of ergot of rye. The earliest symptoms of the disease occur about the time of blooming, when the young seed is observed to be covered with a white powdery matter—the spores or seeds of a fungus—which gives the grain a mildewed appearance, arrests its natural growth, and causes its abortion. This aborted embryo gradually increases in size, passes out beyond the paleæ or husk, becomes more and more deformed, acquires a purple or brown colour, and forms the ergot or spur. The spores just noticed, as the exciting cause of the disease, still cover the spur and other parts of the seed, and are believed to belong to a fungus called the *cordyliceps purpurea.* (Tulasne.) The ergot, besides, bears on its summit a grey feathery appendix, which was once considered a variety of fungus, but which the majority of competent authorities now believe to be the shrivelled remains of the stigma, anthers, and elevated pericarp of the aborted seed. The manner in which the disease propagates itself is not very evident. Most persons believe that the spores come into actual contact with the fructifying seed; others suppose that they may engender the disease even when scattered on the soil on which the rye is growing; whilst Mr Corbett of Beauly, in the fifth volume of the Transactions of the Botanical Society of Edinburgh, states, that when, from any cause, rye in bloom is deprived of its anthers, the ovary becomes liable to ergot. But besides the presence of the fungus, close, damp, still weather also appears essential to the development of the ergot, which abounds only in warm, wet seasons, and in undrained localities. The extent of injury done to the rye crop by ergot varies much; sometimes only a few grains in each head are diseased, sometimes scarcely one is altogether sound. The average number affected is from five to ten. Rye is unusually susceptible of the disease, being attacked more often, and to a greater extent, than any other plant. All the *Graminaceæ*, however, are liable to it, and also, though in a less degree, the *Cyperaceæ* and the palms. Ergot of rye is brought chiefly from Germany, France, and America, and about thirty cwts. are said to be imported annually. (Pereira.)

Properties.—Ergot of rye has a curved spurred appearance; varies in length from one-third of an inch to an inch and a half, and in breadth from one to four lines; is marked by a longitudinal furrow on its concave side; is obtuse at its ends; and has at its apex a pale, grey coloured excrescence, very fragile, and easily rubbed off. It is usually covered by a white powdery dust, is dark violet coloured externally, and greyish yellow within. Its odour, especially when in powder, is dull and musty; and though at first of a sweetish taste, it is bitter and disagreeable when chewed. When dry, it is inflammable, hard, and brittle; when moist, or exposed for some time to the air, it is soft, darker in colour, and covered with a little acarus which eats the interior of the seed. Its internal structure, when examined by the microscope, is observed to be made up of cells, of which many are oleaginous. Its best solvent is water, with which it forms a claret-coloured solution, retaining the odour, taste, and physiological actions of the ergot, and precipitated by alcohol, alkalies, and strong acids. Boiling destroys the activity of the solution, by volatilizing the active principle. Dr Wright gives the following analysis of ergot:[1]

Thick white oil, ...	31·0
Fungin, ...	11·4
Altered starch, ...	26·0
Mucilage, ...	9·0
Gluten, ...	7·0
Ozmazome, ...	5·5
Colouring matter, ...	3·5
Salts, with phosphoric aid, . .	3·1
Loss, ...	3·5
	100·0

The oil is separable from the other constituents by agitation with ether; and appears to contain, in a concentrated form, the poisonous as well as the medicinal properties of the drug. It is either the active principle of the ergot, or the vehicle which contains it. Since Dr Wright's investigations, the medicinal properties of the ergot have been ascribed by M. Bonjean "to an extractive matter, soluble both in water and alcohol." (Christison.) Winckler has found in it several nitrogenous substances, chemically analogous, of which the more important are, secaline, resembling the volatile alkaloids; ergotine, a nitrogenous acid; a red colouring matter like hæmatine, and a basic substance not yet examined. The presence of hydrocyanic acid has been entirely disproved.

[1] Dr Wright's valuable paper on Ergot may be found in the Edinburgh Medical and Surgical Journal, vols. lii., liii., and liv.

Impurities.—Ergot is not very liable to adulteration. It is said to be sometimes mixed with fictitious seeds made with paste or plaster of Paris, and coloured brown. It is more likely, however, to be of inferior quality from long keeping, especially if in powder, and from the attacks of insects. It should not be kept longer than two years; and should be preserved, excluded from the air, in closely stoppered bottles. Sulphur and camphor, which some mix with it, are of little avail in preventing its deterioration.

Actions and Uses.—Ergot of rye is a poison, but neither so powerful nor so certain in its effects upon the lower animals as on man. When given in single large doses, it causes local irritation of the parts with which it comes in contact, and subsequently affects the nervous system, especially the spinal chord. When given to dogs, it produces vomiting, tenesmus, and, after a variable but generally short time, dulness, prostration of muscular power, and spasms, chiefly of the diaphragm. These effects are produced in small dogs by doses of from six to twelve drachms. Twenty-four drachms proved fatal to a terrier bitch in twenty hours. Horses and cattle are even less susceptible of the action of ergot than dogs; and very large quantities, indeed even several pounds, have been given to them, not only with impunity, but even without any very obvious effects. When injected into the veins of the dog in quantities of from two to six drachms, dissolved in several ounces of water, it causes, first, great excitement and excessive acceleration of the pulse; and then, after a variable time, depression, paralysis, especially of the hinder extremities, spasms, and coma. Death ensues, generally from paralysis of the heart, in from five minutes to two hours. When injected into the arteries, it acts still more rapidly. If placed underneath the cellular tissue, or in contact with a recent wound, it causes much irritation and inflammation, the formation of fœtid unhealthy pus, and great depression of the vital powers.

When ergot is given for some time continuously, it produces somewhat different symptoms from those which follow its administration in single doses. Dr Samuel Wright, to whose admirable paper I have already referred, found that it caused in dogs and rabbits nausea, impaired appetite, a weak, irregular pulse, soon becoming intermittent, diarrhœa, excessive fœtor of the secretions and excretions, paralysis, particularly of the hinder extremities, enlargement of the liver, contraction of the spleen, formation of tubercles both in the lungs and mesentery, impairment of all the senses, wasting, and general debility. It does not, however, as in man, cause gangrene of the extremities. A dog which got from two to three ounces daily, survived for seven weeks, when it had consumed in all fifty-six ounces of dry ergot. All animals to which it was given—dogs, cats, and rabbits—showed great aversion to it, even when it was mixed with sound grain, or considerably diluted with water; and, although pressed by hunger, would scarcely eat it of their own accord.

Much discussion has occurred, and much contrariety of opinion still prevails, concerning the power of ergot to induce contractions of the uterus, and expulsion of its contents. But amongst the lower animals it has certainly no power of producing abortion. It has been given in large and repeated doses to cows, bitches, cats, swine, and rabbits, in all stages of pregnancy, but without causing abortion. Dr Wright's experiments on this subject are very conclusive. He administered half an ounce of ergot to a terrier bitch five weeks gone with young (Experiment 37); and the same quantity to another bitch within a few days of pupping (Experiment 35); both animals carried their pups the usual time. He gave a bull-terrier bitch half an ounce daily during the last three weeks of pregnancy; but she also went her full time (Experiment 38). Its effects on ruminating animals, both during gestation and at other times, are always less marked than on dogs or cats. In the rabbit, very large doses have been given without influencing the uterus. Two and three drachms respectively were administered daily to two female rabbits, from the day after impregnation until parturition, which occurred at the usual time. During the whole period the rabbits were to all appearance in a healthy state, and the young ones were born of good size, and well nourished. These experiments, and others which were attended with similar results, certainly justify the conclusion, that amongst the lower animals ergot has no tendency to cause the expulsion of the contents of the uterus at any period of gestation, whether early or late, either when given by the mouth or the rectum, in single large doses, or for some time continuously. Where it is given for a long period, the usual physiological effects of the ergot are produced, and the general health of the mother may be so deteriorated as to cause the death of some or all of the fœtuses, but no special action on the uterus is observable.

Even when the natural period of parturition has arrived, and when labour has actually commenced, ergot is often given to the lower animals with little if any effect. I have often given it to cows and bitches, in which the process of parturition was protracted, without observing any increase in the force or frequency of the labour-pains. The same has been observed by Dr Wright, though in some of his experiments on bitches he gave doses two or three times as great as those usually prescribed. He also laid open the parietes of the abdomen at various intervals after the administration of full doses of ergot, but without observing any uterine contractions. In fact, ergot has no more action on the uterus of the lower animals than any other substance which causes intestinal irritation; and whatever action it may occasionally have in accelerating parturition, is owing, not to any special effect on the organ itself, but to the local irritation, tenesmus, and vomiting which so commonly succeed its administration. Those who place reliance on it as a parturient, recommend it when the throes are languid, and occurring at long intervals; when the animal has been in labour for some time; and when the os uteri is considerably dilated; but disapprove of it when there is any malformation either of the mother or the fœtus, when the position of the fœtus prevents its ready expulsion, and sometimes also in first pregnancies. An infusion of ergot is a favourite remedy with many for bringing away the placenta. But if the ergot has no effect in expelling the fœtus, it can have none in expelling the fœtal membranes, which may, however, be very readily removed by the hand. I am not aware of ergot being given internally for any other purposes than those already mentioned. It is often, however, used externally as a styptic. Besides being effectual in most ordinary cases, a diluted solution may be advantageously injected into the uterus to arrest the hemorrhage which, in veterinary patients, occasionally follows parturition. It is also useful in staying vaginal hemorrhage.

Doses, etc.—The usual dose of ergot, as a parturient for the mare or cow, is from ℥ss. to ℥i.; and for sheep, swine, and bitches, about ʒi. These doses are generally repeated at intervals of half an hour, until parturition occurs. It is usually given in the state of infusion, which, during its preparation, must not be exposed to a boiling temperature. A still better solution, of which the same weight may be given as of the powder, is made by exhausting two pounds of ergot, first with spirit and then with water; evaporating the watery solution to the consistence of treacle; adding to this the spirituous solution, filtering, and making up the whole to two pounds weight with proof spirit. The *oil of ergot*, from its state of concentration, would be more convenient than any of the ordinary forms of administration. It has been successfully used in the human subject in cases of lingering parturition; and also externally as a styptic, and an anodyne in rheumatism and toothache.

ETHER.

Sulphuric Ether. Æther Sulphuricus. $C_4 H_5 O$ or Ae O.

Ether has now been known for upwards of three hundred years. It is always obtained from alcohol by depriving it of one equivalent of water, which is most easily and conveniently effected by the action of sulphuric acid. The Edinburgh Pharmacopœia gave the following directions for its preparation:—

"Take of sulphuric acid, ten fluid ounces; rectified spirit or methylated spirit, fifty fluid ounces; pour twelve fluid ounces of the spirit gently over the acid in an open vessel, and then stir them briskly and thoroughly; transfer the mixture immediately into a glass mattrass connected with a refrigeratory, and raise the heat quickly to about 280°. As soon as the etherial fluid begins to pass over, supply fresh spirit through a tube into the mattrass in a continuous stream, and in such quantity as to equal the volume of the fluid which distils over. This is best done by connecting one end of the tube with a graduated vessel, containing the spirit—passing the other end through a cork fitted into the mattrass—and having a stop-cock on the tube to regulate the discharge. When the whole spirit has been added, and forty-two fluid ounces have distilled over, the process may be stopped. Agitate the impure ether with sixteen fluid ounces of a saturated solution of muriate of lime, containing also half an ounce of lime recently slaked. When all odour of sulphurous acid has disappeared, pour off the supernatant liquid, and distil it with a gentle heat so long as what passes over has a density not higher than 735. More ether of equal strength may be obtained from the muriate of lime. And from the residuum of each distillation a weaker ether may be obtained in small quantity, which must be rectified by distilling it gently again."—(Ed. Phar.)

The essential ultimate change which occurs in the manufacture of ether is simply this. The sulphuric acid unites with the water of the alcohol, which has the composition $C_4\ H_5\ O + HO$; and the ether, $C_4\ H_5\ O$, thus set free, being exposed to an elevated temperature, distils over along with water, a little alcohol, and a trace of sulphurous acid. It is to remove these impurities that the Edinburgh College directed the crude ether to be treated with chloride of calcium and quicklime, and redistilled.

Properties.—Ether is a mobile, colourless fluid, having a peculiar etherial odour, and a warm pungent taste. It is exceedingly volatile, and, from its rapid evaporation, speedily reduces the temperature of any part to which it is applied. It boils at 95°, and freezes at —24°. As it is exceedingly inflammable, and forms explosive mixtures with air, much care should be used in approaching it with a light. It is miscible with alcohol in all proportions, and soluble in about ten parts of water. It readily dissolves many organic substances, but especially balsams and resins. Ether, when perfectly pure, has, at the temperature of 55°, a specific gravity of 720; but that commonly sold in Scotland is generally about 735. The Scotch ether used to be of lower density, and consequently stronger than the English or Irish.

Impurities.—Alcohol, water, and oil of wine, are the only impurities to which ether is liable. The presence of the two former may be discovered by the increased density of the specimen, or more certainly by its undergoing a diminution, exceeding five or six per cent., when agitated with a concentrated solution of chloride of calcium. When a little ether containing oil of wine is allowed to evaporate from the back of the hand, it evolves a peculiar odour, which the practised sense readily distinguishes from that of the pure ether. If such a specimen be gently distilled with water, the oil remains floating on the surface of the water.

Actions and Uses.—Ether is stimulant, narcotic, and anæsthetic; and, when used externally, refrigerant.

Like other spirituous and etherous substances, it is rapidly absorbed, and acts on the nerves and nervous centres, and in large doses particularly on the brain, producing either great excitement or great depression, according to the dose and mode of administration. When given for a short while, it impregnates with its odour and taste the flesh and milk. Like most other volatile bodies, it appears to be excreted particularly by the lungs. In veterinary practice it is chiefly valued for its stimulant action, which, though transient, is prompt and powerful, and forms the physiological source of its activity as an antispasmodic. Its narcotic effects are readily observed when it is given to dogs or other small animals in considerable doses; and the preliminary stage of excitement, which is sometimes attended by convulsions, is generally very brief. Thus, when Orfila gave a dog four drachms, at the same time securing the œsophagus by ligature to prevent vomiting, he observed in about ten minutes inability to stand; and, after fifteen minutes, complete insensibility, which continued, with occasional and partial awakenings, for about three hours, when death occurred. The coats of the stomach were found after death to be red, and much congested. (Christison on Poisons.) The anæsthetic and narcotic actions of ether are closely allied; but the former is best developed by causing the medicine to be inhaled. Among the lower animals the anæsthetic effects of ether are tolerably easily induced, and are seldom attended by any evil consequences. A two-year-old thorough-bred filly, experimented on by Mr Barron, of Newmarket, was fully etherized in four minutes, and continued in that state for about twenty-nine minutes, during which time the operation of neurotomy was performed on both fore limbs without the animal's evincing any pain. A donkey was fully affected in four minutes, another in five minutes, and a third in three minutes and a half; the latter remaining insensible to pain for about half an hour. (Veterinarian for 1847.) In these experiments, however, the effect seems to have been induced with unusual rapidity; and I have sometimes seen the exhibition of six, eight, and even ten ounces, attended by only very imperfect action, even after the inhalation had been continued for some minutes. The refrigerant effect of sulphuric ether is only developed during its local application; and depends on its abstracting heat during its evaporation, which, on account of its volatility, is very rapid.

Ether is distinguished from alcohol chiefly in the degree of its action, in the extreme rapidity and efficacy of its stimulant and antispasmodic effects, and in its possession of anæsthetic properties. Although resembling ammonia, it also differs from it in its acting particularly on the brain and cerebellum, and in its being attended by a greater amount of secondary depression.

It is much used as a powerful and prompt stimulant when nervous power is to be exalted or increased; and, though seldom effectual in removing causes of disease, it often counteracts violent and dangerous symptoms. It is generally useful in removing those shiverings which sometimes precede attacks of internal disease, and which indicate the operation of some depressing agency acting on the system generally through the skin. It speedily relieves colic, tympanitis, and stomach staggers, by overcoming that nervous derangement or torpidity on which these disorders usually depend. On account, however, of its active stimulating properties, it must be withheld whenever these cases are accompanied by acute inflammation and high fever. In colic, asthma, and other spasmodic affections, it is advisable to combine it with opium—a combination which forms a very effectual antispasmodic. In inflammatory diseases of a chronic or sub-acute kind, and where there is much prostration of strength, or irritability depending on weakness, in all typhoid fevers, and in convalescence from exhausting diseases, ether is of much service, especially in cattle, often reducing the number and increasing the strength of the pulsations, and producing an amount of reaction favourable to the operation of tonics and other appropriate remedies. Any doubt which, in such cases, may arise with regard to the propriety of using the medicine, may be removed by observing its action on the pulse; and if this be improved by the first or second dose, it affords a decided indication in favour of the continued administration of the medicine. Ether is often effectual in the expulsion of intestinal worms, and especially of ascarides in the rectum, which may usually be dislodged by giving it in a state of considerable dilution as a clyster. In this form it is also often useful in relieving spasmodic affections of the intestines. The administration of ether must always be avoided where there is undue excitement, inflammatory fever, or sthenic inflammation. Ether is never used as a narcotic, and very rarely as an anæsthetic. As such, however, it is useful in the same cases in which chloroform is generally employed; and its effects are most conveniently developed by pouring the fluid on a sponge placed in the bottom of a nose-bag, perforated with holes for the admission of a sufficient quantity of air, and attached to the patient's head. It forms a very good refrigerant, and is likely to be more used for such purposes, as, owing to the use of methylated spirit in its preparation, it can be obtained much cheaper than formerly. It is sometimes used as a solvent for oils, resins, balsams, neutral crystalline organic bodies, and gun-cotton, with which it forms the adhesive solution known as collodion, and noticed below.

Doses, etc.—The dose of ether, as a stimulant for horses, is from f℥i. to f℥ij.; for cattle, from f℥ij. to f℥iij.; and for dogs, about fʒi.; as an anæsthetic, for the larger animals, from f℥iij. to f℥vi.; and for the less, from fʒiv. to fʒvi. When used as a stimulant it is given with water, which, to prevent the volatilizing of the ether, should be cold, and, if thought necessary, the mixture may be sweetened with sugar or treacle, or flavoured with aromatics. Diluted with twice its volume of rectified spirit, it constitutes the *spiritus ætheris sulphurici* of the shops. Ether, on account of its transient effects, must be administered at least every hour, until some permanent good is produced; and as the system gradually becomes less susceptible of its action, the doses, when it is given for some time continuously, must be increased.

COLLODION is a solution of gun-cotton in ether, mixed with one-third of its volume of rectified spirit. The first and most difficult step in its manufacture is the preparation of gun-cotton, which may be made by the following process, communicated to the late Professor George Wilson by the late Mr Macfarlan, pharmaceutical chemist, Edinburgh:—"Take of clean dry cotton one ounce; powdered nitrate of potash fourteen ounces; and rectified sulphuric acid fifteen fluid ounces. Mix the acid and the nitre in a basin, which should be in a cool place, and exposed to a current of air; add the cotton little by little; press and stir the mixture; and prevent as much as possible the escape of nitrous acid fumes, by covering it up with a basin, or other convenient article. Allow the whole to stand for about two hours, and wash well with cold water." The gun-cotton resulting from this process scarcely differs in appearance from the unchanged cotton; but Mr D. R. Brown, of Messrs Macfarlan and Co., informs me that it generally weighs heavier than the cotton employed; that in an average of seven experiments 700 grains of common cotton yielded 1043 grains of gun-cotton; but that in a few cases, where the process and circumstances of preparation were apparently the same, the cotton lost weight by its conversion into gun-cotton. The cotton so prepared is then dissolved; the proportions generally consisting of one part of cotton, ten of ether, and five of rectified spirit. This is collodion. It is clear, colourless, and inflammable, and evolves a strong odour of ether. It was several years ago introduced as a substitute for sticking plaster. Applied with a fine brush over the part, the ether evaporated, leaving a delicate film of cotton, which, by repeated applications of the solution, at intervals of a few minutes, became sufficiently thick to protect wounds from the action of the air, or other causes of irritation. But for such purposes collodion has fallen into disuse, and is now chiefly important to the photographer.

EUPHORBIUM.

Conerete resinous juiee of undetermined speeies of *Euphorbia.*

Nat. Ord.—Euphorbiaceæ. *Sex. Syst.*—Dodecandria Trigynia.

The eroton and eastor oil plants both belong to the natural family *Euphorbiaceæ.* The eaetus-like plants yielding the medi-einal euphorbium grow in the kingdom of Moroeeo. When ineisions are made into the eortieal part of their angular, jointed, priekly stems and branehes, an aerid, milky, resinous juiee exudes, and eoneretes into irregular, dull-yellow tears, about the size of a pea, often hollow, and perforated with little holes. The dried juiee is brittle, with an aerid and persistent taste, without odour, and, in a state of fine division, so irritating, that those who eolleet it are obliged to eover their mouths and nostrils with eloths. In powder, it is grey, and insoluble in water, but its resinous prineiple dissolves in aleohol. When heated, it melts, swells up, and burns with a pale flame, and an agreeable odour. It eontains from 37 to 60 per eent. of resin, whieh is its aetive ingredient; and from 14 to 19 per eent. of wax, a little eaout-ehoue, and various salts. As it eontains no gum, it ought not to be ealled a gum-resin.

Actions and Uses.—Euphorbium is one of the most powerful vegetable irritants. When introdueed into the stomaeh or eellu-lar tissue, rubbed on the surfaee of the skin, inhaled into the nostrils, or applied to any other mueous membrane, it speedily eauses violent and often fatal inflammation. Two ounees given internally destroyed a horse, with all the symptoms of gastro-enteritis; and four draehms retained in the stomach of a large dog had the same effect in about twenty-six hours. Inflamma-tion of the intestines, with oeeasional patehes of little uleers, are the usual post-mortem appearances. So intensely irritating, in-deed, is the aetion of euphorbium, that the workmen employed in grinding it are obliged to wear masks or handkerehiefs over their faces, and, in spite of all preeautions, often suffer severely from headache, inflammation of the eyes, and sometimes even delirium.

When applied externally, it produces an abundant crop of inflammatory pustules. It is used to increase the potency of many blistering applications, but is apt, especially in horses and dogs, to destroy the deep-seated parts of the skin, and thus prevent the future growth of hair. On this account, it should not amount to more than one-fourth part of the active ingredients of any counter-irritant used for either horses or dogs. For cattle, however, it may with impunity be applied in larger quantity. Unlike cantharides, it has no tendency to act on the kidneys.

FERN ROOT.

Dried Rhizome of Male Shield Fern (*Aspidium Felix Mas.*)

Nat. Ord. —Filicaceæ. *Sex. Syst.*—Cryptogamia Filices.

The male fern grows wild throughout most parts of Europe, on the sides of roads and in open woods, especially where the soil is light. Its pennate leaves reach to the height of three feet. Its root stock is perennial, about a foot long and two inches thick, is scaly, tufted, greenish brown, and firmly fixed in the ground by numerous black root fibres. "The powder is greenish yellow, with a disagreeable odour, and a nauseous, somewhat astringent taste." (Brit. Phar.) Besides the usual constituents of plants, the root contains 2 per cent. of a fixed oil, and 4 of resin. The root should be collected in summer, preserved in stoppered bottles, and the supply renewed annually; for when long kept, its virtues are lost. This deterioration from keeping, and the substitution of the roots of other ferns for those of the male shield fern, in great part explain the depreciatory accounts sometimes given of its efficacy.

Actions, Uses, and Doses.—In large doses it acts as an irritant, but is used only as a vermifuge, and is given especially for the destruction of tape-worm. It is sometimes said to kill the worm in two hours, when it may be removed in mass by a dose of purgative medicine. The powdered root is used in doses of a pound for horses and cattle, ℥iij. to ℥v. for sheep, and ℥ii. for dogs and cats. (Professor Gamgee's Vet. Vade Mecum.) But the powder is inconveniently bulky, and less certain in its action than the fluid extract, which is the only preparation mentioned in the new Pharmacopœia. It is thus directed to be made:— "Take of fern root, in coarse powder, two pounds; ether, four pints, or a sufficiency; mix the fern root with two pints of the ether; pack closely in a percolator; and add the remainder of the ether at intervals, until it passes through colourless. Let the ether evaporate on a vapour bath, or recover it by distillation, and preserve the oily extract." The dose for horses or cattle is an ounce; for sheep, ♏xxv.; and for dogs or cats, ♏x. to ♏xx. It is best given in a little oil or gruel, and after several hours' fasting, and should be followed after a few hours by a dose of physic.

GALLS.

Gallæ. Excrescences on *Quercus Infectoria*, caused by the punctures and deposited ova of *Diplolepis Gallæ Tinctoriæ*.—(Brit. Phar.)

Nat. Ord.—Amentaceæ. *Sex. Syst.*—Monœcia Polyandria.

Galls, or gall-nuts, are found on the branches of a shrubby species of oak, and are caused by punctures made by a small insect, which takes this method of depositing its ova. From the irritation thus produced, the punctures become surrounded by woody matter; and within this the insect passes through the various stages of its growth, until, about the month of July, it becomes a perfect fly, perforates its cell, and escapes. This is the time when the galls ought to be gathered. Galls are imported to this country from Aleppo, Constantinople, and the East Indies. Of late years they have been found abundantly on the oaks in the southern and midland counties of England; but those home-grown specimens are not so rich in tannin as the imported. Galls vary from the size of a bean to that of a small walnut; are round, hard, smooth, and studded with tubercles; are of a bluish grey colour externally, and yellow within. In their interior is a hollow, in which the insect may generally be found. Sometimes, however, the central hollow is empty, from the death of the insect, or from its escape in a perfect form, when a small hole may be found, through which the creature has liberated itself. Such galls may be distinguished from those which still contain the insect by the larger internal hollow, the presence of the hole through which the fly has escaped, the duller appearance, want of tuberosities, low density, and light colour, on account of which they are termed *white galls.* They are less astringent than the other sort, which, from their darker colour, are called *blue galls.* Galls are easily reduced to a yellow-grey powder devoid of odour, but having a powerful astringent taste. They yield their properties to water and proof spirit, forming with the latter the dark-red tincture of galls. The watery solution forms, with persalts of iron, the dark blue or black solution of the tannate and gallate of iron, or ink; and, with a solution of gelatine, a grey flocculent precipitate of tanno-gelatine—the essential principle of leather. These reactions, as well as the other important properties of galls, depend on the presence of about sixty-five per cent. of tannin or tannic acid, which is associated with 10·5 of fibre, 11·5 of moisture, 5·8 of gum, sugar, and starch, 4· of gallic, ellagic, and luteo-gallic acids; together with extractive matter, chlorophyll, volatile oil, albumen, and salts. (Guibour.)

Actions and Uses.—Galls are powerfully astringent, occupying, as regards activity, a mediate place between pure tannin and oak-bark. They are of much service in chronic mucous discharges, especially those depending upon relaxation and want of power; in relieving passive hemorrhages; and as antidotes for poisoning by tartar emetic, and vegetable alkaloids. They are further used externally for all the purposes of styptics and topical astringents.

Doses, etc.—The dose of powdered galls for the horse is from ʒiv. to ʒvi.; for cattle, ℥i. or ℥ij.; for sheep and swine, from

℈i. to ʒi.; for dogs, grs. v. to grs. x.; and for cats, from gr. i. to grs. iij. Various forms of administration are adopted. The simple powder may be made into a bolus, with any ordinary excipient, or dissolved in warm water or proof spirit. A tincture of convenient strength may be made by digesting or percolating together three ounces of powdered galls and a pint of proof spirit. The tincture should be diluted and sweetened as required. For external purposes the following preparations are in use:—the simple powder, infusions of various strengths, and an ointment made with one part of powdered galls to four of lard, and to which half a part of opium may sometimes be advantageously added.

Tannin or Tannic Acid is the principle to which oak-bark, oak-galls, and most other vegetable astringents, owe their characteristic properties. It is extracted from coarsely powdered galls, by ether diluted with water; and when carefully dried, is a soft, spongy, whitish-yellow, uncrystallizable, odourless substance, with an intense astringent taste, but devoid of bitterness. It is soluble in water, and sparingly so in alcohol. The solution gives a dark blue or black colour with persalts of iron, a grey flocculent precipitate with gelatine, and is also precipitated by the vegetable alkaloids and mineral acids. It is a tribasic acid, and consists of $C_{18}\,H_6\,O_{10} + 2Aq$.

Actions and Uses.—Tannin is the most powerful of vegetable astringents. When given internally, it diminishes the mucous secretions, whether healthy or morbid, and causes especially dryness, and sometimes even thickening, of the intestinal mucous membrane. It appears to be converted in the body into gallic acid, which communicates to the urine a brown colour, and a characteristic reaction with salts of iron. Its uses are the same as those of galls and of oak-bark; but, from its concentrated form, it is often specially suitable as an internal astringent. Drachm doses repeated every second hour, and given in gruel, sometimes along with ♏xx. of creasote, often prove serviceable in arresting red-water in cattle. It has been recommended for the removal of tape-worms, which it appears to curl up and destroy, probably in virtue of its power of coagulating the albumen and gelatine of their structures.

Doses, etc.—It is given to horses and cattle in doses of from ℈i. to ℈iij.; and to sheep and dogs, from gr. i. to grs. iij. It is used either in the form of pill, infusion, or tincture. A drachm each of tannin and opium, with an ounce of lard, makes an excellent ointment for piles in dogs.

Gallic Acid.—When tannin is exposed for some time to air and moisture, it becomes converted into gallic acid (C_7 H O_3 + 2 Aq.). The method usually adopted is to mix with coarsely powdered galls, enough of water to form a paste, which is allowed to stand in a porcelain vessel for about six weeks, at a temperature of 60° or 70°, water being added at intervals to replace that lost by evaporation. The paste is then boiled and drained, the crystalline deposit dried between folds of bibulous paper, and purified by washing and recrystallizing. (Brit. Phar.) Another and more speedy method of preparation consists in boiling tannic acid with excess of sulphuric acid. Excess of alkali has a similar effect. (Gregory.) Gallic acid occurs in delicate silky prisms of a pale yellow colour, and a sweetish acid taste. It is soluble in alcohol and in three parts of hot water, but is hardly soluble at all in cold water. It produces a black-coloured solution with persalts of iron, but is not precipitated by gelatine. Its actions, uses, and doses, are analogous with those of tannin; from 3 to 6 grains, with about half that amount of opium, forms a useful pill for dogs suffering from chronic diarrhœa or dysentery. From its not combining with gelatine or albumen, gallic acid is not such a powerful topical astringent as tannic acid; but by admixture with solutions of gum or grape sugar, it acquires astringency, probably owing to its being thus reconverted into tannic acid. The reverse of this process most likely occurs when tannin is given internally, when, as already remarked, gallic acid is discharged by the urine. Three equivalents of anhydrous tannic acid form six of gallic acid, and one of grape sugar.

GAMBOGE.

Camboge. The gum-resin of an undetermined species of *Garcinia*. (Brit. Phar.)

Nat. Ord.—Guttiferæ. *Sex. Syst.*—Monœcia Monadelphia.

Gamboge is the produce of a tropical tree, is imported from Siam and Ceylon, is obtained from incisions into the bark, or by breaking the leaves and branchlets, when the yellow milky juice exuding is collected in leaves of the tree, in cocoa-nut shells, or in bamboo canes. "It is met with in cylindrical pieces, breaking easily with a smooth conchoidal glistening fracture, colour tawny, changing to yellow when it is rubbed with water." (Brit. Phar.) It is odourless, with little taste, but leaves, when chewed, acridity in the throat. It is soluble in water, alcohol, and ether, forms a soap with potash, and owes its properties to the presence of from 65 to 74 per cent. of an orange-red resin insoluble in water, but soluble in alcohol, and still more so in ether.

Actions and Uses.—In consequence of its powerful irritant effect, it is an active purgative. Moiroud gave horses from six to twelve drachms, and found that the dejections were frequent and fluid, the pulse became irregular, the animal shivered, and was anxious. Two drachms killed a sheep, two ounces and a half had little effect upon a cow, but five ounces caused dysentery, which continued for seventeen days. Although uncertain and almost unsafe when given alone, its purgative effect on ruminants is safe, speedy, and regular, when it is given in combination with some other purgatives. My attention was first directed to the value of gamboge, as a purgative for cattle, by my friend Mr J. C. Adkins of Milcote, who has used it successfully for many years. In indigestion, fardel bound, and other such disorders of cattle, no formula proves more prompt and effective than an ounce each of gamboge and aloes given in solution, or six or eight drachms of gamboge dissolved in water with a half or three-quarters of a pound of salts. By such prescriptions the bowels of cattle may, in ordinary circumstances, be moved in ten or twelve hours, which is several hours sooner than we expect purgation from the saline or oily drenches in ordinary use. Gamboge is too drastic and irregular to be safely given either to horses or dogs.

Doses, etc.—For cattle, the dose is from six to eight drachms, for sheep about a scruple. In both classes of animals it should be given in combination with other purgatives, and in solution.

GELATINE.—GLUE.

Nitrogenous matter extracted by the action of boiling water from animal membranes.

Gelatine is usually obtained from bones, cartilages, tendons, or skin; and is believed to be formed from these tissues by the breaking up of their albuminous materials, under the conjoined action of heat and moisture. The ordinary gelatine of the shops is chiefly made from bones, which are cleaned and boiled to remove fatty matters, and then crushed or steamed in a partial vacuum until a gelatinous fluid is obtained. Glue, which is a coarse variety of gelatine, is made by boiling the parings of hides and horns; whilst *isinglass*—a pure, colourless gelatine—is procured from the swimming bladder of the sturgeon. Gelatine, when dried, is hard and tough, varies in colour according to its purity, and forms, when dissolved in a limited quantity of water, a viscid tremulous mass.

Actions and Uses.—Unless given with albuminous and starchy matters, gelatine is very indigestible, and quite inadequate to healthy nutrition. Animals restricted to it for any considerable time die of utter inanition. Along with other proximate principles, it appears, however, to be a useful article of diet, both for men and dogs, especially during recovery from acute disease, when it probably affords materials for the repair of the bones and other gelatinous tissues. It is an effectual demulcent; but is apt to become hard and dry, and hence is not very suitable for forming a permanent sheathing for irritable surfaees. The eoarse impure gelatine or glue is often employed in veterinary practiee for seeuring the broken horns of cattle, and for making adhesive plasters for the closing of wounds. For this latter purpose, two pieees of stout eloth are eut so as to leave a number of tails with uncut margins of several inehes, and are smeared with melted glue, and applied, one on either side of the wound, and with the uncut margins overlying for some inehes. When the plaster is dry, these approximating uneut margins are sewed together; whilst, to prevent the plaster slipping with the movements of the skin, a few narrow strips of calieo may then be applied with the glue, in various directions, over the injured spot. Large wounds may be thus secured by non-professional persons who cannot use sutures or needles; and even where a serious wound is properly sewed up, the immediate application of such plasters is often useful in keeping the parts in position, and preventing the annoyance of flies; a dependent opening must, however, in all eases, be left for the egress of matter. Glue plasters are also often effectual in reducing and retaining umbilieal hernia both in calves and foals; and in these, as in all other cases, the ehief requisites for applying them seeurely are to eut the cloth into ribands or tails, to smear both the cloth and skin with the melted glue, and to keep the plaster smooth and firm until it be thoroughly dry: the admixture with the glue of one-third or one-half of piteh, increases greatly the adhesive qualities of sueh plasters. In pharmaey, gelatine has been used instead of paper, as a neat and cleanly envelope for pills and boluses.

GENTIAN.

Gentiana. Dried Root of *Gentiana Lutea.*

Nat. Ord.—Gentianaceæ. *Sex. Syst.*—Pentandria Digynia.

The *Gentiana lutea*, or yellow gentian, has a perennial root, and an annual herbaeeous stem, whieh rises three or four feet in height, and bears numerous yellow flowers. It abounds in most parts of temperate Europe, thrives best between 3000 and 5000 feet above the level of the sea, and is extensively cultivated in the mountainous districts of the Alps, Vosges, and Pyrenees. All parts of the plant are bitter and tonic, but the root alone is used in medicine. It is brought to this country in bales, chiefly from Switzerland, by way of Marseilles and other Mediterranean ports. It usually occurs in pieces "half an inch to one inch in thickness, several inches in length, often twisted, much wrinkled or marked with close transverse rings, brown externally, yellow within, tough and spongy." (Brit. Phar.) It has a peculiar aromatic and rather disagreeable odour; and a taste at first sweetish, but afterwards strongly and permanently bitter, but without astringency. When moist, it is tough and flexible; but when dry, is brittle and easily pulverized. When powdered, it has a yellow colour, with a shade of brown, and readily yields its bitterness to water, alcohol, and ether.

"Gentian consists of a bitter extractive matter, gum, uncrystallizable sugar, a principle analogous to bird-lime (consisting, according to later investigations, of wax, oil, and caoutchouc), concrete oil, a yellow colouring principle, a trace of volatile oil, and a peculiar acid named gentisic acid. Some chemists thought they had succeeded in separating, by means of ether, an active neutral crystalline principle of a yellow colour, in which the bitterness of the root is concentrated. It appears, however, that the active principle has not yet been isolated." (Neligan.)

The root of the *Gentiana lutea* is occasionally mixed with that of various other plants of the same natural family; but this is of little importance, since they are all possessed of similar properties. Other roots of a different and sometimes poisonous action are also occasionally mixed with the gentian. Such are monkshood, belladonna, and white hellebore, which may, however, be distinguished by the absence of the pure bitter taste and bright yellow colour so characteristic of true gentian. The powder, especially that met with abroad, is said to be occasionally adulterated with yellow ochre, which, however, may be easily detected by heating the suspected specimen with a little sulphuric acid, filtering the solution, and testing for iron.

Actions and Uses.—Gentian is a pure and simple bitter, and is consequently a stomachic and tonic. It is probably the best of all bitters, and some consider it little inferior to cinchona as a tonic. Narcotic properties have been ascribed to it; but no such effects follow its administration to veterinary patients. Horses have received from four to twenty-four ounces, and dogs from two to four ounces, repeated during several days, without evincing the slightest symptoms of narcotism. For all classes of patients it is a valuable remedy for improving the appetite and the general tone. Amongst horses no combination is more effectual in simple colds than half an ounce of gentian and two drachms of nitre, made into a bolus with linseed meal and treacle, and repeated every night and morning. After the more acute fever is passed, the same bolus also proves very serviceable in inflammatory diseases, especially of the air passages. Where a more decided tonic effect is desired, sulphate of iron or of copper may be added to the mixture; and where the bowels are not in a normal state, or the febrile symptoms are insufficiently subdued, one or two drachms of aloes may be advantageously united with the gentian and nitre. The early use of four drachms of gentian with an ounce or two of sweet spirit of nitre, given three or four times daily in a bottle of ale, proves an excellent stomachic and stimulating tonic in influenza, bronchitis, and many other weakening complaints. Such a combination hastens recovery from all exhausting disorders, and has an almost magical effect in restoring horses that are jaded, overworked, or suffering from loss of appetite or slight cold. Gentian is sometimes useful in simple indigestion, especially in young animals; and in such cases is frequently combined with antacids or aromatics. Two drachms each of gentian, ginger, and carbonate of soda constitutes a useful stomachic and carminative, and may be made either into a bolus with treacle, or into a drench with gruel or ale. From its bitterness and laxative tendency, gentian is often effectual in expelling intestinal worms. Some practitioners still recommend it in jaundice, but in such cases the utility ascribed to it may possibly be mainly owing to the laxatives with which it is usually combined. In similar circumstances amongst cattle these formulæ are as serviceable as for horses, and only require to be given in somewhat larger doses. For sheep, gentian is also a useful stomachic and bitter tonic, and when given along with salt appears to arrest for a time the progress of rot. It stands next after quinine as the best vegetable tonic for dogs laid up with, or recovering from, reducing disorders. Like other tonics, gentian is contra-indicated in irritation of the intestines, and in the earlier stages of acute inflammatory diseases. In the form of an infusion, it is occasionally applied externally as a mild stimulant and antiseptic.

Doses, etc.—The dose for the horse is from ʒiv. to ʒviij.; for cattle, from ℥i. to ij.; for sheep, ʒi.; and for dogs, from grs. x. to xx. These doses may be given twice or thrice a day, either alone or with ginger, cardamoms, a salt of iron, or some other tonic. For horses and dogs it is generally made into a bolus with syrup, or some other excipient; and for cattle is used as an infusion or tincture. An extract, though recommended by some authorities, is troublesome to prepare, and of little use in veterinary practice. The *infusion* may be conveniently made by macerating together two ounces of gentian, a pint of water, two ounces of proof spirit to facilitate solution, and two or three drachms of cardamoms or caraways as flavouring ingredients. After maceration for a day or two, the whole may be strained through linen or calico. A *tincture* may be prepared with the same ingredients, substituting only proof spirit for water, and using either the process of digestion or percolation. The *compound tincture* is made with an ounce and a half of bruised gentian, three-quarters of an ounce of orange peel, cut small and bruised, a quarter of an ounce of bruised cardamoms, and a pint of proof spirit. Macerate the gentian and the other ingredients for forty-eight hours with f℥xv. of the spirit in a close vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, pour into the percolator the remaining five ounces of the spirit. As soon as the percolation is completed, subject the contents of the percolator to pressure, filter the products, mix the liquids, and add sufficient proof spirit to make one pint. (Brit. Phar.)

GINGER.

Zingiber. Scraped and dried Rhizome, or underground stem of *Zingiber officinale.*

Nat. Ord.—Zingiberaceæ. *Sex. Syst.*—Monandria Monogynia.

The *Zingiber officinale*, long known as the *Amomum Zingiber*, is grown in many warm climates, but especially in the East and West Indies. Its rhizome is biennial, creeping, fleshy, and nodulous, and gives off numerous descending short radicles, with several ascending annual stems, which reach to the height of three or four feet, are invested with smooth sheathing leaves, and terminated by a spike of purple flowers. The rhizomes used for making green or preserved ginger are gathered when about three months old, and while still soft and juicy. For other purposes they are taken up when about a year old, and while still plump and soft.

Properties.—The black and white gingers are the chief commercial varieties. Both are believed to be obtained from the same plant, and the difference in their appearance depends chiefly on the manner in which they are prepared for use. The black gingers are cleaned, but without the removal of the external skin, are immersed in hot water, and dried; while the white are first peeled, and then dried, without being moistened. The former are covered by a dark-brown wrinkled epidermis, and have a tough fibrous structure; the latter are destitute of epidermis, lighter in colour, of a soft, starchy texture, and usually of superior quality. Both varieties are met with in irregular lobed knotted pieces, from two to four inches in size. When broken across they have a marbled appearance, the outer parts being somewhat resinous, and the inner starchy and fibrous. They have a strong, agreeable, aromatic odour, and a warm, pungent taste, and dissolve in water and alcohol of all densities.

Impurities.—The drug-merchant sometimes attempts to give the inferior varieties the light colour of the finer Jamaica ginger, by exposing them to sun-light, to sulphurous acid, or to chloride of lime; but such bleaching processes cannot impart the soft resinous structure, short mealy fracture, aromatic odour, and hot taste which distinguish good ginger. In the following analysis by Bucholz, the two first constituents should be specially noticed as the active principles of the medicine:—Pale yellow volatile oil, 1·5; aromatic, acrid, soft resin, 3·5; extractive matter, 11; starch, 19; gum, bassorin, and mucilaginous matters, 46; woody fibre, 8; and water, 11.

Actions and Uses.—Ginger is slightly irritant, stomachic, carminative, and mildly tonic. It stimulates the various mucous membranes with which it comes in contact. If blown into the nostrils it promotes the nasal discharge, and if chewed augments the flow of saliva. When administered internally in repeated doses, it increases the gastric secretions, facilitates digestion, and prevents the formation of flatus. From these stomachic and carminative properties, and from its action as a mild vegetable tonic, it is a useful remedy during convalescence from debilitating diseases, especially when accompanied by atony of the digestive organs. It is, besides, a valuable adjunct to many kinds of medicine, and, when conjoined with purgatives, diminishes their tendency to nauseate and excite griping, while it also somewhat expedites their action. To fulfil these purposes, it is used for all domesticated animals, and especially for cattle and sheep.

Doses, etc.—The dose of ginger for the horse is about ℥i.; for cattle, from ℥ij. to ℥iij.; for sheep, about ʒij.; and for dogs, from ℈ij. to ℈iij. It may be made into a bolus with any suitable excipient, or dissolved in hot water, the solution being either given alone or sweetened with treacle or sugar. The tincture is rather too expensive for general use in veterinary practice, but is highly spoken of by Mr Morton, who recommends it to be made with two ounces of ginger to every pint of proof spirit. Such a tincture, however, speedily becomes turbid and unsightly. A much better preparation may be made with four ounces of ginger to a pint of rectified spirit,—macerating the solution for a few days, straining and diluting it as required.

GLYCERINE.

A sweet principle, $C_6 H_8 O_6$, obtained from fats and fixed oils. (Brit. Phar.)

Glycerine was first discovered in 1789 by Scheele as a product in the manufacture of lead plaster. It is the basic principle of oils and fats with the exception of spermaceti and wax, and is separable when the fatty acids are removed by an alkali or otherwise. It is mainly obtained as a by-product from soap and stearine candle-making; and Mr G. F. Wilson, of Price's Patent Candle Company, has discovered the most simple and convenient process for getting it in a state of purity. Into a distilling apparatus containing palm oil, steam at a temperature of 550° or 600° is introduced, the fatty acids and glycerine each take up their equivalents of water, and distil over, the glycerine being the heavier occupying the lower part of the receiver. For most purposes it is redistilled, reaches a specific gravity of 1·240, and contains 94 per cent. of anhydrous glycerine. It is viscid and colourless, devoid of odour, and has a sweet taste; when heated in air it burns with a luminous flame, evolving irritating vapours; is freely soluble in water and alcohol; is itself an excellent solvent for vegetable acids and alkaloids, and takes up a fifth part of arsenious acid. It is a valuable antiseptic, meat steeped in it retaining its freshness for several months. It appears to possess many of the feeding and alterative properties of cod liver oil and other such fatty matters, and has been given with benefit to sickly dogs impoverished by bad management or disease. It is an excellent demulcent, a useful dressing for cracked heels and newly blistered surfaces, for cutaneous irritation in dogs, and for allaying the irritability of burns. For many of these purposes it is advantageously used, mixed with an equal quantity of Goulard's lotion. It is a convenient and palatable menstruum for giving nauseous medicines, especially to dogs, and on account of its viscid and antiseptic properties is a useful addition to various masses and boluses.

GUM ARABIC.—GUM TRAGACANTH.

Gummi Acaciæ. Gum of various species of *Acacia.*

Nat. Ord.—Leguminosæ. *Sex. Syst.*—Monodelphia Polyandria.

Gum is a large constituent of many plants, but for commercial and medicinal purposes is chiefly got from various undetermined species of *Acacia.* These are trees usually of medium size, with a stunted, withered aspect, a grey bark, oblong linear leaflets arranged along either side of the stalk, and a moniliform fruit resembling the laburnum. They abound in dry, warm climates, especially on the African continent, and are most prolific when old and stunted, and during dry, hot seasons. In the warm months of June and July, a viscid juice exudes from natural cracks or artificial incisions in the bark, and concretes by the heat of the sun into little round masses or tears, which are of a yellow or brown colour, have a density varying from about 1100 to 1300, no odour, and a bland, sweet taste. They dissolve in water, forming an adhesive, viscid fluid. The colour and transparency of gum are liable to many variations, being sometimes different in specimens obtained from the same tree, and sometimes identical in those from different species.

Gum Acacia, or Gum Arabic—the most important medicinal variety—does not come from Arabia, as its name might indicate, but is collected chiefly in Cordofan, in Eastern Africa, and is imported from Alexandria. When imported, it is picked, sorted, and separated, usually into three different qualities, distinguished by the size, colour, and transparency of the tears. It is tough and difficult to powder, but must not be triturated in iron mortars, as it is apt thereby to become acid and discoloured. When pure, it is soluble in its own weight of both hot and cold water, and also in vegetable acids. It is insoluble in alcohol, ether, and oils, and is decomposed by mineral acids. Heated with sulphuric acid, it is converted first into dextrin, and then into grape sugar; heated with nitric acid, it forms mucic and oxalic acids. It consists of 17·6 per cent. of water, 3 of ashes, and 79·4 of a pure gummy principle termed Arabin, which is precipitated when alcohol is added to a watery solution of gum. Its ultimate analysis is C H_{11} O_{11}. From the other gums, which are occasionally substituted for it, it may be distinguished by the following characters, thus given by the Brit. Phar.:—"In spheroidal tears from half an inch to an inch in length, nearly white and opaque from numerous minute cracks, or in shining fragments; brittle, bland, and mucilaginous in taste, soluble in cold water. The solution forms with subacetate of lead an opaque white jelly." Adulteration with starch may be detected by solution of iodine. A yellow colour may be almost entirely removed by exposure to sun-light.

Gum Senegal is very similar to gum arabic, but is less brittle, and dissolves only in four or five parts of water. The *East Indian Gums* are less valuable, being dark-coloured, and more difficult of solution. The gums of Australia and the Cape, now imported in considerable quantity, are also inferior to gum arabic in colour, transparency, and solubility.

Gum Tragacanth is derived from shrubs or small trees belonging to the genus *Astragalus;* occurs in thin, semi-transparent lamellæ or plates of a white-grey or yellow colour, and marked with concentric ridges; and is tasteless, odourless, and very tough. Cold water causes it to swell into a sort of jelly, called bassorin, which is tinged violet by tincture of iodine; but boiling water readily dissolves it, forming a dense and viscid mucilage. It contains 53·3 per cent. of arabin, 33·1 of an insoluble gummy principle called bassorin, 11·1 of water, and 2·5 of ashes.

Actions and Uses.—Gums, though perhaps the least nutritive of all the non-nitrogenous or heat-producing articles of food, are superior to most of these articles as demulcents and emollients. When dissolved in water, they are often serviceable in diarrhœa, whether caused by purgatives, poisons, or other irritants; as injections in inflammation of the kidneys and bladder; and as applications for dry, painful, and abraded surfaces. In all such cases, they afford a mechanical investment for injured or inflamed parts, and thus protect them from the action of irritants. They are used for making emulsions, electuaries, and boluses; but such preparations, when made with gum, have the disadvantage of speedily becoming dry and hard.

Doses, etc.—The dose of gum for horses and cattle is from ℥i. to ℥ij.; for foals, calves, and sheep, about ʒiv.; and for dogs, from grs. xv. to grs. xl. It is best given in the form of mucilage, which is best made by suspending, in a muslin bag, four ounces of gum in small pieces, in six ounces of distilled water, and after thirty-six hours, squeezing out the fluid in the bag and mixing. (Brit. Phar.) When used in cases where there is much irritation, mucilage is often conjoined with laudanum, and where there is relaxation, with catechu, chalk, or alum.

HELLEBORE.

Helleborus. Dried underground stem and root of *Helleborus Niger*.

Nat. Ord.—Ranunculaceæ. *Sex. Syst.*—Polyandria Polygynia.

The *Helleborus niger*, or Christmas rose, is indigenous to many parts of continental Europe, and is often cultivated in this country. It is a herbaceous plant, from one to two feet in height, with numerous digitated, dirty-green leaves, with flowers which appear in January and February, and with a perennial, black, scaly root-stock, from which descend numerous dark-coloured radicles, about the thickness of a quill, having a faint, unpleasant odour, and an acrid, bitter taste, and constituting the officinal part of the plant. There is no satisfactory analysis of hellebore. At present, its active principle is believed to be a volatile acid united with an acrid oil.

Actions and Uses.—In large doses it is an irritant poison, producing gastro-intestinal inflammation. Two drachms, given internally, destroy a medium-sized dog in a few hours, and much smaller quantities have proved fatal in a shorter time, when applied to a wound. (Christison.) Quantities of two or three drachms produce in horses colic, enteritis, and death in from forty to fifty hours; and from one to three drachms induce similar effects among sheep and goats. (Hertwig.) It acts in all animals as a purgative and anthelmintic; but is so violent and unmanageable, that it has been entirely superseded by other medicines. For the dog, it is an emetic; but, as such, it has also deservedly fallen into disrepute. It is used externally for the same purposes as veratrum album, namely, as an irritant for promoting discharges, and as a constituent of blistering ointments. But unless used cautiously, and in small quantity, it is inconvenient and hurtful, on account of its liability to become absorbed, and its tendency to act with unexpected violence, and thus cause blemishing. An ounce of powdered hellebore, and two ounces of alum dissolved in a gallon of hot water, is an excellent means of destroying caterpillars infesting gooseberry, rose, or other trees.

HEMLOCK.

Conium. Leaves and Branches of *Conium Maculatum.*

Nat. Ord.—Umbelliferæ. *Sex. Syst.*—Pentandria Digynia.

Hemlock grows wild in all parts of this country, and is a biennial plant which, when one year old, has a small slender root, and a few leaves lying flat on the ground. During its second year's growth, when the plant is usually collected for use, the root is large, white, and fusiform; the flowering stem is from two to five feet high, hollow, jointed, smooth, and thickly covered with purple spots; the leaves are large, cut into segments, and have a bright green colour, a nauseous, bitter taste, and a strong, peculiar odour, which is characteristic of all parts of the plant, and aptly compared to that of mice; the flowers are small, white, and, like those of the other plants of the family, arranged in umbels or clusters; the fruit resembles that of the anise, is round, ridged, of a brown colour, devoid of hairs, more active than the leaf, and less apt to lose its energy by keeping.

The leaves are the chief officinal part of the plant, and should be gathered when the fruit begins to form. They are rapidly dried in stoves at a temperature of about 120°, and preserved in bottles or jars excluded from light. As they gradually lose their activity, they should not be kept for more than two years. They readily communicate their properties to water, alcohol, fats, and oils. When exposed for a short time to a heat of 212° or upwards, their active principle is decomposed, and hence all preparations of hemlock which have been subjected to such a temperature are nearly inert. When the leaves are strongly heated, there is produced a powerfully narcotic empyreumatic oil, similar to that got by the same method from hyoscyamus. Hemlock contains albumen, resin, colouring matter, odorous volatile principles, and a volatile oleaginous alkaloid called *conia*, which, when liberated by distilling the leaves with potash, is transparent, oily, and colourless, but soon becomes brown when exposed to air and light. It has an intense suffocating odour of mice, a peculiar acrid taste, is sparingly soluble in water, but readily dissolved by alcohol, ether, and dilute acids. Its formula is said to be $C_{16}\,H_{15}\,N$.

The leaves of hemlock are liable to admixture with those of other plants. This can only be detected by knowing accurately the botanical characters of the hemlock, and noting especially the odour, taste, colour, and form of the leaf. A tolerably accurate estimate may be made of the goodness of a specimen of hemlock, or of any of its preparations, by observing the intensity of the odour of conia developed when the specimen is rubbed with caustic potash.

Actions and Uses.—The conflicting accounts of the actions of hemlock chiefly depend on its different effects on the various classes of animals, and on the variable activity of its preparations. It acts in most animals as a peculiar narcotic poison, causing general paralysis, and death by asphyxia. But, like all such narcotic vegetables, it has little effect on the larger ruminants. Hertwig gave a cow the fresh two-year-old herb in quantities varying from six ounces to three pounds, without any other effect than slight hoven. He also mentions that a year-old ram, which got nothing but hemlock for five days, consumed it without much reluctance, and suffered no bad consequences. Horses also have got doses of four pounds with the same negative results. Moiroud, however, poisoned a horse with half a pound of the dried leaves given as a decoction, and observed nausea, spasmodic contractions of the muscles of the extremities, cold sweats, dilatation of the pupils, and dulness. Hemlock acts with much greater energy on dogs, cats, and all carnivora. Professor Christison gave an extract, made from the leaves, to dogs, and found that an ounce, when swallowed, proved fatal in forty-five minutes; 90 grains, when applied to a wound, had the same effect in an hour and a half, and 28 grains in two minutes when injected into the veins. It acts by whatever channel it can be absorbed, and produces palsy, first affecting the voluntary muscles, and by and by the diaphragm and other respiratory muscles, thus causing death by asphyxia. Twitching of the extremities and slight convulsions sometimes also occur, but no topical irritation, nor any narcotism, or impairment of common or special sensation. Judging from its symptoms, it appears to paralyze the motor tract of the spinal chord.

Hemlock has been used medicinally as a calmative in rheumatism and neuralgia, as a deobstruent and diuretic, and externally as an anodyne. But its curative actions have as yet been very imperfectly studied.

Doses, etc.—The dose of the dried leaves for horses or cattle may be about ℥ij.; but from the slightness of its physiological action, it is not likely to be of much curative value in these animals. The extract is given to horses and cattle in doses of ʒi., and to dogs in doses of grs. ij. to grs. v.

The dose of the tincture for horses and cattle is fʒi. or fʒij., and for dogs ♏xxx. From carelessness in drying the leaves, or in concentrating the expressed juice, the extract is often quite inert. The tincture may be prepared in several different ways, but especially by expressing the juice of the leaves, branches, or fruit, and adding to it about a fourth part of rectified spirit. *Conia* is a very active poison, being almost as powerful as anhydrous prussic acid. It causes at first local irritation, which, however, is speedily superseded by swiftly spreading paralysis, which proves fatal by arresting respiration. One drop applied to the eye of a rabbit caused death in nine minutes; three drops and a half placed on the conjunctiva of a cat had the same effect in a minute and a half; and five drops, when swallowed by small dogs, began to operate in thirty seconds, and destroyed life in one minute. Still smaller quantities, when injected into the veins, caused death with even greater rapidity. (Christison on Poisons.)

HENBANE.

Hyoscyamus. Leaves and branches of *Hyoscyamus Niger.*

Nat. Ord.—Solanaceæ. *Sex. Syst.*—Pentandria Monogynia.

Henbane grows wild in most parts of this country, but is also cultivated in the medicinal gardens at Mitcham, in Surrey, and elsewhere. All parts of the plant manifest peculiar narcotic properties, but the leaves are the principal officinal part. They are of a yellowish-brown colour, rough, hairy, and clammy, with a fœtid narcotic odour, and a nauseous, bitter taste. The seeds are also sometimes used, but are difficult to collect in quantity. They resemble the leaves in taste and odour, are of a yellowish-brown colour, rough, ovoid, and somewhat less than those of the poppy. The root is white, contains much starch, and is similar in appearance to the parsnip, for which it has occasionally been mistaken. There are two varieties of henbane, an annual and a biennial; the latter being larger, stronger, more branched and clammy, and generally considered the more active of the two.

Henbane consists chiefly of water, woody fibre, fatty oil, resin, albumen, and an actively poisonous alkaloid termed *hyoscyamia*, which bears a close resemblance to atropia, the active principle of belladonna, and is crystalline, sparingly soluble in water, readily dissolved by alcohol, of a nauseous acrid taste, volatile, and, like most other narcotic alkaloids, very easily decomposed by heat. When hyoscyamus is subjected to destructive distillation, it yields a very poisonous volatile empyreumatic oil, which probably contains the hyoscyamia in a modified form.

Actions and Uses.—As a poison, henbane is narcotico-acrid; as a medicine, anodyne, calmative, and antispasmodic. It closely resembles belladonna and other *solanaceæ* in its general actions. It has little perceptible effect on ruminants; but acts somewhat more powerfully on the horse, three to four ounces of the leaves given in decoction causing dilatation of the pupils, spasmodic movements of the lips, and increased frequency of the pulse, but no symptoms of acute poisoning. It affects the dog much in the same way as it does man, causing dilatation of the pupil, insensibility to light, small, depressed pulse, and coma, often disturbed by delirium. Hyoscyamus is little used by British veterinary surgeons. It seems almost useless either for horses or cattle; but may be given to dogs as a calmative and antispasmodic, and a convenient substitute for opium. Mr Mayhew recommends ♏xxx. of tincture of henbane, with ♏lx. of ether, to be given in cold soup, to dogs suffering from distemper and threatened with fits. When combined with drastic cathartics, henbane effectually prevents griping, without diminishing purgation. For external purposes it is generally superseded by belladonna.

Doses, etc.—The leaves are not used in their crude state. Their most convenient medicinal preparations are—the extract, made by evaporating the expressed juice; and the tincture, prepared with two and a half ounces of dried powdered hyoscyamus, and one pint of proof spirit. For the dog, the dose of the former is grs. v. to grs. x.; of the latter, ♏xl. to ♏l. For horses and cattle the dose of the extract is from fʒi. to fʒij. The dose of the tincture would be f℥ij. or f℥iij. Both extract and tincture are apt, from faulty preparation or long keeping, to be deficient in activity: indeed, Mr Donovan states that he has frequently swallowed an ounce of a properly prepared tincture with perfect impunity; that ten grains of the extract have likewise no effect; and that no henbane grown in the British Isles possesses much poisonous or medicinal activity, or yields more than an infinitesimal amount of hyoscyamia. (British Medical Journal, April 1862.)

IODINE.

This chemical element was discovered in 1812 by M. Courtois, a saltpetre manufacturer in Paris. Its medicinal properties were investigated by Dr Coindet, senior, of Geneva, in 1820; and since that time it has come into general use, both in human and veterinary practice.

Preparation.—The iodine used in this country is mostly prepared in Glasgow from kelp—the semi-vitrified ashes of various sorts of sea-weed—by breaking it into small pieces, dissolving it in water, and allowing the common salt, carbonate and sulphate of soda, and chloride of potassium, to crystallize out. The iodine ley remains as a dense, dark-brown liquid, containing the iodine chiefly in combination with sodium. This liquor is generally mixed with one-eighth of its bulk of sulphuric acid, and allowed to stand for twenty-four hours; sulphur and crystals of sulphate of soda are deposited; and carbonic acid, sulphurous acid, and sulphuretted hydrogen gases, are given off. The fluid is then cleared from the deposit, transferred to a leaden retort, and mixed with binoxide of manganese, when, on heat being applied, the iodine comes off, and is received in a series of glass globes. Another method sometimes pursued yields a drier and purer iodine. To the iodine ley is added a solution containing one part of sulphate of copper, and two and a half of sulphate of iron; the whole of the iodine is thus thrown down as diniodide of copper, and this may afterwards be decomposed by sulphuric acid and binoxide of manganese.

Properties.—Iodine usually occurs in small black or bluish-black scales, which are soft, brittle, and easily pulverized. It has an acrid, disagreeable taste, and a pungent, unpleasant odour, somewhat resembling that of chlorine or sea-water. Its density is 4·94. When applied to the skin, it produces a yellow stain, which, however, is readily removed by alkaline solutions. At the temperature of the atmosphere it slowly evaporates; at 212° its vapour rises with that of water; and at 350° it volatilizes entirely in beautiful violet-coloured, heavy, irritating vapours. It forms with water a brownish-yellow solution, which contains, however, only one seven-thousandth part of iodine. It is entirely dissolved by twelve parts of rectified spirit, and by still smaller quantities of ether, volatile oils, and many saline solutions, of which the best and most commonly used is a solution of iodide of potassium, with which iodine forms a red-brown fluid. Iodine readily unites with bases, and forms many compounds used in medicine. Those with the alkalies closely resemble iodine in their actions, whilst those with the heavy metals partake chiefly of the properties of the base. Iodine is easily distinguished by its characteristic odour, by the brown stain which it leaves on the fingers when touched, the violet-coloured vapour which it evolves when heated, and the blue compound which it forms with a cold solution of starch.

Impurities.—On account of its extensive use and high price, iodine is very apt to contain intentional adulterations as well as accidental impurities. Fixed substances, such as black lead, are easily discovered by remaining as a residue when the sophisticated article is heated. Water, which is frequently present, sometimes in the proportion of fifteen or twenty per cent., may be readily discovered; for the little scales of iodine, if narrowly examined, will exhibit minute drops of moisture adhering to them; if rolled in bibulous paper, they will moisten it; or if shaken in a dry phial, they will adhere to its sides. The tests of the New Pharmacopœia are as follows:—"Entirely soluble in ether. It sublimes without leaving any residue, and the portion which first comes over does not include any slender colourless prisms emitting a pungent odour. 12·7 grains dissolved in an ounce of water containing 15 grains of iodide of potassium, require, for complete decoloration, 100 measures of the volumetric solution of hyposulphite of soda."

Actions and Uses.—Iodine in large doses is irritant and corrosive; and in medicinal doses alterative, tonic, deobstruent, and capable of producing, when given for some time, a peculiar state of general disturbance termed iodism.

When placed in the cellular tissue, it causes local inflammation and the formation of abscesses. Quantities of two or three drachms of solid iodine, when given to dogs, are speedily evacuated by vomiting; but when the œsophagus is tied, they cause death in from two to seven days, producing numerous yellow spots and little ulcers in the stomach, and a peculiar rose-tint of the liver. (Cogswell.) Hertwig found that such doses killed every dog to which they were given. Horses and cattle are less susceptible than dogs, both of the local irritant and general constitutional effects of iodine. This probably results from the structure of their alimentary canal, the chemical nature of their alimentary juices, and the large quantities of starchy food which are present in the canal, and which convert the iodine into the mild, insoluble iodide of starch. Hertwig mentions, that doses of from forty to sixty grains given to horses twice a day, for fourteen days continuously, caused merely slight diarrhœa, with black-coloured evacuations and increasing emaciation. Professor Dick has repeatedly given iodine to the horse in large quantities for several weeks, without observing any other symptom than the total refusal of water. In one case, he gave for three weeks doses averaging two drachms per day, and amounting, towards the end of the experiment, to two ounces daily. Quantities of several ounces have also been given to cattle with the same negative results. But the slight effects observed in these and in Professor Dick's cases, while they certainly depend in great part on the natural insusceptibility of horses and cattle to the poisonous action of iodine, are also partly owing to the iodine having been given in the solid form, and hence being slowly, and perhaps only partially, dissolved and absorbed. It is no uncommon thing to find boluses of iodine—and, indeed, of many other substances—in the intestines of horses, almost in the same condition in which they were administered several days or weeks before,—a strong argument in favour of giving medicine in as soluble a condition as possible. But though iodine has often little effect on horses and cattle when given in these large doses, and in a solid state, still, in medicinal doses, and in a properly soluble form, it usually produces marked effects. It imparts new activity to the digestive and assimilative processes, and improves the appetite and the general strength. Hence it is usually considered a tonic. When given for some time, it also increases the nasal mucus and saliva, as well as the biliary and pancreatic fluids, and accelerates the removal of effete matters, and the assimilation of fresh materials. During its employment, various morbid processes are arrested, and glandular enlargements absorbed, which entitles it to the appellation of a deobstruent. These effects are usually ascribed to what is termed an alterative action, and probably result from the stimulant power which iodine exerts, especially upon the secreting glands and vessels, and in virtue of which the blood and solids nourished by it undergo some beneficial changes. When given for a long time in considerable doses, it produces a state of constitutional debility, emaciation, and derangement of almost all the functions, called *iodism.* The usual symptoms of this condition are loss of appetite, abstinence from water, languor, and inaptitude for exertion. In the human subject, wasting of the testicles and mammæ have been observed; and in the bull, atrophy of the testicles, with loss of sexual desire. (Morton.) But among the lower animals iodism is of exceedingly rare occurrence, and even in man it is now scarcely ever seen. Where it does occur, it may be readily arrested by immediately withholding the medicine; exhibiting quantities of starch, so as to convert any iodine that may still be unabsorbed into the mild, innocuous iodide of starch; and then giving mineral tonics, bitters, and a nutritive diet.

Iodine produces its constitutional effects by whatever channel it enters the body. Like the other non-metallic elements, it unites with hydrogen. Being thus converted into hydriodic acid, it is absorbed, and may be detected in many of the secretions and excretions, as in the blood, sweat, saliva, milk, and especially in the urine, by adding to them a cold solution of starch, and then a little chlorine or a few drops of nitric acid, when the blue iodide of starch is immediately formed. Iodine leaves the body chiefly in the urine. Many consider that, like mercury, lead, and digitalis, it has a cumulative effect. But this is extremely doubtful; for it has been given to man in small doses for many months together, and even for more than a year, without any deleterious consequences being observed; while its effects, unlike those of mercury and other undoubted cumulatives, cease whenever its administration is discontinued.

Its compounds with iron, copper, or mercury are generally believed to have few of the actions of iodine; and in large doses, in which their effects are most discernible, exhibit only the actions of the base. The iodide of potassium, however, retains all the more important properties of the iodine, only differing from it in being somewhat less powerful, and rather apt to act on the kidneys.

Iodine is employed in many different diseases, sometimes rationally, and often empirically. In inflammatory affections it is unsuitable so long as acute inflammation and fever continue; but when these are subdued, it is of service in all animals as an alterative and tonic in promoting convalescence, and as a resolvent for removing effusions, such as hydrothorax and ascites, indurations of mucous membranes, and enlargements of glands. Indeed, in chronic glandular affections, few remedies are so effectual as iodine; and perhaps the best proof of this is its success in reducing enlargements of the thyroid gland,—a disease occasionally met with in man, and known as goître, or Derbyshire neck. It is often serviceable amongst the lower animals in chronic enlargements of the liver and udder, and also in rheumatism, especially that of a chronic nature, and amongst cattle. It is given with some benefit in scrofulous affections, as in diseases of the mesenteric glands, pulmonary consumption, and malignant tumours. There are, however, no cases in veterinary practice in which iodine is of more decided and unfailing advantage, than in that variety of diabetes insipidus which affects the horse. In this disease, from twenty to thirty pints of urine are often evacuated daily, the animal suffers from intense and insatiable thirst, and rapidly loses strength and flesh. The symptoms, however, even when very aggravated, yield almost immediately to the use of iodine; the thirst disappears, the urine is reduced to its normal quantity, and the animal is restored to perfect health, and that often within two or three days. The modus operandi of iodine in curing diabetes is not very evident, the removal of thirst being the only apparent physiological action capable of exerting any curative influence. Its tonic action can have little to do with this therapeutic effect; for one or two doses are often sufficient to establish a perfect cure, while no such prompt curative result is produced by iron, quinine, or other powerful tonics. Iodine is used by some practitioners in the treatment of chorea and epilepsy in dogs, but without much advantage. In doses of a scruple, with one drachm each of camphor and extract of belladonna, I have found it serviceable in allaying the cough and irritability of catarrh, bronchitis, and bronchitic influenza. It is said to mitigate the evils of excessive doses of mercury; to arrest the process of ulceration; and to counteract poisoning by strychnia, brucia, and veratria.

Iodine is much used externally. When applied to a mucous surface or to the skin, especially where it is thin and tender, it causes superficial inflammation. Hence it is used as a stimulant and resolvent in swellings of joints, bursal enlargements, strains of tendons, thickening of the periosteum, scrofulous and other tumours, sore throat, and indurations of the udder, in which it is most effectual when frequently applied with smart friction. In cutaneous eruptions, as mange, scab, and ringworm, it is often useful; as also in mallenders, sallenders, and other sorts of scurfiness, especially in the neighbourhood of joints. In many of these cases it may be advantageously mixed with sulphur or mercurial ointments, or used alternately with them. It has recently been applied in a somewhat novel manner in the cure of indolent sores and chronic ulcers, which are first enveloped by a piece of lint smeared with simple cerate; over this is sprinkled from one to five grains of iodine, and this is covered with a piece of oiled silk and tinfoil. Excess of iodine must be avoided, as a corrosive instead of a healing action will be produced. Slowly evaporated, it has been recommended by Dr W. B. Richardson as a disinfectant; and it decomposes the organic compounds, probably by uniting with their hydrogen. Iodine is contra-indicated in high fever, acute inflammation, and derangement of the bowels; and Hertwig considers that, in most affections of the eyes, even in those of a chronic kind, it does more harm than good.

Doses, etc.—The dose of iodine for the horse is from ℈i. to ℈iij.; for cattle, from ℈iij. to ℈iv.; and for dogs, from grs. iij. to grs. viij. Such doses should be given three or four times a day, and may be continued for a week or ten days, then withheld for a day or two, and, if necessary, again administered as before. Much larger doses than these are often given with impunity, but in most cases without any increased medicinal effect. If it be thought requisite to give iodine in very large quantity, it should be exhibited in moderate but often repeated doses; for, when so used, it is more certain in its effects, and less apt to derange the bowels, than when administered less frequently in larger doses. It should be given some time after eating, so as to prevent as much as possible its conversion into the mild, insoluble iodide of starch. It is usually given to horses and dogs in boluses made up with any convenient excipient; but although this form recommends itself by its facility of administration, it is more uncertain in its effects than a good fluid preparation. Such a preparation may be readily obtained by shaking one part of iodine and one of iodide of potassium in three or four parts of water. The addition of the iodide of potassium, whilst it does not interfere with or alter the action of the iodine, ensures its perfect solution and full action. The solution may be diluted with water as required; and its dose is easily ascertained, for the iodide is about half as powerful as iodine itself. Some practitioners use the compound solution of the Edin. Phar., which is thus prepared:—"Take of iodine two drachms; iodide of potassium, an ounce; distilled water, sixteen fluid ounces. Dissolve the iodide and iodine in the water with gentle heat and agitation." Each fluid ounce of this solution contains thirty grains of iodide of potassium, and seven and a half grains of iodine; and is equivalent to twenty-eight grs. of iodine. The dose of it for horses and oxen varies from f℥i. to f℥ij., and for dogs from ♏xv. to ♏xl.

Tinetures of iodine should be made, like the watery solutions, with iodide of potassium, otherwise they do not bear dilution. They are, however, little used, and for most purposes have nothing to reeommend them in preferenee to the eompound solutions, whieh have the advantage of eheapness, and further, keep unaltered for a mueh longer time. An ounee eaeh of iodine, eamphor, iodide of potassium and strong ammonia, with a draehm of oil of rosemary or lavender, as a flavouring ingredient, and eight ounees of proof spirit, make a good embroeation for sore throat.

For external use the eompound solution is often quite suitable, but an ointment may also be employed. That eommonly used at the Edinburgh Veterinary College eontains one part of iodine and eight of lard, and, when freshly prepared and applied with smart frietion, it aets very well. But the iodine is apt to separate from the lard and beeome partly volatilized ; whilst the insoluble iodine is often only partially absorbed. These evils may be easily obviated by using one part eaeh of iodine and iodide of potassium, with six or eight of lard. For external purposes, espeeially for all eutaneous diseases, the *iodide of sulphur* bears favourable eomparison with most remedies. It is readily prepared by "heating gently in a elean oil flask four parts of iodine with one part of sulphur until fusion is effeeted. Part of the iodine volatilizes, and the remainder unites with the sulphur." (Pereira.) It is a red-brown fluid, and is generally used as an ointment made up with six or eight parts of lard. This makes a eapital dressing for indolent sores, farey buds, and itehy skin eomplaints.

IPECACUAN.

Ipeeacuanha. Dried root of *Cephaëlis Ipecacuanha.*

Nat. Ord.—Rubiaceæ. *Sex. Syst.*—Pentandria Monogynia.

The *Cephaëlis Ipecacuanha* is a small Brazilian plant with a ereeping stem, whieh gives off a few branehes aseending to the height of several inches. The root, which is the offieinal part, is collected at all seasons. It occurs in twisted, knotted, annulated pieces, three or four inches in length, of the thickness of a quill, and covered with a brittle brown bark, which is of greater medicinal value than the tough white internal woody matter. The powder is greyish-yellow, and has an acrid bitter taste, and a faint nauseous odour. It communicates its properties to water and alcohol. The cortical, external, and most active part of the root contains a fixed fatty matter, wax, gum, starch, lignine, about two per cent. of an odorous volatile oil, and about one per cent. of a colourless, uncrystallizable alkaloid called *emetina.* It is of such activity, that two grains given to a dog caused violent vomiting, inflammation of the stomach and intestines, stupor, and death in twenty-four hours. (Magendie.)

Actions and Uses.—Ipecacuan is irritant, emetic, slightly cathartic; and, in the human subject, diaphoretic and expectorant. In virtue of its emetic action, it is also sedative. Bracy Clark considered that three ounces would kill a horse. It acts more powerfully on dogs and other carnivora, causing considerable irritation of the alimentary canal. In canine patients it is, in properly regulated doses, a mild and safe emetic, acting more slowly and gently than sulphate of zinc or of copper, and producing less secondary nausea and depression than tartarized antimony. When it fails in producing a full emetic effect, it usually acts as a laxative. When given to the human subject, it also augments the secretion of the skin and pulmonary mucous membrane; and these effects may be developed independently of any other action, by giving the medicine in combination with opium, and in doses insufficient to cause vomiting. These valuable diaphoretic and expectorant actions are, however, produced with difficulty, either in dogs or in any other of the domesticated animals.

It is given to dogs and cats for the various purposes of an emetic, to relieve derangements of the digestive organs by the evacuation of undigested food or irritant matters; and to arrest febrile and inflammatory complaints, especially of the eyes, brain, or air-passages, by reducing the action of the heart, and bringing the stomach and bowels into a healthy condition. Dalafond and other French veterinarians consider that it gently opens the bowels and allays irritation, and accordingly prescribe it in cases of diarrhœa in cattle, in doses of from one to three scruples, given in gruel, or any simple drink. In colds and sore throats amongst horses, the Messrs Dollar, of New Bond Street, London, give with advantage a drachm of ipecacuan with an ounce of the solution of the acetate of ammonia in a pint of water, repeating the dose several times daily. Such a combination appears to answer well where the patient is feverish, the appetite indifferent, and the bowels somewhat out of order.

Doses, etc.—The dose, as an emetic for the dog, is from grs. xv. to grs. xxx.; and for the cat, grs. v. to grs. xij., given in tepid water, either alone or with a grain of tartar emetic. Mr Mayhew recommends for the dog four grains of ipecacuan, a quarter of a grain of tartar emetic, with a dessert-spoonful of antimonial wine, all dissolved in an ounce of tepid water, and repeated every half hour until vomiting takes place. Some practitioners use, as a nauseant and sudorific, the celebrated *Dover's Powder*, or the pharmaceutical imitation of it, which is made by triturating together one part each of ipecacuan and opium, and eight parts of sulphate of potash. This is given to dogs in doses of from grs. x. to grs. xv., and even occasionally to the horse in quantities of ʒi. or ʒij. It should be administered four or five times a day, and the patient should have plenty of diluents, and be kept well clothed.

IRON AND ITS MEDICINAL COMPOUNDS.

IRON. Ferrum. Fe.

Iron is a brilliant, lustrous metal, with a specific gravity of about 7·73. It is very tenacious, malleable, and ductile, and capable of being welded at a low red heat. The carbonate, bisulphuret, with the black and red oxides, are its most common ores. It has been used in medicine for upwards of three thousand years, and appears to have been the first mineral substance administered for the cure of disease. It is still sometimes given in the metallic state, in the form either of wire or filings, as an antidote in cases of poisoning by soluble salts of mercury and copper. Iron, so long as it remains in the metallic state, acts only mechanically. Some of its more soluble salts are irritant and caustic when given in large doses. Such are the sulphuret, nitrate, and sesqui-chloride. In properly regulated doses, all of them are astringent and tonic. The salts of the black oxide are generally more active than the corresponding salts of the red oxide. The British Pharmacopœia enumerates fifteen compounds of iron; but as they owe their properties to a common base, and differ but little even in the degree of their action, I shall only notice the sesqui-oxide, carbonate, sulphate, iodide, and chloride; and for veterinary purposes, even this small number might possibly be diminished without materially weakening our curative resources.

Red, Per, or Sesqui-oxide of Iron. Ferrugo. Rust of Iron. $Fe_2 O_3$.

The red oxide of iron is found native in the different varieties of hæmatite, ochre, and red chalk. For medicinal purposes it is prepared in the form of a hydrate, by boiling a solution of green vitriol with a few drops of nitric acid, and as much sulphuric acid as it already contains; decomposing the solution of sesqui-sulphate ($Fe_2 O_3$, $3 SO_3$), so made, by ammonia; and washing the soft red-brown magma thrown down. This is a hydrated sesqui-oxide, with the composition $Fe_2 O_3 + 2 HO$. When dried, it constitutes the red-brown sesqui-oxide of the shops. It is devoid of odour, and insoluble in water. When heated, it assumes a purple colour, and loses its chalybeate taste. It dissolves in hydrochloric acid without effervescence.

Actions and Uses.—The red oxide closely resembles the other compounds of iron in its general actions, but is considerably less active. It is seldom used internally, and is only of medicinal importance as being the best antidote for arsenical poisoning. It is generally believed to owe its efficacy to its causing the formation of an insoluble arsenite of the protoxide of iron; and is most effectual when given in the form of the soft red-brown magma above noticed. Dr Douglas Maclagan says that

12, and Devergie that 32, parts of this are sufficient to neutralize one part of arsenious acid.

CARBONATE OF IRON. Ferri Carbonas. $Fe\ O, CO_2$.

Carbonate of the protoxide of iron is the compound present in the clay-iron ore, and in many mineral waters. It may be readily prepared by decomposing a solution of sulphate of iron or green vitriol by carbonate of soda. It is a greyish-green body, having a chalybeate inky taste, and dissolving with brisk effervescence in muriatic acid. Water, unless containing a considerable proportion of carbonic acid, fails to dissolve it. When exposed to the air, it very readily gives off its carbonic acid, and becomes converted into the red hydrated sesqui-oxide—a change constantly taking place along the banks of chalybeate waters. To prevent this decomposition, Dr Clark of Aberdeen proposed to boil the freshly made carbonate with sugar; and this plan is now adopted by the Pharmacopœia in the preparation of the *saccharated carbonate of iron*, which occurs in small coherent greyish-brown lumps, has a sweet, very feeble chalybeate taste, and should contain at least fifty-seven per cent. of the carbonate. (Brit. Phar.)

Actions and Uses.—The saccharine carbonate, from its solubility in acidulous solutions, and perhaps from other causes, is an active and valuable chalybeate; and, as such, it is used for all the purposes to which the sulphate is more commonly applied. It is especially convenient in canine practice, and is administered in the same doses as the sulphate.

SULPHATE OF IRON. Ferri Sulphas. Green Vitriol. Copperas. $FeO, SO_3 + 7\ HO$.

All the sulphate of iron used in commerce and medicine is prepared by the manufacturing chemist from a clayey shale or alum schist, highly impregnated with pyrites or bisulphuret of iron ($Fe\ S_2$). Such schists yield both alum and sulphate of iron by the same process. They are broken into fragments, which are placed in large heaps, frequently wetted, and exposed to the air for several months. The aluminum, the iron, and the sulphur of the shale thus treated, absorb oxygen, and hence are produced alumina, oxide of iron, and sulphuric acid, the last of which speedily unites with the two bases, forming sulphate of alumina and sulphate of iron. Large quantities of water are then added, and the solution thus obtained is evaporated, when the sulphate of iron crystallizes out, leaving the more soluble sulphate of alumina in solution.

Properties.—Sulphate of iron occurs in bluish-green, oblique rhombic prisms, which, on exposure to the air, gradually absorb oxygen, becoming opaque, and covered with a red coating of sesqui-oxide. In specimens containing an excess of sulphuric acid, the oxidation ensues less rapidly. It has an intensely inky metallic taste; and is insoluble in rectified spirit, but soluble in three-fourths of its weight of boiling water, and twice its weight of cold water. When heated it fuses, and readily parts with six atoms of its water of crystallization, retaining, however, the seventh far more tenaciously. The characters already mentioned are sufficient to distinguish it in mass. In solution, it is easily identified by its giving, with sulphuretted hydrogen, no precipitate; with hydro-sulphuret of ammonia, a black precipitate of sulphuret of iron ($Fe\,S$); with caustic potash, a green precipitate of oxide ($Fe\,O$); with yellow prussiate of potash, a bluish-white precipitate, which gradually deepens in colour; with red prussiate of potash, a beautiful deep blue precipitate; and with a solution of galls, a black precipitate, which forms the basis of common ink. These tests will also identify any other proto-salt as well as the sulphate.

Actions and Uses.—Sulphate of iron is irritant, astringent, and tonic.

Its irritant properties appear to depend on its chemical action on the albuminous tissues, and the vital reaction consequently induced; but are so slight as to be scarcely observable either in horses or cattle. In dogs, however, Dr Smith found that two drachms introduced into the stomach occasioned vomiting and death in about twenty-four hours; as also "redness of the alimentary mucous membrane, and the effusion of a thick layer of tough mucus;" and that the same quantity applied to a wound, proved fatal in twelve hours.[1] The astringent action of the salt appears to be merely a mild degree of its irritant action; is exerted both locally and on the system at large; and probably induces that diminution in the size and increase in the firmness of the spleen, mentioned by Weinhold as the common effect of the continued exhibition of sulphate of iron to dogs.[2] When given in small and repeated doses, it acts not only as an astringent, but also as a tonic, increasing the amount of the red globules, and, according to the chemical school of therapeutics, directly supplying iron to the hæmatosin. But this explanation is unsatisfactory; for salts of copper, zinc, and silver, besides quinine, cod-liver oil, and substances of very dissimilar composition, and which can supply no iron to faulty hæmatosin, appear to produce tonic effects similar, if not identical, with those of iron. Such effects more probably depend on a chemically astringent and vitally invigorating influence, exerted first on the intestinal canal, and subsequently on all parts of the body to which the medicine is carried in the blood. But the tonic action of iron, however obscure in its *modus operandi*, is certain and powerful, and consequently of much service in the alleviation and cure of many diseases affecting the domesticated animals.

Sulphate of iron is beneficially administered in all cases where the powers of life are languishing and depressed; in diabetes, red-water in cattle, and internal hemorrhages; dysentery, consumption, and various other forms of scrofula; in sub-acute and exhausting affections of the mucous membranes and skin, as scarlatina, erysipelas, and purpura hæmorrhagica; in indigestion and impaired action of the bowels, depending upon local atony and general weakness; in chorea, and occasionally also in epilepsy; and in convalescence from most acute debilitating diseases. In the treatment of such cases, the patient must further be provided with a clean, roomy, well-ventilated dwelling, and abundance of good, easily digested, and nutritive food. When such sanitary conditions are neglected, tonics, and

[1] Christison on Poisons, p. 506.
[2] Pereira's Elements of Mat. Med., 3d Edit., pp. 193 and 776.

indeed all medicines, act slowly and imperfectly. Sulphate of iron, although scarcely entitled to be considered as an anthelmintic, often prevents the production of worms, by arresting an undue accumulation of mucus, and imparting a healthy tone to the intestines. Although itself devoid of cathartic action, it increases the activity of most purgatives with which it is combined. It is occasionally used externally as a styptic and astringent, usually in the form of powder or solution. Sulphate of iron is contra-indicated where there is excessive firmness of the muscular system; where the blood-vessels are unduly filled with blood containing an abnormal proportion of red globules; and where there is acute fever, active inflammation, or much irritability of the bowels. During early convalescence from inflammatory complaints, milder tonics are often preferable.

Doses, etc.—The dose for the horse is from ʒi. to ʒiij.; for cattle, from ʒij. to ʒiv.; and for dogs, from grs. x. to grs. xx. These doses should be repeated three or four times a day; and may either be made into a bolus with linseed meal and treacle, dissolved in water, or mixed with soft food. It is often conjoined with other medicines. Thus, in want of tone and torpidity of the bowels in horses, a drachm is given daily with one or two drachms of aloes. Such a combination is also often serviceable in removing worms. As a useful general tonic for horses, two drachms of green vitriol are united with half an ounce each of ginger and gentian, made into a ball, and repeated twice or thrice daily. The same ingredients dissolved in a bottle of ale or gruel prove a valuable tonic for cows. The quantities mentioned will make three doses for sheep, and eight or ten for dogs. Thirty grains, with a drachm each of common salt and nitre, is recommended to arrest the progress of sheep-rot. After sulphate of iron is used for several days, it is usually advisable to withhold it altogether for a day or two, or replace it during that time by some other tonic. This, besides preventing derangement of the digestive organs, also appears to maintain the continued efficacy of the medicine. Care should further be taken, that, during its use, the bowels be kept open by the occasional exhibition of laxatives, which are especially necessary in horses and dogs, on account of their liability to suffer from the astringent and constipating action of the salt. The dark colour and disagreeable odour which the feces usually acquire during a chalybeate course, depend on the production, in the intestines, of the hydrated sulphuret of iron, and generally indicate that the medicine is being given in unnecessarily large doses.

Iodide of Iron. Ferri Iodidum. Fe I.

The British Pharmacopœia gives the following directions for the preparation of iodide of iron :—"Take of fine iron wire one ounce and half, iodine three ounces, distilled water fifteen fluid ounces. Introduce the iodine, iron, and twelve ounces of the water into a flask ; and having heated the mixture, raise the heat, and boil until the solution loses its red colour. Pass the solution through a small paper filter into a dish of polished iron, washing the filter with the remainder of the water, and boil down until a drop of the solution taken out on the end of an iron wire solidifies on cooling. The solution should now be poured out on a porcelain dish, and as soon as it has solidified should be broken into fragments, and enclosed in a stoppered bottle."

Properties.—When thus prepared, it is a greyish-black, lustrous, crystalline mass ; has a styptic, metallic taste; dissolves readily in water and alcohol ; gives off violet-coloured fumes of iodine when heated ; and when exposed to the air, deliquesces, gradually becoming of a red-brown colour. This change is owing to the formation of sesqui-oxide of iron ; and is retarded by boiling the solution, from which the salt is crystallized, in syrup, or by keeping the solution secluded from light, and in well-stoppered bottles containing portions of fresh iron wire.

Actions and Uses.—The iodide of iron resembles the sulphate in its actions and uses, but is somewhat more active. It is irritant, astringent, and tonic. Although at one time thought to conjoin the actions of its two constituents, it is now satisfactorily shown that it resembles the compounds of iron rather than those of iodine. This is especially observable when the salt is given in doses sufficiently large to induce obvious physiological effects. Thus, three drachms given to a dog caused purging and vomiting; and one drachm in concentrated solution killed a rabbit in three hours and a half, with the symptoms and *post-mortem* appearances of poisoning with other soluble salts of iron.[1] It may be used in the same doses for exactly the same purposes as the commoner and cheaper sulphate. Mr Morton makes special mention of its efficacy in diabetes, and in nasal gleet accompanied by debility. Besides being used in powder and in solution, a syrup is prescribed in human and also in canine practice.

TINCTURE OF THE PERCHLORIDE OF IRON. Tinctura Ferri Perchloridi. Perchloride of Iron ($Fe_2\ Cl_3$) dissolved in water and spirit.

The watery solution of the perchloride of iron is an orange-brown, odourless, inky-tasting fluid, with a specific gravity of 1·338. It mixes with water and spirit in all proportions. Diluted with two measures of rectified spirit, it constitutes the medicinal tincture popularly known as steel drops, or tincture of steel. It has a reddish-brown colour, an etherial odour, an acid chalybeate taste, and a specific gravity of 0·992.

Actions and Uses.—From its solubility, the tincture of the perchloride is one of the most active and convenient salts of iron, and it deserves to be more extensively employed in all veterinary patients for the various purposes for which the sulphate and other salts are generally used. In frequently repeated doses of an ounce, I have found it especially serviceable in cases of red water in cattle, in farey, purpura hæmorrhagica, and other typhoid complaints in horses, and in distemper in sickly dogs. Besides being given simply diluted with water, it is also sometimes used conjoined with hydrochloric acid, tincture of gentian, and other tonics. Where indigestion occurs from want of tone, whether in horses or cattle, a good combination consists of an ounce each of the tincture of iron and compound tincture of gentian, to which a few drops of hydrochloric acid are sometimes a useful addition. Such a mixture is also often valuable as a vermifuge.

[1] Experimental Essay on Iodine and its Compounds. By Charles Cogswell, M.D. Harveian Prize Essay for 1837, pp. 126-134.

The dose for horses and cattle is f℥i. or f℥ij.; for dogs, from ♏v. to ♏xv.

JALAP.

Jalapa. Dried tubers of *Exogonium Purga.*—(Bentham.)

Nat. Ord.—Convolvulaceæ. *Sex. Syst.*—Pentandria Monogynia.

Jalap derives its name from Xalapa, a town in Mexico, whence it was first obtained, and from the neighbourhood of which it is exported. The plant is a hardy climber, found on the heights of the American Andes, 6000 feet above the level of the sea. When brought to this country, it thrives well, flowers, and comes to maturity in the open air. It has a smooth, round, brown annual stem; long-stalked, cordate, and somewhat hastate leaves; purple-red flowers; and a fleshy perennial root-stock, with numerous pear-shaped tubers, varying in size from a walnut to an orange. These tubers, which are the officinal part of the plant, are gathered about March or April, just before the young shoots spring, and dried by suspending them in nets over or near the fire. The tubers of the jalap, when imported entire, are round or pear-shaped, and invested with a thin brown wrinkled cuticle. Sections or slices of the tubers are often met with; are of a hard and compact structure, a marbled appearance, and more or less marked with concentric rings and pieces of shining resin. Jalap is triturated with difficulty, unless mixed with some hard salt, as the tartrate or sulphate of potash. When powdered, it has a pale-brown colour, a faint disagreeable odour, and a taste at first sweet, but afterwards acrid and nauseous. Water only dissolves it partially, and separates the starchy and mucilaginous matters without the cathartic, resinous principle, which, however, is readily dissolved by alcohol.

The various analyses of jalap differ considerably from each other. Guibour, who is generally very trustworthy, found about 28 per cent. of saccharine matters, 29 of gum and starch, 21 of woody fibre, and 17 of resin. This resin is the active principle of jalap; is contained in different specimens in the proportion of ten to eighteen per cent.; and is best obtained by moistening the powder with rectified spirit, and then passing it slowly through a percolator, recovering the alcohol by distillation, and evaporating the residuum to a proper consistence in a vapour bath. It occurs in dark-brown brittle opaque fragments; but Dr Murray Thomson informs me that he has got it nearly white, by adding water to the alcoholic solution, and collecting the precipitated resin on a filter. It has a sweetish smell and an acrid taste; is insoluble in water, but soluble in alcohol; and causes, in doses of a few grains, repeated and violent purging. This resin has recently been found to consist of two different sorts,—the one soft, brown, greasy, and soluble in ether; the other, the more abundant of the two, colourless, odourless, tasteless, insoluble in ether, and remarkable for the production of a beautiful crimson colour when moistened with sulphuric acid. (Gregory.) Jalap is not very liable to adulteration. When of good quality, it is dark-coloured, dry, compact in structure, and with an acrid, bitter taste. Worm-eaten roots are more active than those which are sound, for, the starch being removed, the resinous substance remains in relatively larger amount.

Actions and Uses.—Jalap is irritant and cathartic. Two drachms caused the death of a small dog, when the œsophagus was tied so as to prevent the drug being vomited. When a large quantity is rubbed into the skin, or applied to any of the mucous membranes, it excites inflammation. As a cathartic, it has little effect either on horses or cattle. Two or three ounces given to the horse have no effect on the bowels, but act slightly on the kidneys (Moiroud); and the same, and even larger quantities, are without perceptible effect on cattle. In doses of one to two drachms it is a good purge for sheep and pigs. In dogs, its cathartic action is mild. It is believed to operate chiefly on the small intestines, increasing both their secretions and their peristaltic motion. It is used for all the ordinary purposes of a purgative for the dog; and, though not very speedy, is safe and certain in its effects. It is also useful as a vermifuge.

Doses, etc.—The dose for the dog is from ʒi. to ʒij.; but it is better to give it in combination than alone. One of the best purges that can be used for dogs consists of from twenty to fifty grains of jalap, with one or two grains of calomel, made into a bolus with linseed-meal and water, or any convenient excipient.

JUNIPER TOPS, BERRIES, AND OIL.

Juniperi Cacumina Fructus et Oleum. Dried tops and fruit of the *Juniperus Communis*. Oil distilled from the unripe fruit.

Nat. Ord.—Coniferæ. *Sex. Syst.*—Diœcia Monadelphia.

The *Juniperus communis* is a shrubby, evergreen tree, growing in most temperate countries. The leaves are dark green, linear, and arranged three in a whorl. The berries are dark purple, of the same size and appearance as currants, and marked with little furrows. They have an aromatic, terebinthinate odour, and a warm, sweetish taste, followed by bitterness. They are chiefly brought from the shores of the Mediterranean and the Baltic. All parts of the tree have very similar properties, and yield, when distilled with water, a transparent colourless oil, possessing in a concentrated form all the characteristics of the plant. It is present in the berries in the proportion of about one per cent., and is associated with grape-sugar, gum, resin, lignine, salts of lime, and water.

Actions and Uses.—The tops, berries, and oil of Juniper are carminative and diuretic. In horses and cattle two ounces of the berries act only on the digestive organs; but three or four ounces induce diuresis, and also slight diaphoresis. The action of the heart, however, is not affected. Juniper resembles the balsams and turpentines in its general actions, but is less stimulant. It is given as a stomachic and carminative in indigestion and flatulence; is said to diminish the evil effects of bad fodder and marshy pastures; and is believed to be serviceable both in the prevention and cure of sheep-rot. It is occasionally used as a diuretic, and is both prompt and powerful in its effects. It was at one time used for fumigating stables and cow-houses; and its vapour was considered to be a certain cure for the filaria occasionally found in the bronchial tubes of calves and lambs. But for both these purposes it has been superseded by more effectual remedies.

Doses, etc.—As a stomachic, the dose of the berries for horses and cattle is from ℥i. to ℥iij.; for sheep, from ʒij. to ʒiv.; and for dogs, from ℈i. to ℈iij. These doses may be repeated several times a day. As a diuretic, the oil, which is the best form of administration, is given to horses and cattle in doses of ʒss.; and to the dog in doses of ♏iv.; and repeated at short intervals till diuresis is induced. The berries are usually given coarsely powdered and mixed with fodder, and are readily eaten by most animals. Sheep especially soon become very fond of them. A decoction is used occasionally internally, and also as an external stimulant.

A brown, empyreumatic oil, called *huile de cade*, is got from the wood of the *Juniperus oxycedrus* by dry distillation; is used in France and other continental countries for most of the purposes of oil of tar, and is especially recommended in cutaneous diseases.

LEAD AND ITS MEDICINAL COMPOUNDS.

Lead. Plumbum. Pb.

Lead rarely occurs native in the metallic state, but is commonly found as a carbonate or sulphuret. It has a bluish-grey colour, and is readily cut or scratched. It has a density of 11·38. When exposed to the air it oxidizes, loses its metallic lustre, and becomes dull and opaque. In pure soft water it undergoes similar changes, and the oxide first formed becomes converted into the carbonate. It unites with oxygen in four several proportions, and also forms many important crystallizable salts.

Actions, etc.—Lead, in the metallic state, appears to be devoid of medicinal or poisonous action. In the form of shot, it is occasionally used by the lower order of dealers, temporarily to relieve the distressed breathing of broken-winded horses. Four ounces were given to a dog at the veterinary school of Lyons, without effect. The metal may sometimes, however, be converted within the body into an oxide or active salt. The soluble compounds of lead, as the nitrate and acetates, are corrosive and irritant. Those which are insoluble, as the oxides and carbonates, have scarcely any irritant action. All preparations of lead, when introduced into the system in repeated doses for some time continuously, induce a peculiar state called *plumbism*, which is sometimes met with among the lower animals, though not so often as in man. In the end of 1851, Mr Shenton, an intelligent veterinary surgeon, practising in Derbyshire, had eleven fatal cases of this disease among horses, and several among cattle; and about the same time, Mr Mayor, V. S., of Penrith, had two horses that died near the head of Ullswater, in Westmoreland.[1] The symptoms of lead poisoning among the lower animals are analogous to those observed in man. They usually continue, in a more or less aggravated form, for several weeks or months. They appear to depend on the accumulation of lead in the system, and on the consequent impairment of the digestive functions and the deterioration of the blood. The appetite becomes capricious, is sometimes entirely gone, and at other times is morbidly increased. Colic and constipation are not so invariable as in the human subject. The gums and teeth are of a grey or blue colour. The animals suffer a good deal of pain, gradually fall off in strength and condition, and exhibit a disordered or depressed state of the nervous system, with symptoms of paralysis, epilepsy, or apoplexy. Indeed, these diseases occasionally simulate some forms of lead poisoning so exactly, as to have been mistaken for them by various practitioners. In a letter received from Mr Shenton, he thus describes the symptoms in those cases of lead poisoning which came under his observation:—"There was a rough staring coat, a tucked-up appearance of the abdomen, and a slightly accelerated pulse; in fact, symptoms of febrile excitement, which usually, however, passed away in about a week. About this time, large quantities of grey-coloured matter were discharged from the nostrils, and saliva from the mouth; but at no time was there any enlargement of the sub-maxillary, lym-

[1] See Professor George Wilson's excellent paper on cases of Lead Poisoning, in the Monthly Journal of Medical Science for May 1852.

phatic, or salivary glands. Neither was there constipation of the bowels, which appears to be nearly always present in cases of lead poisoning in man. Fits and partial paralysis came on at intervals; and when the animals got down, they often struggled, for a long time ineffectually, to get up again. The breathing up till this period was pretty tranquil, but now became so difficult and laboured, that the patients appeared in danger of suffocation. The pulse was in no case above sixty or seventy; and I ascribed the difficulty of respiration to a paralyzed state of the respiratory apparatus. The animals did not live more than two or three days after these symptoms appeared. The *post-mortem* appearances varied but little. The lungs and trachea were inflamed; the lungs engorged with large quantities of black blood; the trachea and bronchi filled with frothy spume. In all cases but two, the villous part of the stomach presented isolated patches of increased vascular action; and in all cases the intestines, and especially the large ones, were inflamed. The blind pouch of the cæcum was nearly gangrenous. There was nothing remarkable about the liver, spleen, or kidneys, except that they were of a singularly blue appearance. The brain and spinal cord were not examined." It may further be observed, that, in dogs destroyed in about three weeks by lead poisoning, the muscular system was flaccid, pale, and bloodless. (Schwepfer.)

Mr Cartwright of Whitchurch, Salop, records, in the Edinburgh Veterinary Review for August 1863, three cases of milch cows poisoned by eating sheet lead which had been used for lining tea-chests, had been carelessly thrown on the manure heap, and thence been spread on the clover fields. Besides failure of the milk and the appetite, grinding of the teeth, and dulness, several curious symptoms are mentioned. The head was rested against the wall as if the animal was asleep, whilst the pupils were nearly closed, and were little sensitive to light or to the movements of the finger. The gait was weak and tottering; whilst for an hour or two at a time, the cows, although persistently standing on their hind limbs, went down on their knees, propping themselves against the wall. The cases survived four or five days. From the fourth stomach of one a pound of the fragments of the sheet lead was removed; the lining membrane was thickened, and of a brown colour. The mucous membrane, both of the stomachs and bowels, was unnaturally vascular, and exhibited in places patches of ecchymosis. The liver was pale, clay-coloured, compact, and contained little blood. There was nothing amiss with the urinary organs. Mr W. Watson, Rugby, records the poisoning of three cows, which languished for several months, and died from the eating of grass on which the bullet spray from the Rugby Rifle butts had fallen. Fragments of the lead were found adhering to the coats of the stomachs, and the poison was also detected, by Professor Tuson of the Veterinary College, in the intestines, liver, and kidneys. (Veterinarian for May and August 1864.)

Mr Herapath reports, in the Chemist for 1855, some interesting cases of lead poisoning which followed the erection of smelting furnaces on the Mendip Hills, in 1853. The injury appeared to commence half a mile from the chimney, and to extend for half a mile farther. Oxide, carbonate, and sulphate of lead were found on the herbage, hedges, and hay. On the live stock "the effects of the metal were, a stunted growth; a leanness; shortness of breathing; paralysis of the extremities, particularly the hinder ones; the flexor muscles of the fore-legs affected, so that they stood upon their toes; swelling of the knees; but no constipation or colic, as in the human species;—in a few months death followed. If the injured beasts were removed to another farm they never throve. In the young the symptoms were more conspicuous, and the mortality greater. Lambs were yeaned paralytic; when three weeks old they could not stand, although they made great efforts to do so; in attempting to feed them from a bottle, they were nearly suffocated from paralysis of the glottis; twenty-one died early, out of twenty-three. Colts also died, and those that lived could not be trotted 150 yards without distressed breathing. Pigs confined to the stye were not injured, but if allowed to roam were soon affected. The milk of cows and sheep was reduced in quality and quantity, and cheese made from the former had less fat in it; I found in the milk of both, minute traces of lead. The dead subjects showed the mucous surfaces to be paler than natural; the lungs had large portions of a dark-red colour, with circumseribed edges, not like ordinary inflammation, but evidently surcharged with fluid. This accounted for the shortness of breathing, as only portions of the lungs were fit to perform their functions; in some parts there appeared bluish spots, where the powder had been stopped by the bifurcation of the air-passages. A blue line appeared in the gum of the lower jaw, which, Dr Taylor said in court, was not caused by lead poison, as it did not occur, as in the human subject, on the upper edge of the gum, but where the gums first come into contact with the teeth, about 3-16ths of an inch below the top edge. I therefore dissected out this line, which was about three-quarters of an inch in length, and the thickness of sewing cotton; and, by aid of carbonate of soda and the blow-pipe, reduced a spangle of lead from it, quite visible to the jury without the aid of a microscope. I was agreeably surprised at this result, as I expected the mark arose only from altered blood; but it will now become, in the hands of a good blow-pipe manipulator, the most ready means of detecting lead in the dead subject."

"It will be observed that, of the symptoms, those of emaciation, paralysis, and the blue line, are similar to those of the human subject; that constipation and colic are absent; and we get two new ones, shortness of breathing, and swelled knees. I will merely add, that the Company agreed, without calling witnesses, to pay L.500 damages, and to buy the estate at full value."

When animals are killed while labouring under the saturnine malady, or die from its effects, lead can usually be found in most parts of the body. It has been detected in the blood, the contents of the stomach and intestines, the brain and spinal cord, the muscles, lungs, liver, and spleen. It has hitherto been generally believed that lead accumulates particularly in the liver; but this appears doubtful, for the late Professor George Wilson discovered it in especially large amount in the spleen,—an organ which can always be speedily and easily examined, on account of "its small size, loose, spongy texture, and comparative freedom from fatty matter." The best process for preparing for analysis the different organs and parts to be examined, in cases of lead poisoning, is that which Professor Wilson followed in the chemical investigation of Messrs Shenton and Mayor's cases, above referred to. The organs should be digested in aqua regia, over a slow fire, until all the soluble matters are separated. The liquid, which should then be clear and pale-brown, is cooled, filtered through calico, and evaporated. The dried residue is charred in a Hessian crucible, boiled with diluted nitric acid, filtered, dried, and dissolved in dilute hydrochloric acid. This solution will usually be sufficiently pure to exhibit, with appropriate reagents, the characteristic reactions of lead and its compounds. It should give a black precipitate, with sulphuretted hydrogen and hydro-sulphuret of ammonia; a white precipitate, with sulphuric acid and soluble sulphates; and bright gamboge-yellow precipitates, with iodide of potassium and bichromate of potash.

In cases of lead poisoning among the lower animals, the metal usually enters the body in the food or water which the animal consumes. Lead poisoning sometimes occurs from drinking water conveyed through leaden pipes, or allowed to stand in leaden cisterns. The conjoined action of the air and moisture soon produces, on the surface of the metal, a crust of hydrated oxide, which unites with carbonic acid drawn from the air, and crumbles away as a crystalline powder, partly dissolved and partly suspended in the fluid. According to Professor Christison, this crust consists of two equivalents of neutral carbonate and one of hydrated oxide. Leaden vessels, or vessels with lead solder, must therefore be used with caution for holding, especially for any length of time, water or other fluids likely to effect a solvent action on the metal. This caution is especially applicable to the softest and purest waters, as distilled, rain, or snow waters. Hard waters, however, are not so liable to be contaminated with lead, for their carbonates, sulphates, phosphates, or other salts, are decomposed; and the carbonic, sulphuric, phosphoric, or other acid, unites with the lead, forming slowly an insoluble crust, which effectually protects the metal from any further action of the air or water. This view was generally entertained by the best authorities, but seems now to require some modification; for several cases of lead poisoning have occurred where lead cisterns have been acted upon by waters decidedly hard. A bit of iron, a patch of soft solder, or even a few carbonaceous or other impurities in the lead, appear, in such cases, to set up a galvanic action with the metallic lead, thus inducing its solution. Such facts should make persons exceedingly careful to prevent lime, mortar, nails, or in fact any foreign body, from getting into leaden cisterns, and to empty and clean them out occasionally, especially when new.

There are two chemical antidotes for poisoning with lead, —namely, sulphuretted hydrogen, which converts it into the insoluble black sulphuret; and sulphuric acid, which converts it into the insoluble white sulphate. Iodide of potassium has also been recommended. These antidotes should be given with diluents. In treating cases of lead poisoning, the bowels must be opened by saline purgatives, and sulphate of magnesia appears especially suitable. Where there is much pain, opium must be prescribed; and in all cases good feeding and tonics are necessary to perfect a cure. It need scarcely be added, that all food and water impregnated with the poison must be carefully avoided.

Oxide of Lead. Litharge. Plumbi Oxidum. Pb O.

When melted lead is exposed to a current of air it oxidizes, forming a yellow, semi-crystalline powder, called *massicot;* and when this is fused at a red heat, it acquires a foliaceous or scaly structure, and a red or greyish-red colour, and is known as *litharge.* It is insoluble in water and spirit, but combines with acids, forming salts which are colourless unless coloured by the acid. It may be readily identified as a preparation of lead by the tests above mentioned. One of the simplest tests for its purity is its being almost entirely soluble in diluted nitric acid.

Actions and Uses.—Litharge, in large doses, acts as an irritant, and also produces the usual constitutional effects of other lead compounds. It is not administered internally, but is occasionally used externally as an astringent and desiccant. Many vegetable fluids, when shaken with it, are deprived of their colour; and it is sometimes used for this purpose by pharmaceutical chemists. It is largely employed in the preparation of the *emplastrum lithargyri or plumbi*—the diachylon or common sticking plaster. The Brit. Phar. gives the following directions for its preparation:—"Take of litharge, in very fine powder, four pounds; olive oil, one gallon; water, three pints and a half; boil all the ingredients together gently in a copper pan over a clear fire, and keep simmering for four or five hours, stirring constantly until the oil and litharge acquire a proper consistence for a plaster, and adding more water during the process if necessary." When these ingredients are thus heated together (at a temperature between 200° and 212°), the oil undergoes a change similar to what occurs in the making of soap. It separates into two parts,—a sweet, soluble, basic principle called glycerine; and several fatty acids, of which the chief are the oleic and margaric. These fatty acids unite with the oxide of lead, and the substance so formed may thus be regarded as a soap in which oxide of lead has taken the place of potash or soda. The lead plaster is sold in rolls, about a foot in length, of a yellowish-white colour, and a faint, sweet, soapy odour. It is brittle when cold, but becomes soft and adhesive when heated. It is a mild stimulant, and a useful agent for uniting incised wounds, and protecting them from the action of the air. It is generally used spread on linen or calico. Such plasters may be rendered more adhesive, and consequently better adapted for most veterinary purposes, by adding three or four ounces of pitch or resin to every pound of the lead plaster.

IODIDE OF LEAD. Plumbi iodidum. Pb I.

Iodide of lead is best prepared with equal parts of nitrate of lead and iodide of potassium. Each salt is dissolved in a small quantity of water, and the solutions mixed, when double decomposition occurs, nitrate of potash remaining in solution, and iodide of lead precipitating. It is met with in brilliant golden yellow crystalline scales; or in a fine, bright yellow, heavy powder. It is tasteless, colourless, and very sparingly soluble in water.

Actions and Uses.—In its physiological actions it resembles the other salts of lead, but exhibits no effects which indicate its acting as a compound of iodine. In the belief, however, of its uniting the actions of lead and iodine, it has been prescribed for the reduction of scrofulous and other indolent tumours, being commonly used internally, and also at the same time externally, in the form of an ointment. But as its efficacy in these cases is not well established, and as the effects ascribed to it are more certainly produced by other remedies, there is little use of retaining it in the veterinary materia medica.

ACETATE OF LEAD. Sugar of Lead. Plumbi acetas. $Pb\ O, \bar{A} + 3HO$.

DIACETATE OF LEAD. Plumbi diacetas. $2Pb\ O, \bar{A}$.

There are at least five different acetates of lead, but only two of them are of much medicinal value,—namely, the neutral acetate, or sugar of lead, and the diacetate which occurs in the solution generally sold in the shops as Goulard's Extract.

Preparation and Properties.—Sugar of lead is obtained by dissolving litharge in acetic acid; or very commonly, on the large scale, by immersing sheets of lead in diluted pyroligneous acid, scraping off the crust of subacetate and subcarbonate which accumulates, dissolving it in acetic acid, and evaporating the solution. Acetate of lead is sold in minute needle-like crystals, which are slightly efflorescent, and have an acetous odour, and a sweet astringent taste. Water at 60° dissolves somewhat less than its own weight of it. The salt, when dissolved, has a remarkable power of uniting with different proportions of the oxide, forming subsalts; and one of these, namely, the sub, or diacetate, is the chief ingredient of the familiar Goulard's Extract, which usually, however, also contains several other subacetates. The officinal *solution of the diacetate* is prepared with "acetate of lead, five ounces; litharge, in fine powder, three and a half ounces; water, a pint and a sufficiency. Boil the acetate of lead and litharge with the water for half an hour, constantly stirring; then filter, and, when the liquid is cold, add to it more distilled water, until the product measure twenty fluid ounces. Keep the clear solution in stoppered bottles." (Brit. Phar.) It is a eolourless, transparent, alkaline fluid, with a sweet astringent taste; and, when evaporated, exhibits the diaeetate, usually in the form of a tough, opaque, uncrystalline mass. It is distinguishable from the aeetate, by its yielding a eopious white preeipitate, when a stream of earbonie aeid is passed through its watery solution.

Actions and Uses.—The aeetates, like the other soluble salts of lead, eause, in exeessive doses, irritation, peeuliar derangement of the nervous system, and depression of the aetion ef the heart; in frequently repeated doses, those peeuliar symptoms already mentioned as eharaeterising lead poisoning; and in medieinal doses, astringent and sedative effeets. The two aeetates above mentioned are very similar in their aetions and uses; but the diaeetate, on aeeount of its greater solubility, is probably the more aetive of the two, and, although not used internally, is generally preferable as an external applieation, on aceount of its being less apt to dry up or erystallize.

Hertwig exhibited sugar of lead to horses in doses of a pound, and observed nausea, eolie, a quiek, small, hard pulse, stiffness of the limbs, paralysis of the nerves of sight, and sometimes of other parts, insensibility, and often death. Its effeets on eattle are even more energetie. Prinz observed, that doses of half an ounee daily, eontinued for three days, produeed in eows feverishness, with a quick, throbbing pulse, eolie, and other symptoms of abdominal pain, in one ease mania, but in none death. Mecke found that eight ounces, dissolved in water, and given in divided doses during two days, destroyed nine cattle; the first on the second, and the last on the fourteenth day after the poison had been given. Early in 1857, a farmer near Glasgow lost eight eows from their boiled food having been prepared in a large tub, whieh had been obtained from a chemieal manufaetory, and was impregnated with sugar of lead. The symptoms were similar to those above reeorded. Doses of half an ounee, administered to dogs, and retained in the stomaeh by tying a ligature round the œsophagus, produced intense intestinal irritation, and death oceasionally in nine hours, but sometimes only after two or three days. (Orfila.) On post-mortem examination, the villous coat is found grey, and of a macerated appearance, owing to the chemical action of the salt, and sometimes vascular, especially in cases that survive long. Similar symptoms and appearances are also observed when sugar of lead is applied in large quantity to a wound, injected into the veins, or brought into contact with any absorbing surface.

Acetate of lead owes its astringent effect in great part to its forming insoluble compounds with the albumen of the animal fluids and soft solids. Its astringent action is accompanied or succeeded by a topical sedative effect, resulting from the diminished calibre of the vessels, and probably also from some action on the nerves of the part. It is administered in cases of internal hemorrhage, and also in diarrhœa and in dysentery, in which it is effectual in drying up the excessive secretions, and quieting the undue vermicular motions. In such cases, it is generally prescribed with opium. Some practitioners speak favourably of its use in diabetes. On account of its twofold action as an astringent and sedative, it is very effectual in the treatment of such case of superficial inflammation as conjunctival ophthalmia, painful skin eruptions, and bruises. It is besides, a useful astringent for many chronic sores. Both the acetate and diacetate have been used as deodorisers and disinfectants; but are probably much inferior to compounds of chlorine and sulphurous acids.

Doses, etc.—The dose of acetate of lead for horses and cattle is from ℈i. to ℈iij.; and for dogs, from grs. ij. to grs. v. These doses may be given either in bolus or solution, and repeated two or three times a day. Care must, however, be taken to avoid producing the constitutional effects of the poison, and the medicine must be withdrawn whenever the appetite becomes impaired, the gums discoloured, or the bowels constipated or affected by spasms. For external application, sugar of lead is used in powder, as an ointment, or more commonly dissolved in forty or fifty parts of water, with a little vinegar, to increase its solubility. Goulard's extract, diluted to suit convenience, is also much used for external purposes. Whichever solution be preferred, it should, when used for the relief of inflammation, be applied diligently, and for a considerable time, cloths wetted with it being kept continually about the part. A mixture of one part of Goulard's extract, and four of olive oil, has been recommended as a cooling application for blistered or contused surfaces. (Morton.)

LINSEED AND LINSEED OIL.

Nat. Ord.—Linaceæ. *Sex. Syst.*—Pentandria Pentagynia.

The *Linum usitatissimum*, or common flax, yields several important articles of the materia medica. The stem affords lint and tow; and the crushed seed linseed meal and linseed oil.

To prepare the stem for use, the plant is steeped in water, which, in the more recent and improved methods of procedure, is used hot; the starchy and cellular matters are got rid of by scutching; whilst the tough fibres are hackled and carded, the shorter coarser portions forming tow, the finer, when bleached, constituting linen, which is scraped down to form the familiar surgeon's lint. Both lint and tow are often useful for protecting wounds from the irritating action of the external air; and, when saturated with moisture, are frequently, with advantage, substituted for poultices.

Flax Seeds are small, smooth, and shining, of a brown colour and oval shape, flattened laterally, and pointed at one extremity. They are inodorous, but have an oily mucilaginous taste. The external envelope of the seed consists chiefly of starch and wax, with about one-sixth of its weight of mucus. The internal nucleus contains albumen and gum, with about one-fifth part of a fatty oil—the linseed oil of commerce. The seed boiled or soaked is much used as an article of diet for all the domesticated animals, especially in scrofulous affections; and is also prescribed, usually in the state of decoction, as a mild mucilaginous demulcent in irritating diseases of the intestines, kidneys, and bladder, and in poisoning with irritants and corrosives. It makes very good poultices, especially when mixed with an equal quantity of bran or oatmeal; but the bruised *oil cake*—the residue remaining after the expression of the linseed oil—is usually substituted for this purpose, as it is cheaper, less apt to become rancid, and equally effectual in retaining heat and moisture. Both linseed meal and bruised oil cake are in every-day use in making up boluses intended for immediate administration; the common mass employed for making up so many medicines into balls or pills, usually consists of equal quantities of linseed flour and treacle. Linseed flour, when made into a paste with water and a little oil, form a good *luting* for distilling apparatus.

Linseed Oil is got from the flax seed by expression, and, except in the case of the inferior qualities, without the aid of heat. It has a pale yellow colour, a mild but nauseous taste, and a specific gravity of about 930. When exposed to the air it speedily becomes rancid; but when in a thin stratum it quickly dries up, forming a hard transparent varnish, and hence its extensive use in the arts as a drying oil. It is insoluble in water, soluble in five times its weight of boiling alcohol, in about forty parts of cold alcohol, and in about one and a half of ether. Like other oils, it forms soluble compounds with alkalies. When mixed with an equal quantity of lime water it forms carron oil —a remedy once much used for scalds and burns. It is sometimes adulterated with rapeseed oil; but is more commonly of inferior quality, from its being rancid, prepared with the aid of heat, or unsightly from the presence of impurities.

Actions and Uses.—Linseed oil is cathartic and emolient. Though less active as a cathartic than castor oil, it is more frequently used on account of its being considerably cheaper. It causes less irritation than most other purgatives, and hence is especially indicated in such cases of irritability of the intestinal canal as require the administration of medicine. It is often serviceable in arresting diarrhœa, by carrying down the crude undigested food or other irritant matters, which so commonly produce that complaint. In virtue of its laxative and emolient actions, it is frequently of value in relieving irritant poisoning; is useful in cases where saline or active vegetable purgatives have been ineffectual, or where their repetition is deemed inexpedient; and is prescribed in colic, usually along with stimulants and anodynes. For horses, the colic draught usually given at the Edinburgh Veterinary College consists of one pint of linseed oil, with one or two ounces each of laudanum and oil of turpentine. On account of its lubricating and emollient properties, linseed oil is of much benefit in relieving cases of choking; is sometimes injected into the rectum and bladder to allay irritation of these organs; and is often applied as a soothing dressing to hard, dry, and irritable surfaces. It is often employed for making ointments and liniments; but on account of its drying properties, is less suitable than olive oil or lard.

Oleaginous matters enter largely into the composition of all valuable feeding stuffs, but appear to answer best when used in the familiar condition of "cakes." I have repeatedly tested the feeding value of linseed oil, but have always been disappointed with the results. During the winter of 1862–63, I undertook a series of experiments on eighty twenty months' old Cotswold sheep, which were equally divided into four pens. All were regularly supplied with as many sliced Swedes, and as much clover hay, as they could readily clear up. Each sheep in the first pen received half a pound of the best linseed cake, broken into conveniently small pieces. Lot second had for each half a pound of old beans split. Lot third had half a pound each of good oats. Whilst the fourth lot had for each sheep an allowance of two ounces of linseed oil made up with a few ounces of bran, and a little wheat straw cut into chaff. The experiments were continued for three months. The oil fed sheep, although costing rather more than the others, made the least progress. They were longer in becoming used to, and clearing up readily, their artificial food. A few individuals, having had at first more than their share of the mixture, scoured freely, two died, and several did indifferently throughout the experiment. The sheep of this lot ate more Swedes and hay than their fellows, but notwithstanding made less progress. Although of equal value with the others at the commencement of the experiment, there was at the end of the three months a difference of four or five shillings per head. Indeed, when examined for the purpose of selecting from them those fit to kill, the butcher found but four "indifferently ripe" sheep. Amongst the other three lots, all the sheep, with the exception of one or two in each, were readily selected for purchase. The sheep on cake had, throughout, rather the healthiest and best appearance, but those getting beans were little inferior to them, and the lot on oats were only a little behind those fed with beans. From these experiments we are compelled to conclude that linseed oil, which is probably a fair representative of the mild fixed oils, cannot be successfully used for the feeding of sheep. Except in carefully regulated doses it has the disadvantage of inducing a laxative effect. It increases rather than diminishes the quantity of ordinary food consumed. As an adjuvant feeding stuff it thus appears to be of lower value than linseed cake, beans, or oats.

Doses, etc.—The doses of linseed oil as a cathartic for horses and cattle, is from Oi. to Oij.; for sheep, from f℥iij. to f℥vi.; and for dogs, from f℥i. to f℥ij.

LIQUORICE ROOT.

Glycyrrhizæ Radix. The fresh dried root, or under ground stem of *Glycyrrhiza Glabra.*

Nat. Ord.—Leguminosæ. *Sex. Syst.*—Diadelphia Decandria.

Liquorice grows in most countries of Continental Europe, thriving best on dry, light, sandy soils. The best qualities are grown in England, or imported from Spain or Italy. The plants vary from two to four feet in height, and have large, irregular yellowish-green leaves; papilionaceous white flowers; and long, creeping, fibro-fleshy, perennial roots, or underground stems, which are smooth, brown, cylindrical, and about the thickness of the thumb, arrive at perfection about the third year, have a peculiar sweet and somewhat sickly taste, and constitute the officinal part of the plant. To preserve them from moisture, they are generally kept in sand. The powdered root has a yellow colour, a strong sweet taste, and is soluble in water, and also, though to a less extent, in alcohol. It contains starch, albumen, lignine, wax, various salts, a resinous oil, to which it owes its sub-acrid taste, a nitrogenous, crystallizable substance, and a sweet, yellow, uncrystallizable principle termed glycion or glycyrrhizine. The natural juice or watery infusion, when concentrated until it becomes solid, forms the well-known extract of liquorice or black sugar.

Actions and Uses.—Liquorice resembles sugar in all its more important uses, whether dietetic or medicinal. It is serviceable as a demulcent and emollient, especially in irritation of the pulmonary mucous membrane in man; and is employed for making up boluses, and covering the disagreeable taste and odour of many drugs. In veterinary practice, however, it is generally superseded by treacle.

MAGNESIUM AND ITS MEDICINAL COMPOUNDS.

MAGNESIA. Calcined Magnesia. Oxide of Magnesium. Mg O.

Magnesia is usually prepared by heating the carbonate to redness, in covered crucibles, until its water and carbonic acid are expelled. It may also be got by adding caustic potash to a solution of any magnesian salt.

It is a white odourless powder, with a slightly earthy taste, is very sparingly soluble in water, and has much affinity for moisture, but little for carbonic acid. Its density is about 3·, but varies somewhat according to the temperature at which it has been prepared, the lighter sorts being produced at the lower temperatures. It is sometimes impure from the presence of lime, silica, or carbonate of magnesia. Magnesia and its salts give negative results with sulphuretted hydrogen and hydrosulphuret of ammonia; a white precipitate with carbonate of potash; and a white precipitate with phosphate of soda, in the presence of ammonia or its carbonate.

Actions and Uses.—Magnesia is antacid and laxative, but is rarely used in veterinary practice. It is sometimes prescribed in doses of from ʒij. to ʒviij. for foals and calves troubled with indigestion; and is best given along with carminatives. In virtue of its antacid properties, it is an antidote for poisoning by the mineral acids. It removes arsenic from solution, is consequently one of the antidotes for that poison, and is best given in the form of a gelatinous hydrate made by adding caustic potash to a solution of the sulphate. Its laxative effect is scarcely appreciable in either horses or cattle, but is produced in dogs, especially when used with jalap, calomel, or other purgatives. It is most conveniently given suspended in milk or gruel.

Carbonate of Magnesia. Magnesia alba. $3 (Mg\,O, CO_2 + HO.) + Mg\,O, 2\,HO.$

Carbonate of magnesia is prepared by mixing carbonate of soda with bittern or with a solution of sulphate of magnesia, when double decomposition ensues, and the precipitated carbonate of magnesia is collected, washed, and dried. The solutions when mixed without heat yield a heavy, when boiled they produce a light, carbonate of magnesia. The former is dense, loose, and granular; the latter lighter and more starchy, and when examined under the microscope is found to be partly amorphous with the intermixture of numerous slender prisms. Both varieties are white, odourless, and tasteless, sparingly soluble in water, but more easily dissolved in hot than in cold water.

In their actions and uses the carbonates are very analogous to magnesia itself, and may be used in double the quantity either as antacids or laxatives.

Sulphate of Magnesia. Epsom Salt. Magnesiæ Sulphas. $MgO, SO_3 + 7\,HO.$

This important magnesian salt is found in various rocks, soils, and mineral waters. It has been long recognised as a constituent of the famous mineral streams of Epsom, whence it derives its vernacular name.

Preparation.—It is generally prepared from magnesian limestone, or dolomite, which is a mixed carbonate of lime and magnesia; or, from bittern, the oily-looking liquid left when sea-water is concentrated for the separation of common salt. When prepared from the first of these sources, the following process is usually adopted:—The magnesian limestone is calcined to expel water and carbonic acid; the caustic lime and magnesia, so formed, are slaked with water; hydrochloric acid is added in sufficient quantity to convert all the lime into chloride of calcium, which is separated in solution, leaving the insoluble magnesia, which is then treated with sulphuric acid, and the sulphate of magnesia thus produced crystallized out. Bittern, when concentrated, yields an abundant crop of crystals of sulphate of magnesia; and still larger quantities are obtainable by first adding some sulphuric acid to convert the chloride and other salts into the sulphate. These two processes are sometimes conjoined, the calcined dolomite being added to the bittern, the mixture heated with diluted sulphuric acid, and the solution concentrated until crystals separate on cooling.

Properties.—Epsom salt is usually sold in transparent, colourless, needle-like crystals; but by slow crystillization it may be got in large four-sided rhombic prisms. It has a cooling, saline, nauseously bitter taste; is insoluble in alcohol, but soluble in its own weight of temperate water, and in three-fourths of its weight of boiling water. When heated, it fuses in its water of crystallization; but, as the temperature is raised, the water volatilizes, and a colourless glass remains. "In solution, it gives copious white precipitates, with chloride of barium, and with a mixed solution of ammonia, hydrochlorate of ammonia, and phosphate of soda."—Brit. Phar. It resembles sulphate of zinc, from which, however, it may be readily distinguished by its saline bitter taste; by the absence of metallic astringency; and by its neutral solution giving with sulphuretted hydrogen no precipitate, but with potash a white precipitate, which, unlike that produced by potash in solutions of sulphate of zinc, is insoluble in excess of the precipitant. Epsom salt is distinguished from Glauber's salt by its neither efflorescing when exposed to the air, nor communicating any yellow colour to the flame of alcohol. From oxalic acid, for which it has been sometimes mistaken, it is easily distinguished, by its finer and more needle-like crystals, its bitter taste devoid of acidity, and its precipitating alkaline carbonates without effervescence.

Actions and Uses.—Sulphate of magnesia is a purgative, alterative, and febrifuge. Like other saline substances, it is a tardy and uncertain cathartic for horses, tends in them to act rather on the kidneys than on the bowels, but in repeated doses of two or three ounces proves a valuable alterative and febrifuge. Among dogs its purgative effect is slow and irregular, and often accompanied by nausea and vomiting. For cattle and sheep, however, it is a most convenient and useful cathartic, being second only to common salt in rapidity and fulness of action. Among cattle, it usually operates in about twelve or fifteen hours, and in full doses causes very fluid evacuations. Although purgation is its most prominent effect, it also appears to augment the secretions of the kidneys and skin, and especially when given in moderate frequently repeated doses. It is given to ruminating animals for all the ordinary purposes of a purgative—to evacuate the bowels in indigestion, constipation, and many cases of diarrhœa; to remove noxious matters from the blood, as in febrile and inflammatory affections; and to induce extensive counter-irritation, as in inflammation of the brain, eyes, and most other organs, except the intestines. It is a useful antidote in cases of lead poisoning, for it produces an insoluble sulphate, and also calls forth the action of the bowels, which, in these cases, is apt to be impaired. In smaller and repeated doses it acts as a diuretic; but is seldom, if ever, used for that purpose. It is frequently used as a constituent of laxative clysters.

Doses, etc.—The dose, as a cathartic for adult cattle, is lbj. to lbij.; for average-sized calves, of two to three months, ℥iij. or ℥iv.; and for sheep, from ℥iv. to ℥vi. Doses, amounting to about a fourth part of these, are often effectual in removing indigestion, and keeping up the action of other cathartics. Epsom salt should be given dissolved in from ten to twenty parts of water. To remove its nauseously bitter taste, and render it more palatable, it may be given with a quantity of treacle, or with sulphuric acid, in the proportion of fifteen or twenty drops to every ounce of salt. To expedite its action, and prevent nausea and griping, some carminative should also be added, such as a drachm of ginger to the ounce of salt. To increase its activity, as is often advisable, when it is given in those cases of obstinate constipation and torpidity of the bowels, so frequently occurring among cattle, it may be advantageously united with twelve or fifteen croton beans, a drachm of calomel, or half an ounce of gamboge, and its exhibition followed up by repeated doses of treacle and ginger. Although not very serviceable as a purgative for horses, it is, however, a useful febrifuge. In doses varying from one to three ounces it is used in influenza, pneumonia, and indeed in most febrible and inflammatory disorders, especially where the bowels are much out of order. In such circumstances it improves the appetite, diminishes the noisome clamminess of the mouth, lessens the fever, and helps to establish and maintain a healthy and regular action of the bowels. It may be given once or twice daily, but should be altogether withheld, or diminished in amount, whenever the bowels become unduly relaxed, or where flatulence or spasms follow its use. It seems to act more certainly and regularly when given in solution rather than in bolus. It is often conjoined with half an ounce of nitre and a drachm of camphor; or in convalescence from acute disorders, with an ounce of compound tincture of gentuan, or an ounce of ginger and a drachm of carbonate of ammonia.

MARSH MALLOW ROOT.

Althææ Radix. Dried Roots of *Althæa officinalis.*

Nat. Ord.—Malvaceæ. *Sex. Syst.*—Monadelphia Polyandria.

The plants of the natural family, *Malvaceæ*, are rich in mucilaginous matter, and most of them yield tenacious fibres, from which cordage is often obtained. The several species, *Gossypium*, are surrounded by delicate, twisted-looking hairs, which constitute raw cotton. The marsh mallow, and more rarely the common mallow, are the plants of the family chiefly in request for their mucilaginous properties. The former grows both in this country and on the Continent, generally in the neighbourhood of rivers and salt marshes. The flowers, stem, and leaves yield mucilage, but in lesser proportion than the root, which is consequently preferred. It is sold in light-coloured, fibrous, silky-looking pieces, several inches long; has a sweet, mucilaginous taste; contains about twenty per cent. of mucilage, with starch and a little sugar; and readily yields its properties to water.

Actions and Uses.—Marsh mallow root is very similar in its actions and uses to linseed and other mucilaginous substances. It is employed both internally and externally, for all the purposes of a demulcent and emollient, in the various forms of drench, poultice, and fomentation; and is also occasionally used for making up boluses, emulsions, and other pharmaceutical preparations.

MERCURY AND ITS MEDICINAL COMPOUNDS.

MERCURY. Quicksilver. Hydrargyrum. Hg.

From its mobility and volatility, this metal has been aptly named after the messenger of the gods. To its silvery appearance, it owes its Latin synonyme hydrargyrum; and to its mobility and metallic lustre such appellations as aqua argentum, aqua metallica, and quicksilver. Although occasionally found in metallic globules, its most important source is the sulphuret, or cinnabar, of mineralogists, chiefly obtained from Idria in Carniola, and Almaden in South America. When the ore is heated with iron or lime the mercury distils over, and is exported in cylindrical wrought-iron bottles, holding from 60 to 112 lbs.

Mercury is easily distinguished by its mobility, liquidity, and silvery-white lustrous appearance. It is tasteless and odourless, freezes at —40°, and boils at 660°, forming a dense colourless gas. Its specific gravity at 60° is 13·5, and its atomic weight is now generally considered as 100. When triturated with fatty or saccharine substances, it loses its fluidity and globular structure, and becomes a dark grey powder. By this process of extinction, as it is called, the mercury is reduced to a state of fine subdivision, and a small portion is probably also oxidized. Mercurial ointments, liniments, and some other compounds, are made in this way.

Chemical Tests.—Mercury itself is easily identified by the characters already mentioned, and its several compounds are distinguishable by the following tests. When slightly heated in a test tube with dry carbonate of soda, they undergo decomposition, their metallic portion volatilizing, and condensing in the cool part of the tube in minute metallic globules. All compounds of mercury in solution, when treated with a solution of protochloride of tin, yield white precipitates, which, as the precipitant is slowly added, become grey, owing to the calomel first thrown down being gradually reduced to the metallic state. All the lower or sub-salts of mercury, that is, all the compounds of the black oxide, as calomel or the sub-nitrate, when dissolved, and treated with sulphuretted hydrogen or hydro-sulphuret of ammonia, give black precipitates of the sulphuret (Hg_2S); with potash and lime water, black precipitates of the oxide (Hg_2O); and with iodide of potassium, green precipitates of sub-iodide of mercury (Hg_2I). All the higher or proto-salts of mercury, that is, all the compounds of the red oxide, as corrosive sublimate or the higher nitrate, when dissolved, and treated with sulphuretted hydrogen, give a precipitate which is at first yellow, but on continued addition of the precipitant, passes through the various shades of brown until the black sulphuret ($Hg\,S$) is obtained; with caustic potash and lime water, yellow precipitates of the hydrated red oxide ($Hg\,O$); and with iodide of potassium, the brilliant carmine-red iodide ($Hg\,I$).

Actions and Uses.—So long as mercury remains uncombined with oxygen, acids, or salt radicles, it is, like other metallic substances, devoid of physiological action. It has been given to the human subject in doses of several pounds, for the purpose of removing obstruction of the bowels, and exerts only a mechanical effect. When given, however, in a state of fine division, it readily unites with oxygen, and is thus endowed with very active properties. In this way mercurial vapours, in themselves innocuous, speedily become, by exposure to the air, powerfully poisonous, as is well illustrated by the following case:—"In 1810, the 'Triumph' man-of-war and 'Phipps' schooner received on board several tons of quicksilver, saved from the wreck of a vessel near Cadiz. In consequence of the rotting of the bags, the mercury escaped, and the whole of the crews became more or less affected. In the space of three weeks, two hundred men were salivated, two died, and all the animals, cats, dogs, sheep, fowls, a canary bird—nay, even the rats, mice, and cockroaches, were destroyed." (Pereira, vol. i., p. 813.) Out of 516 workmen variously employed at the Quicksilver Works at Idria, 122 were, in 1856, affected with dyspepsia, scrofula, anæmia, neuralgia, mercurial gout, tremor, and caries. The finely divided mercury so pervades the atmosphere that cows feeding in the neighbourhood of the furnaces suffer from excessive secretion of saliva, become unthrifty, and abort; the calves are also often ailing; whilst trout kept in the adjacent reservoirs, contaminated by the waste products of the furnaces, lose their red spots and become sickly.

With metallic mercury, however, veterinarians have little to do. But many of its compounds are of much interest both as medicines and poisons. Their actions are very various. The nitrates, and the higher chloride, better known as corrosive sublimate, are powerfully irritant and corrosive. The peroxide and lower sulphate are astringent. Many of the compounds are cathartic, such as calomel and blue pill. Some, as the perchloride, are believed to act especially on the kidneys. Most of them undergoing oxidation or partial solution, are absorbed, produce disintegration or decomposition of the blood, and are excreted from the mucous or glandular surfaces. During their presence in the blood or passage out of it, they produce that peculiar state of body called *mercurialism*, of which the symptoms are tolerably uniform in all animals. Secretion and excretion become increased. The saliva is especially augmented, but this is not observable to the same extent amongst the lower animals as in man; large quantities of fæces are passed, containing much mucus and bile; the kidneys and skin are also unusually active; the mouth becomes tender, the gums red and swollen, and the breath fœtid; the pulse is usually somewhat accelerated. There is impaired appetite, with nausea, gradual loss of condition, and general weakness. During the continuance of this peculiar condition, the blood loses in man one-third of its fibrine, one-seventh of its albumen, one-sixth of its globules, and is loaded with a fœtid oil. The mercury is detected in various of the secretions and excretions, but especially in the urine, in which it has been discovered in man four weeks after its administration ceased. (Schneider.) Various curative actions are developed. Anasarcous swellings are removed, and glandular enlargements or indurations diminished, and often entirely dissipated. Acute inflammation is mitigated or subdued, whilst exudation of lymph is arrested. Such beneficial effects are especially observable in pleurisy, rheumatism, liver complaints, and inflammation of the eye, and where the administration of mercurials has been preceded by blood-letting. Mercurialism may be produced in all animals, but with most difficulty in horses, which, like other animals, manifest, however, very various degrees of susceptibility to it. Thus, Mr Percivall, in his "Effects of Medicines," mentions that ten grains of calomel, given to a four-year-old horse, made the mouth so sore by the fifth day, that he "cudded" his hay; whilst a mare had six drachms of calomel, two ounces of blue pill, and mercurial ointment well rubbed into her thighs, without suffering either from sore mouth or salivation. It occasionally follows the exhibition of one large dose, in which case it is unusually violent and difficult to control. It is induced most certainly and safely by small and repeated doses of calomel, or any of the milder mercurials, and its production is expedited by using the medicine both externally and internally, and by employing blood-letting, nauseating medicine, or other means which diminish vascular tension and favour absorption. Whilst mercurialism continues, the patient must be carefully protected from cold and wet. When it is to be arrested, the administration of the mercurial must be suspended, a saline purge exhibited, and the mouth, if sore, repeatedly washed with a solution of alum or borax. Dr Schneider's recent observations indicate that the iodide of potassium, although generally recommended for the purpose, has little, if any, influence in expediting the removal of mercury from the system.

MERCURIAL OINTMENT. Unguentum Hydrargyri.

Mercurial or blue ointment, of good quality, cannot be made on the small scale without immense labour and loss of time. The wholesale manufacturer prepares it in the following manner. The materials, consisting of equal weights of mercury and hog's lard, to which the Phar. directs the addition of one-sixteenth part of suet, "are kept in the fluid state by a temperature of about 100°, and are driven round with rapidity in a circular trough by two spherical iron balls, which are propelled by means of a steam-engine; and in this way extinction is accomplished in the course of twelve hours." (Christison's Dispensatory.) The process is facilitated by adding to the materials a sixteenth part of old ointment. The quality and purity of mercurial ointment may be conveniently judged of by comparing its colour, which is bluish-grey, with that of a specimen of known purity; estimating its specific gravity, which, according to Pereira, should be 1·78; and observing, with a magnifying lens of four powers, whether the metallic globules be extinguished. So long as they continue visible with such a glass, the ointment must be considered as imperfectly prepared. Another simple test is to remove the fatty matters by boiling water, when the residue should be half the weight of the ointment first taken. For most purposes, this ointment is too strong, and may be conveniently diluted with two or three parts of hog's lard or soft soap. All good mercurial ointment contains about one-fifth of its mercury in the state of oxide united with a fatty acid, and this proportion is probably increased when the ointment is applied to the skin with infriction and exposure to the air. The activity of the preparation is believed to depend wholly on the oxidized portion (Christison), metallic mercury being, as already mentioned, altogether devoid of action.

Actions and Uses.—Mereurial ointment, when merely laid on the surfaee of the skin, aets very slightly; but when applied with smart frietion, it induees topical irritation, and even vesieation. It is used in all the domestieated animals as a remedy for mange, seab, surfeit, and other seurfy skin diseases, being generally applied along with tar and sulphurous or iodine ointments. It is oeeasionally used to destroy vermin affeeting the skin, but is not, in this respeet, superior to many milder and safer remedies. It is an effieient stimulant dressing for indolent sores and uleers, and for ehronie swellings. For all such purposes it must, however, be eautiously used, inasmueh as it is apt to beeome absorbed and do much mischief. I have repeatedly known sheep dressed for seab gradually waste and die from mereurial poisoning. This tendeney to beeome absorbed is sometimes useful, and the ointment is applied over a large extent of surfaee, to aid in produeing the eonstitutional effeets of mereury given internally; and even when used alone, two ounees of the stronger mereurial ointment of the shops rubbed daily into the skin of a horse will salivate in four or five days.

Mercurial Liniment. Linimentum Hydrargyri.

It is made by diluting the ointment with about its own weight of lard or oil, and usually adding, besides, some reetified spirit and aqua ammoniæ. Its effeets are similar to those of the ointment. Two eompound liniments suitable for skin diseases, enlarged glands, and chronie indurations, are subjoined:—

Mereurial ointment,	3 ounces.	Mereurial ointment,	2 ounees.
Camphor, .	1 draehm.	Camphor, . .	1 draehm.
Oil of tar, .	4 ounces.	Creasote, . .	1 draehm.
Linseed oil, .	4 ounces.	Liquor ammoniæ,	2 ounces.
		Linseed oil, .	6 ounees.

Mercurial Plaster. Emplastrum Hydrargyri.

The Pharmaeopœia gives the following direetions for preparing mereurial plaster:—"Take of mereury three ounees; litharge-plaster, six ounces; olive oil, one fluid ounee; resin, one ounce. Dissolve the resin in the oil with the aid of heat; let them cool; add the mercury, and triturate till its globules disappear. Then add to the mixture the litharge-plaster, previously liquefied, and mix the whole thoroughly." It is occasionally used as a stimulant application for discussing glandular and chronic enlargements, windgalls, and other bursal swellings.

MERCURY WITH CHALK OR MAGNESIA. Grey powder: Hydrargyrum cum Creta vel Magnesia.

These mixtures are made by triturating together an ounce by weight of mercury with two ounces of chalk or magnesia. Both preparations are laxative and antacid. I have frequently given them with good effect to young calves suffering from indigestion and diarrhœa, in doses of ten or fifteen grains, repeated twice a day, usually united with a drachm of ginger, and administered either in spirits and water, two ounces of linseed oil, or a little gruel. They are also recommended as alteratives for dogs, in doses of from five to ten grains. In the earlier stages of distemper in dogs, Mr Mayhew recommends from grs. v. to grs. xv. of grey powder, conjoined with from gr. i. to grs. v. of ipecacuan.

MERCURIAL OR BLUE PILLS. Pilulæ Hydrargyri.

These pills, though much used in human medicine, are seldom employed in veterinary practice. They contain two parts by weight of mercury, one of liquorice root, and three of confection of roses. The addition to this of about one part of sesquioxide of iron, produces a pill mass which has been recommended by Mr Morton as an alterative for horses, in doses of from half a drachm to a drachm. Mr Mayhew recommends, as a purge for a middle-sized dog, 5 grains of blue pill, 6 grains of powdered colchicum, and 10 grains of extract of colocynth. Five grains of blue pill and 10 grains of compound extract of colocynth, flavoured with a few drops of oil of peppermint or of cloves, makes a convenient laxative and alterative pill for a large dog, or two or three doses for a smaller.

Black Oxide of Mercury. Hydrargyri Suboxidum. Hg_2 O.

The black, grey, or lower oxide of mercury is prepared by decomposing calomel (Hg_2 Cl) with a solution of an alkali or an alkaline earth. It is a heavy black powder, devoid of taste or odour, and insoluble in water and alkalies, but soluble in nitric and acetic acids. It is unstable, and readily decomposed on exposure to light. It is little used, either in human or veterinary practice, is milder than most other mercurials, and forms a series of salts which are less soluble, and consequently less active, than the corresponding salts of the higher or red oxide. The black oxide is chiefly used in the form of a lotion, known as the black wash, and used as a stimulant for unhealthy sores and ulcers.

Red Oxide of Mercury. Hydrargyri Oxidum. Hg O.

The red, yellow, or higher oxide of mercury, also known as red precipitate, is prepared by decomposing corrosive sublimate (Hg Cl) with lime water, or by heating nitrate of mercury (HgO, NO_5) until acid fumes cease to be evolved. Prepared by the former process, it occurs in a hydrated state, has a yellow or brown colour, according to the proportion of the ingredients used, and constitutes the yellow wash of surgery. Obtained by the latter method, it occurs in bright scarlet scales, which become yellow when powdered, and brownish-black when heated, recovering, however, their original colour on cooling. It is dissolved sparingly in water, but readily in hydrochloric acid. It is devoid of odour, but has a metallic, acrid taste. It is greatly more active than the black oxide, causing fatal gastro-enteritis when given to dogs in doses of a few grains. From eight to fifteen grains caused colic in horses, and one or two drachms enteritis and death. (Hertwig.) It is used externally for the treatment of indolent ulcers, luxuriant granulations, unhealthy eruptions, and chronic tumours, being applied in the various forms of powder, lotion, or ointment.

Sulphuret of Mercury. Hydrargyri Sulphuretum. Hg S.

Sulphuret of mercury occurs in two different conditions, as cinnabar, a red brown substance found in Carniola and Spain, either in an amorphous or crystalline state, and constituting, when powdered, the beautiful bright scarlet vermilion; and as Ethiops mineral, a heavy black powder, got by triturating together equal weights of mercury and sulphur. Both of these are insoluble and nearly inert. The latter used to be employed by the old farriers as an anthelmintic and a specific for glanders, and was given to horses in doses of ʒi. to ʒiij. It has now, however, deservedly fallen into discredit.

SULPHATE OF MERCURY. Turbith Mineral. $3HgO, SO_3$.

Subsulphate of mercury is the only one of the four sulphates of this base which possesses any medicinal interest. It is prepared by triturating the higher sulphate with warm water, and is a heavy, inodorous, insoluble yellow powder, with an acrid taste. It poisons dogs in doses of half a drachm to a drachm. It was once frequently used as a remedy for glanders and farcy, as an emetic for the dog, and, on account of its actively irritant properties, as an errhine; but for these and all other purposes, it is now justly superseded by safer and more certain remedies.

CALOMEL. Subchloride of Mercury. Hydrargyri subchloridum. $Hg_2 Cl$.

Calomel is found native in Carniola and Spain, but in too small amount to be of any commercial value. The large quantities used in medicine are obtained either by decomposing a solution of the nitrate with a hot solution of common salt, or by subliming a mixture of the lower sulphate and common salt. The latter process is that usually preferred, and is best conducted in the following manner:—Two equal quantities of mercury are taken. One of these is heated with a little nitric acid, and a sufficiency of sulphuric acid to form the protosulphate of mercury (HgO, SO_3), which is dried and triturated with common salt and the remaining portion of the mercury. The mixture is then introduced into appropriate subliming vessels and heated. The calomel rises in the state of vapour, and is either condensed in dome-shaped receivers, or more commonly conveyed into large chambers, where it is precipitated as a fine impalpable powder, and subsequently washed with cold water, to remove any traces of corrosive sublimate. The chemical changes which occur in this process are very simple:—the protosulphate of mercury being triturated with as much mercury as it already contains, thus becomes converted into a subsulphate (Hg_2O, SO_3), and this, when heated with chloride of sodium ($NaCl$), is decomposed, the mercury uniting with the chlorine of the salt to form calomel ($Hg_2 Cl$), and the other elements forming sulphate of soda.

Properties.—Calomel differs somewhat in its properties, according to the mode of its preparation. When obtained by precipitation, it is usually not quite pure, but contains a trace of metallic mercury. When sublimed and condensed in receivers, it has a fibrous, horny, crystalline structure, a sparkling lustre, and a yellowish-white colour, both in powder and mass. When sublimed and condensed in large chambers, it is finely divided, and of a dull white colour. It is inodorous, nearly tasteless, and insoluble in cold water, alcohol, and ether; but is partially decomposed into metallic mercury and corrosive sublimate, by boiling water, especially when rich in salts, and by potash, soda, and lime. At a red heat it volatilizes, but at lower temperatures it becomes yellow, regaining, however, its original appearance when allowed to cool. Its specific gravity is nearly 7·2.

Impurities.—Although many dread the admixture of corrosive sublimate, it appears to be very rarely present. The minutest trace is readily dissolved out by agitating the calomel with cold water, and testing this solution with sulphuretted hydrogen, caustic potash, or lime water. Sal-ammoniac, which is occasionally present, is discoverable by its taste; while all common inorganic impurities are easily detected on account of their being left when the calomel is volatilized by heat.

Actions and Uses.—Calomel is irritant, stimulant, sedative, alterative, and antiphlogistic; is capable, like other compounds of the base, of causing mercurialism; and, in passing out of the system by the various emunctories, acts, in virtue of its irritant properties, as a cathartic, cholagogue, diuretic, diaphoretic, and sialogogue.

The irritant properties of calomel are greatly inferior to those of corrosive sublimate, and most of the other proto or higher salts of mercury. They are developed, however, along with the usual symptoms of mercurialism, when the medicine is given in doses varying from three to four drachms to horses, from one to two drachms to cattle, from fifteen to thirty grains to sheep, and from six to thirty grains to dogs. Hertwig found that such doses given to these animals caused, in about twenty-four or thirty-six hours, and in dogs in less time, occasional colic and copious excretion of feces, which contained considerable quantities of bile, and were greyish green in cattle, but black in dogs. Such doses, when repeated three or four times, and especially if continued for several days, further induce thin and stinking evacuations, fœtor of the breath, soreness of the mouth, rapid impairment of the appetite and condition, and fatal low fever and dysentery. At the Edinburgh Veterinary College, in June 1853, a healthy donkey got a drachm of calomel daily in three separate doses. About the sixth day the animal became excitable, and the pulse rose to about 85. By the eighth day the secretion of saliva was augmented, the breath was fœtid, the gums red and tender, and the appetite impaired; but nothing abnormal was observed in the quality of the feces or urine. By the twelfth day, these symptoms became more aggravated; the pulse softer and less frequent, indicating the sedative action which renders calomel so useful for many curative purposes; and the strength much reduced. On the fourteenth day, the administration of the calomel was suspended; but death occurred two days afterwards. The animal had received fourteen drachms in fourteen days. On post-mortem examination, the teeth were found quite loose, the mucous membrane of the mouth and air-passages blanched, while that of the stomach and intestines was softened, easily torn, and in many places thickly covered with mucus and epithelium. The liver was rather friable, but the kidneys, spleen, and lungs were healthy. Three or four grains given night and morning salivated large dogs in a week, and killed them in nine days; the only notable appearances were inflammation of the large intestines, and of the sympathetic ganglia of the abdomen.

Hertwig considers that dogs and swine, on account of their often getting rid of the medicine by vomiting, are less easily affected than the other domesticated animals; and that horses are less susceptible than cattle.

There is no doubt that the absorption of calomel necessarily precedes the production of its general actions; but the manner in which it is dissolved, and so fitted for absorption, and the particular changes it subsequently effects on the blood and animal solids, are as yet very imperfectly understood. It has been supposed by many that calomel owes its activity to its being converted into corrosive sublimate by the hydrochloric acid, and chlorides of the alimentary canal. This, however, has been disproved by Dr G. Oettinger, who found that the alkaline chlorides in the alimentary secretions were in too minute quantity, and too diluted, to having any decomposing action on calomel; and that the gastric juice was also devoid of any power of converting calomel into corrosive sublimate. He ascribes, however, to the albuminous matters of the stomach, a slight solvent action on calomel. (See Monthly Journal of Medical Science, 1851, p. 88.) When given in small and repeated doses, it appears to accelerate the normal processes of change ever going on within the body, to increase the activity of secretion and excretion, and to cause absorption of adipose and other liquefiable deposits. These are what are usually styled the stimulant or alterative effects of the drug. The action of calomel on the various excreting organs is not difficult of explanation. By one or more of these it is separated from the blood, and appears to have a greatly more extended choice as to the channel of its excretion than most other medicines. Like other irritants, however, it produces during its elimination increased activity of the excreting organ.

Few substances have been applied to so many and diversified uses as calomel; but I shall notice here those only which are of recognised importance. It is employed in almost all animals in reducing and controlling acute inflammations; and appears especially serviceable in those affecting the serous membranes, as in pleurisy, common and puerperal peritonitis, iritis, and rheumatism. In such cases, it probably owes its good effects to its diminishing the fibrine, albumen, and red corpuscles of the blood, weakening the action of the heart, and promoting the excretion of morbid matters and inflammatory products. To effect these purposes, it must be given at intervals of two or three hours, and combined with opium or some other drug which will retard its excretion. It is frequently prescribed in jaundice and other chronic affections of the liver, accompanied with impaired action of that gland; in inveterate skin diseases; and in some dropsical affections; in all of which it should be used in small and frequently repeated doses, until the early symptoms of mercurialism present themselves. The occurrence of such symptoms indicates that the system has become saturated with the drug, and that its administration should either be immediately suspended, or continued only with extreme caution. In large doses, conjoined with opium, it has been used both in the human subject and the lower animals in the treatment of acute diarrhœa, dysentery, and enteritis; and in such cases is said to produce a marked sedative instead of an irritant effect. The success of such treatment, however, more probably depends on the calomel clearing the bowels of crudities; but the practice is too hazardous to be commended. In dysentery and protracted diarrhœa a safer and often successful plan consists in giving, for horses and cattle, ten grains of calomel, a drachm of opium, and an ounce each of chalk and gentian, and repeating this daily either in bolus or drench. In doses of a scruple, with the same quantity of quinine, it is of much service in rheumatism, both in horses and cattle. It is occasionally employed as an emetic for the dog; but unless given in combination, it sometimes fails to act either with speed or certainty, and usually causes purgation as well as vomiting. When united with ordinary cathartics, it is of much value in obstinate constipation and torpidity of the bowels, particularly in cattle. In these animals it is usually combined with croton or salts; in horses, with aloes; and in dogs, with jalap. In establishing these actions, it is thought to act also on the liver; and M. Buchein has detected calomel in the increased biliary secretion of dogs to which the drug has been administered. (Headland.) As an anthelmintic it is valuable chiefly on account of its active purgative properties, and is, therefore, best given along with a cathartic, or a few hours before one. Its diuretic and diaphoretic actions are not applied to any therapeutic purposes, and are only decidedly developed when it is given with medicines which themselves produce such effects. The use of calomel, especially in doses adequate to induce mercurialism, is to be avoided in all malignant diseases, in erysipelatous inflammation, and in most typhoid and asthenic affections. It is occasionally used externally for removing mange and other cutaneous affections, as a dressing for warts, and as one of the best remedies for thrush.

Doses, etc.—The dose, as an alterative and antiphlogistic, for horses and cattle, is from ℈i. to ℈iij.; and for dogs, from grs. ij. to grs. iij. Such doses must be given three or four times a day, or oftener, and along with an equal weight of opium or belladonna, to prevent their passing off by the bowels. As a cathartic, it is never used alone; and the dose must consequently be regulated by the amount of the other purgatives with which it is combined. A drachm of calomel, with three drachms of aloes, is a full purgative for the horse; from one to two drachms, with a pound of Epsom or common salt, a pint and a half of oil, or twenty croton beans, for cattle; and three or four grains, with one or two scruples of jalap, for the dog. As a vermifuge for the horse, it may be used in the following combination:—A drachm each of calomel, oil of the male shield fern, and aloes, with four drachms of ginger, made into a ball with linseed meal and treacle, and given before feeding, for three or four consecutive mornings.

Corrosive Sublimate. Chloride of Mercury. Muriate of Mercury. Hydrargyrum Corrosivum Sublimatum. Hg Cl.

Corrosive sublimate and calomel must be carefully distinguished from each other. Both are chlorides of mercury; and, owing to an unfortunate difference of opinion respecting the combining equivalent of their base, are apt to be described by different chemists under the same scientific name. Corrosive sublimate, however, contains twice as much chlorine as calomel, is now generally regarded as the protochloride of mercury (Hg Cl), and is an easily soluble and actively corrosive poison; whilst calomel, or the lower chloride, is now considered a subsalt (Hg_2 Cl), and is an insoluble and comparatively mild and innocuous body. By using, whether in speaking or writing, the vernacular names of these two chlorides, all risk of mistake may be effectually guarded against.

Preparation.—Corrosive sublimate may be prepared by heating metallic mercury in chlorine gas, or dissolving it in hydrochloric acid. The most common process, however, consists in subliming a mixture of persulphate of mercury and common salt.

Properties.—It occurs either as a dense white powder of broken prismatic crystals, or in white, heavy, semi-transparent crystalline masses. It has no odour, but an acrid, disagreeable metallic taste. It has a specific gravity of 5·2, and is brittle, fibrous, and easily pulverized. When heated, it fuses, and afterwards rises unchanged as an exceedingly acrid poisonous gas. It is very soluble both in alcohol and ether, and dissolves in three parts of boiling water, and eighteen of cold water. It has an acid reaction on colouring matter, and forms flaky precipitates with albuminous matters. A sufficient number of tests for corrosive sublimate have been already mentioned; but the following deserves to be noticed on account of its simplicity and delicacy. When a drop of a solution of corrosive sublimate is placed on a sovereign or other piece of gold, and a key or some convenient piece of iron applied, so as to touch at the same time the gold and the solution, a current of electricity is produced, which decomposes the corrosive sublimate, and precipitates its mercury on the gold as a black stain, easily removable by heat. Corrosive sublimate is not subject to intentional adulteration. When pure, it is free from colour and moisture, leaves no residue when heated, and is entirely soluble in water, and still more so in alcohol and ether.

Actions and Uses.—It is an active irritant and corrosive; and is used internally as an antiphlogistic, and externally as a caustic and stimulant. Large doses of corrosive sublimate induce in carnivora vomiting, and in all animals uneasiness, colicky pains, tenderness of the abdomen, evacuation of bloody feces, a small, wiry, and accelerated pulse, short and difficult breathing, nausea and prostration of strength, with occasional convulsions—in short, all the symptoms of acute enteritis or dysentery. Doses of seven or eight grains destroyed dogs in seven, twelve, or thirty hours; four drachms dissolved in three pounds of water killed a horse in twelve hours; two drachms caused in cattle great emaciation, and death in fourteen days; whilst one drachm proved fatal to a sheep within twelve hours. (Hertwig.) Larger quantities, however, are borne when the poison is given at first in small doses. Thus Mr Percivall, experimenting upon a horse, commenced with ten grains, and gradually increased the dose to five drachms before the appetite or pulse became affected. On post-mortem examination of cases of poisoning by corrosive sublimate, the stomach and lower intestines are found disorganized by the chemical action of the poison, and also inflamed and ulcerated, except where death has occurred before the establishment of vital reaction; the kidneys and other urinary organs are unusually vascular; the lungs spotted with effused blood; and the heart occasionally inflamed, and filled with blood, thus indicating a state of paralysis which probably depends on derangement or depression of the nervous system. (Moiroud.) Similar effects are observed when the poison, in the quantities above mentioned, is placed within the cellular tissue, or injected into the veins. In small and repeated doses, corrosive sublimate speedily induces violent mercurialism.

The best antidote for corrosive sublimate is albumen, which combines with it to form an insoluble and inert albuminate of mercury, and is, besides, useful as a demulcent. It is best given in the form of white of egg. The white of one egg is said to be sufficient to counteract the effects of four grains of sublimate. When eggs cannot be had, wheat or barley flour, milk, or other albuminous substances, must be given, followed up by astringent solutions.

On account of its violently irritant properties, corrosive sublimate is rarely used internally. Without the slightest show of reason, or hope of success, it has been recommended, in doses of from four to eight grains, for the cure of glanders and farcy, inveterate skin diseases, and "chronic engorgements." It is used externally for the cure of exuberant granulations, indolent ulcers, and fistulæ. It has been recommended as a valuable means of preventing the escape of synovia from open joints; but, in such cases, the rational treatment consists in keeping the limb perfectly fixed, and reducing irritation of the injured parts by light cold-water dressings. All devices for plugging up the orifice, and all synovia-coagulating matters, are quite useless, and usually very injurious. It is occasionally employed in the form of solution, as a stimulant for mange, scab, and such like complaints, and as a poison for lice and other vermin infesting the skin; but for such purposes it must be used with much caution, since it is very apt to become absorbed, and induce serious and even fatal results. The solutions in common use generally contain from four to six grains of corrosive sublimate to the ounce of water. Two grains of corrosive sublimate, and two minims of prussic acid to an ounce of water, are sometimes used to relieve the itching of skin complaints, especially among dogs. But such poisonous solutions must be used warily.

IODIDES OF MERCURY. Hydrargyri Iodida.

The lower or green iodide corresponds to calomel, having the composition $Hg_2 I$; is prepared by adding iodide of potassium to calomel, or any subsalt of mercury; and has considerable activity as an irritant, a scruple destroying a rabbit within twenty-four hours, and a drachm a pointer dog in five days. (Cogswell.)

The proto or red iodide (HgI) is usually met with as a bright vermilion, heavy, inodorous crystalline powder, with a disagreeable metallic taste. It is almost insoluble in water, sparingly soluble in alcohol, but soluble in ether, acids, solution of the iodide of potassium, and most saline fluids. It is prepared by triturating mercury and iodine with a little rectified spirit, boiling the mixture in a concentrated solution of common salt, and allowing it to crystallize slowly; or, according to the Brit. Phar., by mixing a solution of corrosive sublimate with one of iodide of potassium, when mutual decomposition ensues, the clear supernatant fluid is decanted away, and the red precipitate is washed with distilled water and dried. The red iodide resembles other mercurials in its effects; is less active than corrosive sublimate, but more active than calomel. A scruple, given to a rabbit, induced enteritis, and death in twenty-four hours. It is not used internally; but, in the form of an ointment, is applied externally as a caustic and stimulant for unhealthy wounds and chronic indurations, and as an irritant dressing in sore throat. For reducing splints, spavins, and other bony deposits, it is the best of all applications; but is too powerful to be used, as fly blisters often are, immediately after firing. When thus employed, it is apt to cause sloughing and blemishing. The Brit. Phar. orders the ointment to be made by thoroughly mixing with an ounce of lard sixteen grains of the red iodide. Of this, a piece about the size of a large bean is a sufficient dressing for a splint or spavin.

CITRINE OINTMENT. Ointment of the Nitrate of Mercury. Hydrargyri nitratis unguentum.

Citrine ointment is the pharmaceutical imitation of the famous empirical preparation known as the Golden Eye Ointment. Mr Duncan, of Messrs Duncan, Flockhart, and Co., chemists, Edinburgh, first discovered the secret of preparing good citrine ointment, capable of being kept for any considerable length of time, and recommends it to be made as follows:—Take four ounces of mercury, twelve ounces of nitric acid, of density 1380 to 1390, thirty-two ounces of olive oil, and fifteen ounces of lard—all by avoirdupois weight: mix the mercury with the acid, and let the mixture stand for several hours. Melt and strain the lard; and while it is yet hot (at about 180° or 190°), add the nitrate of mercury, and stir with wooden spatulæ until the ointment assumes its proper colour. When a less active preparation is required, the amount of mercury may be reduced to a half or a fourth, still using, however, the same quantity of nitric acid. (See Christison's Dispensatory.) Mild ointments, when made by diluting the strong citrine ointment with lard, are only fit for immediate use, since they become decomposed, and alter in colour, within a few days.

Properties.—Well prepared citrine ointment has a golden yellow colour, an unctuous consistence, a nitrous acid odour; and retains these characters for a long time if kept in earthenware or glass vessels, secluded from light. When badly prepared, or much exposed to light, it speedily, however, becomes of a greyish-green colour, hard, brittle, and easily pulverized. This is believed to depend on the lard depriving the nitrate of mercury of oxygen, and so reducing portions of it to the metallic state. Such changes are best prevented by preparing the ointment with excess of nitric acid, which oxidizes the lard, and thus prevents its appropriating the oxygen of the nitrate of mercury. Citrine ointment, when injured by long keeping, regains its original characters if heated with nitric acid.

Actions and Uses.—Citrine ointment is chiefly used as a stimulant in chronic skin complaints, unhealthy sores, and ophthalmia. It appears to be tolerably easily absorbed, and if applied over a large extent of surface, induces the usual constitutional effects of mercury.

MURIATIC OR HYDROCHLORIC ACID.

Spirit of Salt. Hydrochloric Acid Gas (HCl) dissolved in Water.

Hydrochloric acid is prepared by distilling together equal weights of common salt, sulphuric acid, and water. The strong liquid acid of the shops contains about 36 per cent. of the pure gaseous acid (HCl), and has usually a yellow colour, which may, however, be removed by diluting and redistilling it, a density of 1180, a sour taste, and a pungent odour. It is readily distinguished by its yielding, with nitrate of silver, a curdy white precipitate, insoluble in nitric acid, but soluble in ammonia. From careless preparation, it sometimes contains sulphuric acid, nitrous acid, chlorine, and iron,—impurities which interfere with some of its more delicate pharmaceutical uses, and are easily discovered by their special tests.

Actions and Uses.—Hydrochloric acid is exactly analogous to sulphuric and nitric acids in its actions and uses. In large doses it is irritant and caustic; in medicinal doses tonic; and is also used externally as a caustic, astringent, antiseptic, and occasionally as a disinfectant.

Doses, etc.—The dose is one or two drachms for horses and cattle; and from two to five drops for dogs. It is given diluted with water.

MUSTARD.

Sinapis. Flour of the seeds of the *Sinapis Nigra.*

Nat. Ord.—Cruciferæ. *Sex. Syst.*—Tetradynamia Siliquosa.

The mustard plant is an annual about two feet high, with yellow cruciform flowers, and pods containing several brown seeds. It is indigenous in all parts of Europe, and is extensively cultivated in many parts of Durham and Yorkshire. A wild variety abounds in the corn-fields in most parts of the country; is familiarly known under the names of charlock and kellocks; and is sometimes used for adulterating the better sorts, of which two kinds are known—the black and the white. The former is a dark-brown seed, about the size of the millet, and with a greenish-yellow powder, which has a pungent oily taste, a slightly nauseous odour when dry, and a powerfully irritant flavour when moistened. The seeds of the white mustard are lighter in colour, larger in size, and considerably less pungent and irritating. The mustard of the shops is a mixture of both these two kinds, and, according to information given to Professor Christison by an English manufacturer, is made in the following manner:—"Two bushels of black, and three of white seed, yield, when ground, 145 pounds of flour; which, to diminish the pungency and improve the colour, is mixed with fifty-six pounds of wheat flour, and two pounds of turmeric; and the acrimony is restored without the pungency, by the addition of a pound of chilly pods and half a pound of ginger. Black seed alone, it is added, would be much too pungent for use at table. Wild mustard-seed is sometimes substituted for the black species if the latter be scarce. Some manufacturers remove the fixed oil from both the white and black seed, by means of expression, before making them into mustard flour with the other ingredients; and the acrimony of the product is thus increased." (Christison's Dispensatory.)

The principal constituents of mustard are,—a fixed oil very similar to that of rape-seed; a crystalline fatty matter called sinapisine; myronic or myroxic acid (in combination with potash); a bitter uncrystallizable substance, not as yet very fully studied; and myrosine, an albuminous principle closely resembling the emulsine of bitter almonds, and which, in presence of air and moisture, has the property of causing a peculiar fermentation of the myronic acid, and the consequent development of a peculiar volatile oil. This oil is colourless, a little heavier than water, boils at 300° Fahrenheit, and is the principle to which all the preparations of mustard owe their characteristic properties. Its formula is $C_8\ H_5\ N\ S_2$. The seeds of the white mustard, as above stated, are less powerful than those of the black; and this depends upon their containing no myronic acid, and being in consequence incapable of yielding any volatile oil.

Mustard is scarcely ever pure, for commercial specimens contain, as above noticed, starch and various aromatics. The starch may be readily detected, in a solution made with warm water, by adding, after it has cooled, a little iodine, when the characteristic blue iodide of starch will be produced. These admixtures greatly diminish the efficacy of the pure black mustard, especially as a counter-irritant. Inorganic impurities, which are occasionally present, may be easily detected by their remaining after burning.

Actions and Uses.—Unbruised mustard-seeds have but little effect when swallowed, probably because they are very partially digested. The flour, however, acts in large doses as an irritant, and in medicinal doses as a stomachic and carminative. Some practitioners believe it to have laxative properties; but most consider that it renders the feces hard and dry, and slightly increases the secretion of urine. A dessert-spoonful dissolved in several ounces of water, and given to the dog, causes vomiting; but mustard is rarely given internally, either for this or for any other purpose. It is, however, much used externally as a counter-irritant; and may be applied so as to act either as a mild rubefacient or a powerful suppurant. When made into a paste with water, and applied to the skin, the part soon becomes red, hot, and tender, and the animal restless and uneasy. When applied in considerable quantity, and with smart friction, the epidermis, after three or four hours, is separated from the true skin by effusion of serum, producing numerous small vesicles, which speedily run on to suppuration. The surrounding parts also become swollen. The skin generally heals up in about a week. Occasionally, however, from the injudicious use of the agent, the true skin is actively inflamed, sloughing occurs, and the hair seldom reappears, or does so only after a long time. As compared with cantharides, the action of mustard is more prompt; but its effects, though sometimes violent, are not usually so permanent. It causes less exudation of serum, but more swelling of the surrounding parts. When applied repeatedly, especially to the extremities of the horse, it is more apt to affect the deep-seated parts, and hence produce sloughing; but, unlike cantharides, it has no tendency to act upon the kidneys. Mustard is an excellent blistering agent for cattle, often acting on their thick and insensible hides when other agents have little effect, and seldom causing permanent injury or blemishing. The special applications of mustard are not very different from those of cantharides. It is employed in sore throat, bronchitis, pleurisy, and sometimes, but usually with less advantage, in pneumonia. It is often of service in chronic rheumatism, especially amongst cattle; in inflammation of joints, indurations of external parts, especially of glands; and as a stimulant for chronic unhealthy wounds. It is occasionally applied to overcome stupor and cerebral congestion, such as occur in the human subject in apoplexy and poisoning by opium, and in cattle in the latter stages of the apoplectic form of puerperal fever. Many practitioners use it for determining the secretion of pus, and for maintaining or increasing the effects of cantharidine applications; but in horses considerable caution is generally necessary in applying the one irritant soon after the other. Mustard applications are specially indicated where it is desirable speedily to induce extensive counter-irritation, and at the same time to avoid the chance of stimulating the kidneys. Hence it is often eminently suitable as an irritant in those cases in which the urinary organs are in an unduly excitable state. Mustard blisters, and indeed blisters of all kinds, must be carefully avoided, so long as the parts to which they are applied continue in a state of inflammation. Unless this be attended to, disorganization and sloughing will almost certainly ensue.

Doses, etc.—Mustard is administered as a stomachic, carminative, and mild stimulant in the following doses:—For the horse, from ʒiv. to ʒvi.; for cattle, ℥i.; and for the dog, from grs. x. to grs. xx. In dogs, larger doses, especially in solution, act as emetics. To prevent its irritant action on the fauces, it is best given in the form of a pill or electuary, and may be administered either alone or in combination. Mustard is used as a counter-irritant in the several forms of paste, plaster, and poultice. The paste is made with water, which should be tepid, but not hot; with oil of turpentine; or, when still greater activity is required, with a mixture of equal parts of oil of turpentine and strong ammonia. Besides other solvents, vinegar has been recommended, but it is less effectual than water. A paste, made with water alone, produced in six minutes effects similar to those which it required fifty minutes to produce with the same mustard made up with vinegar instead of water. Mustard preparations are generally applied directly to the skin, being rubbed in with smart friction. Sometimes, however, they are spread upon linen or calico, and applied in the form of a plaster, but this is a less convenient and effectual way of using them. Mustard poultices used to be recommended by the London and Dublin Colleges to be made with equal weights of mustard and linseed meal, and a sufficiency of vinegar. But for veterinary practice these preparations are nearly useless. They contain so much linseed meal, that their irritant action in ordinary circumstances is scarcely appreciable, while their activity is still further diminished by the injudicious addition of the vinegar. To ensure the full effect of mustard preparations, the parts to which they are applied should be previously freed of hair, either by shaving or clipping, and also fomented with hot water—a preliminary operation which is especially essential in the treatment of the internal diseases of cattle. The *volatile oil of mustard*, prepared by macerating and distilling the seeds, has been used as a vesicant, and acts very promptly and powerfully. Two drachms rubbed into the skin of a dog caused immediate irritability of the parts, and the speedy formation of large vesicles, surrounded by a violently inflamed tumour. It is applied dissolved either in spirit or in any of the fixed oils.

MYRRH.

Myrrha. Gum-resinous exudation from the stem of *Balsamodendron Myrrha.* (Nees.)

Nat. Ord.—Terebinthaceæ. *Sex. Syst.*—Octandria Monogynia.

Myrrh is the gum-resinous exudation of a shrub grown in Arabia Felix and Abyssinia, and having spiny branches, ternate leaves, and an oval-shaped fruit. It is imported to this country in large chests from the coasts of the Red Sea, and chiefly by way of Bombay. It is believed to be one of those substances which the Israelites used for frankincense. It exudes spontaneously from cracks in the trunk or branches, and also from perforations and bruises; is at first of an oily consistence, and of a yellow-white colour; but gradually becomes as solid as gum, and of a brown-red tint. The best sorts of myrrh (generally termed Turkey myrrh) are met with in irregular shaped, semi-translucent red-brown pieces, which deepen in colour when breathed on. They are of variable size, are brittle and easily powdered, and their fracture is irregular, shining, oily, and occasionally dotted with opaque white markings. Myrrh has an acrid bitter taste, and an agreeable aromatic odour. When heated it softens, froths up, and after a while takes fire, but burns with difficulty. It is nearly insoluble in water, but readily dissolves in rectified spirit. It consists of 63·7 per cent. of gum; 27·8 of resin; and 2·6 of volatile oil; the two latter being its active ingredients. (Christison.)

Impurities.—Inferior varieties of myrrh are often mixed with those of better quality. They are coarse, opaque, hard, resinous, very dark coloured, and devoid, or nearly so, of the pure aromatic odour and peculiar balsamic taste of the superior varieties. Straw, sand, and other mechanical impurities, are also sometimes present.

Actions and Uses.—Myrrh is a stimulating tonic; and seems to act chiefly on the digestive organs, improving the appetite, and promoting assimilation. According to some, it also stimulates the uterus, and arrests excessive mucous secretions, bearing in this respect some resemblance to copaiva. It is allied to the turpentines and balsams, but differs from them in possessing tonic properties; and from the fœtid gum resins in being devoid of antispasmodic action. It is prescribed in indigestion depending on weakness, and also in chronic catarrh and other mucous discharges; but for all internal purposes it may be readily dispensed with. Its principal employment in veterinary practice is as a stimulant for indolent sores and ulcerations; and for such purposes it may be used in the form of powder, tincture, or compound tincture.

Doses, etc.—The dose for horses or cattle is ʒij., and for dogs, grs. xv. to grs. xx. These doses are given repeatedly, either alone, with other tonics, or with aloes, as in the form of the compound tincture of aloes and myrrh. The tincture is thus prepared:—"Take of myrrh, in coarse powder, two ounces and a half; rectified spirit, one pint; macerate the myrrh for forty-eight hours with fifteen ounces of the spirit in a close vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, pour into the percolator the remaining five ounces of the spirit. As soon as the percolation is completed, subject the contents of the percolator to pressure, filter the product, mix the two liquids, and add sufficient rectified spirit to make one pint." (Brit. Phar.)

NITRIC ACID.

Aquafortis. Acidum Nitricum. $3HO, 2NO_5$.

Anhydrous nitric acid (NO_5) is a white crystalline deliquescent solid, which is only met with as a chemical curiosity. The strongest acid of the shops contains 80 per cent. of this anhydrous acid, has the density of 1500, and is prepared by distilling together two pounds of nitrate of potash or of soda, and seventeen fluid ounces of sulphuric acid. But the strength and causticity of this acid are so inconvenient, that a diluted variety is generally preferred. That ordered by the Brit. Phar. is made with two fluid ounces of strong nitric acid and thirteen of water, and has the density of 1101.

Properties.—Nitric acid is colourless, or nearly so, has a pungent, suffocating odour, and an intensely sour taste, corrodes and dissolves many organic substances, and when dropped on the skin produces a yellow stain, which is deepened in colour by the application of alkalies, and removed only by the wearing down of the part. Strong nitric acid has a great affinity for water; if kept in imperfectly stoppered vessels, it soon increases in quantity and diminishes in strength; and when diluted with water evolves much heat. When exposed to light, it gradually acquires a yellow colour from small quantities of it being decomposed into oxygen, which is given off, and ruddy brown nitrous acid (NO_4), which remains dissolved in the liquid, imparting to it a red-brown colour. This solution constitutes the *nitrous acid* of the shops, is even more corrosive than pure nitric acid, and if dropped on the fingers, causes effervescence. Nitric acid is readily deoxodized, especially by metals; and combines with bases, forming nitrates, which are all soluble salts, undergoing decomposition at a red heat, and deflagrating when thrown on burning fuel. A mixture of one measure of nitric acid, and three of hydrochloric, forms *aqua regia*, which is used as a solvent for gold, and is distinguished by its orange-brown colour, and odour of chlorine. There are many characteristic tests for nitric acid: it produces, with morphia, an orange-red solution; it becomes deoxodized by zinc and some other metals, with evolution of ruddy nitrous acid fumes; gives a yellow stain of xanthoproteic acid to wool, and to the skin; bleaches a warm solution of sulphate of indigo; and produces, with a solution of proto-sulphate of iron, an olive-brown coloured ring where the two liquids meet.

Impurities.—The density and colour of nitric acid are the simplest and best tests of its purity. Its density indicates the proportion of water it contains, and its colour the presence of nitrous acid. Any trace of sulphuric acid is precipitated from a diluted solution by chloride of barium; while the presence of hydrochloric acid is readily indicated by nitrate of silver.

Actions and Uses.—The actions and uses of nitric acid are the same as those of the other mineral acids. According to its quantity and degree of concentration, it is irritant, caustic, astringent, or tonic; and is also used as an antiseptic and disinfectant. In excessive doses, it causes extensive gastro-enteritis, disorganization of the mucous membrane, and fatal exhaustion, with the same symptoms and post-mortem appearances as occur in poisoning by sulphuric acid. When a strong solution has been given, yellow or brown marks may usually be perceived about the mouth and fauces. In the stomach and intestines, however, this discoloration is seldom observable, owing to the inflammation and extravasation of blood. In men and dogs it sometimes causes chronic inflammation of the alimentary mucous membrane, with consequent arrestment of assimilation, and death after some weeks. As with other irritant poisons, it is less active and fatal in cattle than in horses and dogs, owing to the stomachs of ruminants being constantly filled with food, and the alimentary mucous membrane being unusually thick and non-vascular. When injected into the veins, it coagulates the blood, and causes death in a few minutes. In all animals its appropriate antidotes are diluted alkalies, soap, chalk, and magnesia.

It is seldom used internally. It might, however, like sulphuric acid, be given as a stomachic and tonic during convalescence from debilitating disorders, in inveterate skin complaints, and in chronic enlargement of the liver in cattle. For all animals it is serviceable in bad sore throats, acting locally as an astringent, and generally as a tonic. Among the lower animals, it is not used as a diuretic. It is a useful caustic for extirpating warts and fungous growths; for removing the hardened scurf which often accumulates in old cases of scab and mange; and for improving the condition and destroying the fœtor of unhealthy wounds, caries, foul, and foot-rot. Its causticity chiefly depends on its affinity for water, and its readily parting with oxygen. It is very effectual in destroying animal and vegetable effluvia; but its deodorizing and disinfectant properties cannot be extensively applied, owing to its expense, and its corroding action on all organic and metallic substances

Doses, etc.—The dose of the diluted medicinal nitric acid for horses or cattle, is one or two drachms, and for dogs, from two to four drops. It should be given largely diluted. A diluted solution is also the common form for external application, but an ointment is sometimes used, and may be made as follows:—"Take a pound of olive oil, four ounces of axunge, and five drachms and a half, by measure, of nitric acid. Melt the axunge and oil together in a glass vessel; when the mixture is nearly concrete, add the acid, and stir briskly with a glass rod till the whole solidifies." (Dub. Phar.) A paste made with sulphur is also in use for extirpating warts, and improving the state of the skin in scab and mange.

NUX VOMICA.

Seeds of *Strychnos Nux Vomica.*

Nat. Ord.—Strychneæ. *Sex. Syst.*—Pentandria Monogynia.

The *Strychnos nux vomica* abounds on the southern coasts of India, and in many islands of the Indian Archipelago. It is a moderate-sized tree, with a crooked stem, irregular branches, a tough, white wood, known in commerce as *snake wood;* a white or yellow bark—the *false Angustura bark* of the shops; oval-shaped, shining leaves, of variable size; round berries, about the size of apples, and containing, amid a soft gelatinous pulp, several round, flat, grey coloured seeds, about an inch in diameter, and covered with short satiny hairs. These seeds (*nuces vomicæ*) have a little umbilicus on their ventral surface, and are so tough and horny that, in order to powder them, they require to be steamed, sliced, and ground in a coffee-mill. The powder has a slightly sweet odour, and an intensely bitter, acrid taste; dissolves in water and alcohol; and is easily distinguished by its dirty green-grey colour, its intensely pure bitter taste, and its producing an orange-red tint when moistened with nitric acid. In solution, it is coloured orange-yellow by nitric acid, and green by perchloride of iron. Nux vomica contains gum, starch, lignine, wax, concrete oil, yellow colouring matter, a peculiar soluble crystallizable acid called *strychnic* or *igasuric acid*, and three poisonous alkaloids—*strychnia*, *brucia*, and *igasuria.* These are present in all parts of the tree, but especially in the seeds and bark. Their properties and uses will be noticed below.

Actions and Uses.—Nux vomica, in large doses, is a deadly poison, and in medicinal doses is occasionally used as a tonic.

It acts as a powerful stimulant on the spinal cord, especially on its motor tract. It does not affect those parts of the brain connected with thought or special sense; nor has it any direct effect on the action of the heart. It acts as a deadly poison on all animals, and by whatever channel it enters the system.

Half a drachm of powdered nux vomica killed a moderate-sized dog in forty-five minutes. Eight grains have proved fatal to dogs, five grains to cats (Christison), and one or two ounces to horses (Moiroud). Hertwig observed that doses of ten drachms were inadequate to destroy a horse, when given in the solid state, but proved fatal in ten hours when given in solution. Professor Coleman gave a mare two ounces in a drench; in an hour, and after the animal had drunk some water, she had violent tetanic symptoms, and died half an hour later. Ounce doses given to a glandered horse caused tetanus, but were not fatal. Sheep are destroyed by half-ounce doses in about thirty minutes; but goats, curiously enough, are much less susceptible to its action. Hertwig gave a goat 440 grains in eleven days, without observing any obvious effect; and Tabourin considers that eight ounces would be requisite to poison. The same authority has seen violent tetanus caused in pigs by 50 grains. Poisonous doses produce in all animals trembling, twitching of the voluntary muscles, and violent tetanic spasms, which gradually become more frequent and severe, and from their involving the glottis diaphragm and muscles of respiration, cause death usually by asphyxia, occasionally by exhausting the irritability of the heart. The symptoms and mode of death are much the same as in tetanus, from which, however, this variety of poisoning may be readily distinguished by the sudden development of the symptoms, their intermittance, and their rapidly fatal termination. The post-mortem appearances vary somewhat with the severity and duration of the case, and usually include general venous congestion; engorgement of the lungs, right side of the heart, membranes of the brain, and spinal cord; softening of the cerebellum and spinal cord; and, when the patient has survived for some time, redness and inflammation of the intestines. The voluntary muscles are generally soft and flaccid, but the involuntary are usually hard and rigid as before death. Where the spasms have been severe and rapidly fatal, the left side of the heart is firmly contracted, and contains little if any blood. There are no antidotes for poisoning by nux vomica. The removal of the unabsorbed poison by the use of emetics, or the stomach-pump, is often effectual in saving a patient; tinctures of iodine and galls may probably have some slight effect in neutralizing the unabsorbed poison; whilst extract of hemlock, tobacco, and its active principle nicotine, retard the production of its effects. When, however, the poison has been absorbed, and its physiological action developed, there is little hope of recovery, even with the use of artificial respiration, chlorine water, ammonia, opium, and other remedies generally recommended. In frogs poisoned with small doses of strychnine, the tetanic symptoms are arrested by removing the animals to a warmer medium, or bringing them within the circle of a current of electricity, itself capable of causing tetanus. (T. Kunde, in Virchow's Arch., vol. xviii., 1860.)

Nux vomica has hitherto been little used in veterinary practice, but is useful in all animals in certain cases of chronic paralysis. Mr David Aitkin, veterinary surgeon, Dunfermline, informs me that he has used it in cattle practice since 1853, and generally with good success. He has kindly placed at my disposal the following particulars of the case of two bullocks suffering from chronic paralysis, one of which had so entirely lost the power of its limbs that it had to be carted home from the grass field. The pulse in this case was fifty-five, and rather weak; the hinder extremities and tail had lost their power of movement, and were devoid of sensation; the sphincter ani was relaxed, and urine came dribbling away involuntarily. The animal besides was dull, and had a peculiar expression of countenance. Purgative medicine was given, which operated next day, without, however, relieving the symptoms. Two drachms of nux vomica were then prescribed night and morning for ten days; and as little improvement was then visible, the dose was increased to three drachms thrice a day; and on the third day thereafter, Mr Aitkin, whilst examining the animal, accidentally trod on his tail, when he jumped on his legs and endeavoured to stand; in another day he could turn himself from side to side; in about ten days he was able to walk round the house in which he was confined; and in a few months became the best looking bullock of the herd. The other bullock exhibited very similar symptoms, was treated in the same manner, and with the like satisfactory results. A week or two before the period of parturition, cows, especially if in low condition, occasionally lose the power of their hind limbs, and are unable to stand. Until parturition is over, little more can be done besides allowing good diet, with tonic medicine, and shifting the cow several times a day from one side to the other. After the calf is born, the cow in most cases gradually regains the use of her limbs; but sometimes, apparently from want of nervous power, she continues much as before, and in such cases nux vomica, or strychnia, is decidedly indicated, and has been used, especially by Mr Aitkin, with marked success. To Mr Aitkin the profession is also indebted for the application of nux vomica to the treatment of congestive puerperal, or milk fever. Amongst other cases, he informs me of a cow which was taken ill at eight o'clock at night, and which he found next day at noon prostrate, motionless, scarcely able to swallow, insensible, and almost devoid of sensation, and given over as a hopeless case by the village blacksmith, who, it may be mentioned, had bled her, when first affected, the evening before. Along with a powerful stimulating purgative, two drachms of nux vomica were given, a mustard embrocation well rubbed in over the loins, and injections of tepid water with a little turpentine thrown into the rectum. Next day the bowels were acted on; but as the animal could not move, two drachms of nux vomica were given in gruel twice a-day, when the animal rapidly recovered. French veterinarians have sometimes given nux vomica with good effect in amaurosis and stringhalt in horses, and chorea amongst dogs, especially when accompanied by debility. To use it with advantage, it must be persevered with until it produce some of its earlier physiological effects, as twitching of the extremities or of the affected part—symptoms which are usually first apparent during the night, and when the paralysed part is suddenly touched or struck. If therapeutic effects do not shortly succeed the production of these physiological effects, the medicine will be of little service how long soever it be given, and need not, therefore, be longer continued. It is not, as some have thought, a cumulative medicine, nor, on the other hand, is the suseeptibility of the system to its aetion diminished by use, as is the case with opium and tobacco. It must be avoided in spasmodie diseases, and also in all nervous affeetions, so long as they are accompanied by inflammatory symptoms.

Doses, etc.—The dose of powdered nux vomiea is about ʒi. for horses; ʒij. or ʒiij. for eattle; and grs. ij. for dogs. These doses should be repeated twiee daily, and slightly and gradually increased until some of their physiologieal or therapeutical effeets are produeed. The powder is eonveniently given in the state of a bolus. The extraet, mueh used in human medieine, is got by boiling the powder with sucecssive portions of rectified spirit, reeovering most of the spirit by distillation, and evaporating the residue in a vapour bath. It is six or eight times as aetive as the simple powder. Tinctures of nux vomiea are oeeasionally used, but are ineonvenient, as they do not eover the bitter taste of the drug.

Strychnia or Strychnine.

Strychnia, besides being found in the *Strychnos nux vomica*, is also present in the bean of St Ignatius, and in other plants of the same natural family. At present it is only prepared from nux vomiea, but Professor Christison eonsiders that it might be as eheaply and easily proeured from the false angustura bark. The important steps in the preparation of stryehina are, redueing the nux vomiea to powder, forming a watery solution eontaining the alkaloid as the igasurate of strychina, deeomposing that salt by aeetate of lead or by caustie lime or magnesia, dissolving out the precipitated stryehnia by alcohol, and purifying the impure erystals. The proportion of impure or crude stryehnia got from nux vomica does not exeeed one 200th part. That sold in the shops as strychnia is in reality a mixture of the three alkaloids of the nux vomiea, and further eontains a variable proportion of colouring matter. Crystals of pure nitrate of stryehnia may, however, be readily obtained from a solution of the eommercial strychnia in nitric acid.

The alkaloids are colourless when pure, are crystalline, alkaline, intensely bitter, combustible, almost insoluble in water, but readily soluble in ether, chloroform, hot alcohol, and volatile oils. Strychnia has the composition $C_{42} H_{22} N_2 O_4$. With pure sulphuric acid it forms a colourless solution, which, on the addition of a little powdered bichromate of potash or peroxide of lead, acquires a beautiful deep purple colour, which, however, is very evanescent, speedily passing through red to yellow. Brucia differs from strychnia chiefly in being less bitter and insoluble.

Actions and Uses.—Strychnia is one of the most active of poisons, destroying both vegetable and animal life. One-sixth part of a grain, given in solution, destroys a dog in two minutes, and sometimes even in shorter time; and one-eighth of a grain in twelve minutes. (Christison.) Half a grain killed an English terrier in twenty-four minutes; three grains killed a greyhound in an hour and a half; whilst one grain killed another greyhound in thirty-three minutes. (Dr S. Macadam.) Six grains given to a horse produced twitchings of the muscles; twelve grains caused death in twelve minutes; four grains placed in the cellular tissue of a cow destroyed it in twenty minutes (Tabourin); whilst half a grain introduced into a wound would be sufficient, it is believed, to kill a man within fifteen minutes. Its effects occur by whatever channel it enters the system, and with a celerity varying with the rapidity of its absorption. Absorption appears essential to the development of its action; and Dr Harley has shown that it has no effect when, by the removal of the spines of the vertebræ, it is brought into immediate contact with the spinal cord. He further believes that, circulating with the blood, it everywhere destroys muscular irritability, and renders the tissues unable to absorb oxygen and exhale carbonic acid; and that in this way are produced its prominent symptoms of difficult breathing and convulsions. In poisonous doses, it produces in all animals symptoms apparently resulting especially from derangement of the spinal cord. In dogs, the symptoms are uneasiness, nausea, and sometimes vomiting, trembling, and stiffness of the extremities, general spasm, during which the head is drawn upwards and backwards, tetanic convulsions, which intermit occasionally, but recur again and again with increased force, until death is produced, probably from the muscles of respiration becoming fixed and immovable, and from the heart itself, like the other muscles, becoming so spasmodically contracted, that circulation is suddenly arrested. There is no narcotic effect, but, on the contrary, unusual acuteness both of common and special sense. In horses and cattle similar effects are produced, but only when the doses are both absolutely and relatively larger than those for the dog. On Monday, 18th October 1852, at twelve o'clock, I gave a small brown cow, affected by pleuro-pneumonia, and in a state of great weakness, grs. xv. of strychnia, suspended in f℥ij. of oil. At 12.30 the pulse had risen from 70 to 78, regurgitation was observable in the jugular veins, and quivering and twitching of the facial muscles, particularly during inspiration. At 12.45 the pulse numbered 84, and all the symptoms were aggravated. Two grains of strychnia were given, dissolved in diluted acetic acid; and in a quarter of an hour after, the animal was very uneasy, and attempted to vomit; the pulse was 94, full and strong, and the pupils much dilated. At 1.30 the nausea and efforts to vomit were much increased, and the breathing more laboured. The animal lay down, and the pulse shortly fell to 58. At 2.15 the nausea was diminished, and the pulse was at 92. Thirty grains of strychnia were then given in acetic acid and water. At 2.20 the pulse was 100, sharp and distinct. The muscles were affected by frequent spasms. At 2.25 the pulse was 140, and the animal showed much sensitiveness, especially about the hinder extremities. It reeled and fell. At 2.30 the pulse had risen to 160, the limbs were very rigid, the eyes protruding, and the involuntary spasms more general, frequent, and severe. In two minutes after she died quietly. The post-mortem appearances were similar to those above mentioned as occurring in poisoning by nux vomica. In dogs destroyed at the Veterinary College with one-eighth of a grain of strychnia, the buccal mucous membrane was blanched, the left auricle, as also the intestines, continued to contract for nearly an hour after death, and the cerebral and intestinal vessels were congested with dark venous blood. In poisonous, and even in considerable medicinal doses, strychnia may be readily detected in the stomach and other viscera, as well as in the blood and urine, and is detectible many months after the animal has been destroyed. (See Dr S. Macadam's valuable paper in the Parmaceutical Journal for August and September 1856.)

The uses of strychnia are the same as those of nux vomica. It is serviceable in many of the paralytic affections of cattle, has been recommended in amaurosis in the horse, and I have frequently found it useful in paralysis of the hind extremities both of horses and cattle. Indeed, in most paralytic cases it is entitled to a careful trial, for even where it does not cure, it often mitigates the symptoms. An interesting case, illustrative both of its poisonous and medicinal action, came under my observation in November 1853. A four-year old horse, that had suffered from a severe attack of staggers, lost the power of moving his hinder extremities. He could not be moved, turned, or put backwards, without imminent risk of falling. Mineral tonics were given for a fortnight, without any obvious amendment. Four grains of strychnia, made into a bolus, were then administered morning and evening, and gradual improvement ensued. The doses were slowly augmented until they amounted to ten grains, which were given daily in two separate doses. No physiological action was observable; no twitching or unusual sensitiveness of the muscles; no acceleration or alteration of the pulse. But the appetite improved; the muscles became firmer; and in about three weeks from the first use of the strychnia, the patient was able to walk without reeling, and could also turn and back without any difficulty. The strychnia was withheld for four days, and the patient became decidedly worse, and walked very unsteadily. The medicine was again prescribed, but, from an unfortunate mistake, was given in doses of five grains, repeated twice a day. After three such doses had been administered, violent spasms supervened, affecting especially the head and neck, and becoming particularly severe when the animal was touched or disturbed. Clysters and stimulants were employed, and after two days the symptoms of poisoning disappeared; but the paralysis still remained, and was accompanied by hanging of the head and stupor. Blisters were applied along the spine, and the use of the strychnia renewed in doses of two and a half grains given twice a day. Under this treatment the paralytic symptoms again diminished, and in fifteen days the patient was able to walk and turn with comparative ease, and appeared in the fair way of recovering, when unfortunately the owner, tired of waiting, had the animal removed to a tan-yard and destroyed. Strychnia is used for the destruction of rats, mice, and other vermin, and constitutes the active ingredient of "Hunter's Infallible Vermin and Insect Destroyer," and "Battle's Vermin Killer," which, besides starch, sugar, and Prussian blue, contains ten per cent. of strychnia. The shilling packets have sixty grains, and the sixpenny, twenty-five grains of powdered strychnia. (Dr S. Macadam.)

Doses, etc.—The dose for the horse is about grs. ij.; for the cow, about grs. iv.; and for the dog, about gr. 1-20th. It is generally given twice a day, in the morning and evening, and continued in gradually increasing doses until it produces some physiological or curative effects. From its subtlety as a poison, and its irregularity of strength, it must be used with much caution. On account of its intensely bitter taste, it is best given in the form of a bolus, but may, if preferred, be dissolved in water, acidulated with sulphuric or acetic acid. Being readily absorbed, and used only in small doses, it has sometimes been applied endermically. Arsenite of strychnia, in doses of from grs. iij. to grs. v., has been used at the veterinary school of Turin with some success in the treatment of malignant nasal discharges, supposed to be glanderous.

Brucia differs from strychnia only in the degree of its action, some considering that it has one-sixth, others one-twelfth, and others one-twenty-fourth of the activity of strychnia. Igasuria is believed closely to resemble brucia.

OAK BARK.

Quercus cortex. Dried bark of the small branches and young stems of *Quercus robur or pedunculata.*

Nat. Ord.—Amentaceæ (De Can). *Sex. Syst.*—Monœcia Polyandria.

Oak bark is met with in pieces of various size and thickness; is fibrous and brittle; and, when dry, is brown and wrinkled externally, and smoother and redder within. It has a powerful astringent taste, which is readily communicated to water. The infusion reddens litmus, gives a dark, bluish-black precipitate with sesquisalts of iron, and a white flocculent precipitate with solution of gelatine. The astringency and chemical reactions of oak bark depend on the presence of from 12 to 16 per cent. of tannin. The largest per-centage of this principle is got, during spring, in the white internal part of the bark of the young branches. Acorns are greedily eaten by all animals, are collected in many parts of England for the feeding of sheep and pigs, and are considered to be nearly as valuable as beans.

Actions and Uses.—Oak bark is an astringent and tonic. In omnivora and carnivora, it has a decided astringent effect on all the secreting surfaces, but in vegetable-feeding animals it is more slowly digested and absorbed, and scarcely exerts more than a topical action. It is employed, in all animals, for arresting chronic diarrhœa, dysentery, and similar mucous discharges. For weakly scouring calves, I find no astringent more serviceable. I keep a strong decoction always ready for use, and give it once or twice daily when required, either alone, or with some gentian, a little spirit, or where there is griping, with a few drops of laudanum. As a tonic, oak bark is inferior to cinchona, and probably to gentian; and is apt, when given too frequently, or in too large amount, to cause intestinal derangement. It is sometimes used for stimulating unhealthy ulcerations, and arresting gangrene. It is serviceable in reducing herniæ, and protrusions of the anus and uterus, and in such cases is best used dissolved in a large quantity of water, and mixed with a little laudanum. It is a useful styptic, and an excellent gargle for relaxed sore throats in man.

Doses, etc.—The dose for horses and cattle varies from ℥i. to ℥iv., and for sheep and dogs from ʒiv. to ʒviij. It is generally administered as an infusion or decoction. In many cases it is given with aromatics and bitters; in dysentery, with opium and starch gruel; and, in typhoid fevers, with camphor and mineral acids. As an external application, it is used both in powder and solution, alone and in combination.

OLIVE OIL.

Olivæ Oleum. Expressed oil of the fruit of *Olea Europæa.*

Nat. Ord.—Oleaceæ. *Sex. Syst.*—Diandria Monogynia.

Olives are obtained from several different varieties of an evergreen tree, which grows abundantly in most of the southern parts of Europe. The olive is a succulent fruit, about the size of a damson, and containing a single seed. The oil is chiefly yielded by the fleshy pericarp, but also in small quantity by the seed or kernel. The finest quality of oil is generally imported from Provence or Florence, and is got by expression alone. That of medium quality is brought in large quantity from Naples, and is prepared by steeping the olives in water previous to expression; while a still inferior variety, which is often fermented, comes from Sicily and Spain, and is obtained by moistening and pressing the residue left during the manufacture of the superior qualities.

Properties.—Olive oil belongs to that class of oils known as the fixed, fatty, or expressed oils. They produce, on paper or linen, a greasy stain, which is not removed by heat; they do not dry up or form varnishes; they congeal at low temperatures, boil about 600°, and at higher temperatures are decomposed with evolution of carbonic acid, carbonic oxide, and carburetted hydrogen. Olive oil is a transparent, unctuous, odourless, bland-tasted fluid, of the consistence of syrup. When pure, it is pale greenish-yellow; when impure, yellow or brown. Its specific gravity, at 77°, is about 911. At 36° much of the margarine it contains separates in crystalline grains. It is not miscible with water, is scarcely soluble in alcohol, but dissolves in twice its weight of ether. When exposed to the air, it absorbs oxygen, thickens, and slowly becomes rancid, but does not dry up. Pure olive oil, shaken in a half-filled phial, froths very slightly, and its surface is little broken by air-bells. It contains 28 per cent. of the neutral pearly solid fat, called margarine, dissolved in 72 per cent. of the fluid fatty principle, oleine.

Actions and Uses.—Olive oil, like other oleaginous bodies, is, in small quantity, easily digested and assimilated. In larger quantity, it disorders the digestive functions; and in still larger amount, as in doses of one or two pints for horses or cattle, and two or three ounces for dogs, it has a laxative effect. An ounce each of olive and castor oil makes one of the safest and best laxatives for the dog. Its expense, and the mildness of its action, preclude its use among the larger quadrupeds, and linseed oil generally makes a tolerable substitute for it. Like other fatty matters, it causes death when injected into the veins, probably by obstructing the capillary circulation. Half an ounce injected into the jugular speedily destroys a medium-sized dog. It is used externally as an emollient, and when of good quality is preferable to most other oils, on account of its not readily drying up or becoming rancid; but its high price stands in the way of its extensive use. The "black oil" so extensively used, especially throughout England, as a remedy for bruises, strains, and many sorts of wounds, is usually made with a pint of linseed or of olive oil, and two ounces of oil of turpentine, adding six drachms of oil of vitriol, and leaving the bottle without the stopper until the heat evolved by the mixture of the oil of vitriol has passed away.

OPIUM.

The Inspissated Juice from the Unripe Capsules of *Papaver somniferum.*

Nat. Ord.—Papaveraceæ. *Sex. Syst.*—Polyandria Monogynia.

Opium is one of the most ancient articles of the materia medica, and derives its name from the Greek word ὀπὸς (*opos*), signifying juice. It may be obtained from any of the many species of poppy, several of which abound as annual weeds in most parts of the country. The stem, unripe capsules, and other succulent parts of the poppy, contain a milk-white narcotic juice. The roots of many species contain a cathartic principle. The poppy heads or capsules, gathered about twelve days after the petals fall off, contain mucilaginous matters, and a small and irregular quantity of morphia, and are used, digested in hot water, for making soothing infusions. The seeds contained in these capsules are almost devoid of narcotic properties, but yield a bland, drying oil, similar to linseed or rapeseed oil. The cake or residue of the seeds left after the expression of the oil, is now used in considerable quantity as food for cattle.

The true opium poppy is the *Papaver somniferum*—the common white or garden poppy. It is a native of the warmer parts of Asia, is largely cultivated in Asia Minor, but also thrives well in this country. It flowers in June or July, and the capsules ripen about two months later. It is of large size, from two to six feet high, having a round, smooth, erect stem, with a few white hairs on the peduncles or leaf-stalks; large, sessile, glaucous green leaves, with cut and wavy margins; large terminal flowers, of a white, red, or purple colour, and drooping before they open; and globose capsules about the size of a duck's egg, and containing numerous kidney-shaped seeds, either of a white or brown colour. All the opium of commerce is derived from the several varieties of this poppy. The white-flowered varieties have hitherto been generally preferred, but the darker-flowered kinds, especially the purple, are now believed to yield a larger quantity and better quality of opium.

The collection of the juice is very simple. At sunset the collectors make horizontal superficial incisions into the partially ripened capsules, shortly after the falling off of the petals. There exudes from the incisions a thick milk-white juice, which concretes and deepens in colour, until it forms semi-solid, red-brown, adhesive tears. This is opium. In from twelve to twenty-four hours after the incisions have been made, the little tears, weighing a few grains, are collected from each capsule, formed into larger masses, dried, and packed for exportation in poppy leaves, in the leaves and winged seeds of a species of rumex or dock, or in tobacco leaves and poppy petals. Upwards of 5000 tons are annually imported into this country.

Varieties.—There are at least five distinct sorts of opium—Turkish, Egyptian, East Indian, Persian, and European; and each of these, from differences in the cultivation of the poppy, or in the extraction and subsequent treatment of the juice, is liable to considerable differences in appearance and quality.

Turkey Opium is met with of several different kinds, most of them of fine quality, and highly prized in the English market. It is collected in Anatolia in Asia Minor, and exported from Smyrna, and in lesser quantity from Constantinople. It is generally covered with impressions of the seed of the rumex, or with poppy leaves; and occurs in roundish flattened pieces weighing from six ounces to three pounds. It is soft, moist, and ductile, of a uniform structure, and, when minutely examined, seems made up of small lenticular pieces. It has a peculiar but not disagreeable odour, a bitter taste, and, when recently fractured, a pale liver-brown colour. It readily yields its active principles to water, forming a pale-coloured solution, and to alcohol of all strengths, forming dark-coloured tinctures. It contains more morphia than most of the other varieties. When of inferior quality, it has a dark colour, a resinous structure, and an unequal irregular texture; is often dry and hard from long keeping; forms a dark-coloured infusion; and contains a small proportion of morphia.

Egyptian Opium is a recently introduced variety, and corresponds very nearly with some of the seeond-rate qualities of Turkey opium. It is of a pale-brown eolour, hard, dry, brittle, and of a waxy strueture. Like most other sorts, it is apt to vary in appearanee, and is often made up in imitation of whatever kind happens at the time to be in highest repute.

East Indian Opium is largely prepared in several parts of the East Indies, but ehiefly near Benares and Patna, and in the provinee of Malwa. It is almost all disposed of to the Chinese, who prefer it to Turkey opium, and purehase annually upwards of a thousand tons' weight of it, at the rate of twenty shillings per pound. It is usually inferior to Turkey opium, and contains less morphia, but more nareotine. In preparing it, the juiee is extraeted from the poppy in the usual way, the fluid part is poured off, and the solid residue earefully dried in the shade, and disposed of by the native eultivator to the opium faetories, where it is purified, raised to the desired eonsistenee, and eneased in poppy, and sometimes in tobaeeo leaves. The outer ease gradually beeomes blaek, hard, unyielding, and of the appearanee of a large bullet; and usually eontains about three pounds eight ounees of standard opium, whieh remains for a long time soft and duetile, and has in most speeimens a dark appearanee, resembling piteh. East Indian opium, when not intended for exportation, is dried in the sun, until it eontains only a small quantity of water or volatile matter, in the Benares Ageney not more than 10 per eent. being separable by eontinued exposure to 200° F. It is then moulded into square pieees, weighing rather more than two pounds eaeh, enveloped in oiled Nepaul paper, and paeked in wooden boxes. (Pharmaeeutieal Journal, vol. xi., p. 360.) It is firm, dry, of a yellow-brown eolour, and nearly equal to Turkey opium in quality and per-eentage of morphia.

Persian Opium is of very low quality, and seareely saleable in this eountry. It oeeurs in little rolls, five or six inehes long, about the size of the finger, and enveloped in paper. It has a light-brown eolour, and continues soft even after being kept for some time. Its designation of Persian opium is probably a misnomer, as it is generally believed to be made in London.

European Opium.—Opium has at various times been prepared in several parts of France and Germany, and its cultivation has also been attempted in Great Britain. In 1818, Dr Young cultivated poppies in the neighbourhood of Edinburgh, and obtained nearly six ounces of excellent opium from a fall of ground, being at the rate of $57\frac{1}{2}$ lbs. per acre. A still more extensive trial was made in Buckinghamshire in 1823, by Messrs Cowley and Staines, who grew upwards of twelve acres of poppies, and got a return of 16 lbs. per acre of very fine opium. Its quality was equal to that of any Turkey opium, and it realized the highest price in the London market. From the high price of Turkey opium at that time, and the low rent of land, the speculation was tolerably lucrative. At present, however, the preparation of opium in this country would not, it is believed, be profitable, unless as large a return of opium could be got as in India, where the average yield per acre is 30 lbs., and, according to some, even more. It is possible, however, that in favourable circumstances poppies might be cultivated here expressly for the preparation of morphia, which could be directly obtained from the juice without first inspissating it.

Properties.—The several kinds of opium, although possessed of various distinctive properties, have also many in common. They are all obtained from the partially ripened capsules of the same species of poppy; occur in irregular red-brown lumps, which weigh from four ounces to two pounds; usually indicate their being made up from agglutinated tears, break with an irregular, moist, chestnut-red fracture, shining when rubbed with the finger, and have a specific gravity of about 3·36, a strong, peculiar aromatic odour, and a disagreeable, persistent, bitter taste. When recently imported, they contain from 6 to 17 per cent. of water, and are moist and plastic; but when long kept, or artificially dried, they are hard, and easily reduced to a brown powder, which is apt, unless carefully preserved, to absorb moisture. When heated they soften, and at high temperatures burn with a strong, peculiar odour. Water dissolves about two-thirds of a good specimen of opium, and forms a red-brown solution, including most of the active ingredients; whilst rectified spirit dissolves about four-fifths, and forms a dark-brown tincture, which includes all the active principles. Acids, when strong, disorganize opium; but when diluted, are excellent solvents for it. Alkalies in small quantity decompose it, but in excess dissolve it. Its watery solution reddens litmus, owing to the presence of meconic acid, and is precipitated by vegetable astringents, salts of lime, lead, copper, and many other metals.

Impurities.—As the better qualities of Turkey opium usually bring about 18s. per pound, there is great temptation to substitute inferior qualities of the drug, or to mix it with various foreign matters. Inferior specimens of opium may generally be distinguished by narrowly examining their consistence, texture, colour, odour, and taste. They are often dry, hard, and resinous, or oleaginous and waxy, and their fresh fracture is devoid of that red tint and agreeable aromatic odour which characterize most good specimens of the drug. Water and alcohol dissolve them imperfectly. Many different substances are used for adulterating opium. The most common of these are starch and molasses, the bruised leaves and chips of the poppy, and the juice, pulp, or extract of the prickly pear, the tobacco, or other plants. These additions are generally made before the drug is imported; and their presence may sometimes be ascertained by minute inspection. Inorganic matters, as sand, clay, and mud, may be detected in the same manner, especially if the specimen be first dried. Excess of moisture is easily discovered by drying a weighed quantity in a water bath, and ascertaining the loss, which should not, even in recent specimens, exceed 17 per cent. But by far the best and most certain test of the quality or purity of any specimen of opium, is the proportion of morphia which it contains. Various processes are pursued for its isolation: 100 grains of good opium, subjected to the test process of the British Phar., yield from six to eight grains of morphia. When subjected to Dr Gregory's process, good opium should yield 10 per cent. of muriate of morphia. The following test of the Edin. Phar., though not so accurate, is more easy of application. "A solution from 100 grains of fine opium macerated twenty-four hours in two fluid ounces of water, filtered, and strongly squeezed in a cloth, if treated with a cold solution of half an ounce of carbonate of soda in two waters, yields a precipitate, which weighs when dry at least ten grains, and dissolves entirely in solution of oxalic acid." Pereira, in the last edition of his "Elements of Materia Medica," gives the following characters as distinctive of good opium. When treated with cold water it should be completely divided, the extractive matter becoming dissolved. The solution, although at first turbid, should speedily become clear, should gradually assume a brown colour, and, when boiled with chloride of calcium, should yield a white precipitate of meconate and sulphate of lime.

Composition.—Opium is a very complex substance, and the several published analyses of it differ much from each other. It contains at least seven crystalline principles, which are retained in solution by sulphuric and meconic acids. Some of these, and of the other more important constituents, are stated in the subjoined analysis, made in 1831 by Biltz, and copied from Professor Christison's Dispensatory :—

	Turkey Opium.
Morphia, not quite pure,	9·25
Narcotine,	7·50
Meconic acid, impure,	13·75
Bitter extractive,	6·50
Extractive, slightly bitter,	15·50
Deposit,	7·75
Albumen and Gluten,	20·00
Balsamic oil,	6·25
Gum and a little lime,	1·25
Caoutchouc,	2·00
Sulphate of potash,	2·00
Lime, iron, alumina, and phosphoric acid,	1·50
Lignine and impurities,	3·75
Ammonia, volatile oil, and loss,	3·00
	100·00

In the following paragraphs I shall briefly notice the more important of the various constituents of opium.

Morphia or *Morphine* is the most important of the crystalline principles of opium, and is best prepared by decomposing with ammonia a solution of muriate of morphia prepared by Dr William Gregory's process (p. 372), washing the precipitate, and drying it at a gentle heat. The yield from different specimens of opium varies from 4 to 9 per cent. It is a snow-white, hard, crystalline powder, with an intensely bitter taste, and an alkaline reaction. It usually occurs in six-sided needle-like crystals, which are commonly arranged in little tufts. It dissolves sparingly in water or ether, but readily in alcohol, potash, and weak acids, with which it forms crystallizable and usually soluble salts. With sesqui-chloride of iron, it produces a purple-blue solution, which gradually becomes green; with nitric acid, an orange-red solution; and with iodic acid, a red-brown liquid containing free iodine. Its composition, according to Regnault, is $C_{35}\ H_{20}\ N\ O_6$; according to the British Phar., $C_{34}\ H_{19}\ N\ O_6$. Its actions and uses are identical with those of its salts. (See p. 373.)

Codeia or *Codeine* is a white, bitter, crystallizable alkaloid, soluble in water, ether, and alcohol, insoluble in caustic potash, and unaffected by sesqui-chloride of iron. It exists in opium in the proportion of about a half per cent.; and may be prepared by evaporating to dryness the mother liquid, which remains after the precipitation of morphia from its hydrochlorate, dissolving out all traces of morphia by potash, and then purifying the codeine by solution in ether or water. It is represented by the formula $C_{36}\ H_{21}\ N\ O_6$, and resembles morphia in its physiological effects, but has only a fourth of its activity. It is stated by M. Aran that in the human subject it has all the efficacy of opium, without inducing restlessness, headache, or disordered digestion, and that its high price alone prevents its more extended use. This is, however, contradicted by Dr Garrod of King's College, who states that it allays neither irritability, restlessness, nor pain.

Narcotine exists in opium in quantities varying from one to eight per cent., and generally in inverse proportion to the amount of morphia. It may be got by treating the insoluble residue left in the preparation of morphia with diluted acetic acid, precipitating the solution with ammonia, and purifying the impure narcotine with hot alcohol and animal charcoal. It occurs in pearly tubular crystals, which have an insipid taste, and are soluble in alcohol, ether, and weak acids, but not in water or caustic potash. It is a feeble base, and forms bitter salts, which crystallize with difficulty. It is distinguished from morphia by the non-effect of nitric acid and sesqui-chloride of iron. It consists of $C_{46}\ H_{25}\ N\ O_{14}$. It is probably devoid of all narcotic action, but is antiperiodic, and has been advantageously used in India as a substitute for quinine in the treatment of intermittent and remittent fevers. It was at one time erroneously considered to be the cause of the peculiar and unpleasant effects which some persons experience in using opium.

Narceine is a feeble base present in opium, in quantities of from six to thirteen per cent. When pure, it forms silky, needle-like crystals, which are neutral, sparingly soluble in water, but readily soluble in alcohol, and produce a blue colour with hydrochloric acid. It consists, according to Dr Anderson, of $C_{46}\ H_{29}\ N\ O_{18}$. It is believed to be inert.

Thebaine or *paramorphia* is a white crystalline substance, with an acrid taste and an alkaline reaction. It is almost insoluble in water, but is soluble in alcohol and ether. Its formula is $C_{38}\ H_{21}\ N\ O_6$. It has no narcotic effect; but is said by Magendie to act like strychnine, a single grain injected into the jugular vein or pleura of a dog producing violent tetanic spasms, and death in a few seconds.

Papaverine, another crystalline base, has recently been found in opium. It is as yet little known, but appears analogous to thebaine, and has the composition $C_{40}\ H_{21}\ N\ O_8$.

Porphyroxine is a neutral crystalline principle, forming, when heated with acids, a red or purple solution. Its action is not well known.

Meconine is a white, fusible, volatile, crystalline, neutral principle, soluble in water, alcohol, and ether, and with an acrid but not bitter taste. It has the formula $C_{10}\ H_5\ O_4$; and is probably quite inert.

Meconic Acid is a crystalline substance found only in opium, and forming, along with a small quantity of sulphuric acid, the solvent for the basic crystalline principles already noticed. It is present in Turkey opium in quantities varying from four to seven per cent. (Mülder); and may be obtained as a by-product in the preparation of muriate of morphia, by mixing the crude meconate of lime (see process for muriate of morphia, p. 372) with twenty parts of boiling water and three parts of strong hydrochloric acid. The purifying of the meconic acid from sulphate of lime and colouring matter is troublesome and tedious. The acid, when pure, is in brilliant, snow-white, scaly crystals, which are soluble in water and alcohol. Its watery solution, when heated above 150°, is decomposed, and becomes of a dark-brown colour. It forms, with sesqui-chloride of iron, a blood-red solution; and with ammonio-sulphate of copper, a green precipitate. It is a tribasic acid, with the composition $C_{14}\ H\ O_{11} \times 3\ HO$, and is believed to be nearly inert.

Besides these crystalline constituents, opium contains a brown resinous substance, which, when exposed to the air or to heat, combines with the alkaloids forming insoluble compounds—a brown extractive matter, which has been supposed to impart some narcotic property to the drug—an oily or fatty substance—and a volatile odorous principle not yet isolated, but the chief cause of the characteristic aroma of opium. The more important of the other constituents are mentioned in the analysis above given.

Physical and Chemical Tests.—Having briefly referred to the different constituents of opium, it will be necessary shortly to notice the methods of recognising it, whether in mass or in simple or complex solutions. Solid opium is easily identified by its red-brown colour, peculiar odour, and bitter taste; and a simple solution by the last two of these tests, and by the reaction of nitric acid on the morphia, or of sesqui-chloride of iron on the meconic acid. Opium, however, cannot be detected in the contents of the stomach or other complex solutions, until these be freed of their colouring matters and impurities. This may be effected in several different ways, but the following process will be found simple and effectual:—Reduce the solid parts of the mixture to a state of fine division, add water if necessary, acidulate with acetic acid, filter and evaporate to the consistency of a syrup. Redissolve this in alcohol, boil, and filter when cool. Then evaporate the solution, dissolve the semi-solid residue in water, and filter again. The fluid, which should now be tolerably clear, and contain (if opium has been present) the meconate of morphia, is treated with excess of acetate of lead and filtered. The clear solution so got contains acetate of morphia; the solid residue left on the filter is meconate of lead, and both the solution and the residue afford valuable indications of the presence of opium.

The clear solution is treated with sulphuretted hydrogen to remove any traces of lead; is filtered and treated with ammonia to precipitate the morphia, which is washed, purified if necessary by solution in alcohol, and crystallized in colourless, flattened, hexagonal prisms. Nitric acid dissolves these crystals with effervescence, instantly producing an orange-red colour, which becomes yellow when excess of acid is used. This is a very delicate test, but is not alone certain evidence of the presence of morphia, as nitric acid produces the same effect on brucia and commercial strychnia—the alkaloids of nux vomica. The action of perchloride of iron, though scarcely so delicate, is very characteristic. When a drop or two is added to water, containing morphia suspended in it in a state of fine division, it dissolves the alkaloid, forming a greenish-blue solution. A third test for morphia is the brown colour it produces in a solution of iodic acid. But this test cannot be much depended on, for iodic acid is similarly affected by many other substances besides morphia and its salts.

The solid residue left on the filter, and containing, as above stated, meconate of lead, should also be examined, as the tests for meconic acid are very delicate, and afford indications of the presence of opium, even when it is in such minute quantities as to be undetectable by testing for morphia. The meconic acid may be separated from the lead either by sulphuretted hydrogen or sulphuric acid, both of which combine with the metal forming insoluble salts, which are subsequently got rid of by filtration, leaving the meconic acid in solution. There are several ways in which it may be identified. (*a.*) If in considerable quantity it may be purified, when it appears in fine, thin, delicate, tabular crystals, which when aggregated have an appearance like spermaceti. (*b.*) It may be heated in a tube when it is partly decomposed, partly sublimed, forming radiated tufts of needle-like crystals of pyromeconic acid. (*c.*) In solution, it produces, with sulphate of copper, a pale green precipitate, which is dissolved by boiling, but reappears on cooling. (*d.*) But its most delicate and characteristic test is the production, with perchloride of iron, of an intense blood-red solution of meconate of iron. For all practical purposes, this test, along with the reaction of nitric acid upon morphia, is conclusive evidence of the presence of opium. It may, however, be remembered that perchloride of iron produces a blood-red solution with acetates, but only in strong solutions, and when the acetic acid can be easily detected by other tests; and with sulpho-cyanides, which are very rare bodies, existing, it is said, in the saliva of sheep. There are, however, two simple tests, which remove this source of fallacy, and readily distinguish the sulpho-cyanide from the meconate of iron. Corrosive sublimate bleaches the sulpho-cyanide, but does not affect the colour of the meconate. When a portion of each is placed in a separate test-tube, and treated with a few drops of sulphuric acid and a bit of zinc, sulphuretted hydrogen is given off from the former, but not from the latter of the two solutions. The evolution of the gas is easily detected by its blackening a bit of paper, dipped in a solution, either of acetate of lead or of nitrate of silver.

Actions and Uses.—Possessed of many different physiological actions, opium is applied for the alleviation and cure of many diseases. It is narcotic, sedative and anodyne, stimulant, antispasmodic, diaphoretic, febrifuge, and an inspissant of mucous discharges.

Like many other medicines and poisons, it has a primary stimulant, and secondary depressant action, as is well illustrated in its topical effect on the skin and mucous surfaces. Its absorption precedes the development of its constitutional effects. It is capable of being taken up from any of the mucous or serous surfaces, from the skin, or from wounds. After entering the blood, it appears to act chiefly on the nerves and nervous centres, first increasing and then diminishing their action. It usually develops in the lower animals a greater degree of preliminary excitement than in man, and acts more on the posterior parts of the spinal column than on the brain proper, as is well established by its action in poisonous doses. These produce in the lower animals febrile symptoms, imperfect power of motion, convulsions, and death, usually resulting from apnœa or syncope; whilst in man they cause scarcely any exaltation of nervous force, but vertigo, imperfect perception, deadly stupor, and death usually from coma. While opium circulates in the blood, it also appears immediately and directly to relax muscular fibre, especially that of the involuntary muscles, which is probably the physiological origin of its actions, as a diaphoretic, antispasmodic, and astringent or inspissant.

Horses and cattle are less susceptible to the action of opium than dogs and men, and resist especially its soporific tendency. Hertwig mentions that doses of from two to four drachms, when given to horses, have scarcely any other effect than that of a slight stimulant; and that an ounce given in solution caused first increased liveliness, and, after two hours, dulness, diminished sensibility, slower circulation, less frequent evacuations, and stupor,—symptoms which continued for twelve hours, but entirely disappeared by the following day. Two ounces and a half induced similar effects, with convulsions and death in about twenty hours. On 15th November 1852 I gave a strong healthy horse one ounce of powdered opium dissolved in water, and observed that the pulse became small and weak, and in eight minutes fell from forty-four to thirty-four beats per minute; that the superficial fleshy muscles were relaxed, the nasal mucous membrane blanched, and the animal dull and dejected. From disease of the eyes the condition of the pupil could not be noted. After half an hour, four drachms, also dissolved in water, were given, and increased the dulness, the hanging of the head, and weakness of the pulse, which now numbered thirty-two. In half an hour more, the animal, continuing in the same state, was destroyed by cutting the carotid artery. In another experiment made about the same time on a mare, which, however, was aged and rather feeble, doses of one drachm given in solution thrice a day caused dulness, loss of appetite, constipation, diminished force of the pulse, and death on the fourth day, and after the exhibition of nine doses. One drachm given thrice a day to a healthy donkey induced, after six doses, acceleration of the pulse to eighty-eight, feverishness, vertigo, nausea, champing of the teeth, and death on the third day of the experiment.

Opium acts even less powerfully on ruminants than on such animals as the horse. Cows take an ounce, and sheep four drachms, without suffering any further bad effects than dryness of the mouth, occasional nausea, and slight depression of the pulse. Swine, after receiving one or two drachms, become first lively, and then dull and sleepy, their bowels constipated, and their skins hot. From one to three drachms given to dogs usually cause, within a few minutes, increased force and frequency of the circulation. Shortly, however, the pulse becomes small and weak, and there is nausea, a staggering unsteady gait, dilated pupils, twitching of the limbs, convulsions, stertorous breathing, and, as death approaches, a tendency to coma, which is never, however, so deep or lasting as in the human subject, and from which the animal may always be easily roused. The continuance of these symptoms varies from three to fifteen hours; and most animals which survive the latter period eventually recover.

On opening the bodies of animals poisoned by large doses of opium, the brain and lungs are found gorged with dark-coloured fluid blood, which does not, however, yield on analysis any indication of the presence of opium. The stomach and intestines are occasionally slightly reddened. The body passes very rapidly into a state of putrefaction.

In cases of poisoning by opium, which, however, are much rarer among the lower animals than in man, it is essential, in the first place, to get rid of all the poison that may be still unabsorbed, by the prompt employment either of the stomach-pump or of emetics, the latter of which are most effectual both in men and dogs. Any tendency to coma should be prevented by moving the animal about. Blood may also be drawn from the jugular vein to relieve congestion of the lungs, which sometimes proves speedily fatal. In man, the dashing of cold water over the head and chest, artificial respiration, and galvanism, have sometimes saved life even in very desperate cases. Various chemical antidotes have been proposed, but none have stood the test of experience. Even tincture of galls, which is undoubtedly the best, is of little avail unless the stomach be evacuated, and the antidote given early. Belladonna, which is in some respects antagonistic to opium in its effects, may also be tried.

Opium is prescribed in more diseases than any other article of the materia medica. Relieving pain and irritability, it is often serviceable in bronchitis, pneumonia, and pleurisy, whether in horses, cattle, or dogs; and is commonly given in combination with calomel. The doses usually administered are one drachm of opium, and one scruple of calomel, for horses and cattle; and about ten grains of opium and three grains of calomel for dogs. Such doses, when repeated every two hours, seldom fail in reducing the pulse and relieving the breathing. If, however, after being used six or eight times, they are of no benefit, they should be discontinued. Opium, with stimulants, is generally a very safe and successful mode of treating those epizootic catarrhs, pneumonias, and rheumatisms, which are usually known under the common title of influenza, and which were long erroneously and fatally doctored by antiphlogistic remedies. In such cases a good combination consists of a drachm of opium, and an ounce of sweet spirit of nitre or ether, to which a drachm of kino may be added if the bowels are unduly relaxed. An ounce each of laudanum, chloroform, and sweet spirit of nitre, is also very useful, must be given in a little gruel, and repeated every second or third hour. A similar plan of treatment is also usually effectual in relieving asthma—a common complaint among dogs. Diarrhœa, occurring sometimes as an idiopathic complaint, and sometimes as a symptom of other diseases, is in either case often removed by giving a mild laxative to carry away those irritant matters on which it usually depends. But occasionally the complaint continues from a relaxed or irritable state of the intestines; and in such cases a few doses of opium will be an almost effectual cure, and may sometimes be advantageously united with acids, bitters, or vegetable astringents. The following recipes answer well for such purposes either in horses or cattle:—A drachm each of powdered opium, kino, gentian, and carbonate of soda; or a drachm of opium, a drachm of powdered galls or half a drachm of tannin, and half an ounce of chalk. These ingredients may either be made into balls with treacle or linseed meal, or dissolved in a pint of ale or of gruel, and given twice or thrice a day as required. An ounce of laudanum, thirty drops of sulphuric acid, two drachms of powdered catechu, with an ounce of ginger, aniseed, or fenugreec, make a good drench for diarrhœa in the cow, and may be given in gruel, ale, or spirits and water. Another useful prescription for such cases consists of an ounce each of laudanum, decoction of oak bark, ginger, and carbonate of soda, given several times daily in a bottle of gruel or ale. Half this dose will suffice for three-months-old calves. For dogs, Stonehenge mixes three to eight drachms of laudanum, two to three drachms of chalk, one drachm of aromatic confection, and two drachms of gum arabic, dissolved in seven ounces of water; and orders of this mixture one to two table-spoonfuls every time the bowels are relaxed. In dysentery, whether in horses, cattle, or dogs, opium is of the greatest service in allaying pain and straining, and may usually be freely given both by the mouth and rectum. A drachm each of powdered opium, galls, and sulphate of copper, is a good formula, and may be repeated twice a day for horses, and thrice for cattle. If, however, there is much fever, this mixture, or indeed opium itself, must be used cautiously, and laxatives may occasionally be necessary to remove any undue accumulation of feces. When applied to muscular tissue, opium, as already noticed, almost immediately produces a sedative effect; and hence its value in relieving those spasmodic affections of the intestines which are so common among horses. It is regarded as an almost indispensable constituent of all colic draughts, which usually contain besides, a stimulant, as sulphuric ether, sweet spirit of nitre, or oil of turpentine, and a laxative, as linseed or castor oil, or solution of aloes. As an antispasmodic for the dog, Stonehenge advises from half a drachm to a drachm each of laudanum and sulphuric ether, given in an ounce of camphor mixture. Obstinate chronic vomiting seldom occurs in dogs; but when it does, it may generally be relieved by the exhibition of a few grains of opium daily. A few drops of chloroform or creasote have the same effect. In peritonitis, whether common or puerperal, the chief hope of cure lies in the frequent administration of large doses of opium, which render the patient less susceptible to the intense pain, thus enabling him the better to bear up against the disease. In enteritis also, it should be given immediately after bleeding. In all such cases, where acute pain is to be blunted or violent spasm counteracted, it should be used in very large doses, conjoined with extract of belladonna, and given in solution. For either horses or cattle, a drachm each may, in such cases, be given every hour, until five or six doses have been taken. There is little fear of any bad consequences, for in such circumstances the system appears to attain great toleration of narcotics. Rheumatism is often advantageously treated with opium, which is used in the earlier and more acute stages of the disease with calomel; and in more advanced and chronic cases with colchicum and ipecacuan, smart friction, and warm clothing. In tetanus, occurring in young animals from exposure to cold, it is often of permanent utility, and is also frequently used in more serious cases amongst adult animals, to relieve the spasms and morbidly acute sensibility which characterize the disease: its marked effect in retarding the action of the bowels is, however, a great objection to its employment in such cases. Combined with chloroform, it is of service alike in horses, cows, and bitches, in allaying the irritability and straining which occasionally follow severe cases of parturition. Many practitioners recommend it in rabies and chorea, but it is of little use in either. It was once largely used in diabetes; but is much less to be depended on than iodine. It has no power to

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arrest phthisis pulmonalis; but is often serviceable in relieving the cough and diarrhœa which accompany that malady. The administration of opium is contra-indicated in acute fever, with a hot and dry skin, and a full and strong pulse, in congestive and inflammatory diseases of the brain, and in obstinate constipation.

Opium is much used externally for relieving the pain of wounds, blistered and cauterized surfaces, and superficial inflammation of the eye, skin, or joints. For such purposes, ten drops each of laudanum and Goulard's extract may be added to an ounce of water. When the skin is tender or abraded, it must, in small animals, be used with some caution, as it is apt to become absorbed, and produce its usual constitutional effects. It is of much value in cases of hemorrhoids, and as a soothing injection in enteritis, and in inflammatory affections of the kidneys and bladder. As an injection, it may be safely used in quantities two or three times as large as those in which it is given by the mouth.

Doses, etc.—The doses of opium vary much, according to the purposes for which they are given. The average dose of solid opium for horses is from ʒi. to ʒij.; for cattle, from ʒij. to ʒiv.; for sheep, grs. x. to grs. xxx.; for dogs, gr. i. to grs. iij.; and for cats, gr. ss. to grs. ij. It is often given alone, but, as already remarked, is frequently combined with other medicines, many of which alter its effects, increasing some of its actions and repressing others. To develop a sedative effect, it is combined with calomel, aconite, or tartar emetic; to cause a stimulant or antispasmodic action, it is given with sulphuric or nitrous ether; and to produce diaphoresis, it is conjoined with friction, exercise, and the use of diluents and ipecacuan.

The preparations of opium used in veterinary practice are less numerous than those employed in human medicine. *Crude opium* is often given to horses and dogs made into a bolus, and no other solid form is necessary. When required in the state of powder, it must first be carefully dried in a vapour bath. Its trituration is materially facilitated by previously mixing it with a little sulphate of potash or other hard salt. The *extract of opium*, though somewhat less bulky than crude opium, is not a commendable preparation; for the high temperature to which it is generally exposed during its preparation diminishes its activity, by causing the resinous matter of the opium to unite with the alkaloids to form a compound, which is insoluble, and of comparatively little activity. *Dover's powder*, or rather the pharmaceutical imitation of that patent nostrum, consists of one part each of powdered opium and of ipecacuan, and eight parts of sulphate of potash, which is added to facilitate the trituration and intermixture of the vegetable matters. It is sometimes given to dogs as a febrifuge, in doses of grs. iij. to grs. viij. A *watery solution*, made by rubbing down opium in hot water, is an excellent preparation for veterinary practice, being cheaper than the tincture, and more prompt and effectual than the solid drug. *Tincture of opium*, better known by its vernacular name of laudanum, is thus prepared by the process of the British Phar.:—Macerate an ounce and a half of opium in coarse powder for seven days in a pint of proof spirit; strain, express, and filter; and then add sufficient proof spirit to make one pint. Every 15 minims of this tincture contain one grain of opium; and the evaporation of a known quantity, and the weighing of the residuum, are the best safeguards against adulteration. An ounce of good laudanum should leave from 17 to 22 grains of residue. The dose of laudanum for horses and cattle is from f℥i. to f℥iij., and for dogs, from ♏xv. to ♏xxx. The vinegar and wine of opium are scarcely ever used in veterinary practice. An ammoniated tincture of opium may sometimes be useful, and may be prepared with an ounce of opium to a pint of spirit of ammonia. An etherial tincture is easily made with one or two ounces of opium to a pint of sweet spirit of nitre. By mixing laudanum and soap liniment, an excellent anodyne liniment is readily made, is much used externally, and is occasionally added to clysters; but for this latter purpose the tincture is generally preferred. In violent diarrhœa and dysentery, accompanied by pain and straining, there are few remedies more efficacious than injections of tincture of opium, mixed with warm starch gruel.

Muriate and Acetate of Morphia.

The two salts of morphia in common use in medical practice are the muriate and the acetate. The former recommends itself as being more easily prepared, more soluble, and more readily preserved from change.

Muriate or Hydrochlorate of Morphia (*Morphiæ Hydrochloras*) is got by macerating opium in water, when the meconate of morphia is dissolved out. Chloride of calcium is added to the solution, when mutual decomposition occurs, meconate of lime being precipitated, and muriate of morphia remaining in solution. The solution is concentrated, the salt of morphia is crystallized out, purified by strong pressure in flannel or stout calico (which removes narcotine and colouring water), and is then redissolved in hot water, and again crystallized. Several crystallizations, with the use of animal charcoal, are necessary to remove the last traces of colour; whilst, to free it from the codeia which adheres to it when thus made, it should be dissolved in water, and ammonia added to the solution; pure morphia is then precipitated, collected, redissolved in muriatic acid, and again crystallized. (British Phar.) When the process is carefully managed, good Turkey opium yields from 10 to 12 per cent. of muriate of morphia.

Properties.—The salt generally occurs as a fine snow-white powder, consisting of broken-down crystals, which, however, by the use of certain precautions, may be got entire in white, lustrous, flexible, needle-like prisms, which cluster together in radiated groups. It has no odour, but the same intensely bitter taste which characterizes morphia and all its salts. It is permanent in the air, decrepitates when heated, and at high temperatures is charred, and gives off a strong, peculiar odour. It is soluble in its own weight of water at 212°, and in fourteen parts of water at 60°. It is readily soluble in alcohol. Nitric acid and perchloride of iron act upon it as on morphia itself; and the intensity of the blue colour produced by perchloride of iron is a good criterion of the purity of the salt. Alkalies and lime-water precipitate the alkaloid from a strong solution. Muriate of morphia consists of one equivalent of base, one of acid, and six of water, and is represented by the symbol $C_{34}H_{19}NO_6 + HCL + 6HO$.

Impurities.—Though not very liable to adulteration, it has occasionally been found to contain considerable quantities of sugar, sometimes so much as 20 or even 30 per cent. This sophistication might easily be prevented by purchasing the salt in crystals. Most specimens contain a trace of colouring matter, which does not, however, affect their medicinal properties. The same may be said of the small quantities of narcotine and codeia which are occasionally present. The following are the distinctive tests of pure muriate of morphia:—"Entirely destructible by heat, leaving no residue. Twenty grains of the salt dissolved in half an ounce of warm water, with ammonia added in the slightest possible excess, give on cooling a crystalline precipitate, which, when washed with a little cold water, and dried by exposure to the air, weighs 15·18 grains." (British Phar.)

Actions and Uses.—Muriate of morphia possesses, in a concentrated form, all the actions of opium. In large doses, it acts on small animals, especially on carnivora, as a narcotic and sedative poison; and in medicinal doses, reduces the action of the heart, and allays irritation, pain, and spasm. When given for a short time, it produces constipation, and diminishes the amount of all the secretions, except that of the skin, which is more or less increased. It may be substituted for opium in almost all the many cases in which that drug is given.

Doses, etc.—The dose for horses and cattle is from grs. iij. to grs. x.; and for dogs, gr. $\frac{1}{4}$ to gr. i. It may be given in a bolus or in solution, which is directed to be prepared by mixing water f℥vj., rectified spirit f℥ij., dilute hydrochloric acid ♏xij., and dissolving in the mixture muriate of morphia grs. iv. (British Phar.) The dose of this solution is the same as that of laudanum, namely, about f℥i. for the larger animals, and ♏xv. or ♏xxx. for the smaller.

Acetate of Morphia used to be largely employed, especially in England; but being identical in its effects with the more convenient muriate, it is excluded from the new British Phar. It is prepared by decomposing a solution of muriate of morphia by ammonia, and adding diluted acetic acid to the precipitated morphia. The salt is then dried at a gentle heat. It bears a close resemblance to the pure alkaloid, is snow-white and obscurely crystalline, with an intensely bitter taste. It is decomposed and dissipated by heat; is almost completely soluble in water, and entirely so in acidulated water and alcohol. It is distinguished from morphia and its other salts by the acetous odour which it evolves on the addition of sulphuric acid. It is a compound of one equivalent of base, one of acid, and one of water. It may be easily dispensed with in veterinary practice, for its actions and uses are identical with those of the muriate, which is preferable for the reasons already stated.

PEPPERMINT.

Mentha Piperita. Herb and Distilled Oil of *Mentha piperita.*

Nat. Ord.—Labiatæ. *Sex. Syst.*—Didynamia Gymnospermia.

The natural family *Labiatæ* yields many fragrant plants used in medicine as stomachics, carminatives, and antispasmodics, and in pharmacy as flavouring aromatics. The most important of these are mint, lavender, rosemary, marjoram, and thyme, all closely resembling each other in their properties, actions, and uses.

The only one of these requiring special notice is peppermint, a small herbaceous plant, with a smooth annual stem, and oval, oblong petiolate leaves. All parts, but especially the leaves, have an agreeable aromatic odour, and a warm, bitter taste, followed by an impression of cold; and owe their properties to the presence of about one-320th part of a colourless or yellow volatile oil, which possesses in a concentrated form all the properties of the plant, and is obtained by distilling with water the fresh herb when in flower. The herb itself is little used. The distilled oil is occasionally prescribed in cases of indigestion, flatulence, and griping, in doses of about ♏xx. for horses and cattle, and ℥iij. for the dog. Its chief use is for disguising the flavour of unpalatable drugs, and preventing their nauseating and irritating effects. Peppermint water is prepared by distilling the fresh flowering herb with water and a little rectified spirit. A strong spirit or essence of peppermint, very suitable either for medicinal or pharmaceutical purposes, is prepared by dissolving one part of the volatile oil in eight parts of rectified spirit. (Pereira.)

The *M. Viridis*, or spearmint, and the *M. Pulegium*, or pennyroyal, have exactly the same actions and uses as the peppermint, but are scarcely so powerful.

PEPPERS.

The *black and white peppers* in daily domestic use are obtained from the brown wrinkled berries of an East Indian climbing plant—the *Piper nigrum.* To prepare black pepper, the berries are pulled before they are ripe, dried in the sun, and ground without separating their outer covering. To prepare white pepper, the ripe berries are steeped in water, and their outer covering carefully separated before they are ground. The pepper so got is lighter coloured and milder than the other. Both sorts have, when bruised, a hot, pungent, spicy taste, and contain a white crystallizable substance called piperin, a bland volatile oil, and an oleo-resinous matter, which is believed to be their chief active principle. *Long pepper* consists of small, closely-attached berries, arranged on cylindrical grey spadices about one or two inches long. When ground, it exhibits all the properties of the common pepper.

Cubebs or *cubebæ* are the berries of the *Piper Cubeba*—a plant indigenous to the Spice Islands. The berries resemble those of the common pepper, are globular, rough, and wrinkled, with a grey-brown colour, a strong odour, and a pungent aromatic bitter taste. Their most important constituents are a volatile oil, and an acrid resinous principle called cubebin, which, however, is now believed by most chemists to be identical with piperin.

Jamaica pepper—pimento or *allspice*—closely resembles the true peppers in all important characters, and is the produce of a large tree of the natural family *Myrtaceæ.* The berries are about the same size as those of the *Piper nigrum*, have a penetrating aromatic odour, and a hot, pungent taste, but are more truly aromatic and less acrid than those of the common pepper.

Capsicum berries, also called Chilly pepper or Chillies, are brought from the East and West Indies. The several varieties differ much in their shape and size, but are all of a red colour, and filled with numerous seeds. They are seldom used whole; but, when dried and ground to powder, constitute the familiar *cayenne pepper*, which has a reddish-yellow colour, a faint disagreeable odour, and an acrid pungent taste. It owes its properties to an acrid oleaginous principle called capsicin.

Actions and Uses.—The different varieties of pepper are irritant, stomachic, and rubefacient. In large doses, especially in carnivora and omnivora, they act as irritant poisons, causing inflammation of the bowels, and sometimes also of the urinogenital organs, with general vascular excitement. The popular belief, that they are especially poisonous to pigs, is entirely fallacious. In smaller quantity they are stomachic and carminative, and in properly regulated doses exert merely a local action. When freely applied to the surface of the skin, they cause redness, irritation, swelling, and sometimes suppuration. The several varieties of pepper differ considerably in the degree or intensity of their action. The black pepper is more active than the white and long peppers, which are considered of nearly equal strength. Cubebs is less irritant and stimulant than any of the others, and is chiefly important on account of its power of arresting excessive mucous discharges. Pimento is also less active than the common peppers, is occasionally used as a carminative, and frequently as a flavouring aromatic; while capsicum and cayenne are more powerfully irritant than even black pepper.

Black pepper, which is the variety chiefly used in veterinary practice, is administered in simple indigestion; with other appropriate remedies in cases of colic; and for covering the disagreeable taste, and preventing the nauseating effects of various drugs. It is not now given as a sialogogue; and ought never to be used with the irrational intention of developing or increasing the sexual appetite, which, when defective, may usually be restored, not by irritating drugs, but by measures which improve the general vigour. It is occasionally added to blistering ointments, and is also used for smearing setons. Ground pepper is one of those irritating substances which are sometimes introduced into the rectum of horses exposed for sale,—a barbarous practice, which is apt to induce serious irritation, and even inflammation of the intestines.

Doses, etc.—The dose of black pepper, as a stomachic and carminative, is, for the horse, ʒij.; for cattle, ʒiij.; for sheep and swine, from ℈i. to ℈ij.; and for dogs, from grs. v. to grs. x. These doses may be repeated two or three times a day; and may be given made into a bolus, dissolved in water or spirit, or suspended in well-boiled gruel, which is one of the best and safest ways of administering it. An ointment made with one or two drachms of ground pepper to the ounce of lard is occasionally used for external purposes.

PETROLEUM—BARBADOES TAR—NAPHTHA.

Petroleum is a somewhat vague term, applied to a class of bituminous substances which exude from the soil in many climates, varying in density and solidity from the hard brittle asphalt and mineral pitch to the viscid mineral tar and fluid naphthas. The petroleum brought from Rangoon in Ava is obtained in unlimited quantities by digging into the soil, is of the consistence of paste, of a greenish-brown colour, and an agreeable bituminous odour. Within the last few years enormous quantities of petroleum have been brought from the oil springs or wells of Canada and the Northern States of America. It contains small quantities of paraffin and other allied hydrocarbons, the nature of which have not yet been thoroughly examined, and is mostly purified for burning in lamps. The variety known as *Barbadoes*, or *mineral-tar*, is found in the Island of Barbadoes, floating on the surface of springs or pools, and in Trinidad, forming extensive beds or lakes. It is of a dull, greenish-brown colour, with a strong, disagreeable, and persistent naphthous odour, and a bitter acrid taste. Like other substances of the class, it becomes hard and pitch-like when exposed to the air; and, when heated, first liquefies, and by and by evolves a volatile naphthous fluid, leaving a solid residue of asphaltum. The fixed and volatile oils are its best solvents. It contains carbon and hydrogen, with a little oxygen and nitrogen.

Actions and Uses.—The several varieties of petroleum are irritant, stimulant, diuretic, and anthelmintic. They were once much used as specifics in chest diseases, and as anti-emetics; but as internal remedies they have now fallen into disrepute. Barbadoes tar is still, however, applied externally for the same purposes as wood-tar, particularly for the cure of cutaneous affections, chronic wounds, and various diseases of the feet.

PODOPHYLLUM—PODOPHYLLIN.

Dried root of *Podophyllum peltatum*, from which the resin Podophyllin is extracted by means of rectified spirit.

Nat. Ord.—Ranunculaceæ. *Sex. Syst.*—Polyandria Polygynia.

The Podophyllum or May apple grows abundantly in the Northern States of America, where its subacid fruit is eaten under the name of wild lemons. The root is imported "in pieces of variable length, about two inches thick; mostly wrinkled longitudinally; dark reddish; brown externally; whitish within; breaking with a short fracture; accompanied by pale brown rootlets. Powder yellowish grey; sweetish in odour; bitterish, sub-acrid, and nauseous in taste." (Brit. Phar.) For upwards of forty years the root has been known as an emetic and cathartic. In doses of from thirty to sixty grains, it acts in the human subject much in the same way as jalap; but the unpleasant sensations it produces in the throat, and the nausea, vomiting, and depression often following its administration, greatly limit its use.

The resin or podophyllin is prepared by percolating rectified spirit through the powdered root. It is a pale greenish-brown amorphous powder; almost entirely soluble in pure ether, and quite soluble in rectified spirit, and in ammonia; precipitated from the former solution by water, from the latter by acids. (Brit. Phar.) It contains in concentrated form the active principles of the drug, has been extensively employed by medical men in America since 1847, and has more recently been used by many British practitioners. Half a grain to a grain slowly evacuates the bowels, and is believed to act especially upon the liver; indeed, as a cholagogue, it is considered to be more certain and effectual than mercury. It is found serviceable in habitual constipation and congested states of the liver, and in smaller doses has, besides, been used as an alterative in skin diseases and rheumatism. Dr F. G. Anstie, assistant-physician to the Westminster Hospital, made, in 1863, a series of interesting experiments with an alcoholic solution of podophyllin, which he injected into the peritoneum of dogs, cats, and rats. In dogs about eighteen inches high, the alcoholic solution, in quantities containing from one to two grains of podophyllin, caused no uneasiness or movement of the bowels until ten or fifteen hours after the injection, when vomiting and purging were set up, the frequently passed dejections became very fluid, freely mixed with mucus, and usually tinged with blood; the breathing was shallow and hurried; the pulse feeble, at first rapid, but after a few hours very slow; insensibility, disturbed by occasional convulsions, continued for several hours before death, which occurred in twenty-two hours after the injection. There was no inflammation of the peritoneum, the stomach was perfectly healthy; but the small intestines, and especially the duodenum, were intensely reddened and inflamed; and where two grains had been injected, nine ulcers, of somewhat smaller size than a threepenny piece, were also found in the duodenum. The large intestines were healthy; there was no unusual amount of bile in the bowels, and no congestion or inflammation of the liver; the kidneys and mucous membrane of the urinary passages were slightly congested. Similar results were noticeable in cats, which required for the development of these poisonous effects doses fully larger than those which destroyed dogs. From his experiments, Dr Anstie draws the following conclusions:—

"I. Podophyllin, when injected into the peritoneal cavity of dogs, cats, or rats, has no irritant action upon the serous membrane, unless it remain unabsorbed, lying for some time in contact with it.

"II. Podophyllin, when injected into the peritoneal cavity, passes into the blood, and exercises a special influence of an irritant kind upon the mucous membrane of the intestines, usually of the small intestines only.

"III. As a secondary result of this irritation, or perhaps as a mere consequence of the squeezing of the gall-bladder by the abdominal muscles in repeated efforts at defecation, bile is occasionally poured out in large quantities; but this is by no means necessary.

"IV. Neither poisonous doses, nor those which produce what may be called a medicinal effect, appear capable of exciting any inflammatory process in the liver.

"V. For all these reasons, it appears pretty certain, that podophyllin in the animals above mentioned, does not act directly on the liver; and that the catharsis produced is due to increased secretion from the intestine, consequent on the specific irritation of its mucous membrane."—*Medical Times and Gazette*, March and May 1863.

I find that one grain of podophyllin, bolted in a piece of meat by an English terrier, weighing twenty pounds, produced no notable effect upon the bowels; and that two grains acted as a gentle laxative, but only eight hours after exhibition. My friend, Mr Thomas A. Dollar, V.S., of New Bond Street, London, has used the drug frequently, both in dogs and horses, and has kindly placed at my disposal his notes of the three following cases:—

To a Scotch terrier, eight months old, Mr Dollar administered half a grain of podophyllin in a pill, without any apparent effect; and on the following day a grain, which in the course of an hour caused nausea and vomiting: considerable dulness remained for twenty-four hours.

A bull terrier bitch, of thirty-six lbs. live weight, received four grains in a pill, without showing any notable symptoms; and on the following day got a further dose of six grains, which in twelve hours produced great uneasiness and griping, and a gentle purgative action. During the two following days the bitch refused her food, and for a week continued dull and listless.

A French poodle, suffering from mange and constipation, had a pill, containing two grains of podophyllin, half a grain of calomel, and a scruple of jalap. No effect was observable at the end of twelve hours, when the dose was repeated, and in eight hours more the dog was briskly purged. Half the above dose was repeated every second day for a fortnight, with the result of gently moving the bowels, and gradually removing the mange. In none of these cases were the feces much altered in colour, or were there any indications of any special action upon the liver; the secretion of urine was unchanged; but in all the pulse was reduced in number and in strength.

As is the case with so many other medicines, podophyllin has even less effect on cattle and horses than on men and dogs. To three healthy shorthorn cows I have given three drachms each, and to another cow half an ounce, without observing any laxative effect whatever. I have repeatedly given healthy horses, prepared by a mash diet, two drachms of podophyllin without being able to perceive any increased action of the bowels. Two drachms, even when united with one or two drachms of aloes, added, to determine, if possible, its action on the bowels, produced only such slight softening of the dung as might be expected to follow from the dose of aloes alone. I am again indebted to Mr Dollar for the following interesting experiments:—

A thorough-bred horse, well prepared by mashes, had two drachms of podophyllin without its producing the slightest purgative effect. Two days later he again received two drachms, with a drachm of aloes, still without any noticeable action on the bowels. In four hours after the second dose, the pulse, however, was observed to have fallen from 44 to 34 beats per minute. During three days this horse ate nothing but bran; getting tired of this, he had for two days hay and a little corn; for twenty-four hours he was again restricted to the bran mashes, and then received two drachms each of podophyllin and aloes, which, even after this careful preparation, only produced a slight laxative effect.

To a well-bred hunter, nearly sixteen hands high, under treatment for injury of the psoas muscles, and fed for twenty-four hours on bran mashes, Mr Dollar administered two drachms of podophyllin in a ball, and two ounces of Epsom salt in solution. Scarcely any perceptible action was observed on the bowels, and two days later two drachms of podophyllin, and one drachm of calomel, were given, also without purgative effect, but with a reduction, as in the last case, of nearly ten beats per minute in the pulse.

A powerful cart-horse, under treatment for sand-crack, and previously restricted for twenty-four hours to a mash diet, got four drachms of podophyllin in a ball. Although no purgation followed, there was much nausea, and in two hours the pulse became soft and somewhat weakened, fell from 36 to 24 beats per minute, and did not recover its natural force or number until next day. The appetite continued impaired for a week.

A thorough-bred mare, 14½ hands high, under treatment for abscess from speedy cut, was placed on mash diet for twenty-four hours, and then received two drachms of podophyllin in a ball, but without showing any increased action of the bowels. For four consecutive days the mashes were continued, and two drachms of the drug repeated daily until ten drachms had been taken, still without any purgative effect. The pulse, however, which at first was 44, had gradually fallen a few beats daily, until on the fifth day it was 30. By the end of the experiment the coat stared, all food was refused during nearly two days, and a fortnight elapsed before the mare recovered her usual appetite and appearance.

From these and other experiments, it is very evident that podophyllin is not likely to be serviceable as a purgative for the domesticated animals; and that it acts very tardily, and only when given in doses so large as to induce much nausea. Mr Dollar's observations show, however, that it is possessed of decided sedative effects, which appear considerably to resemble those of digitalis. It may probably be found useful in lowering the inordinate action of the heart in acute diseases of the respiratory organs, rheumatism, laminitis, and other inflammatory disorders.

Doses, etc.—For such sedative purposes podophyllin may be given to horses and cattle in doses of one or two drachms, united with a drachm of calomel, or an ounce or two of nitre or of Epsom salt. For dogs, one or two grains may be conjoined with a grain of calomel, five or ten grains of grey powder, or about the same quantity of ipecacuan.

POTASSIUM AND ITS MEDICINAL COMPOUNDS.

POTASH. Caustic potash. Potassa caustica. Potassa fusa. Hydrate of potash. KO, HO.

SOLUTION OF POTASH. Potassæ aqua.

Aqua potassæ is prepared by boiling together carbonate of potash, or pearl ashes, and milk of lime. It is a dense, oily-like fluid, without colour or odour, and with an intensely acrid, alkaline, soapy taste, and an alkaline reaction on colouring matter. It readily unites with oils and fats forming soaps, and with acids forming neutral, soluble, crystallizable salts. It unites with the soft animal and vegetable tissues, abstracting their watery parts, softening and dissolving them; and to this is owing its actions as a poison, and its uses as a caustic. Although little used in medicine, it is of much importance in chemistry and pharmacy, and in various other arts. When aqua potassæ is boiled down, until a drop removed on a stirrer becomes hard on cooling, and the oily liquid then poured into small pencil-like moulds, it forms dark-grey, deliquescent, hard, crystalline sticks of *caustic potash*, which has all the well-marked characters of aqua potassæ, and consists of potash with an equivalent of water.

Potash and its salts are identified by their giving in solution a crystalline yellow precipitate with bichloride of platinum, a granular white precipitate with tartaric acid; and when evaporated to dryness, and ignited with alcohol, a faint, violet-coloured flame. From faulty preparation or bad keeping, caustic potash is apt to contain various impurities, especially oxide of iron, silica, and carbonates of potash, with other salts of that base; but these impurities seldom interfere with its medicinal actions.

Actions and Uses.—Potash is, in large doses, a corrosive and irritant poison; in medicinal doses, an antacid and diuretic; and is, besides, used externally as a caustic. When excessive doses are swallowed, either in a fluid or solid state, they dissolve, soften, and corrode the coats of the œsophagus and stomach, sometimes so severely as to cause perforation. Hertwig found that two drachms of caustic potash, dissolved in six ounces of water, caused the death of a horse, with symptoms of colic, in thirty-two hours. Orfila gave a dog thirty-two grains of caustic potash, which caused violent vomiting, restlessness, and death in three days. On post-mortem examination, he found the mucous coat of the œsophagus and stomach red and black from extravasation of blood, with a perforation near the pylorus three-quarters of an inch in size, and surrounded by a hard thickened margin. (Christison on Poisons.) The exhibition of small or highly diluted doses gradually interferes with digestion and assimilation, and destroys life by inanition. In poisonous doses it depresses the action of the heart, solely in virtue of its topical corrosive and irritant effects, and does not appear to become absorbed, or to exert any general constitutional influence. To counteract the poisonous action of potash, administer diluted acids which form mild salts, and oils which produce soaps—themselves of service as demulcents, and in men and dogs as auxiliary emetics. Potash is rarely used internally, either in the fluid or solid state. When swallowed in solution in medicinal doses, it counteracts acidity in the stomach, and hence its value in cases of indigestion. In the stomach it appears to be in part converted into a carbonate; but a portion is also probably absorbed before it can be neutralized by the gastric juice, and thus increases the amount of free alkali in the blood. Hence its value in rheumatic affections, in which excess of acid is noticeable alike in the blood and the urine. Hence also its advantage in febrile and inflammatory complaints, in which it probably exerts a solvent action on fibrine, preventing its deposition. Like other alkaline substances, it is removed from the blood through the kidneys, increasing the quantity of the urine, and counteracting its undue acidity,—a condition, however, which seldom occurs amongst vegetable-feeding animals. Most of these important purposes are also effected by the carbonates of potash, and likewise by soda and its carbonates; but these soda salts are less suitable for removing the lithic acid deposits which occasionally occur in men and dogs, for the lithate of soda is greatly less soluble than the lithate of potash. The little sticks of caustic potash before adverted to are frequently used as a caustic for stimulating unhealthy ulcers, and inducing suppuration; but as they are very deliquescent, they must be applied with much caution.

It will materially simplify the understanding of the general actions of the salts of potash, to remember that they are divisible into two groups: 1*st*, Those which are topically corrosive, antacid, and antilithic,—such as potash and its compounds with carbonic acid; 2*d*, Those which are irritant, cathartic, diuretic, alterative, and refrigerant,—such as the sulphate, acetate, nitrate, chlorate, permanganate, and almost all the other salts of potash. A third group might also be added, including those salts which act rather like their acid or salt radicle half than their basyle half,—such as the sulphuret, iodide, and bromide of potassium, which is now recommended in the human subject as a remedy for epilepsy, and may probably prove equally useful for dogs, for which the dose would vary from grs. v. to grs. x., repeated thrice daily.

Carbonate of Potash. Potassæ Carbonas. $KO, CO_2 + 2HO$.
Bicarbonate of Potash. Potassæ Bicarbonas. $KO, HO, 2CO_2$.

These two salts are obtained from the ashes of land plants.

In the American potashes, in their partially purified condition of pearl ashes, there is present nearly eighty per cent. of carbonate of potash, with about twenty per cent. of sulphate of potash and chloride of potassium. These latter are less soluble than the carbonate, and are got rid of by dissolving the pearl ashes in an equal weight of water, pouring off the solution, and evaporating it to dryness. Where a very pure carbonate of potash is required, it is easily got by burning together two parts of bitartrate of potash and one of nitre, adding water, and filtering and evaporating the solution. Carbonate of potash occurs sometimes in crystals, but generally in grains; is white, opaque, and inodorous, with a strong alkaline taste, and an alkaline reaction on test paper. It is soluble in its own weight of water at 60°, deliquesces rapidly in the air; but, as it gradually absorbs carbonic acid, it slowly dries up again.

Bicarbonate of potash is prepared by passing a current of carbonic acid through a saturated solution of the neutral or mono-carbonate; or, according to the directions of the Edin. Phar., by triturating together carbonate of potash and carbonate of ammonia, with sufficiency of water to make a smooth, uniform pulp, and drying this at about 140°, until all ammoniacal odour is removed. The bicarbonate usually occurs in transparent, colourless prisms; has a mild, saline, and slightly alkaline taste; dissolves in about four times its own weight of water at 60°; and when heated to redness, gives off carbonic acid, and becomes converted into the neutral carbonate, from which it is distinguished by its milder taste, by its remaining unchanged when exposed to the air, and by its giving, when in diluted solution, no precipitate with solutions of sulphate of magnesia or corrosive sublimate.

Actions and Uses.—The two carbonates of potash differ only in the degree of their action. Both resemble potash, but have their activity tempered and diminished by combination with carbonic acid. The neutral carbonate, when in concentrated solution, has much of the corrosive action of the pure alkali. Two drachms of it, given to a dog, caused vomiting, great agony, and death in twenty-five minutes. (Orfila.) Its antidotes are the same as those for caustic potash. It is sometimes used medicinally as an antacid, but the cheaper and milder bicarbonate of soda is generally preferred. As a diuretic, it is less certain and active than the nitrate or acetate. In its impure condition of pearl ashes, it is sometimes applied externally as a stimulant and detergent. At the Cape of Good Hope a ley made from wood ashes is used successfully as a remedy for scab, either alone or when mixed with sulphur. Diluted with 20 parts of water, it forms a good dressing for red mange in dogs. The bicarbonate is devoid of corrosive and irritant properties, but is antacid, alterative, and diuretic. It is, however, seldom used in veterinary practice.

Doses, etc.—The dose of the neutral carbonate, as an antacid for horses and cattle, is from ʒiv. to ʒviij.; and for sheep and dogs, from grs. x. to grs. xl. These doses may be repeated several times a day, liberally diluted with water.

SULPHURET OF POTASSIUM. Liver of Sulphur. A mixture of Per-sulphuret of Potassium (KS_3) and Hypo-sulphite and Sulphite of Potash, with a little Sulphate and Carbonate of Potash.—(Winckler.)

This complex body is prepared by rubbing together four and a half ounces of sulphur and ten ounces of carbonate of potash, and keeping the mixture in a crucible over a fire until perfect union occurs. It has usually a whitish-green colour; but, when freshly prepared, is liver-brown, and hence its old name, liver of sulphur. When dry, it is odourless; but when moistened, it smells of sulphuretted hydrogen. It has a bitter, acrid, alkaline taste, and is soluble in water.

Actions and Uses.—It is an irritant poison, similar in its actions to sulphur, but greatly more active. Two ounces are said to have destroyed a horse (Bouchardat); while six drachms and a half, introduced into the stomach of a dog, and retained there by a ligature on the œsophagus, occasioned death with tetanic symptoms in seven minutes; and a drachm and a half in small fragments, introduced into the subcutaneous cellular tissue of dogs, caused extensive inflammation, coma, and death in thirteen hours. (Christison.) The mucous membrane of the stomaeh is said, on examination, to resemble a toad's baek; but in many eases no very obvious morbid appearanees remain after death, and henee the salt has been supposed to aet ehemically on the blood, in the same manner as sulphuretted hydrogen. It has sometimes been used medieinally in chronie coughs, rheumatie affeetions, and skin diseases, in doses of one to three drachms for horses and eattle, and two to ten grains for dogs. It was onee eonsidered a panaeea for all kinds of poisoning, but is now used only in eases of poisoning by salts of lead, whieh it converts into a blaek insoluble, and almost inert sulphuret.

Sulphate of Potash. Potassæ Sulphas. KO, SO_3.
Bisulphate of Potash. Potassæ Bisulphas. $KO, HO, 2SO_3$.

The residue left in the preparation of nitrie aeid from equal parts of sulphurie aeid and nitrc, consists of sulphate of potash, with some exeess of sulphuric aeid, whieh may be got rid of by adding to the solution earbonate of potash or ehalk, filtering and evaporating the mixture, when sulphate of potash erystallizes out in transparent, eolourless, six-sided prisms, whieh have a sharp, saline, bitter .taste, are hard and diffieult to powder, and dissolve in five parts of water, at 212°, and in sixteen parts at 60°.

The bisulphate is prepared by adding to the neutral sulphate its own weight of sulphurie aeid, dissolving and erystallizing. It is a eolourless, erystalline, soluble salt, with an aeid taste and an aeid reaetion on eolouring matter. It is distinguished from the neutral sulphatc by its greater solubility, by its aeid taste and reaction, and by its power of deeomposing carbonates with efferveseence,—a property which has led to its being oeeasionally substituted for tartarie acid in making efferveseing powders.

Actions and Uses.—In the human subjeet, large doses of sulphate of potash (in one ease two ounees, in another ten drachms) are said to have proved fatal. Both sulphates are eathartie and diuretie. As eathartics, however, thcy are less prompt and eertain than the sulphates of soda and magnesia; and as diureties, are less to be depended on than the nitrate or acetate of potash. The sulphate, on account of its being hard, and little apt to absorb moisture from the air, is much used for facilitating the trituration of tough vegetable substances, such as opium, ipecacuan, and jalap.

IODIDE OF POTASSIUM. Hydriodate of potash. Potassii Iodidum. KI.

Iodide of potassium is cheaply and conveniently prepared by decomposing a solution of iodide of iron with carbonate of potash. The British Phar. recommends the following process:—"Put a gallon of solution of potash into a glass or porcelain vessel, and add twenty-nine ounces, or a sufficiency of iodine, in small quantities at a time, with constant agitation, until the solution acquires a permanent brown tint. Evaporate the whole to dryness, in a porcelain dish, pulverize the residue, and mix this intimately with three ounces of wood charcoal in fine powder. Throw the mixture, in small quantities at a time, into a red hot iron crucible; and when the whole has been brought into a state of fusion, remove the crucible from the fire, and pour out its contents. When the fused mass has cooled, dissolve it in two pints of boiling distilled water, filter through paper, wash the filter with a little boiling distilled water, unite the liquids, and evaporate the whole until a film forms on the surface. Set it aside to cool and crystallize. Drain the crystals, and dry them with a gentle heat. More crystals may be obtained by evaporating the molten liquor, and cooling. The salt should be kept in a stoppered bottle."

Properties.—Iodide of potassium occurs in colourless, generally opaque, cubic crystals, has a faint odour of iodine, and a taste of common salt, decrepitates when heated, fuses at a red heat, at a higher temperature volatilizes unchanged, and dissolves in two-thirds of its weight of water at 60°, and in half its weight of boiling spirit. Both the aqueous and alcoholic solutions dissolve iodine freely, and are therefore most useful menstrua for its exhibition. The following tests of the Brit. Phar. guard against all the common impurities of the salt:—"The addition of tartaric acid and mucilage of starch to its watery solution does not develop a blue colour. Solution of nitrate of silver, added in excess, forms a yellowish white precipitate, which, when agitated with ammonia, yields by subsidence a clear liquid, in which excess of nitric acid causes no turbidity. Its aqueous solution is only faintly precipitated by the addition of lime."

Actions and Uses.—Iodide of potassium closely resembles iodine in its actions and uses, but is less active. In large doses it is irritant, and in medicinal doses alterative, deobstruent, and diuretic. Two or three drachms dissolved in water, and given to dogs, caused vomiting, great depression, and death in a few days; one drachm had a similar effect on rabbits; while three drachms injected beneath the skin of the back of a dog, caused extensive subcutaneous inflammation, and death in three days. The iodine was detected after death in the blood and urine, in the brain and spinal cord, in most of the internal organs, and even in the muscles and bones. (Cogswell.) Maillet (quoted by Tabourin) says, that two or three drachms given to horses act as an irritant poison, and that three or four drachms cause fatal intestinal hemorrhage. But I have repeatedly given horses two drachms, in the form of a ball; and believe that ounce doses, given either to horses or cattle, would be devoid of irritant and poisonous properties, and act only as diuretics or mild cathartics. In colds and feverish attacks, or during recovery from inflammatory complaints, it is sometimes used, most commonly in combination with tonics or stimulants. A good formula for either horses or cattle, consists of a drachm each of iodide of potassium, gentian, and carbonate of ammonia, given twice daily, either as a ball or in solution. When administered in small and often-repeated doses, it appears in all animals to accelerate those changes of decay and reparation always going on within the body. It is prescribed in scrofulous enlargements of the glands, and in chronic rheumatism, and is, besides, used externally in the treatment of tumours. In veterinary practice, however, it is chiefly serviceable as a convenient means of increasing the solubility of iodine, both in water and alcohol.

Doses, etc.—When used alone, the dose for horses and cattle is from ʒij. to ʒiv.; and for sheep and dogs, from ℈i. to ℈ij.

These doses should be repeated three times a day, and given either in a bolus or dissolved in water.

Nitrate of Potash. Nitre. Saltpetre. Potassæ nitras. KO, NO_5.

This important substance is found in the East Indies, Persia, Egypt, Spain, and other warm climates, as a brown incrustation on the surface of the soil, and is formed by the potash of the soil fixing the nitric acid which is produced either from the direct union of the nitrogen and oxygen of the air, or, more probably, from the ammonia both of the soil and of the atmosphere. The saline efflorescence, which often covers large tracts of ground, is gathered about the end of summer; in India, usually about the month of November. It contains common salt, sulphate of soda, and nitrates of potash and of lime. It is dissolved in water, and mixed with impure carbonate of potash, which decomposes the nitrate of lime, forming insoluble carbonate of lime, and nitrate of potash. The solution is allowed to settle, and the nitrate poured off in solution, and subsequently purified by repeated solutions and crystallisations. In France, and other continental countries, the salt is prepared artificially, by collecting into large heaps animal and vegetable refuse, with old plaster, and other sorts of calcareous matter. The heaps are sheltered from rain, but freely exposed to the air, frequently watered with urine, and occasionally turned over. After about two years the whole is lixiviated, and purified by a process similar to that followed with the natural nitre.

Properties.—Nitrate of potash occurs in white, opaque masses, or in transparent, colourless, anhydrous, six-sided prisms. It has a sharp, cooling, saline taste, undergoes no alteration in air, deflagrates when thrown on flame, and dissolves in half its weight of water at 212°, and in four parts at 60°, causing, during solution, much abstraction of heat. Warmed in a test tube, with sulphuric acid and copper filings, it evolves ruddy fumes; heated to about 600° it fuses, and the melted mass forms, on cooling, a hard, white, fibrous substance, known as sal prunelle.

Impurities.—The common impurities of nitre are sulphate of potash, chloride of potassium, nitrate of soda, chloride of sodium, and sometimes also a little lime. But none of these impurities are in sufficient quantity to interfere with its medicinal actions. When perfectly pure, its solution is not affected, either by chloride of barium or nitrate of silver.

Actions and Uses.—Nitre is irritant, cathartic, diuretic, alterative, febrifuge, and refrigerant. It requires very large doses of nitre to produce fatal effects, either in horses or cattle. Mr Morton gave a healthy horse two pounds, dissolved in six pounds of water, and found that it acted both on the kidneys and bowels, but that its effects ceased in twenty-four hours. (Veterinarian for 1837.) Moiroud, however, reports that quantities of half a pound for horses, and two or three drachms for dogs, cause inflammation of the alimentary canal and urinary organs, with subsequent depression and death, usually within twenty-four hours. Doses of several ounces usually cause purgation in horses and cattle, and vomiting in dogs; but these actions are uncertain, and apt to be accompanied by excessive renal irritation. The diuretic action is the most certain and useful of all the actions of nitre; is the result of the irritation which the medicine induces during its excretion by the kidneys; is readily produced in all the domesticated animals; and is expedited by giving the medicine in repeated doses, freely dissolved in water. The alterative and febrifuge actions of nitre are partly owing to this diuretic effect, and the consequent removal from the body of large quantities of effete matters; and partly, it is believed, to the nitre maintaining the solubility of the fibrine of the blood, and preventing the aggregation of the corpuscles. The refrigerant properties of nitre are exhibited when a freshly made solution is applied to the surface of the body, and are usefully employed in the cure of inflammation, especially when affecting parts of comparatively low vascularity.

Nitre is given to both horses and cattle in many different complaints, as in scantiness and turbidity of the urine, and in œdema and dropsical affections, in which it is usually prescribed along with other diuretics, and frequently with stimulants. In all febrile, inflammatory, and rheumatic affections it is also of much service, and is usually readily taken either mixed with soft food or dissolved in a pailful of water. Few fever patients refuse to drink water containing even a considerable admixture of saline matters. Many agriculturists give nitre to their horses in doses of about an ounce, mixed with a mash, every Saturday night. While the animals are on hard feeding, this occasional dose of saline medicine appears to keep the bowels and skin in good order, and to ward off those attacks of swelled legs and weed which are apt to ensue when hard-worked horses stand idle. Care must, however, be taken neither to give more than an ounce at a time, nor to repeat the dose oftener than once a week. Nitre, when dissolving in water, abstracts a considerable quantity of heat, and is consequently used as a refrigerant in apoplectic affections and inflammations about the joints and feet. Its efficacy is increased by admixture with salammoniac. Five ounces of nitre, with five of salammoniac, dissolved in sixteen fluid ounces of water, reduce the temperature from 50° to 10°, or through 40°. (Pereira.)

Doses, etc.—The dose of nitre as a diuretic for the horse is about ʒvi.; for cattle, ℥i.; for sheep, ʒi. or ʒij.; and for dogs, grs. x. to grs. xxx. It is usually given along with soap, resin, and other diuretics, which expedite and increase its action by determining its speedy excretion by the kidneys. There is no limit to the number and variety of recipes for diuretic balls. The mass used at the Edinburgh Veterinary College is thus made:—Take soap and nitre, of each lbs. ij.; resin, lbs. iij.; Venice turpentine, lbs. ij.; oil of turpentine, f℥viij. Melt the soap and resin over a slow fire; remove the mixture from the heat, and when it has somewhat cooled stir in the other constituents. The dose of this mass is ℥ij. Some practitioners substitute for the oil of turpentine an equal quantity of oil of juniper, and add, when requisite, linseed meal or flour. As an alterative and febrifuge, nitre is given in doses about half those used to cause diuresis, is repeated every two or three hours, and is usually conjoined with some other medicines. It used to be prescribed with tartar emetic, which, however, is now considered of little therapeutic value, either among horses or cattle.

A good sedative and febrifuge ball for the horse may be made with an ounce of nitre, a drachm of aloes, and a scruple of calomel, made up with simple syrup, or linseed meal and water. Where there are catarrhal symptoms and sore throat, and the bowels are sufficiently open, four drachms of nitre may be united with two drachms of camphor, and one drachm each of ipecacuan and extract of belladonna, made into a ball, and repeated every two hours. Similar combinations are useful amongst cattle. For them a convenient alterative is made with two ounces each of nitre, sulphur, and ginger, given in treacle and water or in a bottle of ale. A good fever medicine for the dog consists of five grains each of nitre and Dover's powder, and one grain of calomel, either placed upon the tongue, bolted in a bit of meat, or made into a pill with syrup, or liquorice powder and water. Mr Mayhew recommends from three to eight grains of nitre, from one to four grains of James' powder, and the same quantity of extract of belladonna, made into a pill with confection of roses. Cats take half the doses requisite for dogs.

ACETATE OF POTASH. Potassæ Acetas. $KO, C_4 H_3 O_3$.

The acetate of potash, made by neutralizing crude acetic acid with carbonate of potash, is a white striated, soluble, deliquescent salt, which closely resembles the nitrate in its actions and uses, and is much prized in human medicine as a diuretic. It is given in the same or somewhat larger doses than nitre.

ACID TARTRATE OF POTASH. Cream of Tartar. Potassæ Tartras Acida. Potassæ Bitartras. $KO, HO, C_8 H_4 O_{10}$.

The acid tartrate of potash is obtained in an impure state from the interior of wine casks, when it is called crude tartar or argol. When purified by solution and crystallization, it is in white, hard, crystalline masses, with a sharp acid taste. When administered in large quantities, it causes in all animals inflammation of the alimentary canal. In doses of several ounces it operates on horses and cattle as a mild laxative, and in lesser quantities induces diuresis, and acts, like nitre, as an alterative and febrifuge.

PRUSSIC OR HYDROCYANIC ACID.

Acidum Hydrocyanicum. H Cy or H, C_2 N.

Hydrocyanic acid derives that name from its being composed of hydrogen and the compound radicle cyanogen ; and its more familiar appellation of Prussic acid from its being obtained from Prussian blue. It may be extracted from various plants, especially those of the *Amygdalaceæ*, or almond tribe, by crushing and moistening them with water, thus causing their emulsine, which is an albuminous or caseous principle, to excite in the amygdaline a species of fermentation from which hydrocyanic acid, a volatile oil, and some other products, are formed.

There are two sorts of prussic acid which it is important to distinguish—the anhydrous acid, and a diluted solution usually containing in this country from 1 to 5 per cent. of it. The diluted acid only is used medicinally.

Anhydrous Prussic Acid is one of the most active poisons known, and may be prepared by decomposing cyanide of silver with well-dried sulphuretted hydrogen, and collecting the vapour evolved in a receiver kept cold by a mixture of ice and salt. At 66° it is a colourless liquid, with a density of nearly 696. It is devoid of acidity, but has a strong pungent bitter taste, and produces a peculiar sensation in the back of the throat. Its odour is generally likened to that of bitter almonds, or cherry-laurel water, but is perceptibly different from either, and entirely devoid of ratafia aroma. It unites both with water and alcohol ; is very volatile ; solidifies at 59° into a brittle fibrous mass ; is inflammable ; boils at 80° ; and when dropped on the skin, produces a sensation of numbness. It consists of one equivalent of cyanogen (C_2 N) and one of hydrogen, and speedily undergoes decomposition, being converted into a black substance partly consisting of paracyanogen.

The medicinal or diluted acid might be got by mixing the anhydrous acid with the requisite proportion of water, but this would be greatly more troublesome and expensive than preparing the diluted acid at once. It is always obtained by the decomposition of a cyanide, a salt consisting of cyanogen and a base, and usually analogous to a chloride. It may be got from almost any cyanide, and often in several different ways—as from bicyanide of mercury by heating it with hydrochloric acid, as recommended by the Dublin College, or from the same salt by the action of sulphuretted hydrogen; from cyanide of potassium and tartaric acid; or from cyanide of silver and hydrochloric acid, a convenient but expensive process, and chiefly suitable on the small scale, and for extemporaneous purposes. The process which is now most generally pursued, and which readily yields, at a very small cost, a pure and well-keeping acid, consists in the decomposition of ferrocyanide of potassium (Fe Cy, 2 K Cy + 3 HO) by sulphuric acid. The British Pharmacopœia gives the following directions:—Dissolve two ounces and a quarter of ferrocyanide of potassium in ten ounces of water, add seven fluid drachms of sulphuric acid, previously diluted with four ounces of distilled water, and cooled. Put them into a retort, and adapt this to a receiver containing eight ounces of water, which must be kept carefully cold. Distil with a gentle heat by the aid of a sand bath, until the fluid in the receiver measures seventeen ounces. Add to this three ounces of water, or as much as may be sufficient to bring the acid to the required strength of 2 per cent. (Brit. Phar.) The changes which occur in this process are complex, but the chief are the union of the iron with a portion of the cyanogen to form a yellow compound, called Everitt's salt; the decomposition of water, the union of its oxygen with potassium to form potash, and the further combination of this with sulphuric acid; and the union of the cyanogen, liberated from the potassium, with the hydrogen of the decomposed water, to form hydrocyanic acid.

Determination of Strength.—Prussic acid, when kept even for a short time, is apt to volatilize and diminish in activity; and different specimens, even when carefully made by the same process, are liable to considerable variations of strength. As such variations in a poison so powerful might be attended by fatal consequences, it is important to notice the method of discovering and adjusting the strength of prussic acid. When nitrate of silver is added to it, there is formed a white precipitate of cyanide of silver, every five grains of which represent one grain of anhydrous acid. The strength of any specimen, or, in other words, the proportion of anhydrous acid which it contains, may therefore be readily determined by precipitating a known quantity of acid with solution of nitrate of silver, of pharmacopœia strength (one grain to forty of water), and collecting, drying, and weighing the precipitate. The weight thus got, if divided by five, gives the proportion of anhydrous acid which the specimen contains. Thus 100 grains of Edinburgh prussic acid, carefully and freshly prepared, yields, when treated with nitrate of silver, 15 grains of a precipitate; and hence one-fifth of this, or three grains, is the amount of anhydrous acid present in it. The same quantity of the London or British Pharmacopœia acid yields ten grains of cyanide of silver, or contains only two per cent. of anhydrous acid. The Dublin acid has hitherto been of rather irregular strength, varying from about two to four per cent.

Properties.—These diluted acids possess, but in a less marked degree, most of the properties of the anhydrous acid. They have the same distinctive penetrating diffusible odour, cause the same numbness of the parts on which they are dropped, and, being very volatile, rapidly diminish in strength, unless kept in well-stoppered bottles. They are a little lighter than water, and redden litmus only very slightly and transiently. Unlike the pure acid, they are not inflammable, do not spontaneously solidify or boil at such low temperatures, and may be kept unchanged for a long time if protected from broad day-light.

Impurities.—Being for the most part prepared with care, prussic acid is generally very pure; and its price, which is little more than a halfpenny per ounce, affords no temptation for intentional adulteration. Sulphuric acid, which is occasionally present, may be detected by nitrate of barytes. A trace of it, or of any of the other mineral acids, is said, however, to improve the keeping properties of the acid. But pure prussic acid, when carefully made from ferrocyanide of potassium and sulphuric acid, and kept in well-corked or closely-stoppered bottles, may be preserved for months without undergoing any perceptible change. As prepared by some of the other processes, it often begins to blacken and decompose, even in a few days. Half a fluid ounce of British Phar. acid (which should contain two per cent. of anhydrous acid), when treated with an excess of solution of soda, requires the addition of 80·66 measures of the volumetric solution of nitrate of silver before a permanent precipitate begins to form.—(Brit. Phar.)

Tests.—Prussic acid is easily identified, even in small quantity and diluted solution. (*a.*) First amongst its tests for simplicity and accuracy is its characteristic odour—strong, diffusible, and penetrating; and, as above stated, readily distinguished from that of cherry-laurel water and bitter almonds, by the absence of ratafia aroma. (*b.*) Scheele's test, or the production of Prussian blue, is very delicate and characteristic. When the acid solution is rendered alkaline by caustic potash, and a solution containing a mixture of proto- and per-oxide of iron added, a greyish-green precipitate is thrown down, which, on the addition of a little sulphuric or hydrochloric acid to re-dissolve the oxide of iron, assumes a deep Prussian blue colour. (*c.*) If a solution containing prussic acid be treated with potash, and then with sulphate of copper, there is thrown down a green precipitate, which becomes white on the addition of a little hydrochloric acid to re-dissolve excess of oxide of copper. (*d.*) Nitrate of silver produces a white precipitate of cyanide of silver, soluble in ammonia and in hot nitric acid, but insoluble in cold nitric acid. The cyanide of silver is very similar in appearance to the chloride, but is easily distinguished from it by its solubility in boiling nitric acid, and also by its evolving, when heated, cyanogen, which, if kindled, burns with a rose-coloured flame, surrounded by a blue halo. (*e.*) When a solution containing prussic acid is heated with hydrosulphuret of ammonia which has been previously boiled with sulphur, a new acid, the sulpho-cyanic, is produced, which gives a blood-red solution with a per-salt of iron. In testing for hydrocyanic acid in a complex liquid, such as the contents of the stomach, the acid, if in large quantity, may be volatilized, and condensed on a watch-glass moistened with nitrate of silver or hydrosulphuret of ammonia. But such a method is ineligible where accurate results are necessary, and the poison exists in small amount. In such circumstances, the complex fluid should first be filtered and neutralized with sulphuric acid, and then distilled, and the clear liquid which first comes over tested in the usual way. As hydrocyanic acid is very readily volatilized, and is decomposed by many organic substances, it cannot usually be detected in the bodies of animals poisoned by it, unless they be examined within four or five days after death. It sometimes disappears even in a shorter time, especially if the body has been exposed to the weather.

Actions and Uses.—There is no poison more active than anhydrous prussic acid. When injected into the jugular vein of the dog, it causes almost instant death. From one to four drops, weighing from a third of a grain to a grain and a fifth, placed on the tongue or within the eyelids of dogs, cats, rabbits, or such other small animals, begins to operate in from ten to thirty seconds, and proves fatal in about a minute—one or two deep, rapid inspirations, and a hurried convulsive expiration, being the only antecedents of death. From ten to twenty drops produce the same effect in horses. The medicinal acid, when given to small animals, as dogs and cats, in doses of forty to ninety minims, sometimes acts with a rapidity scarcely inferior to the anhydrous acid; more commonly, however, life is prolonged for some minutes, and death is preceded by giddiness, convulsions, salivation, irregularity of the circulation, loss of the power of voluntary motion, tetanic spasms, flaccidity of the muscles, great debility, and sometimes coma. If the animal lives for an hour, perfect recovery may usually be expected. Professor Coleman gave an aged horse repeatedly, at intervals of several days, doses varying from one to three drachms of Scheele's acid, containing about four per cent. of the undiluted acid, and found that they caused much excitement, raised the pulse to more than 100, and in one experiment, where the acid was dissolved in a pint of water, to 160; caused also laboured breathing and tetanic contractions of the muscles; but the effects gradually passed away. Six ounces of medicinal prussic acid given to Wombwell's old elephant, killed at Birmingham in 1855, caused only slightly laboured breathing. In experiments made by direction of the Messrs Young of Leith, two ounces were found to cause the rapid death of Greenland whales when discharged by an ingenious device into the wound made by the harpoon.

The *post-mortem* appearances are not very different from those observed in animals dying from natural causes; and any abnormal appearances are much modified by the dose of the poison and the degree of its concentration. There is more or less venous congestion. The blood in all parts of the body is fluid, of a bluish appearance, and evolves the peculiar odour of the acid, which is sometimes also perceptible in the contents of the stomach, and in various of the secretions, especially that of the serous cavities. This odour, however, can seldom be detected where life has been prolonged for some time after the poison has been given. When the strong acid has been administered, some experimenters find that the voluntary muscles and those of the intestines lose their contractility, and that the heart also loses its irritability, and becomes gorged with dark grumous blood. There is, however, much difference of opinion concerning the state of the heart, and the appearances reported are not at all uniform. The villous coat of the intestines is sometimes red, shrivelled, and easily removed, and the nervous centres are usually congested.

The poisonous effects of prussic acid are observed in all animals, and ensue by whatever channel it enters the body—whether introduced into the stomach, injected into a vein, placed in the cellular tissue, or in a wound, or absorbed from a serous or mucous surface. Operating with great rapidity in whatever condition it is administered, it is especially active when in the state of vapour. Air saturated with it killed one dog in ten seconds, another in five, and a cat in two seconds. In combination with bases, it manifests the same tremendous energy, all the cyanides being very poisonous; the ferrocyanides, however, are perfectly harmless. The poisonous and medicinal effects of prussic acid depend upon its being taken up by the blood-vessels, and not, as was long believed, by the transmission of a local impression along the nerves. The coma and convulsions induced by poisonous doses appear to indicate that it deranges and depresses the functions of the brain and spinal chord; whilst the relief afforded by medicinal doses in irritability of the throat and stomach, probably point to a special soothing influence on the vagus nerve.

Various antidotes have been proposed for poisoning by prussic acid; but its effects are so rapidly fatal, that, in the majority of cases, the animal is dead before any remedial measures can be adopted. Ammonia has long been in high repute, and is chiefly useful on account of its counteracting the mortally sedative effects of the poison. It should be given internally, and also inhaled; but care must be taken that it be not too strong, otherwise it will irritate the fauces and other parts with which it comes in contact. Chlorine is a useful remedy, also acting beneficially as a diffusible stimulant. Cold affusion has been effectual in very aggravated cases, both in man and the lower animals. It should be applied only to the head, and should be continued at short intervals for a long time. Bleeding from the jugular vein is often useful, as it relieves congestion of the lungs, and of the right side of the heart. Dogs even in the last stages of poisoning have been roused and recovered by this remedy. By far the best chemical antidote at present known was discovered by the Messrs Smith, of this city. It consists in the conversion of the acid into the insoluble and inert Prussian blue, by giving a solution of carbonate of potash, followed immediately by a mixture in solution of the proto- and per-sulphate of iron. The solutions used by the Messrs Smith consist of 144 grains of carbonate of potash dissolved in two ounces of water; and a drachm and a half of the proto-sulphate of iron, mixed with two drachms of the same, dissolved in two ounces of water, and made into per-sulphate by heating with a little nitric acid, and half as much sulphuric acid as it already contains. ♏52 of each solution remove all the acid present in ♏100 of Edinburgh prussic acid; but to ensure success, three or four times these proportions should be used. If ever called on to treat a case of poisoning by hydrocyanic acid either in man or the lower animals, the practitioner should not, however, content himself with using one of these remedies, but ought to employ several or all of them. While solutions of carbonate of potash and of the mixed sulphates of iron are being prepared as speedily as possible, he should at once use the lancet freely, drawing blood rapidly from a large orifice; then place the head and neck of the patient under a stream of cold water, and cause him also to inhale ammonia.

In medicinal doses, hydrocyanic acid diminishes the force and frequency of the pulse, allays pain, irritation, and spasm, and is consequently used as a sedative, calmative, and antispasmodic. It is efficacious in cases of chronic cough where there is no organic disease; in spasmodic affections, as chorea, epilepsy, and chronic vomiting; and in functional palpitation of the heart and in rheumatism. In troublesome cough in horses, twenty minims of the acid may be united with a drachm each of camphor and extract of belladonna, made into a ball with liquorice powder or linseed meal, and repeated twice or thrice a-day. In obstinate vomiting in dogs, two drops of acid with ten grains of carbonate of soda may be given in an ounce of water, and repeated every hour. Much advantage often seems to attend the use of prussic acid in mild cases of tetanus, especially in young animals, in which it causes remission of the spasms and the other symptoms; but in aggravated cases, and in aged animals, it is of little permanent use. It is occasionally used externally for allaying the irritation of cutaneous eruptions and ulcerations, especially in dogs; and, for such purposes, a good combination consists of a drachm of prussic acid, an ounce of Goulard's extract, and six ounces of water. Another formula consists of a drachm of acid, an ounce of carbonate of soda, and eight ounces of water. In using hydrocyanic acid as a medicine, the doses should at first be small, and, until perfectly regulated, the effects produced must be carefully watched. The occurrence of nausea, or any of the constitutional effects of the medicine, indicates the necessity of at once stopping its administration, or reducing the dose. It does not appear to have any cumulative effect, so that in well-regulated doses it may be given with perfect safety for a long time. When a fresh quantity of the medicine is got, the dose should at first be considerably reduced, to guard against any undue increase of strength.

Doses, etc.—The doses of the medicinal acid for horses and cattle are from ♏xx. to ♏xxx.; and for dogs, ♏i. to ♏iij. It may be given in water sweetened with simple syrup; and, as its calmative effects are very transient, the doses should be repeated from three to five times a-day. To prevent the mistakes which are apt to arise with a colourless liquid, it is often made up with compound tincture of cardamoms. When used externally, it should be largely diluted with water.

PYROXYLIC SPIRIT.

Wood Spirit. Methylic Alcohol or Medicinal Naphtha.

$C_2H_3O + HO$.

This compound bears a close resemblance to alcohol in its properties and composition. It is the hydrated oxide of a radical called methyle (C_2H_3); as alcohol is the hydrated oxide of a similar radical ethyle (C_4H_5). It must be distinguished from the naphthas which are now so largely imported from America under the name of rock oil, and the somewhat analogous bodies which are obtained from the distillation of coal tar. These are pure hydrocarbons. Medicinal naphtha is usually prepared by neutralizing crude pyroligneous acid with lime, distilling the pyrolignite of lime thus formed, and purifying the spirit by redistillation from quick-lime. (Ure and Christison.) It is a limpid, colourless fluid, which gradually becomes yellow by keeping. It has a peculiar agreeable spirituous odour, and a warm aromatic taste. At 68° its specific gravity is 798. It is volatile and inflammable, mixes with water in all proportions, and forms a cheap and convenient solvent for many organic substances.

Actions and Uses.—It is narcotic, sedative, and antiseptic; and has been used in veterinary practice to relieve chronic coughs; to allay irritability of the stomach and vomiting in dogs; to serve the various purposes of an active antiseptic; to dissolve the active principles of many vegetables; and, on account of its inflammability, to singe the hair of horses. For horses and cattle the dose is about half an ounce; for dogs, from five to twenty minims. In half-ounce doses, united with an equal quantity of solution or spirit of ammonia, and given in gruel, it is a good anodyne in typhoid cases, and also helps to relieve irritability of the respiratory organs. It is now also in extensive use for making methylated spirit, which consists of one part of naphtha and nine of rectified spirit, and is sold for pharmaceutic and other purposes free of duty.

RHUBARB.

Rheum. Root of *Rheum palmatum*, and other Species of *Rheum.* —(United States Phar.)

Nat. Ord.—Polygonaceæ. *Sex. Syst.*—Enneandria Monogynia.

The botanical sources of medicinal rhubarb are almost unknown. It is believed that the plant or plants yielding it grow wild in Central Asia, but they have not as yet been seen or identified by any European naturalist. The known plants of the family are herbaceous, and their familiar leaf-stalks have a pleasant acid taste, due to the presence of malic and oxalic acids. Of the several commercial varieties, the Russian is the best. It is collected in summer from the mountain ranges of the interior of China and Thibet, and occurs in trapezoidal, roundish, cylindrical, or flattish pieces, frequently bored with a hole, reddish-yellow externally, with a greyish-red marbling internally. The powder is bright yellow, has a strong peculiar aromatic odour, with a bitter, astringent taste, and is gritty when chewed, owing to the presence of crystals of oxalate of lime. The variety known as Chinese or East Indian rhubarb is coarser and less aromatic, whilst the English rhubarb is of still lower quality. The several varieties are readily dissolved by ether, alcohol, and proof spirit; and somewhat less readily by cold and hot water, with the latter of which it forms an orange-coloured solution, which gradually becomes turbid from separation of rheine. Besides lignine, a small quantity of an odorous volatile oil, three acrid resins, and the ordinary constituents of vegetables, rhubarb further contains a peculiar neutral principle called *rheine* or *rhabarberine*, once believed to be the active ingredient. The active principle, however, does not as yet appear to have been isolated. Rhubarb is often adulterated by mixing the inferior qualities of home growth with the finer Eastern varieties—a fraud which is best discovered by a careful examination of the suspected specimen. When of good quality, it is "free from brown specks externally, and internally without cavities: boracic acid does not turn the yellow exterior brown. In the powder, adulterations are detected with difficulty." (Brit. Phar.)

Actions and Uses.—Rhubarb is tonic, astringent, and cathartic. In small and repeated doses it improves the appetite, facilitates digestion, and when given for some time may be detected in the blood, urine, and occasionally in the milk. In larger doses it acts in the dog and other carnivora as a cathartic; but in herbivora and graminivora, it has scarcely any purgative effect. Several ounces, and sometimes even a pound, have been given to cattle without moving the bowels; while from nine ounces to a pound caused in the horse only a slight laxative effect after thirty-six hours. (Moiroud.) In purgative doses it is believed to act chiefly on the stomach and duodenum. It is generally said specially to increase the secretion of bile; but this is by no means established. When applied to the skin or mucous surfaces, it acts as an astringent, and hence constipation very commonly succeeds its primary cathartic effect. On this account it is particularly useful in many cases of diarrhœa and dysentery, as it first removes the cause of irritation, and then acts as a mild vegetable astringent. Rhubarb is not much used in veterinary practice. It is given as a tonic in enfeebled digestion, especially in young animals, and occasionally as a laxative for the dog.

Doses, etc.—As a stomachic and tonic, it is administered several times a day to horses, in doses of ℥i.; to cattle, in doses of ℥ij.; to sheep, in doses of ʒi.; and to dogs and cats, in doses of grs. x. to grs. xxx. As a laxative for the dog, the dose is ʒij. or ʒiij., usually combined with one or two grains of calomel or with a scruple of jalap. Rhubarb is generally used in the form of simple powder, and occasionally as an infusion or tincture. The compound powder of rhubarb, or Gregory's mixture, is prepared by mixing thoroughly a pound of magnesia, two ounces of ginger, and four ounces of rhubarb—all in fine powder. It is a stomachic and antacid, and may be given in doses twice as large as those of the simple rhubarb. In chronic diarrhœa and dysentery in calves and foals, many veterinarians recommend two drachms each of rhubarb and magnesia, with half a drachm of opium, given several times a day in flour gruel, with a table-spoonful or two of brandy or sweet spirit of nitre. Half the quantity answers well for diarrhœa amongst lambs.

SAVIN.

Sabina. Fresh and dried tops of the *Juniperus Sabina.*

Nat. Ord.—Coniferæ. *Sex. Syst.*—Diœcia Monadelphiæ.

The *Juniperus Sabina* is a small, shrubby, evergreen plant, a native of Southern Europe, but easily cultivated in this country. The officinal parts are the tops or young branches, with their attached leaves. When fresh they are green, but become yellow when kept, have a strong, heavy, disagreeable odour, and a bitter, acrid, resinous taste. They communicate their properties to water, spirit, and the fixed oils, and owe their activity to the presence of a colourless or pale yellow volatile oil, which is prepared by distillation from the fresh tops.

Actions and Uses.—Horses appear to take large quantities of savin with impunity. Hertwig has given half a pound, twice daily for six or eight days, without effect; whilst Professor Sick continued it with impunity for half a year. Fatal effects, however, do occasionally occur from savin. Thus, in the Veterinary Record for 1850, Mr Rose mentions a case of five horses poisoned by it, of which one died immediately, and two after five days; the other two recovered, after suffering much from diarrhœa, accompanied by intense thirst, quickened pulse and breathing, with great prostration. In carnivorous animals it is an irritant poison. Four drachms, according to Orfila, destroyed a dog in thirteen hours, when the gullet was tied to prevent vomiting; and the same effects follow when powdered savin is applied to a wound or introduced underneath the skin. The stomach is found reddened, and the rectum inflamed. Large doses likewise irritate the kidneys and bladder, often causing a copious discharge of bloody urine. The irritation sometimes also extends to the uterus, and savin is on this account occasionally used by ignorant persons to produce abortion or hasten parturition. Two cases of abortion in mares heavy in foal are recorded by Mr Mellet, of Henley-on-Thames, in the Veterinarian for 1855. In these cases, the continued use of the savin destroyed both foals, and, being still persevered with, caused their expulsion apparently ten or twelve days after. No judicious practitioner will, however, use savin to produce abortion; for this result is only attainable when the drug is given in poisonous doses sufficient to produce violent intestinal irritation. It is occasionally used for the destruction of intestinal worms, but is neither so safe nor so certain as oil of turpentine. If used at all, the essential oil is the best form of administration. Both the tops and the oil are occasionally applied as stimulants for indolent sores and warts, and for keeping up the discharge from blisters and setons.

Doses, etc.—As an anthelmintic, the dose of the oil for cattle or horses is about f℥iij. or f℥iv.; and for the dog, ♏iij. to ♏v. It may be conveniently dissolved in any fixed oil. For external application, an infusion made with one part of the fresh tops to six or eight parts of water is sometimes used. The ointment, however, is generally preferred, and is thus directed to be prepared:—"Take of fresh savin, bruised, eight ounces; white wax, three ounces; prepared lard, sixteen ounces. Melt the lard and the wax together, add the savin, and digest for twenty minutes; then remove the mixture, and express through calico." (Brit. Phar.) A mixture of equal parts of savin and of verdigris ointments, is occasionally used as stimulant dressing for foot-rot, and for other indolent sores.

SILVER AND ITS MEDICINAL COMPOUNDS.

NITRATE OF SILVER. Lunar caustic. Lapis Infernalis. Argenti nitras. Ag O, NO_5.

The nitrate is the only preparation of silver of any medicinal importance. It is prepared by heating metallic silver with nitric acid. Oxide of silver is first formed by the decomposition of a part of the acid, and is subsequently united with the undecomposed acid. When the salt is to be used as a caustic, the water is expelled by fusion, and the product run into small pencil-like moulds. These sticks, or pencils of nitrate of silver, have a radiated crystalline structure, and, when freshly prepared, are of a steel-grey colour, which gradually darkens on exposure to air and light. Nitrate of silver, when crystallized, occurs in transparent, colourless, tabular crystals. It is devoid of odour, has a disagreeable, caustic, metallic taste, remains permanent in the air, but blackens when exposed to light or to contact with organic matters. It is soluble in its own weight of temperate water, and in four parts of rectified spirit. It blackens the cuticle, and corrodes the soft animal tissues. Like other salts of silver, it is distinguished by giving, with sulphuretted hydrogen and hydro-sulphuret of ammonia, a black precipitate, and with hydrochloric acid a white precipitate, insoluble in nitric acid, but soluble in ammonia. Nitrate of silver is not very liable to adulteration. Nitrate of potash, with salts of lead, zinc, and copper, which are its most common impurities, may be discovered by adding hydrochloric acid to a solution until precipitation ceases, and then testing the clear solution for the suspected impurities.

Actions and Uses.—Salts of silver closely resemble those of copper and zinc in their general actions. In large quantity, they are corrosive and irritant; and in less quantity, tonic, stimulant, and astringent. The nitrate, when given to dogs in doses of one or two scruples, acts as a topical irritant, causing fatal gastro-enteritis. It is most powerful when given in concentrated solution. When administered in repeated medicinal doses it becomes absorbed, and is discoverable in the liver and spleen, and also in the structure of the skin, where it produces an indelible black stain, an effect which has occasionally followed its continued administration in man. It is highly recommended by some practitioners as a tonic for the dog, and is of special benefit in chorea, epilepsy, and other nervous diseases. Half-grain doses, given two or three times daily, have been useful in chronic diarrhœa, dysentery, and cholera in dogs. It has scarcely ever been employed either for horses or cattle. In veterinary practice it is chiefly used externally as a caustic, stimulant, and astringent,—actions which it owes chiefly to its uniting with the albuminous matters and salts of the tissues. It is applied for the removal of fungous growths, warts, and angle-berries; and for the improvement of indolent sores, mange, ringworm, and other chronic skin diseases. It is one of the best stimulant applications for conjunctivitis, and such other limited and superficial inflammations, being beneficial chiefly on account of its primary astringent, and subsequent sedative effects. On account of its increasing the vascular activity of the surrounding parts, it is often effectual in removing specks and opacity of the cornea, especially if of recent origin, and produced by accidental causes. Where, however, these have resulted from repeated attacks of deep-seated or periodic ophthalmia, nitrate of silver, as well as all other remedies, will be fruitless. In all animals it is probably the most serviceable of all remedies for relieving the pain and hastening the healing of scalds and burns, for which a suitable lotion is made with from ten to fifteen grains to an ounce of water, and applied either immediately after the accident, or at any time so long as the pain continues. Two grains dissolved in an ounce of water is occasionally used as an injection for removing ascarides from the rectum of horses or dogs. In human practice it is very useful for preventing the spread of erysipelatous inflammation, and for reducing the irritation of common sore throat. On account of its uniting with the sulphur of the hair to form the black sulphuret of silver, it is frequently used as a hair-dye. Where an undue quantity of nitrate of silver has been employed, either internally or externally, its injurious consequences are best counteracted by the use of common salt, which unites with it to form an insoluble and inert chloride of silver.

Doses, etc.—For horses and cattle, the dose of nitrate of silver is from grs. v. to grs. x.; for sheep, about grs. iv.; for dogs, from one-eighth to one-half of a grain. For all patients these doses should be repeated three or four times a day, and on account of their disagreeable taste they are best given in the condition of a bolus, which may be made up with bread crumb, or any convenient excipient. For external application, it is generally used in the form of little sticks, which are sometimes coated with wax to preserve them from the decomposing action of air and light, and held in quills or forceps to prevent their blackening the fingers. An ointment is occasionally used, and may be made with from grs. v. to grs. viij. of the salt of silver to every ounce of lard. The strength of the solution must vary with the uses to which it is applied: as an eye-wash, from grs. iij. to grs. x. may be dissolved in an ounce of water. Solutions must be protected from the light, and kept in bottles with glass stoppers.

SOAP.

Soap is prepared by boiling alkaline solutions with oleaginous matters, which are thus separated into a sweet basic body, called glycerine (see page 267), and several fatty acids, chiefly the oleic and margaric, which unite with the alkali, leaving the glycerine dissolved in the water. Soap is therefore an oleate and margarate of soda or potash. It has an acrid alkaline taste, and dissolves readily in water. When heated, it fuses, swells up, and decomposes, leaving charcoal and carbonate of the alkali. Hard soaps are prepared with soda, and soft soaps with potash. The superiority of the toilet soaps depends on the fine quality of the oleaginous matters used in their manufacture.

Actions and Uses.—Soap is mildly laxative, diuretic, and antacid; and is, besides, used as an external stimulant and excipient.

Although not employed alone either as a laxative or diuretic, it forms a convenient adjunct to other more active medicines, and an excellent addition to laxative clysters. As an antacid, it is less efficacious than the carbonates or bicarbonates of the alkalies or alkaline earths, but is occasionally used as an antidote in poisoning by acids and metallic salts. It is a good stimulant for bruises and strains; and for such purposes a convenient preparation may be made by mixing six ounces of soap and one pint each of proof spirit, liquor ammoniæ, and linseed oil or oil of turpentine. To this may also be added two or three ounces of camphor. In grease, mange, and other cutaneous diseases, the diligent use of soap and water is very effectual, both as a means of prevention and of cure. Rubbed over slight burns, soap protects them from the access of air, and thus greatly relieves their irritation. In pharmacy, it is much used as an excipient for boluses, and for making up ointments and liniments.

SODIUM AND ITS MEDICINAL COMPOUNDS.

CARBONATE OF SODA. Sodæ carbonas. $NaO, CO_2, + 10 HO$.
BICARBONATE OF SODA. Sodæ bicarbonas. $NaO, HO, 2 CO_2$.

Carbonate of soda, formerly largely prepared by lixiviating the ashes of marine and maritime plants, is now chiefly obtained from common salt, by heating it with sulphuric acid, reducing the sulphate so formed to the state of a sulphuret, by roasting with ground coal and again treating the sulphuret with carbonate of lime, lixiviating the product, and purifying it by repeated crystallizations. Carbonate of soda occurs in large, clear, colourless, rhombic laminar crystals. It is alkaline, efflorescent, soluble in water, and, like other soda salts, distinguished by its negative action with sulphuretted hydrogen, hydrosulphuret of ammonia, and carbonate of potash, and its communicating to burning alcohol a bright yellow flame.

Carbonate of soda, when exposed to carbonic acid, freely absorbs it, becoming converted into the bicarbonate—a white, opaque powder, with a saline, slightly alkaline taste, soluble in about eight parts of cold water, and distinguishable from the neutral carbonate by its feeble alkalinity, and its giving no precipitate with sulphate of magnesia, and only a faint opalescence with corrosive sublimate.

Actions and Uses.—The earbonate and bicarbonate of soda differ only in the degree of their action, and elosely resemble the corresponding salts of potash in their effeets. They neutralize acidity in the alimentary canal. They are useful in indigestion and other eomplaints depending on aeidity, and in poisoning by acids. They become absorbed, and while in the blood appear to alter, in some inexplicable way, its constitution, as well as that of the soft solids. They are thus servieeable in relieving febrile attaeks, rheumatism, and other abnormal eonditions of the system. They pass out of the body by the kidneys, increasing the quantity and alkalinity of the urine, and are consequently used as mild diuretics, and also occasionally in men and dogs as antilithies. They have been recommended by eontinental veterinarians as lotions for skin diseases.

Doses, etc.—The dose of the earbonate for horses and cattle varies from ʒij. to ʒvj.; for sheep, from ℈i. to ℈iij.; and for dogs, from grs. x. to grs. xx. The doses of the biearbonate are double those of the carbonate. Both salts may be given either in bolus or solution.

SULPHATE OF SODA. Glauber's Salt. Sodæ Sulphas. Na O, $SO_3 + 10$ HO.

Sulphate of soda is found as an efflorescent crust on the surface of the soil in various parts of India, and is also a eonstituent of many aperient mineral waters. It is chiefly obtained by erystallizing the residuum remaining in the retorts after the preparation of hydrochloric aeid. It occurs either in large rhombic prisms, or in needle-like crystals, and is eolourless, transparent, and of a saline, bitter, nauseous taste. It is soluble in three parts of water at 60°, and, like most other salts of soda, effloresces when exposed to the air.

Actions and Uses.—It is eathartic and diuretic. Like other saline purgatives, it acts very irregularly on horses. Among cattle it is less effectual than sulphate of magnesia or common salt, and more apt to act on the kidneys. In the dog it acts both as an emetic and purgative. It is applicable to all the purposes of a saline cathartic; but is now little used in veterinary practice, except occasionally for cattle. Like other saline remedies, when given in small and repeated doses, insufficient to act freely on the bowels, it notably diminishes in all animals the proportion of fibrine in the blood.

Doses, etc.—The dose, as a purgative for cattle, is from lb. j. to lb. iss., given with ginger and treacle, and succeeded by as much water as the animal can be induced to drink.

SULPHITE OF SODA. Sodæ Sulphis. Na O, SO_2.

Sulphite of soda is now manufactured for the dyer at various chemical works, by passing a current of sulphurous acid through a concentrated solution of carbonate of soda. The salt is readily crystallizable in four-sided prisms, and has an acid taste and reaction, with an odour of sulphurous acid.

Actions and Uses.—It is an antiseptic, deodorizer, and disinfectant; and, like other salts of soda, an alterative.

Professor Polli, of Milan, has made with it upwards of a hundred experiments, mostly upon dogs, and has found that, besides its properties as an antiseptic and deodorizer, it also possesses the most valuable powers of neutralizing, or at any rate of materially diminishing, the effects of animal poisons. He gave it to dogs in quantities of 225 grains daily with impunity for a fortnight; and so thoroughly does it permeate the entire system, that even moderate doses are found in twenty-four hours in the blood, liver, and urine. Two ounces of blood drawn from dogs, which for five days had received daily with their food 30 grains of the sulphite of soda, kept fresh for three weeks; whilst blood taken from dogs similarly fed, but receiving none of the sulphite, became putrid within a few days. Into the thighs of two dogs Professor Polli injected 15 grains of fœtid pus from an unhealthy abscess, and next day repeated this injection. Both dogs were stupified, reeled, and tottered when made to walk, whilst their pulse and breathing were much quickened. For five days previously both dogs had been treated exactly alike, with this difference only, that one had received daily 30 grains of sulphite of soda, which was continued throughout the experiment. In four days after the injection this dog was again eating his food, and the wound in his thigh was healing. The other, however, getting no sulphite, daily became worse, the limb got gangrenous, and in ten days he died of typhus fever. Very similar results followed the injection into the femoral vein of bullock's blood kept for four months, and offensively putrid. Dogs that had previously received sulphite of soda had recovered their appetite, and were almost well in three days; whilst those managed in the same manner, but not receiving the sulphite, died comatose in five days, suffering from typhoid fever, and with the limb gangrenous. Another experiment still more striking was made with the muco-purulent discharge from a glanderous horse. Forty-five grains were injected into the femoral veins of two strong healthy dogs, one of which for several days had received two drachms daily of sulphite of soda. Both were drowsy and panted, but the one protected by the previous administration of the sulphite, although it at first seemed to suffer most from the injection, was in a few hours able to eat, and was next day in tolerable health. The other, however, became more drowsy, and stood with difficulty. By the third day the limb became tender and œdematous; by the fourth, gangrene set in, and a purulent discharge ran from the nose and eyes; whilst by the sixth day the beast died, worn out by pain, diarrhœa, and fœtid suppuration.

These experiments, frequently repeated and verified, indicate that sulphite of soda, and indeed all alkaline sulphites and hyposulphites, are possessed of a most valuable power of neutralizing animal poisons, not only without, but also within, the body. They are therefore invaluable as alteratives, and will probably be found to be effectual in arresting or modifying the course of various blood disorders. In the human subject, sulphite of soda has been advantageously given in cases of boils, and also in lessening the purulent secretion in bad cases of phthisis. In veterinary practice it deserves a careful trial, especially in low febrile attacks, in purpura, inveterate skin disorders, tedious cases of strangles, rheumatism, farcy, and also as a palliative in glanders. In cases of indigestion in all animals it is often of great value, particularly for counteracting flatulence. In ounce doses I have found it of considerable service in pleuro-pneumonia in cattle. Twenty grains given twice daily help to keep the bowels regular, arrest the offensive smell of the secretions, and abate the low fever occurring in distemper in dogs.

Doses, etc.—The dose for horses and cattle is about an ounce, and for dogs a scruple, given in solution, and repeated at short intervals. It may often be advantageously conjoined with ginger, gentian, camphor, or carbonate of ammonia.

CHLORIDE OF SODIUM. Common Salt. Muriate of Soda. Na Cl.

Salt is found in immense strata in Cheshire, Poland, and Spain. It exists in variable amount in every soil, and hence in every water. It is the largest saline constituent of the ocean, and abounds in the tissues of all plants and animals. It is obtained for medicinal and economical purposes by quarrying the solid beds of rock salt, or by evaporating brine springs or sea water. It forms cubical crystals, which vary in size according to the rapidity of their formation, and are soluble in two and a half times their weight of water, at all temperatures. It is rather more than twice as heavy as water.

Actions and Uses.—It is irritant, cathartic, and emetic; alterative, stimulant, and antiseptic; and is, moreover, a valuable dietetic substance.

On horses its cathartic action is uncertain, often violent, and usually accompanied by considerable irritation of the kidneys. On dogs it usually operates as an emetico-cathartic, being used to clear out the stomach and intestines, and to induce that reduction of the action of the heart which accompanies the operation of most emetics. In doses insufficient to act on the stomach or bowels it is determined to the kidneys, increasing the secretion of urine, and its proportion of urea. On pigs it acts as a purgative, but is scarcely so safe or certain as oil, jalap and calomel, or aloes. In the Veterinarian for 1839 and 1862, cases are recorded of pigs suffering flatulence, diarrhœa, vertigo, convulsions, paralysis, and death, in from eight to twenty-four hours, from the eating of about four and a half ounces of salt, repeated during several days. The mucous membrane of the stomach and bowels was found after death highly injected and inflamed.

For cattle and sheep salt is the most useful of all purgatives. In them it is rather more prompt and powerful than Epsom salts or any other saline substance; and by causing thirst, induces the animal to drink large quantities of water or other bland fluids. This free ingestion of fluid is of inestimable advantage in torpidity of the bowels and constipation among cattle, by softening and carrying onwards the hard, dry, feculent matters, which are so apt to accumulate in the first and third stomachs, and resist the action of ordinary purgatives. Among cattle and sheep it is extensively used for all the ordinary purposes of a purgative. It is administered to evacuate the bowels in distension of the stomach with food, in fardelbound, and in diarrhœa depending on over-feeding, or kept up by the presence of irritating matters in the alimentary canal. It is also given to relieve irritation and inflammation of the eyes, brain, respiratory organs, or limbs; and in such cases probably proves serviceable by exciting counter-irritation, diminishing the watery constituents of the blood, freeing it of peccant matters, and restoring the bowels and other excretory organs to a more healthy state. In small and repeated doses, salt is a valuable stomachic, and is useful in all animals in indigestion and irregularity of the appetite. In such cases, an ounce of salt may often be advantageously given either to horses or cattle, with an ounce each of powdered ginger and gentian, either made into a ball with linseed flour and water, or given as a draught in a quart of ale. Salt is believed to counteract any tendency to the production of intestinal worms, to prevent rot in sheep, and to obviate, in great measure, the evil effects of damp and badly kept fodder. It is a common addition to laxative clysters; and, from its action as a stimulant, as well as from the cold which it produces during solution, it is beneficially applied in various affections of the joints, and in some diseases of the feet, particularly amongst cattle and sheep. Where a low temperature is required, salt should be mixed with an equal weight of finely-pounded ice; or, where ice is not procurable, an effective cooling mixture is made with equal quantities of salt nitre and salammoniac, which, during their solution in water, rapidly abstract heat.

The frequent use of small quantities of common salt appears to be of much service in maintaining the domesticated animals in a state of high health. Indeed, so essential is it, that animals in a state of nature will often instinctively travel many miles to reach saline springs, the sea-shore, or incrustations or beds of salt. Some years ago, M. Boussingault made some very interesting experiments regarding the dietetic value of common salt.[1] He selected six cattle, divided them into two lots as equal as possible in weight and appearance, and fed them in exactly the same manner, except that the animals in the one lot received each 1·2 ounces of salt daily, whilst those of the other got none. In about six months, the skin and hair of the latter became rough, dry, and staring, presenting a striking contrast to the smooth, oily coats of the others, which, though not much superior to their neighbours in weight, were more lively, and of so much better appearance that they brought a somewhat higher price. It is also worthy of remark, that the cattle receiving salt exhibited throughout much greater appetite and relish for their food, consumed it in a shorter space of time, and also drunk larger quantities of water. The use of salt is especially necessary for animals receiving cooked food, grains, or roots; for the salt naturally present in such articles is usually in small amount. But all animals should have access to salt at all times. A piece of rock salt should constantly lie in the horse's manger, the ox's crib, and the sheep's trough. The fondness which animals show for salt, and the frequent perseverance with which they lick at it, indicate that the condiment gratifies the taste, and probably also serves some useful purposes in the body. It is thought to be the natural stimulant of the digestive system in all animals; to become decomposed and

[1] Annales de Chemie et de Physique for 1847, vol. xix.

afford chlorine for the hydrochloric acid of the gastric juice, and soda for the bile; to perform some important functions in regard to the blood discs; and to assist the blood in maintaining its "fluidity, its stimulating properties, and its powers of self-preservation."

Doses, etc.—The dose of common salt, as a purgative for the adult ox, varies from three quarters of a pound to a pound and a half; and for sheep, from one ounce to three. Instead of using common salt by itself, I am generally in the habit of giving half doses of common and Epsom salts, dissolving the mixture in two quarts of tepid water, adding two ounces of powdered ginger, anise, or other aromatics, and a pound of treacle. When the mixture is thus sweetened, some cattle will readily drink it, and the trouble of horning it over may thus be saved. In treating various derangements of the digestive organs, and other cases among cattle, accompanied with extreme torpidity of the bowels, it is often necessary to expedite and increase the effects of common salt by the addition of other purgatives; and, in such cases, an effectual combination may be made with three quarters of a pound each of common and Epsom salts, two or three drachms of calomel or twenty powdered croton beans, a pound of treacle, and two ounces of oil of turpentine—all dissolved together in three quarts of water. Where such a dose fails to act in twelve or fifteen hours, it may be again repeated exactly as before, or with a pint or two of linseed oil instead of the salts. Frequently reiterated large doses of salt, or indeed of any active purgative, are, however, to be avoided, since they induce much nausea and depression, which actually prevent purgation. When a patient has got two, or at most three, full doses of physic, without effect, he should have frequent clysters, plenty of treacle, and as much salt and water, or simple water, as he will drink of his own accord, but rarely any more active cathartic medicine. As an alterative and stomachic for horses or cattle, one or two ounces are given, usually united with aromatics, bitters, or vegetable tonics. As an emetic for the dog, the dose varies from one to four drachms, dissolved in tepid water. A still more effectual emetic for a medium-sized dog, consists of a tea-spoonful of salt, and half a tea-spoonful of mustard flour, dissolved in three or four ounces of water. A more prompt result is obtained by adding to the mixture a grain of sulphate of zinc or of copper; whilst a more marked depressing effect on the circulation is gained by the addition of a grain of tartar emetic.

Chloride of Soda. Hypochlorite of Soda. Chlorinated Soda.

Chloride of soda closely resembles chloride of lime or bleaching powder in its composition, properties, and actions. It is prepared by saturating carbonate of soda with chlorine gas. It is a soft white powder, with a strong chlorine odour, and an astringent alkaline taste. It is easily dissolved in water, forming a colourless alkaline liquid, with an astringent taste, and feeble odour of chlorine. This solution readily destroys vegetable colouring matters, and is stated in the Brit. Phar. to consist of bicarbonate of soda, chloride of sodium, and hypochlorite of soda, which is its chief active constituent.

Actions and Uses.—It is stimulant, antiseptic, and disinfectant. It has been recommended in typhoid affections; and from the idea that it has some peculiar action on the lymphatic glands and vessels, has also been given to horses in cases of glanders and farcy, but without much success. Doses of one pound are said to have been used with impunity for horses and cattle. It is chiefly employed to arrest putrefaction, remove offensive odours, and destroy contagious miasmata; but even for these purposes it has been superseded by bleaching powder, which is equally efficient, and much cheaper. Labarraque's soda-disinfecting fluid contains one part of the chlorinated soda dissolved in one of water.

SPERMACETI.

Spermaceti or Cetaceum is nearly allied to the fats and solid oils, and is found in the cells of the large quadrangular head of the sperm whale, which inhabits the Pacific and Indian Oceans.

It is extracted by openings made through the skull, and occasionally by boiling various parts of the cellular and adipose tissues, which do not, however, yield it so abundantly as the head. When purified by melting, straining, and solution in weak potash-ley, it is a soft, slightly oily, pearly-white, crystalline substance, with the density 943. It is tasteless, odourless, tough, and difficult to powder, unless previously moistened with a few drops of spirit. It is insoluble in water, sparingly soluble in cold alcohol, and readily soluble in hot alcohol and oils. Commercial spermaceti consists of a small quantity of liquid oil and cetine, which is a neutral and beautifully crystalline body, having the composition $C_{64}\ H_{64}\ O_4$.

Actions and Uses.—Spermaceti is an emollient and demulcent, is rarely given internally, but is frequently used as an ingredient of ointments and liniments.

STARCH.

Starch is present in large amount in all the cereal grains, in the stems of many plants, and in most roots. It is easily got from any of these sources, by bruising the plants, washing them, allowing the starch thus removed to subside, and then drying it. For commercial purposes, starch is prepared from coarse wheat flour, rice, or potatoes ground to a pulp, and either allowed to ferment until acetic acid is formed, or treated with a diluted alkaline solution. The albuminous matters are thus dissolved, while the starch and lignine which subside from the fluid may be separated by washing the mixture in a sieve. Starch is insoluble in cold water, forms a gelatinous mass with boiling water, and is converted first into dextrine or British gum, and then into sugar, by diluted sulphuric acid, by a temperature of 300°, or by various animal matters. Starch consists of minute granules, varying in size in specimens got from different sources. Its most distinctive test is the blue compound it forms with iodine. It has the same composition as gum and cellulose, and the formula $C_{12}\ H_{10}\ O_{10}$.

Actions and Uses.—Starchy substances are easy of digestion, and when given with a sufficiency of albuminous matters are also very nutritive; but, like the other proximate principles, they cannot alone support life. As demulcents and emollients, they are inferior to albuminous and mucilaginous substances, but like them are used for sheathing, protecting, and softening irritable surfaces. Thus, in diarrhœa and dysentery, they are advantageously given in the form of gruel, both by the mouth and rectum, either alone or with opium or astringents. Starch is sometimes applied in the dry state to improve the quality, and diminish the quantity of discharges from wounds, and with about one-eighth part of alum to arrest the flow of synovia from open joints. It is also occasionally used for mixing up medicines, and sometimes as a vehicle for administering them.

SUGAR.—MOLASSES.

Nat. Ord.—Graminaceæ. *Sex. Syst.*—Triandria Digynia.

Sugar is present in many plants, but seldom in such large proportion as to be worth extraction. In France it is prepared from beet-root, and in America from the *Acer Saccharinum*, or sugar-maple; but almost all the sugar used in this country is got from the sugar-cane. This plant, which is extensively cultivated in the West Indian colonies, has a perennial root, a jointed, annual stem, from six to twelve feet high, and long grassy leaves, which send out a flowering stem terminating in a panicle of beautiful silver-grey flowers. The lower parts of those canes which have not previously borne flowers are richest in saccharine matter. The canes are crushed between heavy rollers; the pale-green expressed juice, which is very prone to ferment, is then mixed with lime and concentrated, when yellow-brown crystals of raw sugar are formed, and there remains a variable quantity of a brown, uncrystallized substance, known as treacle or molasses. The raw, brown, or muscovado sugar of commerce, when brought to this country, is dissolved in water, heated with bullock's blood, and sometimes with alumina, filtered through animal charcoal, concentrated in vacuo at about 150°, poured into conical moulds, and, when solidified, forms the ordinary loaf or refined sugar.

Pure sugar is colourless, odourless, of a shining crystalline appearance, a density about 1500, and soluble in about half its weight of water at 60°. It phosphoresces in the dark, is decomposed by mineral acids, and readily fermented by yeast. Sugar, when slowly crystallized by suspending threads in a watery solution, to which a little alcohol has been added, forms candy-sugar. When heated, it loses its property of crystallizing, and if run into little moulds, forms barley-sugar. When exposed to a high temperature, it loses its sweet taste, acquires a dark colour, is then known as caramel or burnt sugar, and is used for colouring wines and spirits. Cane sugar, when crystallized, consists of $C_{12}\ H_{11}\ O_{11}$.

Grape sugar, *glucose*, *sugar of fruits*, *honey*, *or diabetic sugar*, is found in most plants, and is the variety of sugar formed from starch, whether in or out of the body. It is less sweet and less soluble than cane sugar. It crystallizes in indistinct, warty, granular masses, and is not blackened by strong sulphuric acid, which readily chars cane sugar. When treated with sulphate of copper and caustic potash, and heated, the bluish-green precipitate first formed rapidly becomes bright red, depending on the deoxidation of the oxide of copper, and the formation of the red sub-oxide. The supernatant liquid also becomes colourless. With cane sugar, on the other hand, the bluish-green precipitate first formed undergoes little change, and the solution still retains its blue tint. This is a convenient test for distinguishing between the two varieties of sugar, and also for discovering the presence of sugar in urine and other secretions, in which it exists in the form of grape sugar. Grape sugar, when crystallized, has the composition $C_{12}\ H_{14}\ O_{14}$.

Milk-sugar, or *lactine*, is easily obtained from the homœopathic chemists, who use it extensively for subdividing their medicines. It is usually prepared from whey, occurs in hard, fibrous, crystalline masses, is gritty, less sweet than either of the preceding varieties, requires for solution five or six times its weight of water, and is not directly fermentable. It has the composition $C_{12}\ H_{12}\ O_{12}$.

Actions and Uses.—The sugars are important nutritive bodies, and are chiefly employed in the system in supporting animal heat. It is said that they destroy such creatures as frogs, leeches, and earth-worms; cause stupefaction in fishes; and in quantities of four or five scruples produce in pigeons swelling of the head and convulsions. But the injurious effects which sugar has on these animals has probably been exaggerated, for Hertwig mentions that pigeons consumed from five to ten scruples without any bad consequences. In the higher animals large doses of sugar (in horses one or two pounds, in dogs from eight to twelve ounces) increase the amount and fluidity of the feces, and also usually augment the secretion of urine. Sugar is used in man as a demulcent and emollient in the dry stages of catarrh; is occasionally given, though with little advantage, in poisoning with salts of mercury and copper; and is sometimes used as a domestic remedy for sores, and for removing spots on the cornea. On account of its antiseptic properties, it is much employed for preserving various vegetable, and some soft animal substances, and for making up various kinds of medicines. The simple syrup, the chief pharmaceutical preparation of sugar, is made by mixing, with the aid of gentle heat, five pounds of refined sugar and two pints of distilled water, and adding after cooling as much distilled water as may be necessary to make the weight of the product seven pounds and a half. The specific gravity should be 1330. (Brit. Phar.)

Molasses or Treacle, the uncrystallizable portion of the sugar-cane juice, has a dark-brown colour, a pleasant, sweet taste, and a density of about 1400. It is a mild laxative, and is especially valuable for expediting the action, preventing the nauseating effects, and covering the disagreeable flavour of many active cathartics. Where full doses of physic have been previously given, and their repetition is inexpedient, large and repeated doses of treacle will be found of much service in accelerating and increasing the action of the bowels, especially in cattle and sheep. It is a palatable, digestible, laxative article of food, and consequently well adapted for convalescents. Like sugar, it is antiseptic, and is one of the best excipients for making ball masses, giving them a proper consistence, and preventing their becoming dry, hard, or mouldy. The common mass, so largely used as an excipient, is made by thoroughly mixing together equal weights of treacle and linseed flour. For such pharmaceutic purposes, powdered *liquorice* is also occasionally used. It is the root of the *glycyrrhiza glabra*, and is grown in England or imported from Spain or Italy. The natural juice or watery infusion, when concentrated until it becomes solid, forms the well-known extract of liquorice or black sugar.

Doses, etc.—The dose of treacle, as a laxative for horses and cattle, is about lbi.; for sheep, ℥iij. or ℥iv.; and for dogs, ℥i. or ℥ij. It is given to all animals, at short intervals, until its effects are produced.

SULPHUR.

Sulphur, or brimstone, is a chemical element, and one of the most ancient articles of the materia medica. It is obtained by decomposing metallic sulphurets, or more conveniently by purifying the crude Sicilian sulphur, which occurs in large beds as a product of volcanic action. The purified sulphur is met with sometimes in rolls, which are prepared by distilling or fusing the crude article, and running it into moulds; and sometimes in a finely divided impalpable and minutely crystalline powder, known as sublimed sulphur, or flowers of sulphur, and prepared by subliming crude sulphur, and introducing its vapour into large closed chambers, where it condenses. When sublimed sulphur is boiled with lime and water, and the solution, when cool, is acidulated with hydrochloric acid, a greyish-yellow soft powder, free from grittiness, is thrown down: this is precipitated sulphur, long disused, but again introduced into the new British Pharmacopœia. Its actions are identical with those of the sublimed sulphur.

Properties.—Sulphur in mass is an opaque brittle solid, of a yellow colour, varying in tint according to the degree of heat to which it has been exposed during fusion. It has a faint peculiar odour, very little taste, a greasy surface, and a shining crystalline fracture. It is a bad conductor of heat, and hence, when grasped in the warm hand, crackles, and sometimes splits into fragments. It is insoluble in water, but in a state of fine division is dissolved in alcohol, ether, and the fixed and volatile oils. It has a specific gravity of 1980, is inflammable, and burns with a pale blue flame, evolving sulphurous acid. When heated it exhibits curious properties, and passes through various allotropic conditions. At 212° it melts, becoming as fluid as water, and of the colour of amber. At a higher heat it thickens, and becomes as dark as treacle. At 480° it is very tenacious, and adheres to the vessel even when it is inverted; while from that temperature to 788°, at which it boils, it again becomes thin, and recovers in great part its original colour. Sulphur is usually of sufficient purity for all medicinal and pharmaceutical purposes. Traces of arsenic are, however, sometimes present in that made from pyrites. *Sulphur vivum*, also called *sulphur caballinum*, or horse sulphur, is the residue left in the subliming pots. Some practitioners prefer it to the purer variety; but it must be used with caution, as, besides other impurities, it occasionally contains minute quantities of arsenic.

Actions and Uses.—Sulphur in large doses is an irritant; in medicinal doses, a laxative, alterative, and general stimulant of the mucous surfaces; and when applied externally, an efficacious remedy for many skin diseases.

When given to horses in doses of a pound, it causes colic, purging, prostration of strength, and sometimes fatal gastro-enteritis. (Moiroud.) A horse affected with glanders received doses beginning with an ounce, and gradually increased by additions of an ounce daily, until the sixteenth day, when the animal had got 136 ounces. Diarrhœa supervened on the seventh day; but the appetite remained throughout unimpaired, the urinary secretion unaffected, and the pulse and breathing normal. On the third day the perspiration smelt of sulphur, and a bit of paper moistened with acetate of lead, and laid on the skin, became grey. The muco-purulent discharge from the nostrils increased daily; and the patient, though well fed, became gradually emaciated, and so reduced in strength, that by the seventh day he was unable to rise. After the tenth day the blood, even in the arteries, became very dark coloured, and also very thin and slow to coagulate. On the seventeenth day the animal was destroyed. The mucous lining of the stomach, colon, and cœcum, was of a reddish-blue colour, soft, and easily torn. The lungs, muscles, and intestinal contents, smelt strongly of sulphuretted hydrogen, but the blood had no such odour. (Hertwig.) Like most other non-metallic elements, sulphur is speedily converted within the body into a soluble hydracid, which readily enters the circulation, exercises a topical stimulant effect, especially on the mucous surfaces, and, from its disagreeable odour, is readily detectible in the breath, perspiration, and feces, and indeed in most of the secretions and excretions. Waldinger mentions that a small quantity of sulphur, given for some time to sheep, imparted a very disagreeable flavour to the flesh.

As a laxative, sulphur is frequently given to cattle and sheep for the purpose of gently opening the bowels, or of keeping up the action of more powerful purgatives. In chronic pulmonary disorders, in rheumatism, in convalescence from most acute diseases, and in most skin affections, whether occurring in horses, cattle, sheep, or dogs, sulphur is of much service in promoting the healthy action of the bowels, skin, and kidneys, and is usually administered along with saline purgatives, a little nitre, or treacle. In such cases it acts as an alterative, exerting a gentle stimulant action, especially on the processes of secretion, and gradually improving the general health. Its efficacy as a vermifuge, though often extolled, is probably over-estimated. It is a popular preventive of distemper, as well as of a host of other canine disorders; and its mystic influence is believed to be exerted by keeping a bit of roll-sulphur in the water which the animal drinks. Whatever may be the medicinal or prophylactic effects of sulphur when properly administered, it can certainly be of no benefit when used in this way, for it is quite insoluble in water. The sudorific effects of sulphur are scarcely observable in the domesticated animals. Rubbed daily into the skin, it greatly abates the pain of rheumatism. In all veterinary patients it is much used as a remedy for mange, scab, ring-worm, and such like scaly skin diseases; and in these cases is applied both internally and externally. The external is, however, the more effectual mode of application, removing the itchiness almost immediately, and usually perfecting a cure in eight or ten days. The manner of its operation is still uncertain. It acts as a stimulant, bringing the diseased parts into a more healthy state, and also destroys the minute *acari* which cause most of these skin diseases. In the speedy and effectual cure of the more chronic and intractable of such cases, it is of importance not only to employ sulphur applications, but also to make diligent use of soap and water, to pay scrupulous attention to cleanliness, and to alternate the medicinal remedies at short intervals, using in turn sulphur, oil of tar, mercurial ointment, and solutions of arsenic and tobacco. Even the most obstinate and inveterate cases of mange will soon yield to such medicines when thus frequently changed, and aided by hygienic treatment.

Doses, etc.—The dose of sulphur, as a laxative for the horse, is ℥iij. to ℥iv.; as an alterative, about ℥i. For cattle, as a laxative, ℥v. or ℥vi.; as an alterative, ℥i. or ℥ij. For sheep, as a laxative, ℥ij.; as an alterative, ʒvi. For the dog, as a laxative, ʒvi.; as an alterative, ʒi. to ʒij. It may be administered, either made up in a bolus, suspended in gruel, or dissolved in oil. When used as an alterative, it is usually given in combination with aromatics, saline matters, antimonials, or mercurials. The following prescription is often used for both horses and cattle:—Sulphur, ℥i.; tartar emetic, ʒi.; nitrate of potass, ʒij. A still better formula, which may be repeated once or twice daily, consists of an ounce each of sulphur and ginger, and half an ounce of nitre. Very many preparations of sulphur are used externally, and almost every practitioner has his own formula. The simple ointment consists of one part of sulphur, or sulphur vivum, and four parts of axunge. One part of mercurial ointment is often added, and occasionally a little white hellebore; but the addition of this irritant body is not to be commended, being apt to cause vesication, especially in dogs. If used at all, the quantity should not exceed one-eighth or one-sixth part. Sulphur liniments are made in the same way as the ointments, merely substituting oil for lard. The simple liniment consists of one part of sulphur, and four parts of linseed oil, or any other convenient excipient. The addition of one part of oil of tar, or of Barbadoes tar, is often advisable.

SULPHURIC ACID.

Oil of Vitriol. Acidum Sulphuricum. HO, SO_3.

Sulphuric acid is prepared by burning sulphur or iron pyrites, which has recently come extensively into use for this purpose. The sulphurous acid (SO_2) thus produced, is introduced into large, airy, leaden chambers, where it is oxidized by nitrous acid evolved from a mixture of nitre and sulphuric acid. Sulphuric acid (SO_3) is thus formed, and is dissolved in water admitted into the lower part of the chambers. This diluted solution is then concentrated, first in lead, and then in platina or glass vessels.

Properties.—Strong sulphuric acid is a dense, oily-looking, colourless, odourless, corrosive liquid, with an intensely acid acrid taste, and a density of 1846. It freezes at —36°, and boils at about 600°; readily absorbs moisture from the air, and hence if kept in unstoppered vessels speedily becomes diluted. When brought in contact with any of the soft animal tissues it abstracts their fluid parts, coagulates their albumen, and, if concentrated, chars them. It is miscible with water in all proportions; and, in combining with it, undergoes a slight diminution in volume, and evolves much heat. When diluted, it rapidly dissolves such metals as iron and zinc, and when heated with alcohol produces ether. It is decomposed by charcoal, phosphorus, and various other substances, which unite with part of its oxygen, and thus cause the evolution of sulphurous acid. It possesses, in a marked degree, all the properties of a mineral acid, having an acid taste, turning vegetable blues red, and browns yellow, and uniting with bases to form salts. It is easily distinguished by its forming with soluble salts of barium an abundant white precipitate, which is insoluble in other acids.

Anhydrous sulphuric acid, a white crystalline body, consists of one equivalent of sulphur, and three of oxygen. The strongest acids of the shops contains one equivalent of this anhydrous acid, and one of water; and the Saxon or Nordhausen acid, a dark-brown fluid, got by distilling iron pyrites, and used in the dye-works for dissolving indigo, contains two equivalents of anhydrous acid and one of water.

Impurities.—Water, organic matters, sulphate of lead, and nitrous acid, are the most common impurities of sulphuric acid, and sometimes render it unfit for chemical and pharmaceutical purposes. The three first of these impurities may be got rid of by distillation, which may be conducted with perfect safety if a few fragments of platina be placed in the retorts; and the last by adding to every eight fluid ounces of the acid about fifteen grains of white sugar, heating the mixture for two hours, and distilling. The following tests of the Brit. Phar. guard against all the ordinary impurities of sulphuric acid:—"Specific gravity 1846. One fluid measure requires for neutralization 206 measures of the volumetric solution of soda. Evaporated in a platinium crucible, it leaves no residue. When a solution of sulphate of iron is poured upon it, no purple ring is formed at the surface of the two solutions. Diluted with six times its volume of distilled water, it gives no precipitate with sulphuretted hydrogen."

Actions and Uses.—Sulphuric acid, when used internally, is irritant, tonic, and astringent; and when used externally, irritant, caustic, and astringent. In poisonous doses it causes, in all animals, corrosion of the mucous membranes of the mouth, blackening of the teeth, feebleness and irregularity of the pulse, and great prostration of strength. After death, the contents of the stomach are usually very acid, the alimentary canal studded in various parts with black spots, and the blood in the surrounding vessels coagulated. When the acid has been very strong, it occasionally erodes the walls of the stomach; when the animal lives for some hours, the mucous membrane becomes thickened and inflamed. The appropriate chemical antidotes are bicarbonates of the alkalies, chalk, and magnesia. Mild diluents, as oil, milk, and gruel, should also be given.

Sulphuric acid, when used medicinally in any considerable amount, is not, as has been supposed, neutralized by the intestinal secretions, but is absorbed as an acid into the blood (Headland); and this appears evident from the fact that acids and their salts are not identical in action, which would certainly be the case if acids were converted into salts previous to their absorption into the blood. Further, it is shown that the small quantity of alkali present in the intestinal canal, is quite insufficient to neutralize the doses of acid usually given. The changes which sulphuric acid produces, on its getting access to the blood, are as yet unknown. It usually, however, diminishes thirst, and when given for some time continuously, is astringent and tonic. It is, in consequence, used with much benefit, and for all animals, in cases of feebleness and atony; during convalescence; and, in short, in all cases where mineral tonics are indicated. It has been much used in cases of pleuro-pneumonia amongst cattle, and seems often of good service in reducing the pulse, relieving the breathing, and sustaining the vital powers. Its success, however, is by no means invariable, nor is the per-centage of recoveries greater than when sulphate of iron or other tonic remedies have been given. In these pleuro-pneumonia cases, about an ounce daily is the average dose; but two, and even three ounces, are often given with impunity. Repeated large doses are apt, however, to cause diarrhœa and colic. In diarrhœa and dysentery, when accompanied with weakness and alkaline discharges, a drachm of acid may be given, twice daily, to horses and cattle, united with an ounce of laudanum, and administered in starch—gruel, or mucilage. In typhoid influenza in horses, I have seen much benefit from thirty drops of sulphuric acid given in gruel or ale several times a day, with an ounce each of ether and powdered cinchona bark. In relaxed and ulcerated sore throat, complaints which are not infrequent amongst horses, a diluted solution may be slowly given; part of it usually acts as a gargle, whilst any portion swallowed exerts the twofold influence of a local astringent and general tonic.

Sulphuric acid, when applied to the skin, combines with its moisture, bases, and albuminous matters, and causes disorganization of the cuticle, and considerable pain, owing to the exposure of the nervous fibrillæ. On account of its fluidity, it is well adapted for cauterizing irregular, sinuous, and poisoned wounds, and for most of the uses of a styptic and astringent. Professor Syme now uses it extensively for the destruction of cancerous masses, making it into a thin pulp with sawdust, and protecting the neighbouring tissues by a wall of gutta percha round the seat of its application. It is also used in like manner to remove warts, which, from their shape or situation, cannot readily be removed by the knife or by ligature. It is supposed to increase the efficacy of many blistering ointments, but, unless in small amount, is apt to cause blemishing. A few drops of sulphuric acid are often given along with Epsom salt and other saline purgatives, to diminish their disagreeable taste.

Doses, etc.—The dose of sulphuric acid for the horse is ʒi., repeated several times a day; for cattle, from ʒij. to ʒiv.; and for dogs, from ♏ij. to ♏iv. It is best given with water alone, taking care to dilute it, so that it does not cause injury of the mouth or throat. A suitable solution, for external use as an astringent, may be made by mixing from ten to twenty drops of acid in an ounce of water.

SULPHUROUS ACID.

When sulphur is burned in air or oxygen, it forms suffocating fumes of sulphurous acid, SO_2—a colourless gas, which is soluble in water, reddens litmus, bleaches colouring matter, but not permanently like chlorine, extinguishes flame, and is irritating and irrespirable. It speedily destroys plants, even when much diluted, and, on animals, acts in large doses as an irritant poison. Sulphurous acid gas dissolved in water, is sold as a colourless liquid, with a strong suffocating sulphurous odour, and a specific gravity of 1040. It has occasionally been used as a remedy for skin disorders. Bodies of recently killed animals, suspended in well-closed vessels, containing even very diluted solutions, are preserved unchanged for months. Both the gas and the solution are very effectual antiseptics and deodorizers, and are extensively used for preventing the putrefaction of the gelatine used in paper works, for destroying the foul effluvia of the cochineal dye-works, and for arresting the souring of many of the lighter continental wines. The pre-eminent efficacy of sulphurous acid for these purposes is a very strong argument in favour of its possessing disinfectant properties. But positive proof of the existence of such properties is still wanting, and, from the nature of the subject, can only be procured with great difficulty. For deodorizing or disinfecting purposes, it is conveniently obtained by burning sulphur on a shovel of coals. It is, however, so irritant, that it can only be freely and effectually used in habitations from which all animals have been previously removed. Great care should, at the same time, be paid to thorough cleanliness and ventilation.

SWEET SPIRIT OF NITRE.

Spirit of Nitrous Ether. Spiritus ætheris nitrici A solution of one volume of hyponitrous ether in four of rectified spirit. (Edin. Phar.)

Nitrous or Hyponitrous Ether. Æther nitrosus. $C_4 H_5 O + NO_3$.

Nitrous ether, although of little importance on its own account, demands notice as the chief ingredient of that useful compound, sweet spirit of nitre. It is a pale-yellow, volatile, inflammable, mobile fluid, with a sweet, warm, ethereal taste, and a peculiar, penetrating, fragrant odour, resembling that of rennet apples.

Preparation.—For the preparation of hyponitrous ether, and its subsequent conversion into sweet spirit of nitre, the Edinburgh Pharmacopœia gives the following directions:—" Take of rectified spirit, two pints and six fluid ounces; pure nitric acid (1500), seven fluid ounces; or nine fluid ounces of commercial acid, density 1380. Put fifteen fluid ounces of the spirit, with a little clean sand, into a two-pint mattrass fitted with a cork, through which are passed a safety-tube, terminating an inch above the spirit, and another tube leading to a refrigeratory. The safety-tube being filled with pure nitric acid, add through it gradually three fluid ounces and a half of the acid. When the ebullition, which slowly arises, is nearly over, add the rest of the acid gradually, half a fluid ounce at a time, waiting until the ebullition caused by each portion is nearly over before adding more, and cooling the refrigeratory with a stream of water iced in summer. The ether thus distilled over being received into a bottle, is to be agitated first with a little milk of lime, till it ceases to redden litmus paper, and then with half its volume of a concentrated solution of muriate of lime. The pure hyponitrous ether thus obtained, which should have a density of 899, is then to be mixed with the remainder of the rectified spirit, or exactly four times its volume. Spirit of nitric ether ought not to be kept long, as it always undergoes decomposition, and becomes at length strongly acid. Its density by this process is 847."—(Ed. Phar.) Dr Murray Thomson informs me, that a better way of preparing the spirit from the etherial mixture which distils over, is to add first ammonia until the solution is neutral, and then water, when the ether separates and rises to the top, is separated by a funnel, and then diluted with four times its volume of alcohol. By this process he finds the spirit remain longer neutral, and give the required specific gravity more easily than when the Pharmacopœia process is followed. In order to prevent tumultuous ebullition, violent succussions, and liability to explosion, the precautions above mentioned must always be carefully observed. Sand must be placed within the mattrass, a powerful refrigerator and proper safety-tube employed, the acid added slowly and gradually; and in all operations with this substance proximity to a naked flame must be avoided, as the vapour is very explosive. The new British Phar. has introduced the following somewhat simpler process; but the result is less uniform than that of the Edinburgh process already given:—" Introduce five ounces of nitrate of soda into a mattrass connected with a condenser; pour upon it the spirit and the sulphuric acid previously mixed, and distil thirty-five fluid ounces, the receiver being kept very cool."

Properties.—The properties of sweet spirit of nitre are similar to those of nitrous ether, but vary somewhat with its strength. It is mobile and almost colourless, has an etherial apple odour, and a sweet cooling spirituous taste. When freshly prepared, it should be neutral; but when kept, it gradually becomes acid, both to test-paper and to the taste, owing to its being resolved into ether and hyponitrous acid—a change especially apt to occur in very strong or carelessly prepared specimens. The specific gravity of the sweet spirit of nitre of the British Phar. is 843; ordinary London specimens have hitherto ranged about 834; whilst those of Edinburgh have been 847, and those of Dublin 850. The new Pharmacopœia may perhaps in time equalize these differences, but up to the present date the Edinburgh preparation has been two, or perhaps three, times stronger than the London.

Impurities.—Sweet spirit of nitre is very liable to adulteration. Indeed, though it should be of uniform quality, three different kinds are sold, at prices varying with the per-centage of ether which they contain. The best test for determining the strength of sweet spirit of nitre, and its freedom from water or excess of alcohol, is to agitate it with twice its volume of a solution containing 40 per cent. of dry chloride of calcium, and observe the amount of ether which comes to the surface. Subjected to this test, a good specimen of the Edinburgh preparation yields about 12 per cent.; whilst a London specimen seldom exceeds two. Excess of hyponitrous acid is discoverable by its reddening litmus paper; but this test is rather too delicate, and any specimen may be regarded as sufficiently free of acid, if it effervesces feebly, or not at all, with solutions of bicarbonate of potash or of soda. All the sweet spirit of nitre of commerce contains a variable, but often considerable, quantity of aldehyde; and all is liable to suffer diminution of strength from keeping.

Actions and Uses.—Sweet spirit of nitre is stimulant, antispasmodic, diuretic, and diaphoretic.

In large doses, it acts like alcohol and sulphuric ether, as a narcotic, producing great depression and stupor, with little preliminary excitement. In all its other actions it also closely resembles ether, but is somewhat less active as a stimulant and antispasmodic. During its excretion by the kidneys, it exercises its ordinary stimulating effect, exciting them to increased activity. This action is best ensured by administering the medicine along with a small quantity of nitre. Its diaphoretic action is somewhat more difficult to produce, for the medicine is very apt to be excreted by the kidneys rather than the skin; and the only way to prevent this is to keep the patient well clothed, and in a warm situation, and to give the sweet spirit of nitre in small and frequently repeated doses. Its uses are the same as those of sulphuric ether. It is for all animals a most valuable carminative and antispasmodic in indigestion, hoven, tympanitis, and colic; and a most effectual means of inducing reaction, and exciting the functions of the skin and kidneys in local congestions, typhoid affections, and convalescence from debilitating diseases. Two ounce doses, with the same quantity of laudanum, and repeated every hour, are of much value in counteracting the spasms and pains which occasionally follow parturition in cows. Sweet spirit of nitre is contra-indicated in acute inflammation and high fever.

Doses, etc.—The dose as a stimulant and antispasmodic, is for horses, f℥i. or f℥ij.; for cattle, f℥iij. or f℥iv.; and for dogs, about f℥i. It is best given diluted with water, which, to prevent loss, should be nearly cold; and, when used as an antispasmodic, it ought generally to be united with opium, belladonna, or hyoscyamus. I have treated many cases of colic very successfully by rubbing down three or four drachms of aloes in two ounces of spirit of nitre, and administering it in a bottle of ale or about a pint of water or cold gruel. In typhoid cases of influenza, an excellent prescription consists of two ounces each of sweet spirit of nitre and solution of acetate of ammonia, with one drachm of extract of belladonna, given in water or gruel. This combination is also very serviceable in cases of colic, especially with the addition of three drachms of aloes. In convalescence from inflammatory complaints, when serous exudation is suspected, sweet spirit of nitre is usefully conjoined with iodine as follows: A scruple of iodine, a drachm of iodide of potassium, and two ounces of spirit of nitre, repeated in water or ale twice or thrice a day. This quantity will make one dose for horses or cows, four for sheep, eight for dogs, and twelve for cats.

TOBACCO.

Tabacum. The dried Leaves of *Nicotiana Tabacum.*

Nat. Ord.—Solanaceæ. *Sex. Syst.*—Pentandria Monogynia.

Tobacco derives its name from *tabac*, the instrument used by the American aborigines for smoking the leaf, or, according to others, from the Island of Tobago, or from the Town of Tobasco in New Spain. It appears to have been known and cultivated from time immemorial by the natives of America; and is still grown largely on that continent, especially about the great river Orinoco, and in the United States. It was unknown in the Old World, at all events in Europe, until after the discoveries of Columbus, and was first introduced into England by Sir Francis Drake in 1586.

Natural History.—The *Nicotiana Tabacum*, which yields the Virginian and several others of the more important commercial tobaccos, is a herbaceous plant which has a branching fibrous root, a tall annual stem, funnel-shaped rose-coloured flowers, and large, moist, clammy, brown leaves with yellow spots, glandular hairs, a strong peculiar narcotic odour, and a nauseous bitter acrid taste. The leaves readily communicate their properties to hot water and alcohol. The plant is cut down in the month of August, and the leaves, which are the officinal part, are dried, twisted, and carefully packed, with great compression, in hogsheads. It would be needless here to notice the different sorts of tobacco, which owe their several peculiarities chiefly to the manner in which they are prepared for sale. The Virginian tobacco, being the strongest, is generally preferred for medicinal purposes. Snuff is prepared by cutting tobacco into small pieces, piling it into heaps, and pouring water over it to encourage fermentation. The heaps speedily heat, and evolve ammonia; and the process continues from one to three months, according to the sort of snuff required. The fermented product is then ground and sifted.

The ordinary varieties of commercial tobacco contain about 12 per cent. of moisture, from 40 to 44 per cent. of matters soluble in cold water, from 2·5 to 4 of matters insoluble in cold water but soluble in boiling water, and from 40 to 45 of ligneous materials and insoluble salts.[1] Fresh tobacco leaves contain:—

Nicotina or Nicotine ($C_{20}H_7N_2$), . .	0·06
Concrete volatile oil (Nicotianin), . .	0·01
Bitter extractive matter, . . .	2·87
Gum, malic acid, with malate of lime, .	2·24
Chlorophyll, ...	0·26
Albumen and gluten, . . .	1·30
Lignine, and a trace of starch, . .	4·65
Salts and silica, ...	0·70
Water, ...	88·28
	100·37

In this analysis, made by Posselt and Reimann in 1827, the two first-mentioned substances are the active principles of the tobacco. *Nicotina* is a liquid, oily, volatile alkaloid, with a slight odour of tobacco, and a most acrid burning taste. It is miscible with water, alcohol, and ether, and constitutes from 2 to 10 per cent. of the dried leaves. It is very poisonous, half a grain being sufficient to destroy a middle-sized dog. It may be got by distilling a concentrated infusion of the leaves, with potash, adding sulphuric acid, and dissolving out the sulphate of nicotina by alcohol. *Nicotianin* is a solid, camphoraceous, volatile oil, having the odour of tobacco without its acridity, and readily producing convulsions, coma, and death. It is insoluble in water and diluted acids, but is soluble in ether and caustic

[1] Analyses of tobacco made by the Analytical Sanatory Commission.—Lancet, 13th August 1853.

potash. It is easily got by distilling the leaves with water, when it comes over and swims on the water in the receiver.

Actions and Uses.—Tobacco is a narcotico-acrid poison; and is used medicinally as a sedative, antispasmodic, and anthelmintic, as well as an auxiliary emetic and cathartic. It is, besides, a useful remedy for freeing the skin of various diseases, and almost all kinds of parasites.

Its primary irritant action is illustrated in the stimulant effect it exerts on the nostrils and salivary glands of man, and the vomiting and purging which follow its administration to the dog. Its secondary sedative and narcotic actions are exhibited when it becomes absorbed in sufficient quantity from any mucous, cutaneous, or other vascular surface, and thus finds entrance into the blood. Hertwig appears to have investigated the action of tobacco on the lower animals with much care. He gave horses the powdered leaves in doses varying from half an ounce to an ounce, and found that the pulse was lowered from three to ten beats per minute, and was also irregular and intermittent; and that a repetition of such doses caused increased evacuation, both of feces and urine. Large doses, especially when injected into the veins, induced acceleration of the pulse, considerable irritation, loss of appetite, and in all cases increased activity both of the bowels and kidneys. Two ounces of powdered tobacco, in a pound and a half of water, were given in divided doses, but within two hours and a half, to a healthy middle-aged cow, and produced heightened temperature of the skin, acceleration of the pulse from 65 to 70, quickened but somewhat oppressed breathing, coldness of the horns, ears, and extremities, dilatation of the pupil, and copious perspiration continuing all night. Next day the animal continued dull, but on the third day she was perfectly well. An ox, after consuming about four pounds of tobacco leaves, speedily became very restless, ground his teeth and groaned, lay with outstretched limbs and distended rumen, passed quantities of thin, fetid feces, and died in eleven hours, in convulsions. Quantities of the leaves were found in the alimentary canal, and the mucous membrane, especially of the fourth stomach, was red and corroded, particularly where in contact with the tobacco. Hertwig further mentions that goats are similarly affected by doses of one or two ounces, and generally die in about ten hours. Orfila introduced five drachms and a half of powdered tobacco (rappee) into the stomach of a dog, and retained it there by placing a ligature round the œsophagus. There ensued violent efforts to vomit, nausea, purging, tremors of the extremities, giddiness, accelerated respiration, quicker and stronger action of the heart, convulsions, stupor frequently interrupted by spasms, and in nine hours death. A decoction containing half a drachm, injected into the rectum of a dog, produced most of the same symptoms, but did not prove fatal. Two and a half drachms, applied to a wound, destroyed a dog in an hour.

In poisoning by tobacco, death appears to depend on a perverted and paralyzed state of the nervous centres, producing coma, syncope, or apnœa. This irregularity in the manner of dying, as well as the variety in the general effects of tobacco, seems to depend upon the fact that the drug owes its activity to two constituents, nicotina and nicotianin, which differ in their action, and occur in the different preparations of tobacco either singly or together. Both are present in the powder and solution, but the alkaloid is the chief active ingredient of the smoke; and hence the probable reason why that form of exhibiting tobacco is least irritating, most effectual in relieving spasm, and also in excessive doses most apt to induce convulsions and coma, without materially affecting the action of the heart.

Tobacco resembles digitalis in many of its actions, but has more effect in increasing secretion. Though nearly allied to the other *solanaceæ* (belladonna, hyoscyamus, and stramonium), it differs from these in causing contraction, instead of dilatation, of the pupils. Though resembling opium in its contracting the pupil and relaxing muscular fibre, it is distinguished from it, inasmuch as it induces more prominently the early symptoms of intoxication, acts less on the brain and more on the heart, and increases the secretions as well of the skin as of all other parts.

It acts on dogs and other carnivora as an emetic; but is little used for that purpose. From its relaxing muscular spasm, it is a very valuable remedy in colic, tympanitis, and hernia, and in these cases is most effectual in the form of smoke clysters. In enteritis and peritonitis it is also frequently of much benefit, chiefly on account of its antispasmodic and sedative virtues. In obstinate torpidity of the bowels, it is a most serviceable adjunct to active purgatives. It speedily poisons intestinal worms, and also hastens their expulsion, either dead or alive, by encouraging the action of the bowels. It is specially useful in cases of ascarides. It has been used in retention of urine and dropsy, but with doubtful success. On account of its allaying nervous irritability, and rousing the action of the bowels, skin, and kidneys, it has been proposed as a remedy in tetanus. In several cases occurring in man, one or two drops of the alkaloid nicotina—equivalent to thirty or sixty grains of Virginian tobacco—have been given every two hours, with the immediate result of relaxing the spasms; a strong decoction has also been applied with benefit to the muscles more especially involved. It is used externally in the treatment of various skin affections, as mange in dogs, and scab in sheep; and is also in all animals a potent remedy for the destruction of lice, fleas, and ticks. Sheep and lambs are occasionally dipped in or washed with diluted solutions of tobacco, soft soap, and sulphur, to protect them from the effects of the fly; but for all such purposes tobacco must be applied with caution, since serious and even fatal effects have resulted from its absorption.

Doses, etc.—Tobacco is seldom administered by the mouth. When so used, the dose for the larger animals is about ʒiv. or ʒv.; and for dogs, about grs. v. or grs. vi. As a soothing, laxative clyster, it is employed either in the form of infusion or of smoke. The latter, however, is more safe and certain, and is most conveniently given by filling a common barrel syringe with smoke drawn from a tobacco-pipe. Three or four syringe-fuls are sufficient at a time, and may be repeated at intervals as required. For external application, or for enemata, the infusion should be made with about a drachm of tobacco to a pint of hot water. Solutions of greater strength are often dangerous.

TURPENTINES.

Nat. Ord.—Coniferæ. *Sex. Syst.*—Monœcia Monadelphia.

The natural family *Coniferæ* yields many important medicinal substances, such as common and Venice turpentine, Canada balsam, frankincense, oil of turpentine, resin, tar, and pitch. All the trees of this family contain an oleo-resinous juice, which exudes spontaneously from incisions made into the stems and branches, and is easily separable by distillation into a volatile oil and a resin. The roots and other hard parts, when subjected to smothered combustion or destructive distillation, yield tar, from which pitch is also prepared.

To prevent unnecessary recapitulation, I shall include all these substances under one head, and shall consider,—

I. The various sorts of turpentine—being the oleo-resinous juices of the *Coniferæ.*

II. The oil of turpentine—being the volatile oil procured from turpentine by distillation.

III. The various resins or rosins—being the residue of the distillation.

IV. Tar and pitch—being the substances got by subjecting the roots and branches of the *Coniferæ* to destructive distillation.

I. The various Sorts of Turpentine.

When these terebinthinate juices first exude from the tree they are fluid, or nearly so; but when exposed to the air they solidify, from the volatile oil being partly given off and partly oxidized. By the action of heat, however, they readily regain their fluidity. They have a peculiar taste and odour, are insoluble in water, but soluble in oils, alcohol, and ether; are inflammable, and leave, when burnt, a finely divided carbonaceous residue of lamp-black. There are many varieties of turpentine, but the most important are common and Venice turpentines, Canada balsam, and frankincense.

Common Turpentine is brought principally from the United

States of America, but also from Norway, and other northern countries of Europe. It is the produce of several species of pine, but especially of the *Pinus palustris*—a very large tree found in the southern parts of North America, having bright green linear leaves about a foot in length, and collected into bundles like those of the *Pinus sylvestris*, or Scotch fir, from which turpentine is also procured. It is usually obtained during the spring and summer months by making incisions in the lower part of the trunk, and removing two or three feet of the bark. The hollow thus made becomes filled with turpentine. The variety known as Bourdeaux turpentine is at present imported only in very small quantity. Common turpentine is generally semi-fluid, but its consistence varies considerably with the temperature and the length of time it has been kept. It has a yellow colour, an aromatic odour, and a warm pungent taste. Unless melted and strained, or, as it is technically called, *rectified*, it contains portions of leaves, twigs, and other impurities. Water has little effcet upon it, and does not separate its active principles. The quantity of oil of turpentine it contains varies from five to twenty-five per cent. The American variety, when recent, is said to yield seventeen per cent.

Venice Turpentine (Terebinthina Veneta), as usually met with in commerce, is got from the *Larix Europea*—a lofty tree with graceful drooping branches, and leaves which are at first in fasciculæ, like the pine tribe, but afterwards become solitary by the elongation of the twigs. Holes are bored into the tree, wooden spouts attached, and the resinous juice thus obtained is purified by filtration. It is generally thick, tenacious, and opaque; has a yellowish olive-green tint, an acrid bitter taste, and a peculiar terebinthinate odour, somewhat weaker, however, than that of common turpentine. It contains from fifteen to twenty-five per cent. of volatile oil. *Strasburg turpentine* is very similar to Venice turpentine, and is often confounded with it. Most of the Venice turpentine of the shops is an artificial mixture of five ounces of oil of turpentine with a pound of black resin.

Canada Balsam, better known as balsam of Gilead, is the purest of all natural turpentines. It is chiefly obtained from the *Abies balsamæ*, and is found in vesicles lying between the bark and the wood. It is very rich in volatile oil, and is consequently more fluid than the common turpentines. It is yellow and transparent, with an agreeable odour, and a bitter and slightly acrid taste.

Frankincense, or Thus, is the turpentine got from the Norway spruce fir (*Abies excelsa*). It contains much resin, and little volatile oil, and hence is more solid than many substances of this class. It is of a yellow colour, firm and brittle, without odour, but having an acrid bitter taste. Concrete American turpentine is largely substituted for frankincense, especially in the preparation of *Burgundy pitch*, which is prepared either from the real or counterfeit article by fusion and pressure through a cloth, and occurs in soft, pale yellow masses, having a turpentine odour and taste. It contains a large proportion of resin, and but little volatile oil, and is chiefly used externally, and especially in the human subject, for making stimulant adhesive plasters for chest affections, rheumatism, lumbagoes, etc.

Actions and Uses.—The turpentines are topical irritants; and when given internally, become speedily absorbed, act as general stimulants, and are discharged from the system by the kidneys, bronchial mucous membrane, and skin, stimulating whatever parts are employed in their excretion. Their activity resides chiefly in the volatile oil, and hence those which contain most oil, or in other words, are the most fluid, are also the most active. In point of activity they may be arranged as follows: Canada balsam, Venice turpentine, common turpentine, and frankincense. Their medicinal uses are very various, and identical with those of oil of turpentine. They are given to all the domesticated animals as stimulants in indigestion, colic, and general debility; as laxatives, especially when in combination; and as anthelmintics, diuretics, and inspissants of excessive mucous discharges. They are applied externally as mild stimulants, rubefacients, digestives, and styptics; but for all these purposes they are usually superseded by oil of turpentine. In the south of France the resinous vapours of the coniferæ have been successfully used in the human subject, in the treatment of rheumatism, bronchitis, and even of phthisis. (Edinburgh Medical Journal for February 1864.)

Doses, etc.—The doses of the turpentines for horses and cattle, vary from ℥i. to ℥iij., and for dogs from ℈i. to ℈iij. They are conveniently given with linseed or any other oil, or as emulsions made with treacle, albuminous substances, or about 1-20th part (by weight) of magnesia. For external application they are either used alone, or made into liniments with oil, or ointments with lard.

II. Oil of Turpentine.

Oil of turpentine, often improperly called spirits of turpentine, may be got from any sort of turpentine, but is most usually obtained from the common white or American variety, by melting, straining, and distilling it with water. The oil passes over, leaving a resinous residue, and is purified by redistillation with water, or, still better, with aquæ potassa. The oil is a clear, colourless, limpid, volatile fluid, with a powerful penetrating odour, and an aromatic, bitter taste. Its spec. gravity is less than that of water, being about 860. It boils at 314°; is very inflammable, burning with a heavy yellow flame, and producing much smoke; is neutral to test-paper; sparingly soluble in water; somewhat more soluble in alcohol; and readily dissolved in ethers and fixed oils. It is itself a valuable solvent for resins, fats, many alkaloids, resinous principles, India-rubber, and gutta percha, and might be economically substituted for alcohol in the making of many tinctures. When exposed to the air, it gradually thickens from absorption of oxygen. When moist, and reduced to a temperature of —17°, it deposits crystals. It is charred by sulphuric acid, and ignited by nitric acid or chlorine. It is believed to be a mixture of two isomeric oils; and, when pure and freshly prepared, is a hydrocarbon, having the composition $C_{10}\,H_8$ (or, according to some, a multiple of that, viz., $C_{20}\,H_{16}$). This is the radicle of many of the non-oxygenated volatile oils, as those of juniper, savin, copaiva, and lemons, and, with one equivalent of oxygen, it forms camphor ($C_{10}\,H_8\,O$).

Actions and Uses.—Oil of turpentine is, in large doses, an irritant poison, and in medicinal doses is stimulant, antispasmodic, astringent, cathartic, anthelmintic, diuretic, and diaphoretic.

When injected into the veins of the horse it causes pulmonary inflammation and death. When given to the dog in doses of two drachms, it produces convulsions, tetanus, depression of the circulatory and respiratory functions, and death in about three minutes. (Schubarth.) When less rapidly fatal it causes irritation of the alimentary canal, and general vascular excitement. In all such cases, the lungs are found much congested, and the stomach and intestines red and vascular. It also operates as an active poison on animals low in the scale of being, as lice and worms; and hence is very efficacious in destroying such parasites when inhabiting the intestines, bronchial tubes, or skin of any of the higher animals. Its irritant action is but a higher degree of its stimulant action, which is the source of most of its valuable therapeutic effects. When given internally it speedily becomes absorbed, and may be detected in various of the secretions and excretions, as in the chyle, breath, and sweat, which have in consequence a strong terebinthinate flavour, and in the urine, to which it imparts the odour of violets.

Oil of turpentine is administered in many different diseases, and to all the domesticated animals. It is sometimes used as a stimulant in puerperal apoplexy in cows, and in typhoid fever and general debility in all animals; but as its effects are transient, it must be given frequently. As an antispasmodic it is very efficacious in colic, tympanitis, and even in some cases of epilepsy. It enters into the composition of many colic drenches. That most commonly used at the Edinburgh Veterinary College consists of a pint of linseed oil, and an ounce each of laudanum and oil of turpentine. The last of these ingredients is sometimes increased to two ounces; but must be withheld altogether in every case where there is any evidence of inflammation. When given in repeated doses, it is believed by some to be a tonic: but its tonic action is not well established. In these circumstances, however, it often acts as a constitutional astringent, and hence is frequently effectual in arresting excessive mucous discharges, especially those from the respiratory and urinary membranes. In combination with other medicines, as with aloes and castor oil, it is of much service in overcoming long-standing and obstinate constipation; but when given alone, except in excessive doses, its cathartic action is uncertain. It is one of the best of anthelmintics; and for this purpose should be conjoined with cathartics, given after a fast of several hours, and its administration followed up by turpentine enemata, which are especially useful in dislodging ascarides from the rectum. Besides being of great service in destroying worms infesting the alimentary canal, it is also an unfailing remedy for removing the thread-worms or filaria which at certain seasons appear in the bronchii of calves and young cattle, and give rise to symptoms resembling those of bronchitis. In such cases of hoose, as it is often called, the usual practice is to pour a teaspoonful of turpentine into the nostrils; but this mode of administration is apt to cause undue irritation, and is not at all essential to the cure; for, on account of the rapidity with which the drug is absorbed, it is equally efficacious when given by the mouth,—one or two doses, at intervals of a day or two, seldom failing to effect a perfect cure. Lambs are likewise attacked by the same filaria, which invade both the bronchial tubes and the bowels, giving rise to cough and diarrhœa. Turpentine here also proves the best remedy. Dr Crisp, in his Bath and West of England prize essay on "The Lamb Disease," advises Epsom salt, six ounces; nitre, four ounces; boiling water, three pints; adding, when milk-warm, four ounces of oil of turpentine and half an ounce of bole ammoniac; mix well, and give three to four tablespoonfuls every other day. Another good formula consists of common salt, three pounds; powdered ginger and nitre, half a pound each; dissolved in three gallons of warm water, with twenty-four ounces of oil of turpentine added when nearly cold. These quantities will suffice for 160 lambs. The dose for lambs between four and six months old will be two ounces. In localities where hoose prevails, three or four doses of this mixture should be given as a preventive at intervals of a fortnight throughout July and August; and when so used, will also be found effectual in destroying tape-worms, or preventing their attacks, and in greatly diminishing the scouring and mortality so common amongst lambs when first put upon turnips. On account of its stimulant action on the kidneys, oil of turpentine is used for relieving suppression of urine and dropsies, especially those depending upon weakness, where inflammation has been entirely subdued, and where the effusion occurs independently of venous obstruction. As a diuretic, small and repeated doses (not exceeding half an ounce) are most effectual, especially if conjoined with a little nitre or other saline matters. Like most other diuretics, it causes, in excessive doses, so much irritation of the urinary organs as to arrest their secretions and produce inflammation. To develop the diaphoretic action of the oil, the patient should be kept in a warm place and well clothed.

Oil of turpentine is used externally as a digestive for wounds, a stimulant for chronic swellings, and a counter-irritant. As a counter-irritant, it is not very suitable either for horses or dogs. When applied to the skin of the horse, it causes almost immediately much restlessness and topical irritation, and if used largely or repeatedly, is apt to blemish. In cattle practice, however, it is often useful in hastening and increasing the activity of other vesicants, and is much used along with mustard, ammonia, and similar substances, in cases of inflammation of the intestines, pneumonic affections, and chronic rheumatism. From the antipathy with which it is regarded by most insects, it is very useful in protecting all animals, and especially sheep, from the attacks of flies; and is also often used for the destruction of vermin infesting the skin. For preventing fly-blow in sheep, an excellent recipe consists of three ounces of turpentine, one ounce of oil of amber, and one drachm of corrosive sublimate, which, before mixture with the oils, must be dissolved in a pint of whey or of water. For curing sore heads in sheep, and protecting them the while from the attacks of flies, nothing is more effectual, or adheres so firmly, as equal weights of turpentine and resin, melted with double the quantity of lard.

Doses, etc.—The dose of oil of turpentine varies much with the purpose it is given to fulfil. In horses, the dose as a stimulant and antispasmodic is f℥i. or f℥ij.; as a diuretic, from f℥iv. to f℥viij.; as a cathartic and anthelmintic, about f℥ij., with a small dose of aloes in solution, or of castor or linseed oil. For cattle, the doses for the above purposes are about the same as for the horse, or larger to the extent of one-fourth. For sheep and dogs, the dose as a stimulant and antispasmodic is from ♏xxx. to fℨi.; as an anthelmintic, the quantity may be increased to the extent of ℨiv., and given in combination in the manner above directed; and as a diuretic, again reduced to ♏x. or ♏xv. For internal administration it may be conveniently dissolved in any of the fixed oils, or made into an emulsion with yolk of egg, in the proportion of one yolk to every two drachms of the oil of turpentine. The mixture may be flavoured with some aromatic, and diluted with water to suit convenience. These forms may also be used for clysters. For external application the oil is often used alone; but there are also innumerable preparations of it, of which the simplest are generally the best. A convenient stimulating liniment is made with soft soap, two ounces; camphor, one ounce; oil of turpentine, sixteen fluid ounces; shaken together until mixed. A good blister for cattle may be made with a pint each of oil of turpentine, strong ammonia, and linseed oil, to which greater activity may be given by the addition of an ounce or two of croton oil. For dogs a prompt blister is obtained by mixing an ounce of turpentine and half an ounce of strong ammonia. This may be used alone or added to mustard paste.

III. Resin or Rosin.

Resin is the residue left from the distillation of the various sorts of turpentine, which separate when heated into two distinct parts—the volatile oil which distils over, and the solid resin which remains behind. Two sorts are met with in commerce—black or fiddlers' resin, and yellow resin. The former is got by distilling the turpentine either without water or until all the water first added is expelled; the latter, by adding from time to time fresh portions of water. The yellow resin, when kept in a state of fusion for some time, constitutes the resin used in medicine and pharmacy. It is yellow or brown, brittle, easily pulverized, more or less transparent, inflammable, of a faint turpentine odour, devoid of taste, and rather heavier than water. It is insoluble in water, partially soluble in alcohol, readily dissolved in ether and volatile oils; and unites with fats, wax, spermaceti, and alkalies. It is not, as some have supposed, a simple substance, but consists of pinic and sylvic acids, and a neutral resinous principle. Its ultimate composition is $C_{40}\ H_{30}\ O_4$. The proportion of the acids varies considerably with the temperature at which the resin has been prepared.

Actions and Uses.—Resin possesses, but in lesser degree, most of the properties of the turpentines; is occasionally used as a mild diuretic, in doses, for horses and cattle, of from ℥ij. to ℥vi.; and enters into the composition of many diuretic masses, serving the twofold purpose of increasing their activity and their consistence. Applied externally, it is slightly stimulant and astringent, and hence is used in stopping hemorrhages. In castration, a few grains are often applied to the severed ends of the spermatic chord, and when melted by the contact of the hot iron help greatly to check bleeding. For imparting firmness and adhesiveness to stimulant plasters, resin is largely used. The simple digestive ointment of the Pharmacopœia is made with resin ℥viii., yellow wax ℥vj., lard and almond oil, of each ℥iij.; melt at a gentle heat, and stir constantly until cool. This simple ointment is much used as a mild stimulant for wounds, ulcers, blistered surfaces, and the like, and also for giving consistence to other ointments.

IV. Tar and Pitch.

Tar, or *Pix liquida*, is a dark brown, thick, viscid liquid, procured by the destructive distillation either of coal or wood. The wood tar, the only sort used in medicine, is generally obtained by placing the roots and branches of any of the pine tribe in pits dug in the earth on a bank or inclined plane. Fire is applied, and the heaps covered over with turf. The tar thus produced runs into iron pots placed at the bottom of the pit, and is thence conducted by pipes into the barrels in which it is exported. Tar is a thick, tenacious, dark brown, or nearly black fluid, having a peculiar odour and a bitter taste. When exposed to the air, it slowly dries up. It is soluble in ether and oils. Water, when agitated with it, dissolves out part of its volatile oil and creasote, acquires its odour and taste, and in this state constitutes *tar water*, once considered a very valuable article of the materia medica. The composition of tar is very complex. It is believed to contain modified resin, modified oil of turpentine, acetic acid, and water (Christison); and also creasote, paraffin, and other products of the destructive distillation of vegetable matters. When heated, *oil of tar*, a reddish, limpid fluid, which is merely impure oil of turpentine, is given off; and if the process be pushed sufficiently far, *pitch* is left—a black, bituminous substance, solid and brittle, with a shining fracture, and consisting of modified resin, and various matters produced during the decomposition of the wood.

Actions and Uses.—Tar was once used as a stimulant, diuretic, and diaphoretic; but is now scarcely ever given internally, except by empirics. Some few practitioners, however, still extol it as a vermifuge. It is of much value when applied externally as a remedy in skin diseases in all the domesticated animals, and for this purpose is generally made into a liniment with oil, or an ointment with lard or wax. It is useful in cases of canker and thrush, for which it is used either alone or mixed with alum, sulphate of copper, sulphuric or nitric acids. When mixed with equal parts of some oleaginous matter, or with cow-dung, so as to render it sufficiently soft, it forms a capital stopping for horses' feet, and is believed to stimulate the secretion of horn. With the following adjuncts, it is recommended by Mr Miles as a daily dressing for horses' feet, maintaining the horn in a tough, elastic, and healthy state: A quarter of a pound each of tar, bees' wax, and honey; a pound and a half of lard; and three ounces of glycerine: melt the lard and bees' wax together, stir in the lard, tar, and glycerine, and continue to stir until the mass begins to set. Tar is very serviceable in foot-rot in sheep, and has the twofold advantage of stimulating the parts and preventing the attacks of flies. It is much used for securing wounds, binding up broken horns, and making adhesive plasters.

Oil of Tar is used for many of the purposes of oil of turpentine; and, from the creasote and similar substances which it contains, is very useful in curing mange, scab, and other troublesome skin diseases. United with sulphur and soft soap, it makes an excellent dip for sheep, destroying ticks, and preventing for a considerable time the attacks of flies. The addition of a little naphtha increases the efficacy of the mixture, which may be made as follows: A pint each of oil of tar and common naphtha, three pounds of soft soap, and one pound of sulphur, dissolved with stirring in a few gallons of boiling water. Cold water is afterwards added to make up twenty or twenty-five gallons, which will dip twenty-five lambs.

Pitch is little used in veterinary practice, except as a mild stimulant in diseases of the feet, as in canker, thrush, and sand-crack in horses, and foot-rot in sheep, and as a convenient substance for giving adhesiveness to plasters.

VALERIAN.

Dried Root of *Valeriana officinalis.*

Nat. Ord.—Valerianaceæ. *Sex. Syst.*—Triandria Monogynia.

Valerian is found native in this and other European countries. The radicles, descending from a short yellowish white tuberous root-stock, are the officinal part of the plant, and are collected in autumn from wild plants grown, if possible, on dry soils. They are about the thickness of a quill, two or three inches in length, and of a yellow-brown colour. They have a penetrating odour, which becomes fetid in old specimens, and a bitter aromatic taste. They contain woody and extractive matters and resin, and when distilled with water readily yield nearly two per cent. of a volatile oil, and about one per cent. of valerianic acid, $C_{10} H_9 O_3$, HO, which unites with bases, such as soda, zinc, and iron, to form a series of salts—the valerianates. It is presumed, on insufficient grounds I think, that the active principles of valerian are concentrated in this acid, and that the salts which it forms unite the properties of their acid and basic halves.

Actions and Uses.—Valerian is a diffusible stimulant, antispasmodic, calmative, and anthelmintic. In its general action it resembles assafœtida, the other gum resins, and camphor. It has very little effect on either horses or cattle, even when given in doses of several ounces. It acts, however, with considerable energy on dogs and cats, causing giddiness, reeling about, and all the symptoms of intoxication. Its effects appear to depend on its absorption, and its action on the brain and spinal cord. It is occasionally given to dogs to allay nervous irritability, and to relieve chorea and epilepsy; but little dependence can be placed on it. When given for some time, it is thought to improve the appetite, and produce many of the other effects of a tonic. On account of its pungent volatile oil, it is a vermifuge.

Doses, etc.—If used for horses or cattle, it may be given in quantities varying from two to four ounces. The dose for the dog is from ʒi. to ʒij.; and for the cat, from ℈i. to ℈ij. The medicine is given in powder or infusion several times a day; and as it is not very active, it may be advantageously conjoined with ginger, gentian, or camphor, or dissolved in spirit of ammonia, as is commonly done in human practice.

Valerianate of Soda, the source of the other compounds of valerianic acid, is obtained by the oxidation of fusel or grain oil, $C_{10}\ H_{12}\ O_2$, by heating it with bichromate of potash and oil of vitriol. It is a soluble white solid, with a greasy, soapy feel, a sweet, nauseous taste, and an odour of valerian. It is not used medicinally. When dissolved and heated with a solution of sulphate of zinc, it yields *valerianate of zinc*, which may be crystallized in snow-white plates, and has a slight odour of the acid, and a taste more resembling its metallic base. In doses of four or five grains for dogs, and one or two grains for cats, it has been tried without much success in chorea and various nervous affections, and has been used externally, instead of the acetates, as an astringent and sedative.

Valerianate of Iron is made by mixing, in the cold, a solution of valerianate of soda with one of sulphate of iron. A precipitate falls, and when dried, is an insoluble, loose, light red powder, with a faint taste and odour of the acid. As a general tonic for the smaller domesticated animals, and a remedy in chorea and such cases, it is more certain and active than valerianate of zinc, and may be used in similar doses.

Valerianate of Quinine is prepared by raising to 120° a solution of valerianate of soda and one of muriate of quinine, mixing the two, and setting aside the mixture for twenty-four hours, when valerianate of quinine forms in fine, silky, needle-like crystals, which have a bitter taste of quinine, and a slight odour of valerian, are decomposed by acids, and by temperatures exceeding 120°, and are dissolved with difficulty in water, but readily in alcohol and ether. Like the other valerianates, it was first brought into notice by Prince Louis Lucien Bonaparte, who used it successfully in the agues prevalent in the marshes around Rome. I have seen it given to dogs, in doses of two or three grains, with apparent advantage, in chorea, and in those troublesome nervous disorders which accompany and follow distemper. It is useful in similar cases amongst cats, in doses of one or two grains, either given alone, or with a grain or two of camphor. On account of its bitterness, it is best administered in the form of pill.

VERATRUM.

White Hellebore. Dried Rhizome of *Veratrum album.*

Nat. Ord.—Colchicaceæ. *Sex. Syst.*—Polygamia Monœcia.

The *Veratrum album* is indigenous to many parts of Europe, though not to this country. The rhizome, or underground stem, is the only officinal part of the plant. It occurs in cylindrical pieces several inches in length, to which the radicles occasionally remain attached. Its bark is dark-coloured, and rough; and its internal structure of a greyish-white colour, and fibrous or farinaceous, according to the stage of its growth. When dried, it has little odour, but retains its peculiar taste, which is at first slightly sweet, and afterwards bitter and acrid. Its properties are communicated to water and alcohol, and a decoction and vinous solution are both in use. Its active principle, an alkaloid called *veratria*, will be noticed below.

Actions and Uses.—White hellebore is, in all animals, an active, irritant poison, and operates by whatever channel it is introduced into the body. It resembles colchicum, both in its physiological and therapeutic actions. It causes vomiting, purging, and inflammation of the intestines, accompanied by depression and irregularity of the circulation, and spasms of the superficial muscles, especially those connected with deglutition and respiration. Waldinger states that two ounces of white hellebore root cause in horses slavering at the mouth, efforts to vomit, and relaxed bowels. Rytz declares that one ounce induces purgation and gastro-enteritis. Mr Miller, Bradninch, in the Edinburgh Veterinary Review for 1863, records the case of a three-year-old filly which accidentally ate about two ounces of the powdered root, and in half an hour was in much pain, frothing at mouth, making attempts to vomit, heaving at the flanks, with a full pulse, numbering forty; painful spasms involved especially the muscles of the neck; the mucous membranes of the nostrils and eyes were injected; there was stiffness in walking, and after a few hours, partial paralysis of the hind limbs. The animal was bled, and had drachm doses of tannin given in starch gruel. In three hours the symptoms were much abated, gradual recovery took place, and in four days the filly was again at work. The best antidotes are demulcents and mild laxatives, with diffusible stimulants to counteract the depression of the heart's action. Astringents, such as infusion of nut-galls or solution of tannin, should also be given, as they form insoluble compounds with the veratria.

White hellebore is emetic, purgative, and anthelmintic; but, from its violence and uncertainty, cannot be recommended for any of these purposes. Some veterinary authorities consider that hellebore "powerfully rouses the absorbent system into increased action" (Morton); and recommend it for chronic œdema of the legs, in doses of about one scruple for the horse, and three grains for the dog. Others use it as a sedative; and for this purpose it is highly spoken of both by Percivall and Mr Morton, who prescribe it for horses in doses of from twenty to thirty grains, repeated every four or five hours. For these purposes its efficacy has, however, I think, been over-estimated; and unless used in combination, its actions are irregular, uncertain, and often violent. It is applied externally in cutaneous diseases, for destroying vermin infesting the skin, and for smearing setons; but for these purposes it must be used cautiously, as it is apt to be absorbed and produce serious constitutional effects. Many employ it as an ingredient in blisters, but, unless added in small amount, it renders them very irritant and apt to blemish.

Doses, etc.—As a sedative, the dose for horses is about ℈i.; for cattle, ℈ij.; and for dogs, grs. ij. It is given either in a bolus, or dissolved in diluted alcohol, and is repeated at short intervals until some of the physiological actions of the drug appear. For external use, the ordinary preparations are the powder, and an ointment which may consist of one part of hellebore to four of lard.

VERATRIA is present in several plants belonging to the natural family *Colchicaceæ*, but especially in the Veratrum album and Veratrum cevadilla or sabadilla. The former of these has just been described; the latter, from which veratria is usually prepared, is very similar in its action. It is an American plant, with long grassy leaves; a flowering stem; a fruit of the size and appearance of monkshood, and formed of three dry red-brown follicles or seed-vessels, which are the officinal part of the plant. It is unnecessary here to notice the details of the process for obtaining veratria. The important steps are bruising the follicles—making a concentrated tincture—decomposing this by adding to it a large quantity of cold water—precipitating the veratria by excess of ammonia—and then washing, digesting with animal charcoal, and drying it. The alkaloid so prepared is not perfectly pure. It is a grey amorphous powder, with a most acrid bitter taste, and a powerfully irritant action on the nostrils, causing violent and uncontrollable sneezing. It is insoluble in water, sparingly soluble in alcohol, but readily dissolved in diluted acids. A solution in acetic acid gives a white precipitate with tincture of galls, and a red solution with sulphuric and nitric acids. Heated in air, it melts into a yellow liquid, and at length burns away, leaving no residue. It is believed to have the composition $C_{64}\ H_{52}\ N_2\ O_{16}$.—(British Phar.)

Actions and Uses.—Veratria is one of the most active of irritant poisons. "Magendie found that one grain, in the form of acetate, killed a dog in a few seconds when injected into the jugular vein, and in nine minutes when injected into the peritoneum; and that the principal symptom in such rapid cases was tetanic spasm." (Christison on Poisons, p. 881.) When given to dogs by the mouth (in doses of from one to two grains), it causes great uneasiness, nausea, vomiting, violent purging, slowness of respiration, and slowness and irregularity of pulsation, extreme prostration of strength, spasmodic twitching of the voluntary muscles, especially those of the extremities, and death usually amid tetanic convulsions. The antidotes are the same as those for white hellebore. In the human subject it has been used both internally and externally for various neuralgic affections, and in subacute rheumatism; but the experience of most practitioners is not very favourable to it. It has not as yet been used in veterinary practice. It is scarcely necessary to say that, from its great activity, it would require to be given with much caution.

WATER.

It is scarcely necessary to notice the physical properties of water, chemically styled oxide of hydrogen, and recognised by the symbol HO. When pure it is transparent, neutral, colourless, odourless, and almost tasteless. It solidifies or freezes at 32°, boils at 212°, when it rises in vapour or steam, and also slowly volatilizes at all temperatures. It is an active solvent for many mineral and vegetable substances, and hence its extensive use in pharmacy. It consists of eight parts, by weight, of oxygen, and one of hydrogen. All natural waters hold in solution a variety of salts, gases, and traces of organic matter. When the saline ingredients are in large amount, exceeding one-5000th part, the water is said to be *hard.* It is then unfit for many pharmaceutical and domestic purposes, is not in general so well liked by animals for drinking, and is apt to cause diarrhœa, and other derangements of the digestive organs, especially in subjects unaccustomed to it. When the salts do not amount to one-5000th part, the water is considered *soft*, and the degree of softness of any water may be tolerably accurately judged of by the facility with which it dissolves soap. The most common and abundant constituents of ordinary water are,—common salt, and other chlorides; carbonate of lime, which, when in undue quantity, may be got rid of by boiling the water, when the salt of lime is deposited; and sulphate of lime, which may be removed by the addition of carbonate of soda. The gases dissolved are chiefly common air and carbonic acid. It is the presence of these which renders good drinking water so palatable and refreshing, and the absence of them which renders many waters, as rain and recently distilled waters, so flat and mawkish to the taste. Organic matters are often present in the water of rivers and marshes, causing them to spoil speedily, and rendering them apt to produce diarrhœa and dysentery. Filtration through sand, charcoal, or gravel, will generally remove these organic impurities. *Mineral waters* are unfit for general use, on account of their containing an undue proportion of mineral matters or gases, or from their being at a higher temperature than that of the locality in which they are found. In this country the most common mineral waters are those which contain iron.

Actions and Uses.—Water is an unfailing constituent of all living tissues, and is essential to the support of animal life. It constitutes a large proportion of almost all kinds of food, rendering them more easily digested and assimilated. When swallowed it allays thirst, and supplies the loss of fluid constantly taking place by the lungs, skin, and kidneys. But, besides serving these important dietetic purposes, water is also much used as a diluent, to increase the secretion of urine, and thus lessen its acridity; to dilute corrosive and irritant poisons, and thus diminish their potency; and to assist and maintain the action both of diuretics and purgatives. When tepid, it is a convenient auxiliary emetic for the dog. It is *the* important constituent of most emollients; and is also itself a useful emollient, being applied for softening and moistening hard dry surfaces, and increasing their natural secretions. Lint, tow, or spongiopiline, saturated with hot water, and covered with oiled silk or gutta percha cloth, to prevent evaporation, is frequently substituted for poultices, and is often preferable to them, on account of greater cleanliness, and less tendency to irritate and injure the surrounding parts. Steaming of the head and throat is often useful in cases of catarrh, strangles, and sore throat, and may be readily managed with a well-made bran mash, placed in a roomy nose-bag, or by holding the head over a bucketful of water, from which continued quantities of steam are evolved, by plunging into the bucket, at short intervals, a red-hot iron. Occasionally the steam is used medicated with a little laudanum, belladonna, ether, vinegar, oil of tar, or alkaline hypochlorite.

Boiling water forms one of the most prompt and convenient of all counter-irritants, and is especially useful in cattle practice. To be truly efficacious, it must be used scalding hot; and the best way of applying it, either to the chest or abdomen, is to envelope the parts from below upwards in several folds of thick woollen horse-cloths, and then pour in on either side, from above, water from kettles brought nearly boiling from the fire. An intense and widely spread effect may thus be rapidly induced, which does not leave blemishing, even in the horse, and proves of inestimable advantage in pneumonia and pleurisy, colic, enteritis, peritonitis, and obstinate constipation, both in horses and cattle. In virtue of its abstracting heat, both in raising its own temperature and in volatilizing, cold water is a useful refrigerant. Calico bandages, wetted every half hour by fresh quantities of cold water, are often very serviceable in relieving strains and wind-galls in the legs of horses. Similar treatment is also most serviceable in lessening the irritability of broken knees and other cases of open joints. By dissolving in the water a mixture of salt and ice, or of equal weights of nitre and salammoniac, the temperature can be reduced much lower than by water alone. In phrenitis and tetanus in horses, puerperal apoplexy in cattle, low fever, convulsions, and cases of distemper, accompanied by nervous irritability, in dogs, ice applied continuously for some time, often proves serviceable in abating nervous irritability. It may be conveniently applied to the head, spine, or acutely sensitive spot, enclosed in a portion of intestine, in a bladder, or in one of the thin water-tight bags sold for the purpose. Except for ensuring cleanliness, baths are seldom used for veterinary patients. But for its cumbrousness and cost, the vapour bath would be more extensively used than it has hitherto been. By no other means can we so promptly rouse the functions of the skin of the larger domestic animals, and so readily remove noxious matters from the blood. Sensibly used in the cold or shivering stage, it is often effectual in warding off inflammatory attacks either of the respiratory or digestive organs, and is serviceable, besides, in the treatment of rheumatism and chronic skin disorders. In pharmacy, both hot and cold water are extensively used, especially as solvents; and for this purpose they often require to be distilled, except when, as in Edinburgh, the natural water is very soft. The heating of water increases its solvent power over most salts and vegetable matters, but diminishes its solvent power over gases.

WAX.

Many plants produce waxy matters resembling that furnished by the bee. Bees' wax must, however, be regarded as an animal secretion, for it has been produced by bees fed exclusively upon pure sugar. After the removal of the honey, the comb is fused in boiling water, strained, and poured into moulds, when it constitutes the yellow wax, or *cera flava.* This has a dull yellow colour, a granular fracture, a slightly sweet and pleasant taste, but no odour or greasiness: it is insoluble in cold rectified spirit, but entirely soluble in oil of turpentine. Large quantities of yellow wax are purified by melting it with steam, straining and then decolorizing it by exposure in thin ribbons for two or three weeks to air and sunshine. The yellow wax thus loses all colour and odour, and becomes white wax, or *cera alba.* Wax is tough and solid, insoluble in water, but soluble in fixed and volatile oils, and in about twenty parts of boiling alcohol. It fuses at about 145°, and when pure, burns with a bright white flame. It readily unites with fats and resins, but is imperfectly saponified by caustic alkalies. It contains one-fifth of a volatile crystalline matter, soluble in boiling alcohol and ether, and called cerotic acid or cerine; two-thirds of myrein, a body analogous to spermaceti or Chinese wax, and consisting of two allied waxy matters, both of which are insoluble in alcohol, but soluble in ether; and about five per cent. of an acid greasy substance called cerolin, which is soluble in cold alcohol, and possesses the colour, odour, and toughness of wax. The impurities occasionally present in wax do not materially interfere with its uses in veterinary practice. Adulterations with starch may be detected by iodine; resin, by its separating on the addition of cold alcohol; fatty matters, by their greasiness and fusibility; and inorganic substances, by their remaining as a residue after the specimen is burnt or melted and strained.

Actions and Uses.—Wax is more difficult of digestion, and probably also less nutritive, than fatty matters. When given for some time continuously, it causes constipation, and hence is sometimes used to correct diarrhœa. Its chief use, however, is as an external application and a constituent of ointments, cerates, and plasters, to which it is added in order to impart consistence and stiffness, and prevent rancidity. Yellow wax, mixed with hogs' lard, or any of the common fixed oils, is much used as a simple ointment, for preserving irritable parts from the action of the external air, protecting the sound skin from acrid discharges, and preventing corrosive or blistering applications extending their effects beyond the parts to which their action is to be limited. The proportion of wax to the fats or oils must be regulated by the required consistence of the ointment. One part of yellow wax to four of hogs' lard, or two and a half of olive oil, are the proportions usually recommended.

ZINC AND ITS MEDICINAL COMPOUNDS.

Oxide of Zinc. Zinci oxidum. Zn O.

When metallic zinc is exposed to a red heat it unites with oxygen. This is the old method of preparing the oxide, and that followed, until recently, by the Dublin College. By direction of the British Phar., it is prepared by exposing the carbonate, in a loosely covered Hessian crucible, to a low red heat until it is deprived of its carbonic acid and water. It is a soft, colourless, tasteless, odourless powder; is insoluble in water, but soluble in most acids and alkalies. When heated it becomes yellow, but if free from impurity, should lose its colour on cooling. The impure oxide of zinc found in the chimneys of the furnaces where the zinc ores are roasted, is now seldom used. The oxide, as well as the other preparations of zinc, is distinguished by giving, with hydro-sulphuret of ammonia, a white precipitate of sulphuret of zinc (Zn S), and with caustic potash a white precipitate of oxide, which is re-dissolved by excess of the alkali; but if to this clear solution sulphuretted hydrogen is added, the white sulphuret (Zn S) is thrown down.

Actions and Uses.—The salts of zinc are irritant, astringent, and tonic, and bear considerable resemblance to those of silver and copper. The oxide is seldom given internally, but is frequently used externally, being applied in the several forms of powder, solution, and ointment. The dose of the oxide for horses and cattle is from ʒij. to ʒiv.; and for dogs, from grs. x. to grs. xv.

Carbonate of Zinc. Zinci carbonas. Zn O, CO_2.

Carbonate of zinc is used in veterinary practice under the name of calamine—an ore of zinc which abounds in this and other countries, has a greyish-brown colour, and effervesces with acids. The carbonate of the Pharmacopœia is made by boiling together equal weights of sulphate of zinc and carbonate of soda. The carbonate of zinc is, however, of little importance, and might be easily dispensed with, as its actions and uses are identical with those of the oxide. An ointment made with one part of calamine, and four or five of lard, is occasionally employed.

Sulphate of Zinc. White vitriol. Zinci Sulphas. Zn O, $SO_3 + 7$ HO.

When sulphuret of zinc—the zinc-blende of mineralogists, and an abundant ore of zinc—is roasted, its metallic portion becomes converted into oxide, and its sulphur into sulphuric acid. The salt thus formed is removed by solution and crystallization, and, though usually containing traces of iron, and occasionally of lead and copper, is sufficiently pure for most veterinary purposes. This is the process commonly followed on the large scale, but sulphate of zinc may also be made of great purity by dissolving fragments of zinc in diluted sulphuric acid, as directed by the Pharmacopœia.

Properties.—It is a transparent colourless salt, having a styptic metallic taste, and usually occurring in needle-like crystals resembling those of Epsom salt. In dry air it effloresces. It is dissolved in less than its own weight of boiling water, and in two and a half times its weight of water at 60°. When heated it melts in its water of crystallization, and at high temperatures is decomposed. Any impurities it occasionally contains do not interfere with its medicinal actions.

Actions and Uses.—It is irritant, and consequently emetic, and is also astringent and tonic. Like other metallic irritants, it may be given to horses and cattle in very large doses without much effect. Doses of several ounces have been given with impunity. When swallowed by dogs, it speedily causes vomiting; and, as it is thus rapidly removed from the stomach, large quantities may be used without permanent injury. Orfila found that seven and a half drachms were vomited in a few seconds, and produced no lasting bad effects. When the animals were prevented vomiting by a ligature on the œsophagus, much smaller quantities sufficed to destroy them in about three days, the stomach exhibiting after death symptoms of incipient inflammation. Thirty grains in solution, injected into the veins, depressed the action of the heart, and destroyed life in a few seconds. (Christison on Poisons.) The emetic action of sulphate of zinc is remarkably prompt and full, but is seldom accompanied by such lasting depression as that of tartar emetic. In repeated doses it is readily absorbed, and has been detected in the spleen, liver, and urine. It does not, like lead or digitalis, exhibit any cumulative action. Half an ounce, given to two horses thrice a day for a fortnight, had no effect; but when the doses were increased to an ounce, repeated three times a day, the appetite became impaired, and nausea, with diuresis, supervened. (Veterinarian for January 1844.) In frequent small doses, it acts as an astringent, drying up excessive discharges, especially from the alimentary canal; and is also a useful tonic. It is occasionally given to dogs to empty the stomach of undigested food, foreign bodies, or poisons; but is seldom used either as an astringent or tonic. In the lower animals, its power of arresting spasmodic diseases is not well established. It is much used externally for the many purposes of a mild escharotic, astringent, and desiccant.

Doses, etc.—The dose as an emetic for the dog varies from grs. viij. to grs. xv.; and as an astringent and tonic for horses and cattle, from ʒi. to ʒiij.; and for dogs, from grs. ij. to grs. iij. As an emetic, it is given in solution; for other purposes, however, the solid form is preferable. It is applied externally in powder, and also in solution, which must vary in strength according to the purpose for which it is applied. A convenient preparation for most ordinary cases may be made with one part of the salt to twenty of water.

Chloride of Zinc. Butter of zinc. Zinci chloridum. Zn Cl.

Chloride of zinc is prepared by dissolving zinc or its oxide in hydrochloric acid, evaporating the solution to dryness, and fusing the residue. It is a greyish-white, waxy-looking, deliquescent substance, with an astringent metallic taste. It dissolves in water, alcohol, and ether, precipitates albumen, and decomposes hydro-sulphuret of ammonia.

Actions and Uses.—In large doses it is an irritant poison, and in medicinal doses is believed to be a tonic, but is not used internally. On account of its readily uniting with albumen, it is caustic, astringent, and antiseptic. As a caustic, it is generally considered as scarcely less powerful than butter of antimony; is frequently used with success in the treatment of luxuriant granulations, unhealthy ulcers, and fistulæ, and for such purposes is now sold in the shops in little sticks like those of lunar caustic. When freely dissolved in water, it is a useful stimulant, astringent, and antiseptic; is a valuable dressing in eczema both in horses and dogs, and has, besides, been recommended as a sheep-wash for destroying ticks and preventing attacks of the fly. Decomposing hydro-sulphuret of ammonia, it is a deodorizer, and also, according to some, a disinfectant. For most purposes, it may be conveniently used in the form of Sir William Burnett's

Disinfecting and Antiseptic Fluid, every fluid drachm of which contains 25 grs. of chloride of zinc.

ACETATE OF ZINC. Zinci acetas. $Zn\ O,\ C_4\ H_3\ O_3 + 2\ HO$ $(Zn\ O,\ A)$.

Acetate of zinc is more used in veterinary than in human medicine. It is prepared by dissolving zinc, its oxide, or carbonate in diluted acetic acid, or by decomposing a solution of sulphate of zinc by acetate of lead, when mutual decomposition occurs, sulphate of lead being precipitated, and acetate of zinc remaining in solution. The suitable proportions are about three parts of sulphate of zinc, and four of acetate of lead. The *white lotion*, so much used in the practice of the Edinburgh Veterinary College, is a solution of acetate of zinc usually made by dissolving three-quarters of an ounce of sulphate of zinc and an ounce of acetate of lead in a pint of water, and clarifying the solution by decanting or filtering it.

Acetate of zinc, when separated from solution, occurs in odourless, pearl-like, rhomboidal plates, which are of a sharp disagreeable metallic taste, and readily soluble in water. It may be identified as a salt of zinc by the tests for that metal already mentioned, and distinguished from the other salts of zinc by the acetous odour it evolves when treated with sulphuric acid.

Actions and Uses.—Salts which owe their effects to a common base, and are of equal solubility, always resemble each other very closely in their general actions—a law which is strikingly illustrated in the great similarity observable in the effects of the different salts of zinc. The acetate of zinc is not used internally, but is often applied externally to promote the healing of wounds, to dry up excessive discharges depending on weakness and flaccidity, and to allay superficial inflammation. The watery solution is the only preparation in common use.

APPENDIX.

To render this volume of more practical utility to junior students of veterinary medicine and to amateurs, and to indicate more fully the applications and uses of the medicines already described, I have added an Appendix, containing a brief and popular notice of some of the more common diseases of the domesticated animals. Agriculturists may learn from these observations how to protect their stock more effectually from the common causes of accident or disease, and to recognise and treat simple complaints when beyond the reach of professional advice. Such observations cannot, as has been sometimes urged, injure the well-qualified practitioner, for they cannot impart that tact and experience which can only be acquired by a systematic professional education, and by subsequent daily observation of disease; and, instead of injuring the professional veterinarian, they are more likely to lead to a higher appreciation of his practical skill and experience, to his being more promptly and frequently applied to, and more zealously and ably seconded in his curative efforts.

To economize space and avoid repetition, I have arranged the diseases of which I have treated in the following order :—

Diseases of the Digestive Organs.
... ... Respiratory Organs.
... ... Heart and Organs of Circulation.
... ... Urinary and Genital Organs.
... ... Brain and Nervous System.
... ... Eye and its Appendages.
... ... Skin.
... ... Blood, and System in General.
... ... Locomotive Organs ; Lamenesses.

DISEASES OF THE DIGESTIVE ORGANS.

Injuries of the Mouth and Teeth.—Amongst the domesticated animals, the mouth, tongue, or teeth are seldom the seats of disease. Occasionally, however, thorns get stuck into the back part of the tongue or cheeks, causing discharge of saliva and inability to eat. Sometimes in old horses the back teeth are irregular, and interfere with mastication, when the horse quids his food, and falls off in condition. The balling iron is introduced to keep the mouth open; a concavo-convex rasp on a long handle is applied, and the irregular surfaces filed down. When the irregular prominences are very large, they may sometimes be chiselled off. When the teeth are decayed, they give rise to tenderness and swelling of the face, difficulty in chewing, and fœtor of the breath. When too much decayed to be stuffed with gutta percha, they must be removed. Easily masticated food, such as bruised oats, chopped hay, and boiled food, are the best sorts of provender for old horses thus troubled with their teeth.

Lampas, Skew, or the Barbs, occurs in horses from two to four years old. During dentition, the ridges that pass along the palate above and behind the incisor teeth naturally become very vascular and somewhat enlarged, occasionally preventing the animals eating, and giving rise to slight febrile symptoms. To remedy this simple ailment, the palate is sometimes ignorantly and cruelly torn away, or burnt with a hot iron; but all that is necessary is to scarify the enlarged ridges freely with a pen-knife or lancet, and supply the animal for a time with bran mashes, soaked grain, and other soft food.

Choking rarely affects the horse, except when he is fed upon bran, meal seeds, or other dry food; and when so caused, it is readily removed by a draught of cold water, or a bottle of well-boiled gruel. It is very common, however, amongst feeding cattle, being usually induced by a piece of turnip or a small potato. When the substance is impacted in the upper third of the gullet, endeavours should be made to get it up again, by securing the cord, holding the mouth open with a balling iron, and introducing the hand as far as possible. Where it cannot thus be reached, external manipulation must be tried, the foreign body should be squeezed upwards with the hand, or the gullet rubbed with a stout stick from below upwards, whilst an assistant draws the skin towards the brisket, and the head is held out so as to throw the mouth and gullet as much in a line as possible. Oil or well-made gruel should be given at intervals, to lubricate the passage. When pressure from without fails to move the substance, it will be necessary to use the probang—a flexible rod, made of twisted cane, wire covered with leather, or gutta percha. The cup or broad end of the instrument is introduced cautiously, and continuous steady pressure applied to the offending substance. Undue violence must be carefully avoided, otherwise laceration of the gullet is sure to supervene. A beast remaining long choked is apt to swell from the accumulation of gas in the first stomach, which must be treated in the usual way. From irritability of the gullet, an animal that has been once choked is for some time very apt to be so again, and must therefore be fed on mashes or carefully cut roots.

INDIGESTION.—Neither horses nor cattle are subject to inflammation of the stomach, but both suffer from indigestion. Horses, especially during spring and autumn, are often observed to devour their litter, lick the stable walls, and eat earth ; their appetite is capricious, their skin dry and dusty ; they perspire with little exertion, and often stretch out the nose, and retract the upper lip. These symptoms of indigestion or heartburn are often spread over a considerable period of time, and occasionally give rise to diabetes, colic, and even enteritis. Further information is required regarding the exact pathology of the complaint, but there is generally acridity of the secretions of the stomach, with copious discharges of unhealthy mucus, which, when retained, is apt to form a nidus for bots or worms. Whenever the evil is noticed, the animal must have a piece of rock salt and chalk placed in his rack, and a little pipe-clay, magnesia, or other antacid, in his water. If no benefit is speedily obvious, give a small dose of aloes; and if worms are suspected or have been passed, give three drachms of aloes dissolved in two ounces of oil of turpentine and a pint of gruel. Half an ounce each of ginger and gentian should subsequently be given twice a day, to impart tone to the digestive organs. Amongst cattle and sheep, indigestion generally proceeds from derangement of the first or third stomachs, and will be noticed under hoven and fardel-bound. In young calves, indigestion results from hasty or improper feeding, consists in the accumulation of coagula of curd in the fourth stomach, and is best removed by giving, at intervals of a few days, a dose or two consisting of one or two ounces of Epsom salts, and half an ounce of ginger, sweetened with treacle, and administered in gruel or milk.

Crib-biting is usually a cause and often an effect of indigestion. In highly fed horses that have little to do, it is often, however, in the first instance, merely the result of an idle habit. The animal placing his teeth firmly upon some fixed object, generally the edge of the manger, makes a forcible inspiration. When resulting from indigestion, the treatment above prescribed must be adopted. It is also advisable to employ the usual crib-biting strap, and to cover the manger with a piece of sheet-iron or a fresh sheep-skin, which may be smeared with aloes. Crib-biting usually interferes with a horse's endurance, constitutes unsoundness, and may be suspected where the outer edge of the incisor teeth is worn and ragged.

Stomach Staggers, or acute indigestion, generally depends on the overloading of the stomach and intestines, or on the hurried ingestion of corn, vetches, clover, or any food to which the horse has been unaccustomed, and is most common amongst animals subsisting on a coarse bulky diet, and subjected to long fasts. The function of digestion being arrested either from want of tone in the stomach or from the fault of the food, the alimentary substances undergo chemical change and evolve gas, the belly becomes tympanitic, and there is colic, torpidity of the bowels, dulness, and a staggering gait. Death occasionally supervenes in twelve or fifteen hours, either from inflammation of the bowels, or from rupture of the stomach or intestines, when the mucous membranes become blanched, the pulse quick and imperceptible at the jaw, and the animal nauseated, attempting to vomit, and often sitting on its haunches like a dog. Another and more chronic form of staggers occurs during the summer and autumn months amongst horses fed continuously on ripe vetches, rye grass, or other tough indigestible food, and is known as grass- or sleepy-staggers. The same treatment is applicable to both varieties of the disease. The animal should immediately have a large dose of physic, such as six drachms of aloes in solution, with a drachm of calomel and two ounces of oil of turpentine. Clysters, containing salt, soap, or tobacco smoke, should be injected every hour, and the abdomen diligently rubbed, and fomented with nearly boiling water. Two or three drachms of carbonate of ammonia, an ounce or two of sweet spirit of nitre, or strong whisky toddy, with plenty of ginger, should be given at short intervals to ward off the stupor. Blood-letting is seldom advisable. Regular feeding at intervals not exceeding four or five hours, easily digestible food, and occasional laxatives, will effectually prevent the recurrence of the disease.

Hoven, or distention of the rumen with gas, is a common disease among cattle, and results from irregular feeding, from the eating of food to which the animal has been previously unaccustomed, or from wet clover, vetches, or turnips. Friction to the abdomen, walking exercise, and a few ounces of solution of ammonia, whisky, oil of turpentine, or ether, given with a pint of linseed oil, and an ounce or two of ginger, will usually accomplish a cure. The introduction of the probang, with the small end downwards, will remove the gas, when there is little food in the stomach. When such remedies fail, while the distention increases, and the animal becomes stupid, plunge the canula and trochar into the side, equidistant from the prominence of the haunch, the lumber vertebræ, and the last rib. The trochar is immediately withdrawn, and the canula retained, until the swelling entirely falls. In the absence of a canula and trochar, the operation may be easily performed with a well-sharpened table- or pocket-knife, either of which is preferable to a pen-knife. Animals that have been affected with hoven must, for some days, be fed on soft, digestible, and laxative food. A dose or two of physic may also be necessary, especially when the abdomen is full and the bowels irregular.

Grain Sick, maw-bound, or distention of the rumen from food, corresponds with stomach staggers or acute indigestion of horses. It occurs both in cattle and sheep, and is most commonly induced by indigestible food, such as old vetches, tough woody clover, or over-ripened rye-grass. The symptoms come on more slowly than those of hoven. The animal is dull, and ceases to ruminate; the bowels are torpid; the left side swells up; the breathing is quickened, and often accompanied by a grunt; whilst the pulse rises to 60 or 70. The undue accumulation must be got rid of by large doses of purgative medicine. Three-quarters of a pound each of common and Epsom salts, twenty-five croton beans or two drachms of calomel, with a pound of treacle, must at once be given; the beast encouraged to drink freely; soap and water clysters thrown up every half hour; and the abdomen rubbed and fomented as recommended for horses. If the bowels are not moved in fifteen or eighteen hours, another smart dose of physic must be given; and if dulness increases, a fluid ounce of the medicinal solution of ammonia, four drachms of the carbonate of ammonia, a wine-glassful of oil of turpentine, of whisky or of gin, or a full dose of any other stimulant, must be given, and repeated at intervals of one or two hours. In cattle, such stimulants greatly assist and expedite the action of the physic. When the dulness continues, the pulse becomes small and weak; and if no relief is obtained, the only resource is to cut into the stomach and remove its contents.

FARDEL-BOUND.—The third stomach of cattle lies towards the right side, is of globular form, contains from 120 to 140 leaves or curtains, which hang down towards the floor along which the food passes. They are of two lengths, a long and a short alternating, and are covered by a cuticular mucous membrane, with hooks or tentacula for the purpose of taking up the rougher particles of the food. These tentacula, with an exquisite selective power, gather up only the coarse portions of the food, which, in contact with the leaves, becomes macerated, triturated, and rendered capable of solution in the proper digestive fluids with which they are subsequently brought in contact. The third stomach, if we may so say, is an extra macerating tub, into which especially refractory portions of the food are diverted, in order that no nutritive matter may remain unappropriated, and that nothing may be lost. This process appears unusually liable to derangement. Coarse food in unduly large amount gets packed between these leaves, the organ becomes paralysed, its secretions are dried up, its cuticular coat scales off, and inflammation of the raw surface supervenes. This constitutes fardel-bound, also called clue-bound, or wood-evil. No derangement of the digestive organs of cattle is so common as this. It presents itself in all degrees of severity, sometimes as a mere "loss of cud," sometimes accompanied by obstinate constipation, brain symptoms, and death. It is the condition that constitutes most of the cases of indigestion of stall-fed beasts, and is the invariable concomitant of all fevers and inflammations. It is of most common occurrence in summer and autumn, when there is abundance of strong, tough, hard grass. When a fresh sweet bite comes up amongst the old withered foggage in autumn, fardel-bound is frequent; for the animals, anxious to get the succulent new grass, swallow along with it considerable quantities of the old indigestible stuff. Rye-grass in seed, and ripe vetches, are also prolific sources of it. Cases occur where cattle eat largely of hedge-cuttings or shoots of trees, and hence its synonyme of wood-evil. Sometimes it results from continued high feeding with insufficiency of water, and occasionally it will follow even a few hearty meals. It is very apt, as has been said, to show itself during or after any febrile attack, on account, doubtless, of the natural secretions of the stomach, like those of other parts, being temporarily dried up; and is for a similar reason most prevalent during hot summers, and when water is scarce. The symptoms manifest a very variable intensity, and are often a few days before they become very prominently observable. Rumination is suspended, the animal refuses its food, and if a cow, yields little or no milk. After a day or two there is fever, indicated by the nose and mouth becoming hot and dry, the surface of the body alternately hot and cold, the tips of the horns cold, the roots hot, with somewhat accelerated circulation and respiration. By the second or third day there is a grunt at the end of inspiration and commencement of expiration, which is especially observable when attempts are made to move the animal; and this symptom has again and again misled tolerably acute practitioners into the belief that they had to deal with a case of pleuro-pneumonia, or some such lung complaint. The round, hard, resisting stomach can be felt by pressing the closed fist upwards and forwards underneath the short ribs on the right side. In all cases there is obstinate constipation; and any dung that may happen to be passed is dark-coloured, caked, and often of different degrees of consistence, presenting frequently hard cakes amongst softer matter. Often the first stomach is considerably distended, and the urine high-coloured. Having most of these symptoms, the animal may live for ten days or a fortnight; but, unless relieved, the nausea gradually increases, the pulse becomes very small and scarcely perceptible, and the strength fails. In some seasons, extreme stupor precedes death, as in many cases of stomach staggers in the horse, whilst in others, quite inexplicably, the patients become much excited, and throw themselves frantically about. In a few cases epileptic fits are seen. After death the third stomach is hard and heavy, and between its leaves are found dry caked portions of dark-coloured dung, and imperfectly digested food, often of a kind that the animal has not partaken of for several weeks. So dry are the contents, that they look as if they had been baked in an oven, and will often rub down into a fine dry powder. The cuticular coat investing the leaves is stripped off; and in all cases where the brain is much involved, inflammatory action is traceable, never showing itself, however, in the exudation of lymph or the outpouring of pus, but simply in the removal of the cuticular coat. Occasionally, the inflammation extends to the fourth stomach and intestines.

The treatment consists in removing the obstinate constipation by powerful purgatives, advantage being taken to gain their utmost efficacy by combining several together, and giving them along with plenty of fluid. Three-quarters of a pound each of Epsom and common salt, twenty croton beans, and a drachm of calomel, will suffice for a full-grown middle-sized ox or cow, and must be administered in three or four bottles of water, or very thin gruel. In this disease there is little fear of giving too much medicine. I have known a cow have within two days twelve pounds of Epsom salts, twelve pounds of treacle, and several bottles of castor oil, without effect; and as it is never advisable to give small and frequently repeated purgative doses, large quantities must be administered at the outset. Their action is greatly expedited by the use of occasional stimulants, which in diseases of the digestive organs of cattle may be given without fear of engendering or aggravating inflammation. Every encouragement must be used to get the animal to drink, for large quantities of fluid are obviously most essential in washing on the obstruction which causes the evil. The cessation of the grunt, the passage of some hard cakes of dung, with the subsequent abatement of the fever, are the signs of amendment for which we watch; but even after the first movement of the bowels, considerable attention, a sloppy diet, and several doses of purgative medicine, are requisite to empty the canal, and prevent the recurrence of the obstruction. If twenty hours elapse after the administration of the above combination, without any action of the bowels, the same dose may be again repeated, along with a good quantity of some stimulant, such as a bottle of ale, with two ounces of oil of turpentine, and two ounces of ginger. Half the quantity of the purgative may be given at the end of a like interval, if no effect be produced; but the further employment of purgatives is injurious, inasmuch as it increases the nausea without expediting the action of the bowels. A week will sometimes elapse without any alvine evacuation; in some cases I have known, ten or eleven days, and in some fifteen days. Yet even in these recovery took place; and so long as stupor and frenzy are staved off, there is always hope of a cure. After the prompt and energetic adoption of the treatment recommended, little further remains to be done, except to withhold all solid indigestible food, administer frequent quantities of water or any simple fluid, which must be horned over if the beast will not take it; allow also plenty of treacle, and encourage the action of the medicine by clysters, scalding the belly, and occasional exercise. Blood-letting is not only useless, but even injurious.

Colic or Gripes is the most common disease of badly managed horses; consists of spasms, or violent and irregular contractions, usually of the small intestines; and comes on in sudden fits with intervening periods of quiet. Whilst the spasms last, the breathing is hurried, and the pulse rises often to a hundred; but when they pass away, both breathing and pulse fall towards their natural standard. The pain is generally relieved by pressure and friction, and is unaccompanied by irritative fever. The animal throws itself violently about, and gets up and lies down rapidly and frequently. These symptoms should be noted as distinguishing colic from enteritis, into which it is apt imperceptibly to pass. Food to which an animal has been unaccustomed; food eaten rapidly, especially after a long fast; food freely devoured immediately before fast work; large draughts of water, swallowed especially whilst heated, or before active exertion, are the common causes of colic, and are particularly active in overwrought and debilitated horses, and in those with flat sides, narrow loins, and a general washy appearance. The smallness of the horse's stomach, and the greater amount of work consequently falling to the lot of the small intestines, sufficiently account for colic being so much more common amongst horses than cattle; whilst the simpler and more digestible food of the dog, and the facility with which he gets rid of offending matters by vomiting, prevents his being much subject to this complaint.

Treatment.—A smart trot, friction over the belly, a drink of warm gruel, with a glass or two of gin, whisky, or other stimulant, will often speedily remove the attack. But where such means are not promptly effectual, give three or four drachms of aloes rubbed down in a pint of hot water, to which, when sufficiently cool for administration, add from thirty to sixty minims of strong solution of ammonia. The colic draught most commonly sold in the shops, consists of a pint of linseed oil, with one or two ounces each of oil of turpentine and laudanum. Where the spasms and distress continue severe, and with little intermission, the physic may be followed in an hour by two drachms of the pharmacopœia tincture of aconite, or about fifteen minims of the strong Fleming's tincture, given with an ounce of chloroform in a little water, and repeated every hour; soap and water or tobacco smoke clysters should be injected every half hour; and smart friction and hot fomentations applied to the abdomen. Where the tympanitis is great, nothing answers better than sixty minims of the strong solution of ammonia, given with an ounce of ether in a pint of water, and repeated every hour so long as the distention continues. Two ounces each of laudanum and chloroform, or of laudanum and ether, or sweet spirit of nitre, are occasionally used instead. When the animal is feverish, with the pulse steadily standing above fifty, stimulants ought to be withheld, for inflammation is to be dreaded. When recovery takes place, the horse should be fed for several days carefully and rather sparingly upon laxative and easily digested food; should have next day, unless the bowels be freely opened, three or four drachms of aloes, and should have exercise, and not work, until the day after the physic has ceased to operate. A good colic draught for a medium-sized pointer consists of an ounce of castor or linseed oil, a drachm of ether, and ten drops of laudanum.

DIARRHŒA or Scouring is, as every one knows, the passage of an undue quantity of liquid feces. The active secreting surfaces of the intestines are congested, and pour out an unusual abundance of their natural fluids. In all cases this outpouring proceeds from some ulterior cause, and often serves some useful purpose. It is alike the evidence of something amiss, and the natural effort to remove the evil. A quantity of crude undigested food accumulates—a likely source of annoyance and disease; but the earliest irritation, by a beautiful reflex process, unlooses as it were the sluice-gates of the canal, and the offending matter is thus washed onwards. This is the most common cause of diarrhœa, but there are others. Frequently it follows the use of large quantities of fluid and succulent food, and then it must be regarded as a kind of natural drain, by which the system relieves itself of superfluous liquid, which might be hurtful if retained. Sometimes the outpouring of fluid is determined by the presence of irritating or noxious matters in the blood, and in such cases it is a bountiful means of its effectual purification. This explains the occurrence of the diarrhœa that so frequently sets in during pleuro-pneumonia and other diseases, and which is generally an evil symptom, as it indicates a deteriorated state of the blood, or a badly nourished condition of the intestinal membrane. Lastly, diarrhœa sometimes depends upon a weakened and relaxed state of the membrane, which allows the fluid parts of the blood to percolate through it. This condition is apt to supervene from various exhausting diseases. Diarrhœa is seldom accompanied by pain, and never by fever. The appetite is not impaired, nor the pulse or the breathing affected. When long continued, it is sometimes accompanied by straining, and blood is occasionally passed; but this is by no means so formidable a symptom as it is generally believed to be. Occasionally diarrhœa proves fatal, even without inducing inflammation.

Treatment.—To treat it aright, the causes upon which it depends must, if possible, be discovered. If indigestible food or other irritant matters in the intestines be the exciting cause, as is very generally the case, astringent medicines, the remedies commonly at once had recourse to, are very injurious; for, by drying up the natural flux, they effect the continued retention of the deleterious matters. Nature's methods of cure are ever the most safe and effectual; and in all cases the sensible practitioner derives much advantage by studying and seconding these curative efforts. An excessive discharge, in most cases, soon purges away the peccant matters; and hence, instead of prematurely endeavouring to arrest it, we advantageously encourage it by the administration of laxatives. The medical man (for the same principle is applicable to all classes of patients) gives a rhubarb pill, a dose of Gregory's powder, or a little castor oil. The veterinarian administers to the horse from two to four drachms of aloes, with an ounce each of bicarbonate of soda and ginger or gentian, and occasional clysters; and to cattle three-quarters of a pound of Epsom or common salt, or a pint of linseed oil, combining whichever be employed with two ounces each of bicarbonate of soda and ginger, and half a pound of treacle. When there is much pain or straining, whether in the horse or cow, laudanum must be added to the extent of an ounce. When purging has gone on for several days, when the intestines appear empty, or when laxatives have been already given without the desired effect, then it will be seen that a different sort of case is to be dealt with. Here, probably, the mucous membrane has become relaxed and weakened by the previous irritation; and the faulty action, once established, continues even after the irritation which induced it is removed. In such circumstances aromatics and astringents are called for. An ounce each of catechu, ginger, and gentian, given in a pint of warm ale, may be used several times a day for horses, double the dose for cows, and half the dose for sheep. Another good prescription consists of an ounce each of laudanum and ether, with a scruple of tannin, given in gruel or ale, for the horse; double that quantity for cattle, a sixth for sheep or young calves, and a tenth for medium-sized dogs. Other prescriptions will be found under Opium, Oak Bark, etc. When diarrhœa has existed for some time, and is conjoined with, and probably so far dependent upon, a debilitated state of system, it is advisable to supplement the above prescriptions with tonics; and, for this purpose, nothing is better, either in horses or cattle, than half-ounce doses of sulphate of iron, repeated twice daily. In all cases an entire change of food is serviceable, often more so than any quantity of medicine. Dry nutritive food should be given, such as good hay, with a few bruised oats. Succulent green food ought to be withheld, as also new-mown hay, and quantities of roots. Cattle or sheep, when first placed upon the second crop of clover, are apt to scour freely, and hence such food should also be avoided. Exposure to extreme heat, such as that of the summer of 1858, is very apt to induce looseness of the bowels, especially amongst dairy stock, which, during the summer months, should either be kept in the house during the heat of the day, or provided in the pastures with suitable and sufficient shelter. Diarrhœa in young calves usually results from irregularity of feeding, long fasts, overcrowding, bad ventilation, or filth; and is best treated with two ounces of linseed or castor oil, an ounce of ether or sweet spirit of nitre, half an ounce of laudanum, and two drachms of bicarbonate of soda. This dose may be repeated at the end of eight hours if no relief is given, and the animal placed by itself in a comfortable, warm, well-littered pen, and sparingly supplied with the milk of its own mother three times daily.

CONSTIPATION occurs in all animals. In cattle and sheep it generally depends upon impaction of the third stomach, already described as fardel-bound. In horses, the intestinal secretions and motions are diminished or arrested; the symptoms resemble those of colic, but are more continuous. The appropriate remedies are purgatives. Administer, rubbed down in gruel, four drachms of aloes, with a drachm of calomel; inject every hour soap and water, or tobacco smoke clysters; let the animal have walking exercise, and friction applied to the belly. When no effect is produced in twelve or fifteen hours, repeat the aloes and calomel, adding three or four drops of croton oil, and a wine-glassful of sweet spirit of nitre, ether, gin, or whisky. If the symptoms do not yield to this treatment, if the pulse continues to rise, the mouth gets hot and feverish, and the animal sits upon his haunches, there is reason to suspect the presence of dust-ball, or some such obstruction. Horses fed upon meal seeds, barley dust, or such other dry dusty food, as is sometimes the practice in millers' and bakers' stables, are apt to be the subjects of dust-ball; whilst in Derbyshire, and other localities where calcareous matters abound in the water, small particles of such matters become agglutinated together, produce repeated attacks of colic, and the mass, as it gets larger or firmly fixed into some of the narrower parts of the large intestines, produces obstruction and fatal inflammation. In such cases treatment is almost hopeless. Full doses of purgative medicine, as above recommended, must be given early; and the pain, which in serious cases is intense, may be mitigated by drachm doses of opium or of extract of belladonna, given, at short intervals, along with an ounce of ether or of chloroform.

INFLAMMATION OF THE BOWELS, or Enteritis, in its most usual and fatal form amongst the heavier breeds of horses, affects chiefly the mucous membrane of the large intestines, and runs its course with frightful rapidity in ten or twelve, and sometimes even in six or seven hours. When occurring in connection with influenza and epizootic affections of the air-passages, or from sudden chills after exhausting work, it chiefly affects the mucous membrane of the small intestines, and also involves the peritoneum. The more common variety, affecting the large intestines, generally results from overloading of the stomach and bowels, and follows stomach staggers and colic. From the first, most of the symptoms of colic are present; but soon the animal is observed to lie down with increasing caution; the nostrils are dilated; the respirations increased; the pulse, at first sharp and firm, and about sixty, gets gradually quicker and smaller, and eventually becomes imperceptible. The signs of amendment are diminished dulness and nausea, with returning action of the bowels and kidneys. When the case is unfavourable, the mouth becomes hot and clammy; cold perspirations cover the abdomen; the horse looks wistfully at his flanks, staggers round his box, becomes insensible to external objects, or dashes himself about in wild despair; the bowels remain unmoved; tremors flit over the surface of the skin; and in eight or ten hours he dies, exhausted by the irritative fever, and the immense exudation of dark jellied blood, which covers the mucous surface of the intestine often to the extent of an eighth of an inch.

Treatment.—When the patient is seen in time, whilst the limbs are still warm, and the pulse clear and distinct, and not above sixty, bleed to the extent of five or six quarts. When the bowels are confined, give four drachms of aloes, and half a drachm of calomel in a pint of gruel. Endeavour to relieve the febrile and inflammatory symptoms by giving two drachms of the Pharmacopœia tincture of aconite, or fifteen minims of Fleming's tincture with an ounce of laudanum; or try instead half a drachm of calomel and an ounce of laudanum. Either of these sedative mixtures should be given in a pint of gruel water or linseed tea, and repeated every hour, so long as the acute symptoms continue, and collapse does not take place. To excite the action of the bowels, give frequent injections of oil and laudanum in soap and water; apply diligently to the abdomen, for several hours continuously, cloths wrung out of boiling water; and afterwards rub in mustard paste or some stimulating liniment. When the pulse is over seventy, the animal stupid and nauseated, and the legs cold, bleeding and sedatives only hurry on a fatal termination. The inflammation has already relieved itself by the outpouring of blood on the intestinal surfaces; and the only hope, and that a faint one, lies in supporting the powers of life and alleviating the pain by the combination of stimulants and opium. Administer every hour, in nearly cold gruel, an ounce each of laudanum and sweet spirit of nitre, with half an ounce of carbonate of ammonia; give the same combination, in half the quantity, by the rectum; and persevere in the application of the hot water cloths to the abdomen. When enteritis occurs from superpurgation, or from putting a horse to fast work shortly after drinking, bleeding and purgatives are quite inadmissible. Two-ounce doses of laudanum and compound tincture of cardamoms, and an ounce of prepared chalk, should be given in well-boiled starch gruel every hour; hot water applied to the abdomen; and, where there is much straining, an ounce of laudanum in starch gruel, injected as a clyster every hour.

Inflammation of the bowels is less common in cattle than in horses. Febrile symptoms are present; the pulse is strong, often rising to seventy; the animal shifts about, resting for a little first on one hind limb and then on the other; there is thirst, tenderness along the spine or belly, and constipation. It is most serious amongst calves, in which it may prove fatal in three or four days. In older animals, a fatal issue does not occur so early; but unless amendment takes place in a week, the case is generally hopeless. A variety of enteritis affects the cow three or four days after calving, and involving the womb as well as the bowels, is difficult of treatment. The chief causes of enteritis in cattle are bad food, coarse wet pastures, irrigated meadows, bad water, and over-driving. Bleed early; give a pound of castor oil, a drachm of calomel, three ounces of laudanum, and a pound of treacle, beat up with two eggs and about two pounds of warm water; repeat this in half doses every six hours; order clysters and hot fomentations to the belly; and if no benefit follows in two days, administer thrice daily half a drachm of calomel, two drachms of carbonate of ammonia, and an ounce of laudanum in gruel.

Inflammation of the bowels in sheep is generally known by the name of braxy; exhibits the same symptoms as are noticed in cattle; chiefly affects the young stock; occurs mostly during the winter months in exposed wet localities; and requires, with sheltered lodgings and better keep, the treatment just advised for cattle,—one-fifth part of the doses being given.

Peritonitis, or inflammation of the serous membrane lining the abdominal walls and covering the intestines, is generally, amongst horses, the result of exposure to wet and cold, of castration, or of a haunch from a cow's horn, or some such injury. It is ushered in by shivering, blowing, and some of the symptoms of pleurisy and enteritis. The animal gets up and lies down quickly, shifts about on his hind feet, strains occasionally, and is very feverish. The symptoms are neither so acute nor do they run their course so rapidly as in enteritis. There is, consequently, more time for treatment. Bleed freely; give three drachms of aloes with one scruple of calomel and a drachm of Pharmacopœia tincture of aconite; and repeat the calomel and aconite with an ounce of laudanum every two hours, until four or five doses are given. If the pulse then continues strong and hard, and not too quick, give a drachm and a half of the Pharmacopœia tincture of aconite every hour, for four or five doses. From the first, apply to the abdomen cloths wrung out of boiling water; and give laxative clysters, to which a drachm of belladonna may be added, if the pain and straining are troublesome. Cattle, sheep, and dogs exhibit similar symptoms, and require similar treatment.

Bots (*Œstrus Equi*) occur chiefly amongst young horses, or those that have been recently at grass, especially in damp coarse pastures shaded with trees. The eggs are deposited by the female fly on the horse's shoulders, and other parts within reach of the tongue, by which they are carried to the mouth, and thus find their way into the stomach, where the larvæ are found adhering particularly to its cuticular part. In the succeeding summer they are discharged with the feces; and, passing through the chrysalis stage, the fly appears in about three weeks, and is again ready to propagate its species. Mr Gamgee, senior, in an excellent paper upon bots in the first Number of the Edinburgh Veterinary Journal, has shown that, during their residence in the stomach, the bots interfere with digestion, and keep the animal weak and emaciated, and are, further, more abundant in Italy and other warm climates than in England. Until the bots come to maturity in the early summer months, they usually resist all attempts at dislodgment. The treatment promising most success consists in rubbing down in hot water about two or three drachms each of aloes and assafœtida; and when the solution has got cool, adding to it an ounce each of turpentine and ether. This dose should be repeated two or three times a week, giving it whilst the animal is fasting, and leaving out the aloes if the bowels become too open. Another useful recipe consists of four drachms each of gentian and assafœtida, given in two ounces of turpentine, ether, or pyroxylic spirit, and repeated for five or six consecutive mornings, when three or four drachms of aloes in solution are then administered, often with the effect of clearing away numbers of the poisoned or nauseated bots. In conjunction with such treatment, a change of diet and good feeding must be enjoined.

WORMS of several different sorts are found in the alimentary canal of the lower animals, and usually induce some of the following symptoms:—indigestion, an unthrifty coat and appearance, irritable bowels, unhealthy-looking light-coloured feces, abundantly mingled with mucus, colicky pains, and even enteritis and tetanus. In cattle and sheep they are less common than in horses or pigs, or in dogs, in which they usually cause a thriftless appearance and indigestion, and occasionally convulsions and chorea. In the horse and ass several varieties of *strongyli* are found in the cecum, colon, and occasionally in the duodenum. The *oxyures*, round or maw-worms, are less hurtful, seldom cause much derangement, and occasionally inhabit the cecum of the horse. The *ascarides* are the worms of most frequent occurrence amongst the domesticated animals, and are met with throughout all parts of the canal. Tape-worms, *tæniæ*, are more common amongst men, dogs, and other carnivora, than in horses and such like vegetable feeders. They appear to be developed especially from the eating of meat, either in a raw state or imperfectly cooked. In the flesh of many animals, especially in what is termed measled pork, immense quantities of minute worms (*the cysticercus cellulosæ*) are found; and these, when eaten by men or dogs, gradually become developed into tape-worms. A similar change occurs when the hydatid of the brain of sheep, or the hydatid of the liver of rats, mice, or rabbits, is devoured by dogs or cats. Conversely, when these tape-worms are eaten by sheep or other animals, they give rise to the hydatids.

Treatment.—For worms in horses the prescriptions above recommended for bots should be used; the diet should be altered, giving, instead of hard food and corn, boiled barley, mashes, carrots, and fresh green food, if procurable; place salt within the animal's reach, and give a handful in his mash; administer twice daily some bitter tonics, such as two drachms each of gentian, quassia, camphor, and sulphate of iron, made into a ball with treacle and linseed meal. Another prescription, especially serviceable for dislodging ascarides, consists of two drachms each of sulphate of iron and gentian, and ten grains of arsenic, given every morning in a ball, and followed, after six or eight doses, by three or four drachms of aloes in solution. Professor Gamgee, in his "Veterinarian's Vade Mecum," recommends two drachms of assafœtida, a drachm and a half each of calomel and savin, with thirty drops of oil of male fern, made up with treacle and linseed meal, given at night, and followed by a purge next morning. When ascarides infest the rectum, clysters of turpentine and tobacco smoke are very serviceable. Similar treatment is applicable for worms amongst cattle and sheep. For dogs, give in soup or broth 20 drops of the oil of the male shield fern, 30 drops of oil of turpentine, and 60 of ether, beat up with an egg. Mr Gamgee orders half an ounce of the powdered worm-grass, an approved American remedy, known by the name of the Indian or Carolina pink, and given as an infusion with half a drachm of powdered stinking hellebore. For the special treatment of tape-worm many remedies have been prescribed. That long in common use for dogs consists of two drachms of oil of turpentine, and an ounce of linseed oil, given after twelve or fifteen hours' fasting. A similar dose will answer for lambs, which, in many of the midland counties of England, are becoming every year more subject to tape-worms. For dogs I find nothing acts so safely or effectually as the areca nut. For an English terrier or other dog, weighing about 20 lbs., the dose is one-fourth of a nut, or 30 grains, given powdered in a little soup or milk, after ten or twelve hours' fasting, and followed after a few hours by a dose of oil. Other remedies are occasionally used, such as the pomegranate root-bark in two drachm doses; the flowers of the Abyssinian kosso, an effectual but expensive remedy; kamela, a euphorbiaceous plant used in India; santonica, the unexpanded flower-heads of a species of artemisia or worm-seed, and its active crystalline principle, santonin; and the root-stalks, scales, and rootlets of the male shield fern. This is now generally regarded as the most certain remedy for tape-worm in man. It is also tolerably effectual for dogs, to which it is given powdered in doses of two or three drachms, or, better still, in the form of an oleo-resin, extracted by ether, administered when the canal is empty in doses varying from one to three scruples, and succeeded in a few hours by one or two ounces of a mixture of equal parts of linseed and castor oil. Besides this—and the treatment is applicable to all sorts of worms—the dog should be kept on sound, good, cooked food, and have daily, for at least a week, a pill containing five grains each of gentian, quassia, and sulphate of iron, and made up with conserve of red roses or treacle. Sheep, besides receiving turpentine drenches (see p. 446), should have salt in their troughs, with a daily allowance of beans, oats, or cake, and a transference, if possible, to fresh pasturages.

Inflammation of the Liver.—The liver is the largest gland in the body, is situated within the short ribs on the right side, and secretes the yellow, alkaline, soapy fluid, known as the bile. It is smaller in horses than in cattle, in which, from stimulating food, warm housing, and want of exercise, it is very subject to derangement. Inflammation of the liver, technically termed hepatitis, is rare as an acute disease; but in a chronic form it is very common in cattle that have been long stall-fed. Their highly stimulating food provokes a copious secretion of bile; and the liver, thus continuously overworked, becomes engorged with blood, and sometimes the seat of inflammation. Appetite and rumination are irregular; the skin is harsh, rough, and itchy; the skin and mucous membranes have a yellow tinge; the small quantities of dung passed are dark-coloured and glazed. Occasional saline purges, with plenty of water and laxative food, will palliate the case, and enable the animal to be fed off; but after death the liver will usually be found much enlarged, and very soft and friable. A similar condition is occasionally met with amongst aged horses that have been grossly fed.

Rot in Sheep.—An enlarged and softened condition of the liver, and the presence of flukes (*Distoma hepaticum*), constitutes *rot* in sheep. It is hereditary, but occurs chiefly in wet and undrained, or frequently irrigated lands, and is especially frequent during wet seasons. Thus it is estimated that in the rainy winter of 1829–30 two millions of sheep died or were killed with it, whilst it again prevailed during the wet year of 1852–53. Place the animals on dry, healthy pastures; allow hay and nourishing food; give salt in covered troughs; administer saline purges, such as two ounces of Epsom salt, an ounce of oil of turpentine, and half an ounce of ginger, in treacle and water; and follow this up with tonics if necessary.

Jaundice is more common amongst cattle than in horses or dogs, in which it generally accompanies or succeeds influenza, distemper, or other debilitating complaints. In cattle it also follows pleuro-pneumonia. It comes on more slowly than in the human subject; the skin and mucous membranes become of a tawny hue, giving rise to the names of the yellow or golden pheasant; the appetite often continues almost unimpaired for some days; the bowels, however, are irregular, soon become obstinately constipated, and the dung white and clay-looking. The urine is copious, but very brown, and the milk also acquires a yellow tinge. The pulse becomes quick, the skin itchy, and, as is the case in all liver affections, the strength reduced. Vomiting, a prominent symptom in man, does not occur in horses or cattle. When a fatal result occurs, the yellow colour is observable in the fat, and even in the flesh and blood. The most common cause of jaundice appears to be the choking up of some of the biliary ducts with thickened bile, which, being thus retained, fills up the cells of the liver, and thus arrests its functions. Sometimes the vessels carrying the blood through the liver become engorged; the circulation is thus impeded, and the blood imperfectly freed of the materials of the bile. Most book authorities recommend bleeding, which is, however, worse than useless, as it increases the low fever, which is always an untoward symptom, does not remove biliary concretions, and affords only temporary relief to that congestion of the liver on which, as just stated, the disease occasionally depends. Nothing can be done without purgatives. Administer half a pound each of common and Epsom salt, two ounces of ginger, with a pound of treacle; and if the bowels are very costive, add ten croton beans or a drachm of calomel. If no effect is produced, repeat the dose next day, and give salt, treacle, and plenty of fluids, until the bowels are thoroughly moved. When the strength fails, use tonics and stimulants. There is a popular notion that herbs of a yellow colour are of much efficacy in this disease; but those of them that I have seen used are quite innocent of any power, whether of good or evil. The treatment for horses and dogs does not materially differ from that suitable for cattle.

DISEASES OF THE RESPIRATORY ORGANS.

CATARRH, or cold in the head, is more common amongst horses than amongst any other of the domestic animals. It consists in inflammation of the mucous membrane lining the nostrils and cavities of the head. When neglected or badly treated, the inflammation passes downwards to the bronchial tubes and lungs, and sometimes gives rise to such alterations of structure as produce chronic cough, roaring, or whistling. In simple catarrh, the mucous membrane is reddened and bedewed with an abundant watery fluid, which in a day or two becomes yellow and viscid from admixture of pus.

Sneezing and cough are also present, but the pulse and respiration are almost unaffected. The most common causes are sudden alternations of temperature, draughts, and bad ventilation. The same causes, in more aggravated shape, or acting upon more delicate subjects, often induce inflammation of the lungs, and in cows inflammation of the udder.

The *treatment* consists in supplying the animal with abundance of cool fresh air; keeping the body and limbs warm with horse-cloths and bandages; exhibiting, if necessary, a mild dose of physic and clysters; and allowing soft laxative food, and an ounce of nitre dissolved daily in the animal's water. Where the throat is sore, or the cough troublesome, a mild blister of cantharides or mustard will be useful.

Bronchitis, or inflammation of the mucous lining of the bronchial tubes, although occasionally existing as a separate disease, is more commonly associated with disease of the lungs. The causes of bronchitis are analogous with those of catarrh. It is characterized by tenderness of the throat, a short painful cough, accelerated breathing, and a quick, soft, compressible pulse. Large quantities of thickened mucus speedily accumulate in the inflamed canals; and hence the air, in passing along, produces a rattling sound, which is easily heard when the ear is applied to the lower part of the neck or side of the chest. The imperfect aeration of the blood soon induces great weakness, and blood-letting is therefore inadmissible. A comfortable, well-littered, loose box, with plenty of cool fresh air, are the first essentials in the treatment of bronchitis, and indeed of all chest diseases. I have repeatedly seen a sick horse's pulse fall eight or ten beats per minute in the course of an hour after being put in a cool, comfortable, loose box. Indeed, without a good loose box and fresh air, all medical treatment is comparatively valueless. Ten drops of Fleming's tincture of aconite, or eighty minims of the new Pharmacopœia tincture, should be given in a pint of water every second hour, until the pulse falls towards its natural standard, or until six doses have been given; or, instead of the aconite, a scruple of calomel and a drachm of opium, as directed, p. 367. The body should be clothed, the legs encased in bandages, and the bowels, which are extremely sensitive, gently opened by clysters, or a two-drachm dose of aloes. The animal should be encouraged to drink nitre and water, and blisters applied from the jaw to the sternum. After the second day stimulants are generally advisable, and an ounce each of sweet spirit of nitre and spirit of ammonia may be given four or five times a-day, especially if the weakness increases. The cough may be relieved by a ball, given thrice daily, and consisting of a drachm each of carbonate of ammonia, camphor, and extract of belladonna. Amongst cattle, sheep, and dogs, bronchitis exhibits similar symptoms, and requires similar treatment.

Hoose in Calves.—Young cattle, and also sheep and lambs, frequently suffer, especially during autumn, from a variety of bronchitis induced by the presence in the bronchial tubes of minute filariæ. The animals have a loud prolonged cough, and, unless relieved, rapidly lose flesh. Oil of turpentine dissolved in linseed oil should be administered; but not, as is commonly advised, by the nostrils, for the medicine, when thus given, is very apt to get into the lungs and cause suffocation, and is, moreover, not more effectual than when given by the mouth. Half an ounce of oil of turpentine in two ounces of linseed oil will suffice for a calf six months old, and should be repeated once or twice at intervals of two days. For sheep, the dose may be divided into two (p. 416). Calves should, besides, be comfortably housed at night, receive a little oil-cake and other good food; and, if weakly, two drachms each of sulphate of iron, gentian, and ginger, given in warm ale, sweetened with treacle.

Congestion of the Lungs is the precursor of inflammation of the lungs, but sometimes also presents itself as a separate disease. It occurs to a slight extent in all animals during work; but in a more formidable form in young, fat, or badly conditioned horses, when subjected to rapid or severe exertion, or even to sudden cold. The lungs and heart become overcharged with an unusually large quantity of blood. The lungs, however, if examined, would be found still to crepitate and float in water; but, although free from exudation, they contain, when cut into, dark-coloured blood and frothy mucus. The symptoms are very characteristic. The animal blows, his nostrils are expanded, his elbows turned out, and his sides heaving; he is distressed and stupid; his vascular system is full and turgid; his pulse oppressed, and by and by scarcely perceptible at the jaw, and his skin bathed in perspiration. Give at once plenty of cool air. If the case occur in the hunting field, as is very common at the commencement of the season, turn the horse's head to the wind, remove the saddle, and have him well rubbed over, and then comfortably clothed. Bleeding is often useful, especially if the pulse be full or oppressed, but is always injurious when the pulse is small and imperceptible, the skin cold, and the stupor great. In such cases give active stimulants, such as two or three ounces of ether or sweet spirit of nitre, four drachms of carbonate of ammonia, two or three glasses of whisky, gin, or brandy, or a bottle or two of warm ale.

Inflammation of the Lungs, or Pneumonia, is a common disease amongst all the domesticated animals. It is ushered in by shivering and irregular heat of the skin. The mouth shortly becomes dry, hot, and sticky ; the breathing quick, shallow, and laboured ; the pulse full, oppressed, and often numbering seventy or eighty beats per minute. In health, the proportion of respirations to pulsations is as one to four; whilst in pneumonia it is as one to two and a half, or three. This acceleration of the breathing is a natural effort to compensate for the impaired action of the lungs. An unusual amount of blood must now be purified by those parts of the lungs which still remain sound ; and hence an unusual supply of air is required. Cough is not so invariable a symptom as in bronchitis or pleurisy, and, when present, is fuller, freer, and less painful. The horse affected by pneumonia stands persistently with legs apart and out-turned elbows ; the cow, on the other hand, is most easy when lying on her broad breast-bone, for in this position the ribs are pressed outwards, enlarging the capacity of the chest. When the chest is struck with the tips of the fingers, an unusually dull, dead sound is produced ; and when the ear is applied behind the shoulder, the natural rustling murmur will be found obscured by a crackling crepitation, which is shortly succeeded by a rasping rumbling noise. These sounds depend upon the air-cells, and subsequently the lesser bronchii, becoming filled with viscid mucus and exudation.

The internal changes inducing these symptoms consist in the capillary vessels which ramify upon the air-cells of the lungs becoming filled with an unusual amount of red blood, constituting what has been already described as congestion, and the subsequent exudation of the fluid parts of the blood through the thinned and weakened capillary walls. Such exudation is the characteristic of all inflammation. In pneumonia in the horse, it is chiefly poured into the air-cells, and there solidifies, interfering with the aeration of the blood, and giving to the lung, when cut into, a mottled, liver-like appearance. The right lung is oftener affected than the left, and when both are diseased, is always worst, probably depending upon the bronchii and pulmonary artery on that side being larger. Almost all severe cases are accompanied by inflammation of the pleura.

Treatment.—When pneumonia is brought on by cold, over-exertion, or other ordinary causes of inflammation, it is tolerably easily cured. When occurring, however, as an epizootic, or in connection with influenza, it is very intractible, exhibiting a tendency to early exudation, and a marked intolerance of antiphlogistics. When the patient is shivering, with a cold skin and small pulse, when the disease has continued for several days, or when signs of debility are observable, blood-letting is decidedly injurious. On the other hand, when the disease is just commencing, the fever high, and the pulse strong, firm, or oppressed, blood-letting is of the greatest value. Six or eight quarts may be taken from either horse or cow. A laxative is also usually requisite; three or four drachms of aloes for the horse, and a pint of linseed oil or a pound of salt for the cow. Clysters of soap and water, containing a little linseed oil or common salt, should be given every two hours until the bowels begin to act. Sedatives should also be given, such as Fleming's tincture of aconite, in doses of from ten to fifteen minims (or eight times that amount of the Pharmacopœia tincture), or a scruple of calomel with a drachm of opium. These medicines should be repeated every two hours until the mouth becomes moist and cool, the pulse less accelerated, and the breathing relieved. Cool, pure air must be allowed from the very commencement in unlimited quantity; without it, all medical treatment is useless. The body and limbs should be warmly clothed, the animal restricted to light, easily-digested, laxative food, and encouraged to drink water impregnated with nitre or common salt. Blisters are scarcely so effectual in pneumonia as in bronchitis or pleurisy. As in other cases, they must be applied over a considerable extent of surface, and are only to be used after the more acute inflammation has somewhat abated. Recovery begins to show itself in three or four days; is pretty certain if the animal survives for a week; and may always be expedited by giving the patient comfortable housing, good light food, and plenty of tonics and stimulants.

Inflammation of the Pleura, or serous membrane lining the chest and covering the lungs, is technically termed pleurisy. It is met with in almost all severe cases of pneumonia, and occasionally as an independent disease. In horses, its symptoms are often well marked. There is shivering, the precursor of all internal inflammation; a hot mouth, and other signs of fever; poking out of the nose; disinclination to turn or move; a rapid, firm, clear, corded pulse; an occasional short, painful cough; hurried, shallow, careful breathing, the inspiration especially being spasmodically quickened, and often accompanied by a sigh or grunt. To avoid the pain caused by the movements of the ribs, the abdominal muscles are called in to aid in respiration; and hence the lifting of the flanks, the tucking up of the belly, and the peculiar line running from the haunch round the abdomen to the breast-bone. In man the intercostal spaces bulge, but in the horse the ribs rather appear to do so. Pressure in the spaces between the ribs causes pain; percussion over the ribs elicits a dull sound; and the ear applied to the chest discovers a rough, rasping noise.

In fifteen or twenty hours, but more commonly in about three days, the patient may seem easier, but such amendment is sometimes deceptive; the vessels have been weakened by the intense inflammation, and pour out a quantity of fluid, constituting *hydrothorax*, or water in the chest. I have seen ten gallons of fluid thus accumulated. In such cases, the remission in the symptoms, although very marked, is only temporary. There is soon extreme difficulty in breathing, flapping of the nostrils, and lifting of the sides, a small, soft, irregular pulse, and dropsical swellings of the limbs. Below the line reached by the effusion there is dulness on percussion, and absence of sound on auscultation. The gurgling noise erroneously ascribed to the effusion, depends upon the movements of the intestinal contents, rendered unusually audible by their reaching the ear through the water in the chest. When the fluid does not occupy more than a third of the chest, recovery may still occur; but when it reaches to one-half, the case is hopeless. Death, which may be deferred for six or eight weeks, results from the accumulating effusion pressing upon the lungs, and thus arresting respiration. In favourable cases the exudation is less abundant, and slowly undergoes absorption, when the pulse becomes slower and softer, and the breathing easier.

Treatment.—Dr Walshe says that pleurisy is rarely fatal in the human subject, and with prompt and rational management equally satisfactory results might be obtained amongst the lower animals. During twelve months, in 1854–5, the late Mr Barlow had sixty cases of pure pleurisy under his charge, at the artillery barracks at Leith Fort, with only four deaths. The treatment for pleurisy is somewhat similar to that suitable for pneumonia. Place the animal without delay in a cool, airy, loose box, and bleed to the extent of seven or eight quarts, or until the pulse falters. A greater abstraction of blood can be borne in pleurisy than in any other disease of the air-passages. Bleeding, however, is never justifiable after the third day, when the pulse reaches seventy, or when there are any symptoms of effusion. Give some purgative medicine. Three or four drachms of aloes in solution will suffice for the horse; and clysters must also be given. Until the physic operates, sedatives must be used with extreme caution, as they are apt to bring on superpurgation. Twenty minims of Fleming's tincture of aconite should be given every three hours. It is more certain than anything else. A horse with pleurisy at Leith Fort, in July 1855, got by mistake twenty-five drops of tincture of aconite four times an hour, instead of once every four hours, and after eight doses was slavering copiously, champing with his teeth, and the heart's action much reduced. In three hours these symptoms disappeared, and with them the more acute symptoms of the pleurisy. Towards the close of the second day the aconite may be discontinued, and a scruple of calomel and a drachm of opium given in a bolus, and repeated every four hours until four or five doses have been given. The animal is generally thirsty, and should be encouraged to drink water in which nitre is dissolved. By the third day, the sides should be scalded with hot water, and a liniment of ammonia or mustard applied. The animal should be kept perfectly quiet, and if he will eat, sparingly supplied with any soft laxative food. In favourable cases, amendment comes on about the third day. Dulness and acceleration of the pulse occurring about the third, fourth, or fifth day certainly indicate hydrothorax. In such cases, give tonics, stimulants, and good food to support the strength, and diuretics to remove the fluid. For such diuretic purposes, a two-ounce ball of nitre, resin, and soap, in equal proportions, answers well, and should be given twice daily. When conjoined with stimulants and diuretics, iodine is also sometimes useful. The fluid may be removed by introducing the trochar and canula in the intercostal space, anywhere between the seventh and eleventh ribs. Although the temporary relief is extraordinary, few cases, not one in five, eventually survive the operation. To prevent the sinking which succeeds the drawing off of the fluid, administer (both before and after the operation) stimulants with a drachm each of iodine and hydriodate of potash.

Pleuro-pneumonia consists, as its name indicates, of inflammation of the pleura and lungs; is in all cases of more frequent occurrence than pure pneumonia or pleurisy; occurs in all the domesticated animals; is not, in its acute form, contagious; exhibits most of the symptoms already described as occurring in these two complaints, and requires very similar treatment.

Pleuro-pneumonia Epizootic of Cattle.—An epizootic form of pleuro-pneumonia has existed from time immemorial amongst the horned cattle of continental Europe, and made its appearance in this country in 1841, where it has prevailed ever since. It differs from the pleuro-pneumonia just described, in affecting at the same time most of the structures within the chest, in exhibiting an early tendency to exudation, in assuming a chronic and typhoid form, and in being on these accounts greatly more difficult of cure. Whilst in some cases depending, to all appearance, upon the ordinary causes of epizooties, it is often traceable to contagion, resembling in this respect the typhoid pneumonia of man and influenza in the horse, both of which are occasionally contagious. It first appeared in the West of England shortly after the introduction of stock from Ireland, where it had previously committed great devastation. It spread throughout the country slowly and gradually. It has occurred most frequently and severely amongst stocks replenished by animals purchased in open market; whilst it has been successfully kept out of some farms and localities by using the precaution of purchasing only healthy animals. Such facts appear to me sufficient to justify the belief that contagion is a cause of pleuro-pneumonia. But I would by no means consider it as the only and invariable cause. The disease, like other epizooties, certainly seems sometimes to occur independently of contagion, and apparently from atmospheric causes, and moreover is always most frequent and fatal where the system is in a depressed or vitiated state from over-crowding, insufficient ventilation, filth, exposure to cold winds, and other causes which impair the vital powers.

Symptoms.—The disease comes on very insidiously, and often makes considerable progress before any symptoms are observed. In milk-cows the udder becomes tender and flaccid, and the milk diminished in quantity, and frothy. There is a short, half involuntary cough. Soon the animal gets dull, the appetite and rumination irregular, the mouth, horns, and legs hot, or alternately hot and cold, and the breathing and pulse quickened. Percussion over the chest elicits a dull sound, and auscultation detects a crumpling crepitating noise, which, as the disease advances, becomes louder, and subsequently inaudible. The breathing becomes more difficult, and accompanied by a grunt, which is most audible at the commencement of expiration. The animal, when standing, turns out its fore extremities, and arches its back; and when lying, rests on its broad, flat, thickly padded sternum, thus increasing the lateral expansion of the chest. It usually lies towards the side that is most diseased, thus allowing the utmost freedom of action to the healthy side. The pulse, at first tolerably full, becomes small, quick, and indistinct. From the filling up of the lungs with exudation, the blood is imperfectly aerated, the system consequently is badly nourished, the muscles waste, digestion is impaired, leading to tympanitis or diarrhœa, the strength fails, and death occurs usually in from ten to twenty days.

The right lung is more often and extensively diseased than the left, and the lower more commonly than the upper parts of the lung. The interlobular structures are early infiltrated with serum; lymph in large quantities, with exudation—corpuscles, and subsequently pus, follow, until the lung structure becomes filled up and solidified, and aeration of blood arrested. The pulmonary pleura, like the interlobular spaces, being nourished by the bronchial arteries, speedily takes on the disease; fluid is thus poured into the cavity of the chest, whilst spongy, thickened mucus accumulates in the bronchial tubes. Even where recovery takes place, some traces of the disease long remain; the lung in places is hardened, mottled, and solidified; large scars mark the liquefying and removal of dead portions, which are also sometimes found enclosed in tough fibrous sacs; the surfaces of the pleuræ are roughened and opaque, and the opposing surfaces often connected by shreds of lymph.

Treatment.—The disease, since its first appearance in this country, has gradually become more amenable to treatment, and, under rational management, more than one-half of the cases now affected recover. Some practitioners, indeed, have been successful in ten out of twelve, but few can boast of so high an average; and it is still advisable, where a beast in good condition is affected, to have him taken to the shambles without delay. As exudation occurs so early—before, indeed, anything is observed to be amiss—blood-letting and other reducing agents are quite inadmissible. Provide the patient with a cool, airy, comfortable house; give, four times a-day, from 25 to 30 drops of Fleming's tincture of aconite, or about eight times the quantity of the weaker Pharmacopœia tincture; order small doses of some saline medicine, such as two ounces each of nitre and common salt, which will help to keep up the action of the bowels, skin, and kidneys; bandage the legs, and lightly clothe the body; interdict all solid food, but allow thin mashes, treacle water, cold water, or whatever simple fluids the animal will drink of its own accord. Where the bowels are costive, laxatives must be given; but they must be used cautiously, as the intestines are apt to be very irritable. By the second or third day counter-irritants are serviceable. Apply to the side, or sides, for several hours continuously, sacks or horse-cloths wrung out of boiling water, and subsequently rub in mustard paste, or equal parts of cantharides and euphorbium. If no change for the better occurs about the third or fourth day, give three times daily an ounce each of ginger and gentian, with four drachms of sulphate of iron, or half-ounce doses of commercial sulphuric acid dissolved in about a quart of water. Where there is debility, arrested secretion, and cold extremities, give several times a day a quart of warm ale, with an ounce each of ginger, and cardamoms, fenugreec, or other aromatics. Three-ounce doses of sweet spirit of nitre, or a quantity of whisky toddy with aromatics, may be substituted if preferred. Recovery may be expected when the appetite returns, the milk is more freely yielded, and the breathing and pulse become more natural; but great care must be taken that the animal does not eat too freely, as dangerous indigestion is apt to occur. A mash diet, with plenty of treacle and a little wheat flour and oil-cake, is better at first than solid food requiring rumination. Nitre and salt (two ounces of each) must be given daily, to keep the excretory organs in action, and expedite the removal of the products of inflammation. To prevent the extension of the disease, enjoin strict separation of the sound from the sick, and pay particular attention to ventilation, cleanliness, and the general comfort and health of the herd. Inoculation, where fairly tried, is found quite ineffectual, either for prevention or cure.

Chronic Cough is in all animals a common consequence of catarrh and bronchitis. It consists in an irritable state of the mucous membrane of the throat; is exceedingly common amongst cows that have been long kept in badly ventilated or over-heated hovels; is easily excited by exercise, sudden changes of temperature, or other trivial causes; and is usually treated by blisters and setons, an occasional laxative, a few doses of calomel and opium, or a combination such as a drachm of extract of belladonna, two drs. of camphor, four drs. of Canada balsam, given, beaten up with an egg, in gruel or treacle and water. For the horse, a few months' run at grass is sometimes serviceable. Where this is unattainable, and the animal cannot be spared from work, it is recommended to apply in the hollow underneath the lower jaw a flat piece of iron about the size of the face of an ordinary hammer at a red heat, and repeat the application every ten days or a fortnight. Thus held to the skin for a few seconds, the hot iron induces slight blistering, and is said to operate beneficially in the cure of hunting and steeple-chase horses subject to chronic cough and irritability of the throat. For the dog, apply to the throat soap liniment, with a little strong ammonia in it; feed upon soups and light diet; and give twice daily a pill containing three grains each of extract of belladonna and James' powder, made up with Canada or Peruvian balsam.

ROARING, WHISTLING, ETC.—Roaring, in strict language, consists of wasting of some of the muscles of the larynx, in consequence of which the cartilages fall inwards at every *in*-spiration; and the calibre of the passage being thus diminished and obstructed, the air, in passing along, produces a peculiar roaring, grating noise, and in aggravated cases a sort of flap. These sounds are especially obvious when the inspirations are deepened and quickened by galloping the horse, or threatening him with a stick. A roaring noise is occasionally observed during *ex*-piration, and in such cases usually results from some morbid condition of the bronchial tubes. Another variety of roaring is occasionally met with, produced by tumours in the loose mucous tissue at the root of the epiglottis, which, when they fall into the passages, cause suddenly great aggravation of the symptoms and impending suffocation, from which, however, the animal speedily recovers. Such horses are known in some parts of England as *Bellones*, and often show little defect in their wind until put to draught work, when they fall down nearly suffocated. High blowing generally results from thickening of the nasal mucous membrane, whilst whistling commonly depends upon chronic disease of the larynx, or wasting of its muscles similar to what occurs in roaring. These defects constitute unsoundness, are usually hereditary, and often result from protracted colds. Roaring and whistling sometimes supervene from strangles or phlebitis, owing to their interfering with the healthy nutrition of the muscles of the larynx. From the constrained position of the head, and the consequent unnatural pressure on the larynx, they were also wont to be of frequent occurrence amongst the tightly reined up carriage-horses once so fashionable.

These chronic defects of the wind are incurable, unless when depending upon the presence of tumours, which may usually with some care be removed. They may, however, be palliated by occasional laxatives and sedatives, and by the general treatment recommended below for thick and broken wind. Pads pressing upon the false nostrils relieve somewhat the breathing in cases of roaring; and when there is serious disease of the upper air-passages, tracheotomy may be performed, and a tube kept inserted, with which I have seen a draught horse work well and regularly for years.

Thick-wind consists in a thickened, corrugated condition of the mucous membrane of the ultimate air-cells and remoter bronchii, and usually results from repeated or serious attacks of bronchitis. The breathing is accelerated; the number of expirations and inspirations are equally increased, and are accompanied by a loud wheezing noise, which is particularly observable during exertion. Any sudden movement, a sharp trot, or even an unexpected blow upon the ribs, produces a short, dry, loud cough. Dilatation and rupture of the air-cells, constituting what is technically termed *emphysema*, is a common consequence of protracted cases of thick-wind; whilst grunting and some descriptions of roaring also depend on a thickened condition of the mucous membrane of the throat and lungs.

Treatment.—Thick-wind may be palliated and occasionally cured by sedatives. Professor Dick recommends the combination of a scruple each of calomel, opium, camphor, and digitalis. A safer mixture in unprofessional hands may be made with a drachm each of nitre, opium, and camphor, repeated once or twice daily before the animal is fed, and continued for two or three days. I have found in many cases much benefit to follow from the daily use of a bolus containing a drachm each of nitre and extract of belladonna, and eight grains of arsenic. The complaint may also be greatly mitigated by using easily digestible nutritive food of small bulk, supplying one or two pounds daily of linseed cake, feeding regularly and often, limiting as much as possible the quantity of water by allowing the animal to drink at frequent short intervals, and permitting an hour to elapse between feeding and work.

Broken Wind is characterized by a double effort in expiration, and a hollow, indistinct, muffled cough, similar to that of a roarer, and easily excited by steady pressure upon the larynx. The nostrils are rather dilated, and the ribs and abdominal muscles employed to aid in respiration, the latter producing by their contraction a line extending downwards and forwards along the flank. The animal is generally a gross feeder, a greedy drinker, apt to eat litter and dirt, pot-bellied, and prone to expel flatus *per ano*. Broken wind is apt to be produced by overloading the stomach either with food or water, especially immediately before severe or fast work. It occasionally occurs in horses turned out to grass, from their galloping about with overloaded stomachs. It is often hereditary, frequently follows cases of chronic cough and thick-wind, and is more common in mares than in horses or geldings. Improved management renders it less common than it once was; and it now chiefly prevails in the midland and southern counties of England, and where horses are kept on bulky food, and remain unfed in the yoke for seven, eight, or nine hours together.

Broken wind appears to consist in a deranged or paralyzed state of some of the nerves or nervous centres, most probably of the parvagum, —an opinion borne out by the fact, that when that nerve is cut, symptoms are produced, even during the short time the animal survives the operation, closely resembling those of broken wind. The parvagum being paralyzed by some of the causes above mentioned, the functions of the bronchial tubes and lungs, to which it is abundantly distributed, are thus disturbed; whilst the digestive organs and heart, to which it also extends, are involved, and frequently after death exhibit distinct traces of disease. The prevailing opinion, that the complaint depends upon dilatation or rupture of the air-cells, is untenable; for these conditions occur in most hard-worked aged horses, in many men and cattle, and are, moreover, produced artificially in dogs and rabbits, without causing in any of these cases the peculiar symptoms of broken wind.

Treatment.—Many specifics are recommended, but without much permanent advantage. Large quantities of hog's lard, or other oleaginous substances, or lead pellets, are used by the lower class of horse-dealers; and for a few hours these substances, given fasting, have a considerable effect in mitigating the symptoms. The same result follows the use of large doses of belladonna or opium. Purgatives, by reducing the amount of the alimentary contents, have a similar effect. But in confirmed broken wind no remedies entirely remove the distress in breathing, or alter the character of the cough. The horse, however, may usually be rendered serviceable for moderate slow work by giving him good food in small quantity and at frequent short intervals, bruising his oats, and cutting his hay, and giving both slightly damped; allowing, besides dry food, small quantities of carrots or turnips, restricting the amount of fluids, and feeding and watering at least an hour before work. An occasional laxative dose of aloes is also useful, as horses with bad wind are unusually liable to indigestion. Asthma, frequently occurring amongst dogs, probably depends upon similar conditions to those producing broken wind, and is relieved by similar treatment, and especially by ten drops each of ether and tincture of balladonna, given every hour until the breathing becomes easier.

DISEASES OF THE HEART AND ORGANS OF CIRCULATION.

Diseases of the heart, and its covering the pericardium, occur in horses, cattle, and dogs, sometimes as distinct diseases, often in connection with other maladies, such as influenza, pleurisy, and typhoid pneumonia in horses, rheumatism in cattle, and rheumatism and distemper in dogs. Inflammation of the heart is rare, and when it does occur, it is in consequence of contact with the inflamed pericardium. Enlargement of the heart and thickening of its walls is occasionally met with in old horses, often in connection with long-standing lung disease, and is recognised by a weak, fluttering pulse, in which one or two beats appear to intermit, or are left out; a loud, widely-diffused sound is heard at each contraction of the heart; the animal is weak, and loses flesh. Tincture of the chloride of iron given thrice daily, a daily dose of digitalis, a liberal dietary, and cessation from hard labour, are the best palliatives. The large valves separating the auricle from the ventricle, especially those on the left side, occasionally become diseased, producing irregularity of the circulation, and alteration of the normal sounds of the heart. In old horses, and sometimes also in cattle, the semilunar valves on the aorta become clogged with earthy deposits, or otherwise injured, inducing want of appetite, blowing, inability for exertion, and dropsical swellings, with an irregular or intermittent pulse. Inflammation of the pericardium, or pericarditis, often accompanies pleurisy, and is indicated by a quick strong pulse, distinct vibrations conveyed to the hand when held over the heart, and acute irritative fever. It requires much the same treatment as pleurisy, but will not stand blood-letting. As a result of the inflammation, fluid is sometimes poured into the pericardiac sac, when the circulation becomes weak and irregular, the contractions of the heart produce a thrilling sound, and are spread over a wider surface than natural, dropsical swellings appear, and the patient is weak, yet will not lie down. The treatment in cases of heart disease is unsatisfactory, and mainly consists in quietness, immunity from hard work, good, easily digestible food, and tonics combined with diuretics.

Aneurisms result from the fibro-serous external coat of the blood-vessels giving way, generally from fatty degeneration; the other coats gradually bulge; and, although lymph is often naturally poured out to arrest the evil, rupture is apt to occur. In the lower animals, however, aneurism is rare, except in the case of the anterior mesenteric artery, which, in many horses and all asses, is found, as it leaves the aorta, considerably enlarged, with an areolar structure of bands passing across it, and filariæ usually present. In the horse, fatal aneurism of the internal carotid sometimes occurs, where the vessel, dilated and tortuous, passes through the *foramen lacerum basis cranii.* Bright scarlet arterial blood trickles down both nostrils, gradually increases in quantity, until the eyes, nose, and mucous surfaces become blanched, and the animal slowly dies. Treatment is hopeless, for the vessel cannot be reached to be tied. Such cases, although extremely rare, must not be mistaken for the venous bleedings which frequently occur in purpura hæmorrhagica, glanders, and other cases, and depend on the giving way of some small superficial vein. The blood, in such cases, is dark-coloured, usually comes from one nostril only, and may generally be easily stayed by keeping the head elevated and applying cold. Astringent solutions injected into the nostrils are of little avail, as they cannot with any certainty be applied to the seat of the injury.

THROMBUS is a simple swelling following bleeding, caused by bruising the parts in repeatedly striking at the fleam, or by drawing up the skin whilst pinning the wound. It consists in extravasation and coagulation of blood in the cellular tissue, between the skin and the vein; occurs both in horses and cattle; most commonly follows bleeding from the plate vein ; and is treated by fomentations and pressure, and when affecting the jugular, by keeping the head up.

PHLEBITIS, or Inflammation of the Veins, in horses usually affects the jugular vein, and results from the vessel or adjacent skin being bruised during the operation of bleeding, from the wound being clumsily or roughly pinned up, from hair or a clot being included between the orifices, from the animal rubbing himself, or from bleeding in mange or other irritable states of the skin. The edges of the wound become red, swelled, and covered with matter. Lymph is exuded on the outer coat of the vein, whilst the blood inside flows tardily, or stagnates altogether, and hence the vessel, especially above the wound, becomes hard and corded. Occasionally the inflammation extends to the brain, destroying life. Sometimes it entirely obliterates the vein, constituting unsoundness, and often giving rise to swellings of the head if the animal is turned out to grass. Cows, although often roughly handled before blood can be drawn, are not subject to phlebitis. Poultices or hot fomentations, and keeping the head up and the animal quiet, generally effect a cure ; but when, after several days, the vein still continues corded, a blister must be applied, taking care, however, to keep it away from the irritable orifices.

DISEASES OF THE URINARY AND GENITAL ORGANS.

Inflammation of the Kidneys, or Nephritis, is not a very common disease amongst the lower animals. In horses, it usually results from the eating of musty, heated hay, or damp, kiln-dried oats; from hard water, to which the animal has been unaccustomed; and occasionally from large doses of diuretic medicine, and strains of the muscles of the back or loins. I have seen it occur in young cattle pastured in plantations, probably from their devouring shoots of trees rich in resinous matters, and prone to irritate the kidneys. The animal is feverish, his pulse quick, often reaching 100; he strains, straddles in his gait, and voids high-coloured and sometimes bloody urine. The cortical vascular structure of the kidneys is found, after death, soft, friable, and gorged with blood; whilst the peritoneal coverings also show evidence of inflammation. Bleeding is apt to reduce the strength unduly, and most success attends the use of mild laxatives, such as a pint of linseed oil, laxative clysters, ten drops of Fleming's tincture of aconite, given every three hours; a fresh sheepskin (with the newly-flayed surface inwards) placed over the loins, and replaced if possible every six hours, warm clothing to other parts of the body, friction and bandages to the legs, a mash diet, and an ounce or two of bicarbonate of soda or as much pipe-clay as the animal will readily take stirred into his water.

Inflammation of the Mucous Membrane of the Bladder is seldom met with in veterinary practice. Its symptoms, however, are usually very distinctive. The membrane becomes so irritable, that the urine is evacuated almost as rapidly as it enters the bladder; but the discharge, although very frequent, is rarely bloody. The bowels participate in the irritation, and are unduly open; there is straddling in walking, and in cows tenderness of the udder. Similar symptoms also indicate the presence of calculi and fungous growths, both of which are, however, rare amongst the lower animals, and may usually be readily discovered by manual examination. The treatment is similar to that of inflammation of the kidneys, omitting the laxatives, and encouraging the animal to drink freely of water, or mild mucilaginous fluids.

Bloody Urine, or Hæmaturia, proceeds from disease of the mucous membrane of the kidneys or other parts of the urinary passages, from fungous growths, or from strains of the muscles lying underneath the loins. It is best treated by quiet, laxative food, emollient clysters, and sheepskins to the loins; but where it continues in spite of such remedies, and appears to result from weakness of the parts, administer astringents, such as sulphate and sesquichloride of iron, or gallic and sulphuric acids. Red water will be treated of under the head of Diseases of the Blood. A variety of bloody urine occasionally affects young cattle, especially males; is accompanied by febrile symptoms, with irritation and straining during and after micturition; and is best treated by laxatives and cooling sloppy food.

Inflammation of the Uterus or Womb, also called Hysteritis, occurs occasionally amongst all animals; but is more common in the cow and ewe. It occurs within ten days after parturition, results usually from rough treatment during labour, is most frequent in young animals, and is often accompanied by inflammation of the peritoneum. Following the dulness which ushers in the complaint, there are febrile symptoms, accelerated breathing, and straining at intervals, with the discharge from the vulva of a brownish, bloody fluid, which in fatal cases becomes very fœtid. The womb must be carefully syringed out with tepid water several times daily, hot fomentations diligently applied to the loins, the bowels kept open with gentle laxatives; the pain, fever, and straining combated by aconite and opium, or belladonna: and, as recovery takes place, the system strengthened by good food, and sulphate of iron, gentian, and other tonics, given several times a day.

Leucorrhœa, Fluor Albus, or the Whites, affects cows either shortly after conception or after parturition, depends upon a relaxed and depraved state of the mucous membrane, and is often connected with some chronic uterine disease. The discharge is white, odourless, and flaky, devoid of irritant effects, unaccompanied by loss of appetite, pain, or fever, and usually, when of long duration, destroys the sexual appetite. It is readily distinguished from the natural lochial discharge which succeeds parturition, and which is brown and inodorous. Administer three-quarters of a pound or a pound of salts, two ounces of ginger, and half a pound of treacle; and with a long, smooth syringe, inject into the uterus plenty of tepid water, and subsequently a solution of a drachm of sulphate of zinc to a quart of water. Tonics, with small doses of turpentine and cantharides, are also often serviceable.

Bull-burnt, or Gonorrhœa, consists of inflammation of the urino-genital mucous membrane, and of the lips of the external organs of generation. It i of rare occurrence either in horses or dogs, but is more frequent amongst cattle, originates either in the male or female, and is most common in hot weather. There is restlessness, uneasiness, and slight fever, and the urine is passed drop by drop, often with straining, and always with pain and scalding. The interior of the canal is spotted with minute pustules, and moistened by a muco-purulent fluid. The disease is most serious in the male, in which, when neglected, it is apt to lead to the formation of unhealthy ulcers or chancres, warts, and fungous growths. Give a saline laxative thrice a week; inject tepid water thoroughly to cleanse the parts; and follow up that with a solution of sulphate of zinc or acetate of lead, in the proportion of a drachm to a quart of water. Unless in slight cases, the bull, when affected, must be cast, his penis drawn out and washed, chancres or warts lightly dressed with nitrate of silver, and a solution of sulphate of zinc poured into the sheath. The dressing of the penis must be repeated every four or five days, and injections, first of tepid water, and then of astringents, used daily. Sexual intercourse must, of course, be prohibited for at least a fortnight after perfect recovery takes place.

Inflammation of the Udder, Garget, or Mammitis, is more common in cows than in any other of the lower animals. It usually occurs soon after calving, and in cows that have previously milked well, but occasionally affects young heifers that have never had a calf. Sometimes the inflammation affects the mucous membrane and skin of the udder, when the cow is said to have "a cold in the udder," and when the thin investing skin becomes thickened, dry, hot, tender, and apparently bound to the parts beneath, and the diminished quantity of milk is sour and curdled. Sometimes the inflammation attacks the more deep-seated vascular textures—the secreting cells and lactiferous tubes—when hard, nodulated swellings may be felt amongst the looser, softer structures, affecting one, two, or occasionally all four quarters of the udder; and in this latter case, usually coming on suddenly, and becoming very intractable. Exposure to cold, indigestion, leaving the cow imperfectly milked, allowing her to carry her milk too long, overdriving, and the improper use of milk tubes, are the more common causes of mammitis. It occurs, too, in connection with badly treated cases of murrain; and in its deep-seated form, and accompanied by swellings of the joints and other forms of rheumatism, it appears in autumn amongst barren cows turned off to feed.

Treatment.—When the disease comes on suddenly from causes acting upon the general system, and is accompanied by febrile symptoms, bleeding may be necessary, but will not stand repetition. A dose of common or Epsom salt must be given, along with treacle and ginger; as much nitre as the animal will readily take, put amongst her water; the bowels kept open by laxatives, and the kidneys in action by nitre or other diuretics. The local treatment must be regulated by the parts affected. When the udder is dry, hot, and tender, indicating inflammation of its mucous structure, cold applications answer best. A broad web of cloth, at least two folds thick, should be put round the cow, and secured by stout tape or soft roping passing round the quarters; holes cut in it to keep out the teats; and a good supply of well-teased tow or wool put in round the udder, and kept constantly cool and moist by being frequently wetted with melting ice and salt, sour milk and water, salt nitre and water, or an ounce each of salt, nitre, and muriate of ammonia, mixed in a quart of water and applied immediately. When the swelling and hardness indicate inflammation of the deeper seated parts, the udder must be well supported by the bandage just advised; but, instead of refrigerants, heat and moisture are preferable, and the tow or wool must for a couple of days be kept saturated with frequently renewed supplies of boiling water. The application whether of heat or cold, to be of service, must be continued properly for at least a day, the temperature and moisture being attended to at short intervals. In all cases, the milk must be drawn away every two or three hours; and if milking is attended with pain, a syphon should be used. Hard swellings remaining as a result of inflammation are best reduced by friction, continued twice a day for an hour at a time, the hand being occasionally rubbed over with flour or lard to prevent injury of the skin. Ointments appear chiefly beneficial on account of the friction employed in their application, and the swellings are usually so deeply seated, that the ordinary modes of treatment are comparatively useless. An ounce of ammonia, two ounces of olive oil, and a drachm of iodine, is occasionally useful; but all powerful stimulants and blisters must be avoided, and are generally injurious, especially in cases where there was heat and tenderness at the outset of the disease. Pus occasionally forms in the deeper seated parts, is indicated by pitting and softening of the surface, and is evacuated by free incisions. When the inflammation has been very violent or badly treated, mortification occasionally ensues, when in most cases one-half of the udder gradually drops away.

Abortion is the expulsion of the contents of the pregnant womb before the full period of gestation is completed. Although uncommon amongst the other domesticated animals, it is frequent in cows, and especially in those that are well bred and highly kept. It may take place at any time between conception and parturition, but is most common between the ninth and eighteenth weeks, and almost invariably occurs about one of those periods which would correspond, if the cow were barren, with one of the periods of heat. When the calf has been carried for several months, the premonitory signs are tolerably well marked: there is a brown discharge from the vagina, sudden enlargement of the udder, with looseness and fulness of the external organs of generation. These symptoms may continue for several days, and, if noticed before straining or other signs of calving have appeared, the animal should be copiously bled and placed in a comfortable loose-box, moderately supplied with soft, laxative food, and, if the bowels be torpid, with a pound or two of treacle daily. Purgatives are too irritant, and must therefore be studiously avoided. Two ounces of laudanum, with the same quantity either of sweet spirit of nitre or of chloroform, must be given twice a day until all danger is over, and cold water dashed at intervals over the loins. To prevent the continuance and spread of the evil, place the cow by herself as soon as she aborts; remove and bury the fœtus beyond the reach of other cows; feed off the cow, if practicable, but if she be again bulled, it ought not to be for several weeks, and until the period of heat is passing off; remove all disagreeable smells; and see that the rest of the herd is moderately fed and carefully watched, so that the earliest symptoms of abortion may be noticed. A cow that has aborted once is apt to do so again at the same period of pregnancy, and ought therefore at that time to be carefully noticed.

Blows, leaping, and other such shocks and injuries, occasionally induce abortion; most commonly, however, it results from less tangible causes, which, from their affecting the system, react upon the womb, and disturb the connection between the mother and fœtus. Thus, if cows in the same pasture or herd abort (or even calve), others, becoming cognisant of the fact, probably through the sense of smell, are also apt to abort, especially if they have ever done so before. Bad smells probably induce the complaint much in the same manner; whilst flooded meadows, and rich, stimulating food, disturb the digestive organs, from which, through the nervous chain of connection, the irritation is communicated to the womb.

DISEASES OF THE BRAIN AND NERVOUS SYSTEM.

INFLAMMATION OF THE BRAIN, or Phrenitis, is characterized by dulness and sleepiness, passing on to excitement and madness, and hence its two apparently incompatible popular names of sleepy and mad staggers. In the earlier stages it is sometimes mistaken for stomach staggers; but the pulse is strong and firm, not slow or oppressed, the animal is feverish, more easily roused, and when roused is excited. As the sleepy symptoms, which continue during the stage of congestion, pass off, the eyes become more red and staring, the pulse quickened, and the animal unconsciously dashes himself about, and endeavours to run down any one that comes in his way. He becomes unable to balance himself, and falls blowing, panting, and struggling. In horses, the symptoms extend over one or two days, and in cattle and sheep usually somewhat longer. The *pia mater*, the vascular internal membrane of the brain, is the seat of the disease, and is found after death rough and yellow, with lymph extravasated between it and the arachnoid; there is serum at the base of the brain, and increased vascularity of the brain surfaces in contact with the inflamed *pia mater*.

Treatment.—Bleed at once, and in the horse or cow to the extent of nine or ten quarts; give a full dose of medicine, such as six drachms of aloes and a drachm of calomel for the horse, and a pound and a half of equal parts of common and Epsom salt, with twenty croton beans, for cattle; throw up laxative clysters, and apply cold water, salt and water, or other refrigerant mixtures, to the head. Avoid blisters to the poll, which are apt to irritate, and keep plenty of attendants in readiness, to prevent the animal from injuring himself. A second bleeding is rarely justifiable; but if the medicine does not operate in twelve hours, repeat the same physic in half the dose.

The disease prevalent amongst sheep in some parts of Scotland, and known as Louping-ill, is generally regarded as inflammation of the membranes of the brain and anterior part of the spinal cord, is believed to be connected, in the majority of cases, with derangement of the digestive organs, usually kills four out of five of the sheep affected, and is best treated by purgatives and change of pasture, with a supply of nitre or common salt in covered troughs, and an allowance of oil-cake.

Epilepsy, Fits, or the Falling Sickness, occurs in all animals, but especially in dogs and highly bred pigs. The senses of sight and of hearing, and all the brain functions, are suspended; and the animal, contorted by involuntary spasms, falls with jaws closed, tongue protruded, eyes rolling, and legs thrown about. Cattle bellow fearfully, but seldom die from it; but dogs are apt to be suffocated, and in them it becomes a common cause of sudden death. The attack usually passes off in from ten to fifty minutes, leaves the animal dull, and is apt to return. The disease depends upon some abnormal state of the brain, generally resulting from debility, plethora, constipation, or intestinal worms; and occurs in dogs in connection with distemper, and in cattle, usually from eating tough, indigestible food. Hot weather and excitement are apt to develop the fits, which often come on amongst sporting dogs during exposure to the full rays of a noonday sun, and just when they have made "a point." The first attack, when energetically treated, often prevents the recurrence of the malady. Give, when the fit is over, an active purgative, with an ounce of oil of turpentine in horses or cattle, and twenty to forty drops in dogs; and if worms are suspected, employ the remedies already recommended for such cases. When the animal is in good condition and full of blood, light unstimulating diet should be enjoined, but bleeding is rarely advisable. Animals subject to epilepsy are generally, however, in a debilitated rather than a plethoric state, the nervous centres often appear to be inadequately nourished; and hence good feeding, cod liver oil, and other oleaginous matters, tonics, and especially iron, are often serviceable. Amongst dogs, in cases thus accompanied by weakness, I have often seen good results follow from the combination of a grain of quinine and a tenth of a grain of arsenic made up with conserve of roses, and repeated twice or thrice a day. To nourish and stimulate the faulty nervous structures, it has been proposed to administer phosphorus, in the form of an etherial tincture, which, according to the French Codex, is made by macerating four grains of phosphorus with an ounce of sulphuric ether. For horses and cattle the dose of this tincture would be from ten to fifteen drops, and for dogs from three to five drops, repeated thrice daily. In the human subject, bromide of potassium and extract of belladonna have recently been tried, but without any very encouraging results.

Meagrims or Vertigo is the term usually applied when a horse at work reels, and then either stands for a minute dull and stupid, or falls to the ground, and lies for a few minutes partially insensible. These attacks are usually periodical, are most frequent during hot weather, and when the animal is drawing up a hill or exposed during heavy work to the full rays of a hot sun. Liability to meagrims constitutes unsoundness ; but unfortunately is not, in ordinary circumstances, detectible by any known test. It differs both from chorea and epilepsy in the absence of spasms, and probably depends upon the brain circulation being temporarily disturbed by the presence of tumours. It has been traced to tumours in the choroid plexus, saculous deposits in the velum interpositum, and enlargement of the pineal gland, and may also, in some instances, result from the circulation of some blood poison. Horses subject to it should be driven with a breastplate or pipe-collar, so as to prevent pressure on the veins carrying the blood from the head ; the bowels should be kept in good order ; an occasional laxative is advisable, and a course, either of arsenic and quinine, or of arsenic and iron.

Sturdy, or the Gid, affects both cattle and sheep, especially the latter ; is caused by the presence in the brain of a hydatid called the *cænurus cerebralis*, which floats in a serous fluid contained in a sack or bladder. It attacks sheep from six to eighteen months old, and is most common in low damp pastures. The animal reels and is stupid, strays from its fellows, does not feed, turns round and round on one spot, usually towards the side on which the hydatid lies, and, unless relieved, gradually dies of starvation. Many experienced flock-masters consider it to be hereditary, and shepherds pretend that, from the shape of the head, they can recognise the lamb which, as he grows older, will fail from sturdy ; but the most common cause certainly consists in the lambs or young sheep picking from the pastures the ova or larvæ of the tape-worms which are dropped from dogs, rabbits, and even from the sheep themselves. These minute ova are swallowed and taken up from the intestinal surfaces with the particles of the food, and thus gaining access to the blood, they find a suitable nidus in the soft loose textures of the brain, where they are laid down, while, to limit the injury they might otherwise inflict, nature speedily encloses them in a membranous sac, and in a few months they reach the size of a hazel-nut. The ova of the fluke-worms affecting the liver of sheep, when swallowed by lambs, probably also induce the hydatid of sturdy ; and these hydatids of sheep, when swallowed by dogs, conversely give rise in them to tape-worms. —(See p. 480.)

Treatment.—A stout stocking wire thrust up the nostrils has long been used, with occasional success, to get rid of the hydatid; but the use of the trochar and canula now sold by most surgical instrument makers is much safer and better. The sheep is placed, with its feet tied, upon a table or bench, and the head carefully examined, when a soft place may often be detected, indicating that the hydatid lies underneath. A portion of the skin is dissected back, and the trochar and canula introduced, when the hydatid will often come away as the trochar is withdrawn. If not, it must be drawn to the surface by a small syringe, of which the most convenient is that recommended by Mr Neil Ballingall, late of Kingsdale, and sold by Mr Hilliard, Nicolson Street, Edinburgh, and other surgical instrument makers. The wound heals readily, with simple water-dressing, underneath a leather cap. This treatment is equally applicable to cattle.

Rabies arises spontaneously in dogs and other members of the canine and feline species, and is communicable by their saliva to the horse, cow, and sheep, and also to man, in whom, from the singular abhorrence of water, the disease is styled hydrophobia. In the dog there is dulness, perverted and depraved appetite, thirst, paralysis of the muscles of deglutition interfering with swallowing, a peculiar doleful howl, and great irritability; but although the animal snaps almost involuntarily at objects near him, and quarrels with his neighbours, he is seldom violent unless annoyed or roused. Similar symptoms appear in horses and cattle, which tremble, stagger, get rapidly furious, sometimes endeavour to bite, but more generally attempt to run at and trample down those that come in their way. Such symptoms usually show themselves in from two to eight weeks after the animals have been bitten. Besides other less important post-mortem appearances, the Eustachian cavities and back part of the throat are vascular, and the membranes of the brain and upper part of the spinal cord injected.

Treatment is hopeless. The symptoms, however, may be temporarily relieved by injecting tepid water into the veins, and giving large doses of chloroform and belladonna. Whenever an animal has been bitten by another that is rabid, a ligature should at once be put on above the injury, the whole of the bitten parts excised, and the wound then washed and thoroughly cauterized with solution of nitrate of silver, nitric or sulphuric acids, tincture of the chloride of iron, or any fluid caustic.

CHOREA, or ST VITUS' DANCE, consists in irregular involuntary motions, which the patient is unable to control, and which, even when very violent, do not occasion fatigue. It results from a peculiar morbid or excited condition of some portion of the motor tract of the spinal cord, brought on by worms or other intestinal derangement, by spiculæ of bone pressing upon the cord, or by the pressure of fluid infiltrated into its coverings as a consequence of such disorders as influenza in horses, or distemper in dogs. It is most frequent in dogs, less so in horses, and still less so in cattle, sheep, and pigs. In dogs it produces, as in men, irregular intermittent twitchings of the limbs or head, scarcely arrested by sleep, most obvious when the animal is disturbed, rarely proving fatal, but difficult of cure when of long standing or in adults. In horses its symptoms are not so continuous as in dogs or men, and are much less obvious at one time than another. They put on many appearances, affecting sometimes the back and loins, and producing a staggering, reeling gait; sometimes the head and neck, causing the animal to throw up his head and run backwards, especially if suddenly struck under the chin. Sometimes the nervousness shows itself when the bridle or saddle are being put on, and sometimes when the animal is being shod. Mr Thomas Dunn, police contractor, Edinburgh, had some years ago a horse that was thrown into spasms when his foot was lifted, especially by a stranger. But by far the most common form of chorea in horses is a convulsive catching up of the limbs, usually of one or both hind limbs, during action, especially when the horse is first brought out of the stable, and familiar to horsemen under the name of stringhalt.

Treatment.—In young animals chorea frequently depends upon intestinal irritation, and in such cases is usually remediable; but in adults scarcely one case in ten is curable. All may, however, be palliated by an occasional dose of physic, good feeding, and tonic medicine. For the horse, give twice daily two drachms of sulphate of iron and five grains of arsenic in a ball, or two drachms of carbonate of ammonia and an ounce of Fowler's solution, which contains four grains of arsenic. For dogs, give quinine and arsenic as recommended in epilepsy, or two-grain doses twice a-day of valerianate of quinine or of sulphate of zinc; attend to the feeding and general comfort, insert a seton in the nape of the neck, and try a few warm and afterwards some cold baths.

TETANUS or Lock-jaw consists in a peculiar irritable state of the spinal cord, producing continued spasms of the voluntary and involuntary muscles. It occurs in all animals, but particularly in horses and sheep. It is caused by undue exposure to wet and cold, by intestinal worms and obstinate constipation, and by wounds, especially pricks, saddle-galls, and injuries in the neighbourhood of ligaments and nerves. In young animals it is generally dependent on constipation or exposure to cold. Two varieties are described: traumatic tetanus, or that caused by wounds; and idiopathic, or that resulting from other causes; but the distinction is unnecessary and unscientific, for, although the cause differs, and the lesion in one case is visible and in the other invisible, the disease is nevertheless the same. The nose is poked out, the haw of the eye protruded, the tail upraised, the muscles hard and rigid, the gait straddling, and the bowels constipated. The symptoms in the lower animals are not confined, as is often the case in man, to one set of muscles or one part of the body. They come on gradually, and reach their full intensity usually in three or four days, and the more rapidly they are developed the more serious is the case.

Treatment.—Keep the animal perfectly quiet, and in a cool, airy, darkened loose box; clothe him comfortably, and bandage his legs; place a freshly-flayed sheepskin over his back and loins, and renew it every eight or ten hours; give him a full dose of physic, such as six drachms of aloes in solution with a drachm of calomel or eight croton beans, and supply him with as much soft sloppy food and nutritive drinks as he will take. If the medicine can be got over tolerably easily, and without annoying the patient, give, rubbed up with a little water, four drachms of extract of belladonna and an ounce of chloroform every three or four hours. The Woorara poison has been found serviceable in the practice of the London College. Nicotina has been used with marked advantage in several cases occurring in man (see page 440). Where the operation does not increase the spasms or cause annoyance, tobacco smoke clysters should be thrown up every two hours until the bowels are opened. Advantage often seems to follow from the use of a hot smoothing-iron, applied repeatedly, at intervals of three or four hours, over one fold of a horsecloth along either side of the spine from the head to the tail. Some practitioners clothe the animal in four or five rugs, with the hopes of getting rid of the disorder by profuse perspiration; whilst others senselessly and cruelly endeavour to bring the irritation of the spinal cord to the surface by pouring boiling water along the back several times a day. Any accessible wound must be fomented or poulticed. Bleeding, sedatives, and all reducing remedies, as well as blistering, setons, and every cause of irritation, are injurious.

Paralysis occurs in the lower animals from severe falls, tumours in the ventricles, softening of some part of the brain or spinal cord, or pressure on these important organs from fluid effused as a consequence of such diseases as influenza in horses or distemper in dogs. It mostly affects the hinder parts, occasionally one lateral half of the body. The appropriate treatment consists of laxatives, good food, warm lodgings, the hot smoothing-iron applied along both sides of the spine twice daily, friction, pitch plasters, and the administration of small and gradually increased doses of nux vomica or strychnia, as advised under these articles, p. 351.

Puerperal or Milk Fever occurs within a few days after parturition, and is of two kinds. One, common to most animals, consists in inflammation of the membranes of the womb and intestines, and is produced by exposure to cold, overdriving, or injury inflicted during parturition. The other, almost peculiar to cows, occurs only in those that are well bred, and have previously yielded large quantities of milk, and is seldom met with before the fourth calving. The large quantities of blood that have, till the time of parturition, been nourishing the calf, are not as yet diverted into their new channels for the production of milk. If at this critical period the bowels are constipated, and the udder does not at once take on its functions, this superabundance of blood soon becomes a source of mischief. It produces congestion, and subsequently inflammation of the brain and nervous centres; serum is poured out, causing by its pressure impairment of motion and sensation, arrestment of secretion and excretion, a sluggish, almost imperceptible pulse, and slow, stertorous breathing. Such are the prominent features of congestive puerperal fever, or, as it is more properly called, parturient apoplexy.

Treatment.—In the first stages of the disease the cow must be freely bled, and receive a very large dose of physic, such as three-quarters of a pound each of common and Epsom salt, a drachm of calomel, and twenty powdered croton beans, with two ounces of ginger, dissolved in five or six bottles of water. The animal must have no solid food, but as much thin gruel, salt and water, or treacle and water, as it will drink. Clysters should be given occasionally, and the teats drawn at short intervals. When the animal is down and getting insensible, bleeding does more harm than good; but if it can still swallow, give the above purgative, with two ounces of ether and one of solution of ammonia; repeat the ether and ammonia every hour; turn the cow from side to side at intervals, to solicit the action of the torpid bowels;

and apply along the spine boiling hot water, a hot smoothing-iron, or a mustard blister. Clothe warmly, to excite the action of the skin; ascertain the state of the bladder, and if full and paralyzed, empty it at least once daily with the catheter; cover the udder with flannel, to favour the secretion of milk; and apply to the head and neck several folds of calico, which must be kept cool and moist by the frequent application of cold water or refrigerant mixtures. Mr Aitkin of Dunfermline has found nux vomica, given in doses of from one to three drachms, and repeated twice daily, of much value in ensuring and expediting recovery. To prevent the disease, restrict the allowance of food for some time before calving; for a week previously draw the teats several times daily, and get away as much milk as possible; and give occasional doses of purgative medicine, for at this time the bowels are apt to be in a torpid state.

DISEASES OF THE EYE AND ITS APPENDAGES.

Common Ophthalmia, or Inflammation of the external parts of the eye, occurs in all animals. The mucous membrane covering the eye and lining the eyelids is liable to become inflamed from blows with a whip-lash, from the presence of hay-seeds, chaff, or other such foreign bodies, from exposure to cold, or from influenza, strangles, or distemper. In all animals the eye is watery and half-closed; the membrane looks thickened and rough, and its vessels, scarcely seen during health, stand out red and tortuous. Removal of any foreign body with the fingers, forceps, handkerchief, or camel's-hair brush, bathing repeatedly with tepid water or milk and water, and a mild purge, will usually accomplish a cure. The parts, after being well fomented, may be washed with any mild stimulant, such as ten drops of Goulard's extract, three grains of nitrate of silver, or five grains of alum to an ounce of water.

Specific Ophthalmia, or Moon Blindness, affects the choroid coat and its several processes; is produced by causes which act not locally, but on the system as a whole; often co-exists with a rheumatic diathesis; is engendered by foul air and impure stables; is notoriously hereditary; prevails especially amongst Irish horses, and is also said to be common in the sandy and chalky districts of France. To the symptoms of common ophthalmia are speedily added febrile symptoms, a marked intolerance of light, and opacity of the cornea, concealing for a time the internal parts; but when these, after a few days, become visible, the deeper seated parts of the eye are found to be yellow and muddy-looking, from infiltration of lymph. The inflammation is very prone, on the slightest exciting cause, to return again and again, or affect first one eye and then the other, until one or both is destroyed. An attack of ophthalmia generally leaves the eye smaller than its fellow, more intolerant of light, the cornea dull, the margins of the pupil uneven and ragged, the movements of the iris impeded by adhesions, the interior of the globe of a leaden hue, with shreds of lymph floating in the aqueous humour, or embedded in the lens or its capsule. This condition of the lens and its capsule constitutes what is technically called a *cataract*. This may vary much in size, being sometimes a speck, scarcely perceptible, and interfering very slightly with vision; at other times large, with white lines passing outwards in every direction, and causing nearly total blindness. Eyes having any of these appearances must be regarded as unsound.

Treatment.—When the pain and febrile symptoms are acute, bleeding is serviceable; a dose of physic must also be given, and a ball containing five drops of Fleming's tincture of aconite, a drachm each of extract of belladonna and powdered colchicum, and four drachms of nitre made up with linseed meal and treacle, and repeated every three hours until eight or ten doses have been given. Instead of this, six or eight doses of a scruple of calomel and drachm of opium are sometimes recommended, at intervals of three or four hours. The horse must be removed to a cool, comfortable, darkened loose box, kept upon spare diet, his eye bathed with warm water or well steamed several times a day, for an hour or two at a time, and his orbits smeared with extract, ointment, or tincture of belladonna. After the second day, blisters round the orbit and setons in the poll are recommended, both as expediting recovery and preventing the recurrence of the attack. The bowels must also be kept open by laxative food, a small dose of nitre given in a mash every night, and the eye carefully protected from cold. Specks on the cornea, the result of inflammation, usually disappear in time; but their removal may be expedited by touching them gently with a pencil of nitrate of silver, or by washing them with a solution of three or four grains of sulphate of zinc, acetate of lead, or nitrate of silver, to the ounce of distilled water. Similar astringent solutions are sometimes used for cataracts, which, although they occasionally diminish in size as the animal grows older, are generally in horses quite irremediable.

EPIZOOTIC OPHTHALMIA.—An epizootic form of ophthalmia occasionally attacks cattle and sheep, and prevailed in many of the dairy counties of England in 1850. Cattle under a year old usually suffer most, and in largest proportion. The lids are closed; acrid tears flow over the face, leaving scabs where they go; the eyes are blood-shot, the iris red, the cornea pearly, and the sight almost irretrievably destroyed. The best treatment consists in removing those affected to a shed or house, giving a dose of physic, applying to the eyes linen cloths saturated with Goulard's extract diluted, and inserting a seton behind the ears. Give, besides, plenty of good laxative food, and when the discharge subsides, and the eye is less bloodshot, discontinue the Goulard's extract; wash the eyes daily with a solution of nitrate of silver, containing four grains to the ounce; and paint over the orbits with tincture or extract of belladonna.

GUTTA SERENA, Amaurosis or Glass Eye, is a comparatively rare disease, not occurring in more than one horse in a hundred. The optic nerve, or its finely divided filaments distributed on the inner surface of the eye, and constituting the retina, are either unable to receive, or unable to convey to the brain the impressions that fall upon it. The pupil is enlarged, round instead of oval, and varies less than it should do in full light or in darkness; whilst the interior of the eye is clear, deep-blue, luminous, appears beautifully healthy, but is nearly blind. When both eyes are affected, the horse's high action, and the constant movement of his ears, should lead to a critical examination of the eyes. Depending, as it generally does, upon disease of the brain, or of the nerve of sight, the cure is generally hopeless; purgatives, generous feeding, and strychnia, may, however, be tried. Where the amaurosis has come on from a severe fall, blisters applied to the back of the head, laxatives, diuretics, and tonics, will sometimes accomplish a cure. Occasionally, temporary amaurosis occurs from indigestion, and may be removed by purgative medicine and properly regulated diet.

DISEASES OF THE SKIN.

SURFEIT bears considerable resemblance to the nettle-rash of children, and, like it, usually proceeds from derangement of the digestive organs. Sudden changes of food and copious draughts of water sometimes produce it; but it often comes on suddenly and without any obvious cause, is most common in spring and autumn, and occasionally becomes epizootic. Tumours about the size of small beans, and containing a watery fluid, suddenly appear over the body or limbs, sometimes cause much itching, but, unlike many other skin affections, are not contagious. A dose of physic and a few diuretic balls afterwards will usually accomplish a cure. Washing with soap and water, which is sometimes recommended, is apt to increase the itching of the skin, which should be kept dry, and only lightly clothed with a calico covering. Boiled barley for some days should take the place of oats and beans, and the hay be given cut, and sprinked with salt and water. The bowels should be kept moderately open, and regular exercise given. When the swellings do not disappear, as they usually do, as suddenly as they came, small doses of calomel and opium, or a course of arsenic, may be tried, and the affected parts sprinkled with oxide of zinc, or sponged with a diluted solution of bleaching powder or of chloride of zinc.

ECZEMA.—During the hot months of summer some horses are subject to an intolerable itching eruption, which becomes worse when the animals are heated, and indeed renders them sometimes perfectly unmanageable. They will rub themselves until the skin is sore and raw, and occasionally become so violent, that travest posts and mangers are levelled to the ground. To superficial observation the skin presents nothing remarkable, but closer inspection will discover numbers of minute elevations, closely aggregated, and filled with a watery fluid. Soon the skin becomes thickened, red, and angry-looking, and the hair dry, short, and bristling. The surface is sometimes hot and dry, at other times bedewed with clear, and occasionally with bloody fluid. Coarsely bred horses are most subject to it, and the quarters and hind limbs, especially on the inside, are usually first and worst affected. An inherent hereditary tendency to it occurs in some horses; and when once it has appeared, it is apt to recur annually so soon as the hot weather sets in. It is probably a symptom of a peculiar state of the blood, and is developed and aggravated by rich, generous feeding. It occasionally occurs in cattle. Amongst dogs it attacks especially those that are pampered, highly fed, and allowed to lie too near to the fire, appears first on the inside of the arms and thighs, and is sometimes described as red mange. It is, however, perfectly distinct from mange, which is characterized by scurfiness and subsequent baldness, and wants the minute vesicles and fiery redness of eczema.

Treatment.—Administer a dose of purgative medicine, such as three or four drachms of aloes with a scruple of calomel for the horse, and a bolus of calomel and jalap for the dog. The local irritability is usually very promptly relieved by using a lotion made with two ounces of Pharmacopœia tincture of aconite, or two drachms of the Fleming's tincture, to a pint of water. Another good remedy consists of chloride of zinc, in the form of Sir William Burnett's disinfectant fluid, diluted with about forty parts of water, and rubbed in with a soft brush, once or twice daily. The second application, either of the aconite or of the chloride of zinc, will usually remove all itching, and in a few days the skin will resume a healthier appearance. The compound solution of iodine (see p. 282) is also sometimes useful, as well as solutions containing about four grains of corrosive sublimate to the ounce of water. In obstinate cases, give small doses of arsenic until the system is brought fully under its influence. Laxative medicine and green food expedite the cure; and in horses green food is probably the best preventive.

MANGE in horses, dogs, and cattle, and SCAB in sheep, are essentially the same disease, and result from the attacks of minute animalcules of the order of mites or acari, which burrow in the skin, especially if it is dirty and scurfy, cause much irritation and itching, and the eruption of minute pimples, with dryness, scurfiness, baldness, and bleaching of the skin.

Treatment.—Similar treatment is applicable in all animals, and chiefly consists in destroying the acari on which the disease depends. Wash the affected parts thoroughly every second day with soft soap and water, and dress daily with sulphur or mild mercurial ointments, or with a solution containing four grains either of corrosive sublimate or of arsenic to the ounce of water. My friend Mr Thomas Pritchard, of Madras, informs me, that the best of the remedies he has tried is that used by the native farriers, and consisting of castor oil seeds well bruised, steeped for twelve hours in sour milk, and rubbed smartly into the skin, previously thoroughly cleansed with soap and water. The itchiness disappears almost immediately, and the acari are speedily destroyed. An ounce of tobacco made into an infusion with a quart of boiling water, a pint of oil of turpentine, and a pound of soft soap, dissolved together in a gallon of water, make a good dressing for scabbed sheep. An ounce each of tobacco and white hellebore to two pints of water, is an old and well-approved remedy both in scab and mange. I have used with marked benefit solutions of Burnett's disinfectant fluid, containing about an ounce to a quart of water; iodide of sulphur and linseed oil; and a mixture of a pint each of train oil and oil of tar with two or three ounces of creasote. In slight cases, soap and water, with corrosive sublimate or arsenical solutions, will speedily effect a cure; but in more aggravated cases of longer standing, where the acari abound, the skin is unhealthy, and the system debilitated, much patience is required, the applications must be frequently changed, generous feeding allowed, small doses of salt and nitre given several times a week, with a course of arsenic and iron. The system, for a week or ten days, may be advantageously kept fully under the influence of carefully regulated doses of arsenic. Benefit also sometimes follows the use of an ounce each of oil of turpentine and sulphur, administered daily for a week. Where, from the rubbing and scratching, there is much irritation and heat, as often occurs in dogs, much relief is afforded by applying a few drops of tincture of arnica and chloroform, or of tincture of belladonna or diluted prussic acid, either in a little glycerine, or along with the usual dressing.

To prevent the spread of the evil, those affected must be kept by themselves; and all horse-cloths, harness, or other articles that have been in contact with them, should be thoroughly washed and cleaned before they are again used. Cleanliness, and occasional washing and friction of the skin, by maintaining it in a healthy condition, prevent its being a suitable nidus for the acari, and hence greatly diminish the prevalence both of scab and mange.

Ringworm consists of a parasitic growth of organic cells on the surface of the skin; is most common amongst young animals, especially young dogs; is decidedly contagious, and communicable from man to the lower animals, and probably also from the lower animals to man. Commencing with a small spot, usually about the head or neck, or root of the tail, it produces a scaly white scurf, usually dry, but sometimes moist, and always exhibiting much tendency to spread. The parts affected must be well washed with soap and water, lightly run over with a pencil of nitrate of silver, and subsequently treated with alternate dressings of mild mercurial and iodine ointments. Coal tar, and the ointment of the red iodide of mercury, also make effective dressings. Another good application consists of an ounce each of sulphur and iodide of potassium, with half an ounce of iodine, made into a liniment with eight ounces of oil of tar.

Mallenders and Sallenders consist in a scurfiness of the skin, the former being located in the back of the knee, the latter in front of the hock. In many cases they depend upon, or are kept up by, some derangement of the digestive organs, are aggravated by bad grooming and want of cleanliness, and are removed by washing the parts with soap and water, applying mild mercurial ointment, or any of the astringent solutions recommended for mange, and giving an occasional laxative, with a dose of nitre once a week.

Grease is a diseased condition of the skin of the horse's heels, causing pain, swelling, and redness, and accompanied with a pink-coloured, offensive, oily discharge. In aggravated cases the oil glands and hair follicles become inflamed, and filled up with proud flesh, constituting grapes. Wet, cold, and filth are the direct causes of grease. They remove the natural oily secretion which, in health, keeps the skin about the heels soft and pliant, and inflammation is thus induced. Coarsely bred, heavy horses, on full feeding, frequently get greasy about the heels from standing idle, depending upon the parts becoming congested from want of exercise, and oil being poured out in larger quantity than required. The hind limbs being most exposed to wet and filth, most commonly suffer, and white heels are more subject to it than dark.

Treatment.—Wash the parts thoroughly with tepid water after work, clean them with a soft brush, sprinkle them over with dry oxide of zinc or acetate of lead, and allow plenty of dry litter. Before going to work, smear the heels with a mixture of one part of acetate of lead and four of soft soap; but this must be washed off, and the dry dressing applied when the horse comes in. When the skin is much inflamed and grapes are present, a poultice is useful, until the tenderness is removed. To the poultice, charcoal, yeast, a little diluted Condy's fluid, or bleaching powder, may be added to abate the noisome odour. When the poultice is removed, the surface must be dusted over with oxide of zinc or sugar of lead; or, if so irregular that the dry powder does not reach to the bottom of the cracks, use an ounce of Burnett's solution of chloride of zinc to a quart of water, the white lotion (p. 464), or any other convenient astringent solution. Grapes are removed by the scissors, or by strangulating them with a piece of stout waxed thread, and dressing the surface as already advised for grease. A laxative diet, and diuretics twice a week, will expedite the cure; but, except in slight cases, the limb never recovers its natural size and smoothness.

Laminitis, or Acute Founder, is inflammation of the vascular sensitive laminæ of the horse's foot, and is included under the head of skin diseases, for these laminæ are merely extensions of the true skin, adapted to particular purposes. In draught-horses it usually proceeds from stomach staggers or over-eating; whilst, in the lighter breeds, it results from hard work, from standing in cold water when hot and exhausted, from standing for several weeks on shipboard, or from such complaints as rheumatism, influenza, or superpurgation. It most commonly affects the fore feet, seldom the hind, unless when all four are involved. In the worst class of cases the symptoms come on suddenly. The feet are hot and tender, the animal walks upon his heels; and when the fore feet are alone affected, they are projected forwards, whilst the hind are brought far under the body. As the laminæ are firmly bound down by the unyielding hoof, there is no room for exudation and swelling, and the pain and consequent fever are very acute.

Treatment.—Copious blood-letting must at once be ordered. Besides abstracting three or four quarts from the jugular vein, some practitioners also bleed from the toe, by cutting into the quick with a fine drawing knife, and then placing the foot in warm water, until a sufficiency of blood is obtained. Many careful veterinarians now trust entirely to the local bleeding, which promptly relieves the congested vessels, and forms, besides, a vent by which serum or any other inflammatory products are readily removed. Immediately after bleeding give eighty minims of the Pharmacopœia tincture of aconite, or ten minims of Fleming's tincture, and repeat the dose every hour, until six or eight doses are given. Laxatives may be used if necessary, but always with extreme caution, as the bowels are very easily acted upon. Clysters usually suffice. The shoes must at once be removed, and the toe, if long, moderately reduced; but all rasping and cutting of the crust, as well as frog-setoning, are very injurious. Envelope the feet in hot poultices, have the horse slung as recommended by Mr Greaves of Manchester, or cast him, and get him to lie, which he will generally do after the first restlessness is over, and the relief from pain is felt. By slinging or keeping the animal lying, weight is removed from the inflamed laminæ, the pain and fever are much diminished, and the pulse, in the course of a few hours, often falls fifteen or twenty beats per minute. When the symptoms continue for several days, serum and lymph are poured out between the laminæ; and if an exit has not been already provided in bleeding from the foot, an opening must be made with a small drawing knife in the toe, where the crust meets the sole. Towards the end of a week, cold applications and blisters to the coronet are useful. When laminitis occurs in connection with, or as a sequel of, diseases of the internal organs, it is difficult of cure, will not stand blood-letting or purging, and is best treated by eight drops of Fleming's tincture of aconite, and a drachm of extract of belladonna, given in gruel every hour for six or eight doses, the feet being poulticed, and the animal either slung or kept lying.

Sitfast, Warbles.—From unequal bearing or pressure of the saddle, collar, or harness, inflammation is sometimes set up in the skin, producing exudation of serum and lymph. When the swelling is recent, hot, and tender, it must be kept constantly wetted with a strong cold solution of salt and water, or sugar of lead and water; and the application of the cause avoided by fresh padding to the faulty harness, and keeping linen or soft leather, instead of coarse woollen stuff, in contact with the part. When the tumour is of long standing, hard, and comparatively insensible, it is termed a sitfast, and is best treated by blistering, by laying over it a little of the active biniodide of mercury, by inserting through it a small seton, or by dissecting it out. Warbles in cattle are very common in some seasons; depend upon the irritation produced by the deposit and growth of the larvæ of the œstrus bovis; and are removable by lancing, or puncturing with a red hot iron wire.

Warts consist in a morbidly increased growth of the cuticle or outer layer of the skin, depending upon undue vascularity of the true skin. Sometimes they reach an enormous size, especially when about the navel. If narrow at the neck, when they are generally termed *Angle-berries*, they may be strangulated, and will drop off without hemorrhage in a few days, by tying tightly round them a piece of waxed whip-cord. The wart, when broad at its base, may be taken away by the knife, the blood-vessels being closed by touching them with a hot iron, or tying. Such warts, if small, may also be readily removed by cautiously dressing them, at intervals of several days, with a mixture of one part of arsenic to eight of lard. Calomel is also useful; and, in cautious hands, sulphur, made into a paste with sulphuric or nitric acids. When tough, horny, and broad at the base, remove as much as possible with the knife or scissors, and then dress the remainder at intervals of a few days with the hot iron, or with an ointment of arsenic.

DISEASES OF THE BLOOD AND SYSTEM IN GENERAL.

Murrain, Vesicular or Aphthous Epizootic, first appeared in the south-eastern parts of England about 1836 or 1837, and has since spread throughout most parts of the island. In Scotland, however, it has generally been less serious than in England or Ireland; but, as is the case with most epidemic and epizootic diseases, its severity has gradually diminished. Contagion is the common cause of its diffusion, as is established by its slow and steady spread, by its being mostly traceable to communication with diseased animals, by its frequent occurrence in the neighbourhood of large fairs, and also by the fact, that it has scarcely ever existed in certain localities where strict measures have been adopted for keeping the stock out of the way of contagion. It is an eruptive fever, affecting cattle, sheep, pigs, and poultry, but very rarely attacking either horses or men; it consists in a peculiar inflammation of the mucous membranes and skin; and is characterized by the appearance of vesicles or little bladders on the mucous surfaces, and those parts of the skin uncovered by hair. The vesicles appear in the mouth and along the tongue, inducing irritation, drivelling of saliva, and inability to eat; on the udder of milk cows, rendering it hot, swollen, and tender; and between the digits, causing pain and lameness. The animal is feverish, the appetite impaired, and in milk cows the secretion of milk is diminished. In sheep the feet suffer most.

Treatment.—The disease, as is the case with the other eruptive fevers, whether in man or the lower animals, runs a fixed and determinate course, the eruption cannot safely be arrested, and good nursing constitutes the chief treatment. Soft, easily digested food should be given if the animal will eat it, but should not be forced upon it. The bowels, which are very irritable, and covered with vesicles similar to those in the mouth, may be kept in good order by occasional doses of treacle, with two ounces each of nitre and sulphur. In bad cases, the mouth must be sponged several times a day with tepid water, and then with any mild astringent solution, such as half an ounce of alum, oxide of zinc, sugar of lead, or Condy's disinfectant fluid, to a quart of water. Mashes acidulated with vinegar are also useful, especially in pigs. When the teats and udder are involved, the animal should be milked very frequently, the tender parts bathed with tepid water both before and after milking, and dressed with a little oil. The feet in ordinary cases only require to be kept clean, but in serious cases fomentations and poultices are useful; and after the vesicles have come fully out, the parts should be kept wetted with cold salt and water, and dusted occasionally with oxide of zinc. As the skin is irritable and apt to slough, supply plenty of dry litter; and if the joints begin to swell, give nitre, and foment with hot water. Like other eruptive fevers, murrain seldom attacks the same individual a second time, except after an interval of several years; but during the visitation which prevailed so extensively during the spring and summer of 1861, secondary and even tertiary cases were observed.

STRANGLES is an eruptive fever peculiar to the horse, attacking him chiefly when young, contagious, but probably also producible by other causes. It is characterized by sore throat and cough; a thick, yellow, muco-purulent discharge from the nostrils; some difficulty of breathing; and the eruption of a hard inflammatory tumour in the subcutaneous cellular tissue, between the branches of the lower jaw, which matures, and, in about ten days from the first appearance of the disease, bursts. This is the normal form of the complaint, but in some seasons strangles assumes various irregular forms. Severe catarrh or sore throat sometimes precedes the formation of the intermaxillary tumour; sometimes the tumour comes on very tardily, or does not suppurate properly, goes back and appears in some other part of the body, as inside the thigh, underneath the shoulder-blade, or, still worse, in some of the internal organs. This last issue may be suspected when the tumour beneath the jaw does not come properly forward, when there is wasting, prostration of strength, and derangement either of the respiratory or digestive organs. *Bastard strangles*, or the vives, occurs in old horses that have already had ordinary strangles, and in connection with influenza or other epizootics; the abscess forms slowly, and usually imperfectly.

Treatment.—Blood-letting, physic, sedatives, and irritant dressings, are all of them highly injurious; for they interfere with the natural course of the malady, which, like other eruptive or exanthematous diseases, such as murrain in animals, and scarlatina and measles in man, cannot, without danger, be arrested. The great aim is the healthy maturation of the abscess in the natural site, between the branches of the lower jaw. Keep the animal cool, but not cold. Undue warmth is to be avoided, as it prolongs the catarrhal stage. Encourage the animal to eat bruised oats, boiled or malted barley, carrots, green food, or whatever he prefers; for nutritive food, by maintaining the health and strength, and perhaps also by causing movement of the jaws, favours the formation of the abscess. Except in the very mildest cases, steam the head and foment. Unless symptoms of suffocation appear, the abscess may be safely allowed to burst of itself, when the thickening and knottiness of the skin, the result of premature lancing, is avoided. Blisters are only requisite when the tumour is tardy in maturing, and is not hastened by steaming and hot fomentations. When the animal loses its appetite, its flesh and its strength, and the tumour does not come forward properly, besides steaming, fomenting, and blistering, give nutritive food, and small doses of sulphate of iron or other tonics, with a bottle or two of ale daily. I have known many valuable colts saved by good nursing and the liberal employment of port wine given night and day in frequent small doses.

DISTEMPER is a typhoid inflammation of the upper air-passages of dogs; affects especially, and most severely, the more delicate varieties; occurs mostly in young animals; is nearly allied to those contagious eruptive fevers, such as strangles in horses, murrain in cattle, small-pox in sheep, and scarlatina in men; and, like them, probably depends upon the gradual maturation of a blood poison, which is either naturally present in the system, or introduced by contagion, and which nature endeavours to throw off in the eruption or discharge accompanying and characterizing such diseases. The animal is dull, and his appetite capricious, his eyes red, his nose stuffed with slimy mucus, which, also accumulating in the lower respiratory passages, interferes with the due aeration of the blood, and increases the characteristic debility. From perverted nutrition of the nervous centres, or from their being pressed upon by serous effusions, the gait becomes unsteady and staggering, and various nervous complications, such as spasms, chorea, and epilepsy, are apt to ensue. Within a fortnight the dog will usually be either convalescent, or sinking from debility, lung disease, dropsy, or some of the other complications which are apt to follow, especially in high bred and carefully nurtured animals.

Treatment.—In the earlier stages, give an emetic, such as a tea-spoonful of common salt, and a few grains of mustard flour, in two ounces of water,, or two grains each of tartar emetic and ipecacuan, in a wine-glassful of tepid water; and if this has no effect in half an hour, repeat the dose, adding ten grains of common salt. Gently open the bowels with one or two ounces of syrup of buckthorn, or half an ounce each of olive and castor oil, to which, in large dogs, and if the bowels be constipated, ten grains of grey powder may be added. Beware, however, of irritant purgatives, for the bowels are easily moved, and diarrhœa, if induced, is a most untoward symptom. If there is much fever, give two drops of Fleming's tincture of aconite, and five grains each of nitre and extract of belladonna in cold water four times daily. Withhold animal food, but give milk and bread or any of the simple farinacea; house comfortably, allow plenty of room, fresh air, and a dry bed; interdict exercise, which in weakly patients is very injurious; sponge the nostrils frequently with tepid water; and when the breathing is difficult, wring a piece of thick flannel out of boiling water, place it round the throat and chest, repeat this every twenty minutes for about two hours, and then dry the animal well, and rub in some hartshorn and oil.

In the later stages, and when the animal is weak, emetics, sedatives, and purgatives are injurious. Indeed, so soon as the early febrile symptoms are somewhat reduced, and the bowels gently opened, the failing strength must be supported by frequent small quantities of beef-tea or good soup. After the first week, and even earlier, when the weakness is great, give a dessert-spoonful of port wine every two hours. Other tonics and stimulants, administered several times daily, are also often useful; such as—from two to six grains of sulphate of quinine made into a pill; five grains each of sulphate of iron and camphor, with ten grains of gentian; or five grains of camphor, ten grains of extract of belladonna, and a drachm of ether, given in cold water. Symptoms of nervous derangement must be combated by sulphate of copper and camphor, small doses of arsenic, a seton in the back of the neck, and other remedies already specified under chorea and epilepsy. Vaccination and inoculation, and all the vaunted specifics, are valueless as preventives; and prevention, even if possible, would scarcely be advisable, for the disease, we believe, is the natural outlet for the matured blood poison, of which the germs are present in the systems of most young dogs.

Small-pox in Sheep (*variola ovina*), although somewhat similar to small-pox in man, is a perfectly distinct disease, not communicable, either by contagion or inoculation, to goats, dogs, men, or children. Although common on the continent of Europe, it has fortunately been a rare visitor in this country. For the first time for at least a century, it appeared in Norfolk and the eastern counties of England in 1847, and in the summer of 1862, in Wiltshire, near Devizes. In both cases it appears to have resulted from the introduction of variolous sheep, or infected skins, from the continent.

In ten days after exposure to contagion, the infected sheep become feverish, breathe hurriedly, have a muco-purulent discharge from the nostrils, a hot tender skin, and great thirst. Red inflammatory pimples appear, the eruption first showing itself where the skin is thin, as along the inside of the limbs. In about three days these pimples contain serum and pus, and become white. Some of the vesicles dry up, leaving brown scabs; others, especially in the severer cases, run together, and the scarf skin is detached, leaving an ulcerated surface. It is in this ulcerative stage that the prostration reaches its height, and that most sheep die. The mortality from small-pox in sheep ranges from 25 to 90 per cent.

Treatment and Prevention.—Like other eruptive fevers, variola ovina runs a fixed and determinate course; and hence the treatment mainly consists in good nursing, and a daily supply of bran, steeped oats, bruised cake, and other such tempting nourishing food, which will keep up the patient's strength, and enable it to live down the disease. If any medicinal agents are given, they may consist of a mixture of an ounce of sweet spirit of nitre and about thirty grains of chlorate of potash, repeated in a little water or ale several times daily. But the prevention is of more importance than the curing of small-pox. The disorder is so contagious, that a few diseased sheep speedily infect a whole flock; and where careful separation of the sick from the sound is not promptly effectual in arresting the progress of the disease, some further measures will be requisite. Vaccination has been proposed; but scarcely one-third of the sheep operated on take the vaccine pox, and even these are not protected from small-pox. Professor Simmonds, who has been a careful observer of both the recent small-pox visitations, reports more favourably of inoculation, or ovination, as he more properly terms it. In ten days after the sheep is inoculated, modified small-pox appears, runs a mild course, especially in young sheep, and is over, and all risk of contagion passed, in a fortnight. Nor is the mortality so great as has been represented. Out of 20,000 cases of inoculated small-pox, the losses do not reach five per cent.; and Professor Simmonds states, that where the operation has been carefully performed, they often have not exceeded two per cent. Neither exposure to contagion nor a second inoculation have any effect on sheep that have passed through this modified small-pox. Full details on this subject will be found in Professor Simmonds' excellent report, in vol. xxv. of the "Journal of the Royal Agricultural Society of England."

INFLUENZA is a catarrhal complaint, accompanied by typhoid fever, assuming in different seasons different types, and always tending to involve several different organs of the body. It belongs to an important class of complaints known as epizootic, and exhibiting certain marked characteristics. They extend at the same time over large tracts of country, attack in a similar manner great numbers of animals, tend to assume a typhoid form, and withstand badly all depletive treatment. They depend upon some general causes as yet unknown, but which it has usually been thought sufficient to term "atmospheric;" but are always most common and fatal amongst animals breathing impure air, densely crowded, badly fed, or exposed to cold winds; and are chiefly prevented, or robbed of their virulence, by guarding against such debilitating causes, and maintaining a high standard of general health. Such are the prominent characters of epizootic diseases, of which influenza, pleuro-pneumonia, and murrain, are good examples. The same class of diseases in man is termed epidemic. During the last few years, the following general visitations of influenza have occurred amongst horses,—viz., in 1848, 1852, during the first six months of 1854, in the close of 1856 and beginning of 1857, and in the early summers of 1862 and 1863. It is usually most common in the later spring and autumn months; is most severe and prevalent amongst young horses, and amongst the heavier breeds, which do not bear up under this, or indeed under any debilitating disease, so well as those with more breeding.

The earliest and most prominent symptom is weakness, soon followed by loss of appetite, shivering, a dry staring coat, a dull, sickly appearance, hanging of the head, a staggering gait, a quick, weak pulse, quickened breathing, an occasional short cough, with torpidity of the bowels and kidneys. This is the ordinary form of the complaint, and has been called, by way of distinction, catarrhal influenza. But the disease, as has been remarked, exhibits considerable diversity of form, according as it involves particular organs more or less severely. Thus, in the influenza visitation of the spring months of 1854, and in most of the cases which occurred in London during the summers of 1863 and 1864, the liver and other digestive organs appeared to participate in an unusual degree: there was impaired appetite, but increased thirst; a short cough; a soft, compressible pulse, usually reaching to seventy by the second day; a yellow, bilious-looking appearance of the mucous membranes; and light-coloured feces covered with slimy mucus. In these cases, besides the more ordinary post-mortem appearances, the liver, distended with dark blood, was unusually large, soft, and friable, and the intestinal mucous membrane discoloured, and exhibiting dark-brown patches. Again, influenza sometimes shows a dropsical tendency, when the eyelids, legs, and surface of the belly are covered with diffused, soft, pitting, non-inflammatory swellings. Sometimes it puts on a rheumatic form, when the back and joints are sore and stiffened; but whatsoever shape it bears, it early shows the characteristic weakness and typhoid fever.

When an unfavourable termination occurs, the dulness increases to stupor, the extremities get colder, the breathing more difficult and abdominal, the pulse quicker, weaker, and more irregular, and death occurs from the tenth to the twentieth day. The blood is found dark-coloured, and slow to coagulate ; the muscles soft and of a dull yellow hue ; the respiratory mucous membrane covered with bloody mucus, which, when wiped off, discloses a dark purple surface beneath ; the lungs are dark-coloured, and filled with dark, unhealthy, sickly-smelling lymph, the pleural cavities generally contain some serous fluid, and their walls are roughened by patches of feebly coagulated lymph ; the intestines exhibit purple spots, and are occasionally ulcerated.

Treatment.—Where bleeding, purging, and sedative remedies are heroically practised, the mortality is great ; but where rational medical treatment and good nursing are pursued, the loss should scarcely exceed one per cent. Place the animal at once in a cool, roomy, plentifully-littered, well-ventilated loose box ; clothe him lightly, and bandage his legs, and let his clothes and bandages be removed, shaken, and put on again, two or three times daily ; enjoin quiet and perfect rest ; keep the bowels in good order with soap and water clysters ; and avoid all active purgatives, which increase the weakness and the typhoid fever. Even when the bowels are costive, never prescribe more than two drachms of aloes, supplemented by the clysters. Give in a ball an ounce of gentian, four drachms of nitre, and two of salammoniac, night and morning, and, if possible, get the animal to take nitre in his mashes or water. Supply sparingly and often cooked food, carrots, or crushed corn and bran, with gruel and cold water to drink. Tepid water is unpalatable, and does not quench thirst ; and cold water never does harm, especially if allowed to stand for an hour in the animal's box.

When the cough or breathing is troublesome, give every three or four hours a drachm each of extract of belladonna and camphor, and an ounce of sweet spirit of nitre. in cold water ; steam the head, and rub the throat with soap liniment containing about a fourth part of strong ammonia. When the flanks lift, and the respirations are hurried, apply to the chest cloths wrung out of hot water, and then a blister. A piece of sheet-iron, immersed for a minute in boiling water and placed on the part, answers the same purpose, and appears to act more rapidly. When the breathing is much disturbed, and the animal is not too weak, a few doses of calomel and opium may be tried ; or five drops of Fleming's tincture of aconite, with a drachm of extract of belladonna and four drachms of nitre, may be repeated every two hours until six doses are given. Symptoms of returning health should be apparent by the third or fourth day, and consist in clearer eyes, firmer pulse, more equable and natural surface heat, a discharge from the nostrils, and some movements of the bowels. Recovery is ensured and expedited by good nursing, perfect rest, and the liberal use of such tonics as gentian, chloride of iron, bitter ale, and port wine, where its cost is not objected to. Quickening of the breathing and pulse, coldness of the legs and ears, and increasing weakness, are unfavourable signs, and indicate the necessity for more stimulants. Give every two hours, or oftener if there are symptoms of sinking, two ounces each of ether and of the medicinal solution of ammonia in a pint of ale; half an ounce each of carbonate of ammonia and camphor, with one or two ounces of ether in water; or a quart of warm ale, containing a wine-glassful of gin or whisky. If the animal will not eat, give several times daily a bottle-full of well-boiled gruel, to which some strong meat soup is a valuable addition, and have the legs and body warmly clothed, and well rubbed at intervals. In such cases of prostration, when other remedies seemed fruitless, my friend Mr James Farrall, of Dublin, has obtained the best results by transfusing slowly into the jugular vein about three quarts of blood from a healthy horse. A detailed account of his interesting and valuable observations will be found in the Dublin Quarterly Journal of Medicine for February 1858.[1]

Purpura Hæmorrhagica succeeds strangles, pneumonia, influenza, or even common cold; is peculiar to debilitated subjects; and depends upon the presence in the blood of some morbid matter which reduces its vitality, and renders it thin and imperfectly coagulable, probably by diminishing the quantity or altering the quality of the fibrine. The thin impoverished blood is imperfectly retained in the badly nourished vessels, and becomes extravasated on the mucous surfaces, producing ecchymosed spots in the nostrils, within the lips, and about the head. From these red or purple blotches blood constantly oozes.

[1] I have derived much of the matter embodied in this article from an excellent paper on Influenza, read at the Highland Society's meeting in February 1852, by the late Mr Barlow, whose memory as a most able and accomplished lecturer, an indefatigable and thoroughly scientific teacher, and a kind and Christian friend, will ever be held in grateful remembrance by myself and many others of his devoted and attached students.

Swellings appear in the cellular dependent parts, as about the head, sternum, belly, sheath, and hind limbs. They are tolerably firm, often as large as an infant's head, are well defined, with abrupt edges; but they do not follow the line of the absorbents as in farcy, nor are they soft or pitting as in simple anasarca. The overlying skin is hot, thickened, but not very painful. After a day or two it usually cracks, and exudes bloody serum, especially between the hind limbs where it is thin, or about the heels, where it is more vascular. The appetite soon fails, the bowels are irregular and irritable, the action of the kidneys is also very imperfectly performed. The pulse is quick and weak, and the general debility great. The swellings about the head and lips interfere with eating; and more serious still, purple extravasations similar to those within the nostrils, are apt to spread along the mucous membrane of the stomach and bowels, giving rise to indigestion, colic, and diarrhœa, or appear on the still more sensitive mucous lining of the bronchial tubes and lungs, producing blowing, a choking, suffocating cough, and dilated flapping nostrils, from which bloody serum trickles. In such cases prostration or suffocation carries off the patient usually in from two to eight days. After death the blood-vessels are found to contain thin black blood, which coagulates slowly and feebly, and is extravasated in patches on the mucous surfaces.

Treatment.—There is fair hope of recovery where the swelling is confined to the limbs, and even where the head is swollen to a slight extent; but when, instead of appearing externally, the extravasation is poured out on the mucous membrane of the lungs or bowels, the case is very hopeless. So irritable are the bowels, that even very moderate doses of purgative medicine sometimes cause dangerous irritation; and a laxative condition must accordingly be produced by soap and water clysters, and draughts of linseed tea. Saline diuretics must be given to counteract or remove the faulty state of the blood; and tonics and stimulants early and liberally used to support the strength. A good combination is made with two ounces of the solution of the acetate of ammonia, and an ounce each of turpentine and tincture of the chloride of iron, given several times daily, in a pint of water, of ale, or of gruel. Or, instead of this, give night and morning, two drachms each of sulphate of iron, gentian, camphor, and nitre, made either into a bolus or a drench; half an ounce of strong ammonia, with two ounces of sweet spirit of nitre, administered as a draught several times a day; and as much ale, gruel, and meat soup as the patient will drink of his own accord. To assist recovery, a bolus containing two drachms of sulphate of copper, a scruple of iodine, and a drachm of iodide of potassium, is sometimes useful; or one drachm of sulphate of copper, two of muriate of ammonia, and four each of gentian and ginger, may be given as a ball or drink twice or thrice daily. But in this, as in all other debilitating diseases, the greatest care must be taken in the use of these tonics and stimulants, which, although most valuable when cautiously used, are apt, when too freely given, to sicken and destroy the already capricious appetite. Against this error young practitioners must especially guard.

Besides medical treatment, an airy house is essential, with perfect rest, warm clothing, bandages, and occasional dry friction to the legs, and plenty of good nutritious food offered frequently, varied often, never forced upon the animal, and never, when he refuses it, allowed to lie long before him. To promote absorption of the swellings and extravasations, and to prevent sloughing, bathe the mouth and nostrils frequently with tepid water and vinegar, and subsequently moisten them with equal parts of Goulard's extract and tincture of arnica, diluted with forty parts of water. When sloughings occur, as they are apt to do, especially about the limbs, tepid water dressings, and very mild astringent applications, with tonics, stimulants, and plenty of good food, afford the best hopes of cure. When the lips are so tumefied as to interfere with eating, they must be diligently fomented and scarified, for all treatment will be fruitless if the animal is long unable to eat. The swellings about the sheath limbs and elsewhere will sometimes also require scarifying, and occasional sponging with some mild astringent lotion. When the swelling of the head and throat is so great as to threaten suffocation, tracheotomy may be performed.

Erysipelas is a typhoid inflammation of the skin and subcutaneous tissues, rarely occurring in horses, and distinguished by the eruption of hot, tender, nodulous swellings, usually appearing about the head or limbs, and of a more acutely inflammatory and deeper-seated character than those of purpura. Previous to their appearance the skin is rough, harsh, and thickened, and the animal more feverish than in purpura. The swellings remain hard and unaltered often for days, and then sometimes become absorbed; more commonly, however, the overlying skin becomes purple and spotted, from the decomposition of the blood and lymph within, and extensive sloughings supervene. Erysipelas is brought on in predisposed subjects by wounds, bruises, or any slight injuries; belongs to the same class of complaints as influenza and purpura; and, like them, appears to depend on the presence in the system of a blood poison, apparently engendered by reducing diseases, or other causes which interfere with the general health.

Treatment.—Debilitating treatment and cold applications are injurious. The bowels should be opened by a very small dose of medicine and laxative clysters; any febrile symptoms remedied by saline diuretics; tonics and stimulants, as recommended in purpura, given early; and the affected parts kept constantly wetted with a mixture of Goulard's extract and tincture of arnica, diluted with from 30 to 40 parts of water. Nutritive food, pure air, and general comfort, are equally essential. Free incisions, extending into the subcutaneous tissues, two or three inches in length, and in the proportion of two to every square foot, will relieve the pain and prevent sloughing.

SCARLATINA is ushered in by dulness, febrile symptoms, and sore throat. The animal is weak and unwilling to move, the skin is dry, harsh, and hot, the glands about the head and neck are swollen and tender, the bowels and kidneys act irregularly. The breathing is quickened, and the pulse small and numbering about sixty. In about two days the mucous membrane within the nostrils and lips becomes studded with scarlet spots about the size of a pea, which by and by run together. Except in the very slightest cases, similar ecchymosed spots also spread over the body, are most abundant about the head and neck, and are especially noticeable in light-coloured horses. In about a fortnight or three weeks, the hair falls from these spots on the skin, and the cuticle scales away, leaving bare patches. Dropsical swellings, painless and pitting on pressure, but not so large as those of purpura, nor so hard or painful as those of erysipelas, appear towards the second or third day about the head and legs. The disease appears to depend upon a slighter degree of the same causes as produce purpura or erysipelas; is, like them, allied to the eruptive fevers; runs its course in twelve or fourteen days; supervenes in cases of strangles and influenza; and occurs where the vital powers have, from any cause, been unduly reduced.

Treatment.—Running a fixed and definite course, medical treatment is only requisite to prevent untoward complications. What is chiefly necessary is, a cool, comfortable loose-box, bandages to the legs, a linen cover for the body, and over it a warm rug; two drachms each of nitre and of muriate of ammonia, and half an ounce of gentian given twice daily in a bolus, with small and frequently repeated doses of mild diuretics, tonics, and stimulants, such as have been already recommended in influenza or purpura.

Typhoid, Gastric, or Bilious Fever in horses seldom comes on very suddenly. The animal for a few days is dull and listless, has had a cold or an attack of strangles, or is suffering from influenza. He becomes restless and feverish, his mouth dry, hot, and of a yellow tinge, his bowels confined, his dung hard and coated with mucus. He is disturbed with colicky pains, and his belly is distended and tender. Occasionally sore throat and difficult breathing indicate that the bronchial tubes and lungs are involved. Signs of amendment are usually noticeable in eight or nine days. In less favourable cases the pulse becomes smaller and weaker, numbering 80 or 90; the mouth hotter, more clammy, and marked with yellow spots and blotches; the bowels more irritable and tender, and the strength gradually sinking. Death occurs sometimes in ten days, usually within three weeks.

Post-mortem examination discovers the blood everywhere dark-coloured and deficient in fibrine, forming soft semi-fluid dirty-like coagula. All the structures of the body are soft and badly nourished, yellow-looking, and emitting a peculiar sickly smell. The digestive organs exhibit, however, the greatest departure from health. The mucous membrane of the bowels is softened, thickened, and reddened, largely invested with a dirty greyish-yellow exudation, studded here and there with dark purple spots and occasional patches of ulceration. The spleen and liver are soft, and engorged with thin, dark-coloured blood.

Depending upon a deteriorated and poisoned state of the vital fluids, the prominent causes of typhoid fever are to be found amongst those circumstances which interfere with the general health and vigour, such as the breathing of an impure atmosphere, the drinking of water contaminated with decomposing organic matters, hard work, long hours, irregular and defective feeding, and such reducing disorders as strangles and influenza. With faulty sanatory arrangements, and especially with overcrowding and imperfect ventilation, typhoid fever may propagate itself by contagion. Its occasional spread throughout a locality appears, however, to depend, not so much on contagion, as on some wide-spread epizootic causes. These probably accounted for its prevalence in many parts of the country during the first six months of 1854, and again in London and the eastern counties of England during the close of 1861 and spring of 1862. Owing probably to overcrowding during the cold winter months, to the variable weather, and the animal's weakness incident to the changing of his coat, typhoid fever usually appears during the spring months, and scarcely a season elapses without a number of cases occurring in London.

Treatment.—Whilst the pulse continues firm and not too quick, the surface of the body warm, and the patient tolerably cheerful, a few doses of calomel and laudanum, or of tincture of aconite, will be serviceable. If the bowels are costive, two or three drachms of aloes in solution will be required, and a laxative effect afterwards kept up by clysters and mashes. Saline alteratives afford the best prospect of exerting any salutary change upon the blood. Repeat three or four times daily, either in a bolus or in solution in ale, a drachm each of chlorate of potash and muriate of ammonia, and after three or four days, or whenever dulness or weakness show themselves, add to this saline mixture an ounce of oil of turpentine, ether, or sweet spirit of nitre. Where abdominal tenderness and colicky pains are considerable, hot fomentations must be diligently used. Where flatulence is troublesome, let the animal be well hand-rubbed, and have occasional doses of ammonia, carbonate of ammonia, or whisky and water. So long as the strength can be supported, there is always good prospect of saving the patient. He must be well and generously supported, have a comfortable loose-box, warm rugs on his body, and flannel bandages on his legs, perfect rest and quiet, and any digestible and nutritive food he can be got to eat. Recovery may also be further aided by frequent small doses of gentian, chloride of iron, sound ale, or other tonics and stimulants.

Diabetes, Diabetes Inspidus, or Polyuria, occurs frequently amongst horses, occasionally assumes an endemic form, is usually conjoined with indigestion, and appears to depend upon some impoverished state of the blood. It occurs especially during hot weather, when horses naturally drink most, and amongst hard-worked subjects. It is developed by faulty feeding, as by the eating of musty hay, or stale, kiln-dried oats; by debilitating diseases, such as influenza and strangles; or by the suppression of secretions from exposure to cold, or from drinking freely of water when heated or exhausted. The characteristic symptom is thirst, which is almost insatiable,—eight or ten bucketfuls of water being easily drunk in a day. The urine is very abundant, clear, colourless, free of sweetness, and so deficient in solid matters that its specific gravity little exceeds that of distilled water. The animal falls off in condition, his coat is rough and staring, and by and by his appetite, at first voracious, fails, the blood becomes deteriorated, and the disease, if unchecked, often runs on to glanders.

Treatment.—Change entirely the diet; allow good sound oats crushed and moistened, boiled barley, cut hay damped, green food if obtainable, and gradually restrict the quantity of water, and endeavour to allay the insatiable thirst by giving, mixed with it, a little pipe-clay or bicarbonate of soda, and a few drops of tincture of the chloride of iron, of which, however, the quantity daily drunk must not exceed three ounces. Administer a gentle laxative if the bowels are out of order; and give thrice daily in water a drachm of iodide of potassium, a scruple of iodine, and four drachms of carbonate of soda. Twenty drops of creasote in an ounce of spirit, with water, is sometimes used. Tonics, such as sulphate of iron or copper, in two-drachm doses, are useful; and I have also seen used with advantage, in troublesome cases, an ounce daily of Fowler's solution (containing four grains of arsenic dissolved in carbonate of potash). See page 160.

Saccharine Diabetes, in which the urine is unusually abundant, and also charged with grape sugar, is unknown in cattle and dogs, but occurs, although rarely, in horses. The urine is of heightened density, owing to the presence of sugar, produced by the metamorphosis within the body of the starchy constituents of the food. The animal is very thirsty, and rapidly loses flesh and strength. The cure is difficult and uncertain; but the late Mr Barlow, Mr Prichard of Madras, and some other practitioners, have been successful. The animal must be restricted for some weeks to food devoid of starchy or other matters capable of yielding sugar, and for this purpose must be fed upon meat soup and cooked animal diet, to which he will soon become reconciled. Iodine, as above recommended in diabetes insipidus, must be given to counteract the intense thirst, and tonics and stimulants to support the strength.

Red Water, Bloody Urine, Black Water, Moor-ill, and Hæmaturia, are the names usually employed to designate a disease amongst cattle, of which the most characteristic symptom is the discharge of urine containing the colouring matters of the blood. Occasionally it affects sheep, but is unknown amongst horses or dogs. In Scotland it commonly attacks milk-cows within a fortnight after calving; in England and Ireland it occurs amongst all sorts of cattle, male and female, young and old. Appetite and rumination are irregular; the bowels, at first unduly open, become constipated; and then the alteration in the colour of the urine is first noticed. Gradually, if the disease is unchecked, the colour deepens, until, in a few hours or days, according to the severity of the case, it becomes perfectly black.

The debility and acceleration of the pulse increase, and the animal dies of exhaustion.

Red water is not, as is generally taught, a disease either of the kidneys or of the liver, nor yet even directly of the digestive organs, but of the blood, which, from faulty feeding or other causes, becomes altered and deteriorated,—its several constituents losing their vital affinity for each other, and its watery parts, with the red globules in solution, being drained away by the kidneys. Rank, coarse herbage, stringy, indigestible turnips, such as are met with in spring, and various irritant matters in the food, are its common causes, and favour the view that the disease depends upon a deteriorated state of the blood. This is also borne out by its frequent occurrence during the spring months, when the change in the coat makes unusual demands upon the system; and its prevalence amongst milk-cows, in whom there is, both during pregnancy and lactation, a great drain upon the nutritive parts of the blood. Corrosive sublimate lotions incautiously used induce artificial red water, and thus strengthen the evidence of the disease depending upon a faulty state of the blood, probably produced either from an insufficient supply of some of its nutritive matters in the food, from the introduction into the blood of some irritant matters acting like the corrosive sublimate, or from the retention of those effete particles which destroy the natural affinity amongst its constituents, as is well exemplified in such diseases as purpura and erysipelas.

Treatment.—The severity of red water differs materially; some cases recovering almost spontaneously in a few days; whilst others, in spite even of tolerably sound treatment, run on to a fatal termination. As a general rule, when the urine does not get black towards the second or third day, and the bowels are readily moved, the cure is comparatively easy. I know of one practitioner who, several years ago, had seventy consecutive cases without losing one. Blood-letting, although recommended by Messrs Youatt and Spooner, is decidedly injurious, as it retards the action of the bowels, increases the debility, and has no power to amend the faulty state of the blood. Diuretics are also hurtful. The diarrhœa present in the early stages, and doubtless naturally established for the purifying of the unhealthy blood, affords the clue to the rational and successful treatment. Instead of being checked by astringents, as is often ignorantly done, it must be encouraged, by giving half a pound each of common and Epsom salt, three or four ounces of sulphur, and a pound of treacle daily, to an adult ox or cow, until the bowels act freely. When difficult to move, fifteen or twenty croton beans may be given either with the salt or with a pint of linseed oil. Turnips and other roots should be withheld, and mashes, gruel, sound hay, or grass allowed, with as much water as the patient chooses. The tendency to weakness may be warded off by giving, several times a day, two ounces each of gentian and ginger in a quart of ale. When the urine is black, which is merely an advanced stage of red water, and not, as has been thought, a separate disease, the bowels must, if possible, be opened by some of the saline purgatives already advised, and the failing strength supported by an ounce each of ginger and gentian, four drachms of carbonate of ammonia, with two ounces of ether, given two or three times a day.

The disease may usually be prevented by good feeding, allowing the animals access to common salt, and avoiding, until they have been thoroughly drained and limed, pastures notorious for its production. Considerable tracts of dairy land in Cheshire, once useless for cattle on account of their developing red water, have been rendered perfectly healthy by draining, and subsequently dressing them with bones or superphosphate. Where such means fail, the pasture must be ploughed up, cropped for a few years, and again laid down.

Scrofulous or Tuberculous Diseases are common amongst the domesticated animals, and especially amongst cattle and pigs. Resulting from a faulty state of the blood, they consist in the deposition on the mucous membranes, in the structure of glands, and even in the bones, of a greyish-yellow, gluey, sticky matter, which, passing through a cheesy-looking stage, becomes hard and gritty. This is tubercle. Occasionally it is laid down on the membrane of the brain of calves and young pigs, and sometimes even of dogs and foals, giving rise to hydrocephalus, or water in the head. Occasionally it is deposited in the mesenteric glands, producing indigestion, wasting, and general prostration. But the lungs are its most common site, giving rise there to pulmonary consumption, or phthisis pulmonalis. This is a rare disease in the horse, probably because the same deteriorating causes which produce it in cattle and pigs give rise in him to glanders and farcy. Like other tuberculous complaints, it commonly results from hereditary predisposition—occurring in cows, for example, with small, thin necks, narrow carcases, hollow flanks, and dirty, scurfy, unhealthy-looking skins. Cattle of such conformation, if exposed to the debilitating influences of bad food, wet and cold, or reducing diseases, are very prone to fail either from consumption or dysentery. Continued breeding in and in is also very apt to induce and foster a scrofulous tendency. The tubercle, which usually chooses for its seat the upper and back parts of the left lung, soon causes irritation of the adjoining parts; a cough is set up, at first loud, free, and apparently unaccompanied by pain, but becoming, as the disease advances, more hoarse, frequent, and painful. Appetite and rumination are irregular, the animal thrives badly, is easily purged, blows if smartly moved about, and at intervals is feverish. The tubercles by and by soften, a nasal discharge comes on, the strength continues to fail, and the animal dies exhausted.

Dysentery.—In cattle the same tuberculous matter is often laid down on the mucous surfaces, and in the glands of the intestines, producing dysentery, rottenness, or the bloody flux,—a disease which frequently accompanies consumption, and hurries on its fatal termination. The animal is unthrifty; the coat staring, and long in being changed; the appetite irregular and capricious; the fluid dung, mixed with dark-coloured lumps and imperfectly digested food, is expelled with straining. The animal coughs, loses flesh, is thirsty and feverish; the bowels act very frequently, and, as a fatal termination approaches, the feces become very fœtid, and mixed with blood and serum; the blood gets thin and watery, and swellings appear underneath the jaws and in other dependent parts.

The treatment of scrofulous diseases is very unsatisfactory; for there is not only the local deposit to remove, but also the depraved condition of digestion and assimilation on which the local symptoms depend. In all animals the integrity of the system must be supported by generous diet, comfortable housing, and tonic medicines. For cattle and horses, the food, which should be frequently varied and nourishing, may consist of bruised oats, with bean and pease flour, linseed or oil-cake, and chopped hay, and must be given in small quantities, and often. A daily allowance of strong meat soup is also often serviceable. An ounce of the tincture of the chloride of iron with an ounce of gentian in solution, or three drachms of sulphate of iron in a bolus, should be given every morning, and the same quantity of carbonate of ammonia at night. One or two pounds of treacle may be given daily when the bowels are costive, but active purgatives and all irritating and reducing remedies must be carefully avoided.

In the earlier stages of dysentery, a few ounces of linseed oil beat up with an ounce of laudanum and the white of an egg, and given in gruel, is generally useful in clearing the bowels of their irritating contents, and allaying feverishness. To reduce the discharges, adopt the system of feeding above recommended, and give a drachm each of powdered sulphate of copper and opium, repeated twice a day for three or four days, when it should be discontinued for a few days, as it is apt when used continuously to injure the appetite. Whilst the copper and opium are suspended, and the discharges continue very fluid and abundant, a dose or two of oak bark or powdered galls may be given, or half a drachm each of acetate of lead and opium thrice a day. Consumption and dysentery, when occurring in other veterinary patients, require to be treated much in the same way as in cattle.

Glanders is a specific disease of a most malignant type, originating in a faulty state of the blood, and recognised by ulceration of the lining membrane of the nostrils. The membrane, in the first instance, is thickened, and the neighbouring lymphatic glands and vessels are enlarged and painful. One or more minute pustules appear, first of a red and afterwards of a yellow colour, and commonly situated on the vascular *septum nasi*. After a time they burst, and the pus escaping, leaves a hole or ulcer, with ragged, thickened, inflamed, undermined edges. The ulcer discharges a sticky, greenish, unhealthy pus, consisting of small, degenerate globules, highly charged with the albuminous matters of the disintegrating textures, rapidly drying up when thinly spread out, and often sinking in water, owing to its containing much albumen and few oil or pus cells. This ulceration, once begun, goes on until the membrane is destroyed, and the system poisoned by the absorption of the vitiated pus. The nose occasionally bleeds from the laying bare of minute blood-vessels, the eyes are prominent and watery, the coat rough and staring, the breathing snoring and somewhat disturbed, and the pulse soft and easily accelerated. Symptoms of farcy soon appear. A choking, suffocating cough is often present, owing to ulceration in the throat; the animal rapidly loses flesh; and the excretions have an intolerable odour. In such cases of acute glanders, a fatal effect may occur in ten days or a fortnight from the commencement of the ulcerating stage. Chronic glanders, however, lasts for months and even years; the nasal ulceration is slight; and the animal, with generous treatment, has a healthy coat, and may perform moderate work. Indeed, in the old coaching days, there used to be stages worked entirely by horses affected by chronic glanders, and hence have arisen doubts as to the propriety of compelling by legal enactment the destruction of such horses (16 and 17 Vict., caps. lxii. and lxiii., dated 14th August 1853). But the expediency of the measure cannot be questioned; for horses, however slightly affected by glanders in its ulcerative stage, are able by contact to communicate the disease, not only to healthy horses, but also to men. The vitiated pus, if it come in contact with a raw surface, or with the membrane of the eyes or nostrils, is speedily absorbed, and, gradually impairing the integrity of the circulating fluids, produces the local effects described. Owing, however, to the conservative power of the digestive mucous membrane, balls of glanderous pus may be swallowed without producing any notable effects.

Few cases of glanders, probably not more than one in eight, result from contagion. The other causes include everything that impairs the integrity of the blood; such as bad feeding, over-work, close, foul, damp, or overcrowded stables, and diseases of a debilitating character, such as influenza, strangles, or diabetes. Horses closely confined, even during a few hours, in the hold of a vessel, with the hatches fixed down, as in the Quiberon expedition, and that more recently to Varna, frequently contract glanders. The impure air, loaded with decomposing organic matters, is inadequate to the proper aeration of the blood, which is thus surcharged with effete matters and loses its integrity. When the disease is developed, the blood is found to contain fewer red globules, and a proportionately larger amount of albumen and fibrine than in health. Asses generally exhibit the disease in its acute form, whilst oxen and dogs are altogether exempt from it.

Treatment.—Glanders is quite incurable; but by generous diet, good stabling, and mineral tonics, life, except in extremely acute cases, may be prolonged for many weeks. This, however, is not desirable; for it involves, as above stated, great risk not only to other horses, but also to the attendants.

Farcy is identical in its nature with glanders, which it usually precedes, and with which in acute cases it almost invariably concurs. The chief difference consists in its different site; for, instead of the nasal mucous membrane, the specific inflammation of Farcy affects the superficial absorbent glands and vessels, very commonly of the hind limbs. Abrupt, indurated, and painful swellings, resembling those of erysipelas, but more tardy in their progress, continue sometimes for several weeks before the skin is broken. Lines of firm, corded, inflamed absorbents are by and by felt, with knots over the thickened valves. These run from below upwards, the hair along their course becoming rough and bristling. The vitiated lymph poured out from the inflamed glands and vessels soon undergoes softening, the overlying skin is absorbed, and ulcers or farcy buds appear, similar to those in the nostrils of glandered patients, and sometimes riddling the whole limb.

Such ulcers, although hopelessly incurable when located in the nostrils, as in glanders, are more manageable when affecting the limbs. They must be scarified with a firing iron, which should besides be gently run over the contiguous irritable parts, dressed at intervals of a few days with a little of the red iodide of mercury ointment, and washed daily with a diluted solution of Condy's fluid. To purify the system of its vitiated fluids, the several emunctories must be kept in good working order: the bowels, by two-drachm doses of aloes given occasionally; the kidneys, by the use of two ounces of sweet spirit of nitre every second day; and the skin, by comfortable clothing and good grooming. A pure, well-ventilated atmosphere, and perfect cleanliness, are also essential. Plenty of good food, such as bruised oats, oatmeal gruel, linseed tea, carrots, vetches, clover, or whatever the beast will eat, must be given; and the capricious appetite carefully encouraged by frequent variety. Tonics are sometimes useful, and one of the best combinations consists of a drachm of sulphate of copper and of iodine, repeated twice a day. Even where other remedies have failed, a course of arsenic occasionally proves serviceable. But this and other tonics must be used warily, as they are apt to injure the appetite. The limbs, when hot and tender, must be fomented, and no pus allowed to adhere to the sound parts. In fine weather, a few hours' liberty in an open paddock during the forenoon will expedite recovery, which is at best tardy, occupying usually several months.

Rheumatic Diseases.—Rheumatism consists in a peculiar inflammation of tissues of comparatively low organization, such as the coverings of muscles, tendons, and ligaments, the fibro-serous textures of joints, and the valves of the heart and structures of the larger blood-vessels. It exhibits a peculiar tendency to shift from one part of the body to another; leaves the structures once affected very prone to subsequent attacks; is characterized by the accumulation of various excrementitious matters in the blood, which contains, moreover, an excess of fibrine; is decidedly hereditary; is developed by exposure to wet and cold; and produces acute febrile symptoms, and a full, firm, unyielding pulse,—symptoms which chiefly depend upon the inflammation involving the serous and fibro-serous tissues of the heart and blood-vessels.

In horses, rheumatic affections are seldom idiopathic, but usually follow or accompany influenza. Occasionally they are located in the neck, producing stiffness, and inability to move the head, and known as *the chords;* sometimes in the fibrous coverings of the muscles of the back, constituting *lumbago;* sometimes in the limbs, inducing lameness often troublesome to detect, shifting its site almost daily; and occasionally extending to the pericardium and valves of the heart, and thus jeopardizing life.

In cattle, rheumatic diseases are more common and acute than in horses. In some cases, most of the fibrous textures of the body become involved, causing general stiffness, arching of the back, tucking up of the belly, a hard unpliant state of the skin, a full strong pulse, high fever, constipated bowels, and what is not seen in any other disease of cattle, a buffy coat on the surface of the newly drawn blood. This constitutes *rheumatic fever*, the chine-fellon or body-garget of the older cow leeches. In a less acute form, rheumatism affects the synovial bursæ and fibrous structures of the larger joints of cattle, producing great lameness and swelling, which at first is slight, but afterwards increases, and becomes very hard, from the induration of the lymph poured out. Sometimes the swellings inflame and soften, and abscesses form,—a result which, although common in men and cattle, is unknown in horses. The disease of cattle and sheep known as bustian foul consists of rheumatic inflammation of the fibrous textures of the foot and contiguous parts, resulting not from local but from general causes, and attended with great pain, swelling, and fever.

Rheumatism is common in cold wet seasons amongst young lambs, especially in bleak unsheltered pastures, with a north or north-eastern exposure. Under the name of *kennel lameness*, it prevails amongst dogs badly kept in low, damp, undrained situations, and is indicated by shivering, dulness, fever, extreme stiffness and soreness over the whole of the body, costive bowels, and a scanty flow of acrid, high-coloured urine. Where it assumes a chronic form, and has for several months resisted ordinary treatment, it must be regarded as incurable.

Treatment.—In horses, the disease is seldom so acute as to warrant blood-letting. Give a laxative, and repeat every night and morning for a week an ounce of oil of turpentine, four drachms of nitre, and one drachm of powdered colchicum, in gruel; clothe the body, bandage the legs; apply smart friction and arnica lotions several times a day to the affected parts, and sustain the strength by good food, linseed mashes, and tonics if necessary. Further, apply for half an hour daily, with a rug or piece of flannel over the affected parts, a smoothing-iron, at about the temperature used by the laundress. If no good ensues in a week, apply mustard or hartshorn, add some tincture of aconite to the arnica lotion; and if the rheumatism is in the back or loins, clothe the animal in a thick rug, pour hot water over it repeatedly, put on over all several dry rugs, allow him to stand in this way for twenty minutes or half an hour, throw off all the coverings, rub him dry, give him fresh clothes, and carefully avoid draughts and exposure to cold. This hydropathic treatment, or a vapour bath where procurable, if rationally used daily for a week, will mitigate all cases, and cure many.

In cattle, bleed freely in the earlier stages of acute rheumatism, open the bowels, and administer twenty minims of Fleming's tincture of aconite, or eight times that quantity of the Pharmaeopœia preparation, an ounce of nitre, and two drachms of powdered colchicum, in gruel, every three hours, until the pain and fever are abated, or until ten or twelve doses have been given. Lodge warmly and comfortably, and apply the hot smoothing-iron, or the rugs and boiling water, as advised for horses. Keep the bowels, skin, and kidneys in activity with three ounces of sulphur, two ounces of ginger, and one of nitre, given once or twice daily; and when the more acute symptoms are subdued, try an ounce of oil of turpentine and two drachms of colchicum morning and night. In chronic cases, which usually affect the joints, besides the general treatment already advised, apply to the affected parts dry friction, compound solution of iodine, hartshorn and oil, and other stimulant embrocations, and feed the animal well, to enable him to outlive the disease.

In dogs, prescribe dry comfortable housing, friction and flannel bandages to the affected parts, a dose of opening medicine, a laxative diet, a pill twice a day, consisting of five grains of nitre and two of powdered colchicum, made up with treacle, and subsequently tonics, if there is debility. In chronic cases, sweet spirit of nitre and colchicum may be tried, and the frequent in-rubbing of an embrocation made of equal quantities of oil of turpentine, medicinal ammonia, tincture of arnica, and linseed oil.

Weed, or a Shot of Grease, is ushered in by swelling, heat, tenderness, and lameness usually of one hind limb, and that most commonly the left. The inflammation, beginning in the glands high up between the thighs, extends along the absorbent vessels, and is accompanied by fever and a full bounding pulse. It depends upon a disturbance in the balance which naturally subsists between the waste of the system and the supply of new materials to repair that waste. Food appears to be assimilated in larger quantity than the wants of the system require, and the chyle so formed seems to accumulate in the absorbent glands and vessels, which consequently become irritated and inflamed. Similar effects are apt to occur when hard-worked horses stand idle for a day or two; when the secretions of the skin are arrested by taking an animal hot and exhausted into cold water; or when the excretions of the bowels are impaired. Exposure to wet and cold, by acting directly on the sensitive absorbent glands and vessels, will also produce weed, especially in horses predisposed to it, as in those without much breeding, with soft, flabby, muscular systems and round legs.

Treatment.—The animal must at once be bled, and have a full dose of physic, which, in order that it act rapidly, should be given in solution. Five or six drachms of aloes, with a drachm of calomel, answers well. Bathe the limb diligently with hot water for several hours—the longer the better; rub it dry, and envelope it in a flannel bandage. When the pain and fever are great, give besides, every two hours, ten minims of Fleming's tincture of aconite, or eighty minims of the weaker Pharmacopœia tincture; scarify in a few places the swollen glands, or draw blood from the toe. As recovery takes place, order diuretics, friction to the limb, and gentle exercise.

QUARTER EVIL, BLACK LEG, or CONGESTIVE FEVER, is known in various parts of England under the name of murrain, and occurs, especially during the spring and autumn months, and in cattle under two years old. Occasionally it also attacks young, growing, well-bred sheep. It appears to be indigenous to certain farms, usually where the land is undrained, and the herbage coarse, rough, and innutritive; and has entirely disappeared from others, where drainage, top-dressings, and better cultivation, have improved the quality of the pasture. Dulness and stiffness are the only premonitory symptoms usually noticed; and so suddenly does it appear and run its fatal course, that stock are frequently left at night apparently quite well, and several are found dead next morning. Wherever the textures are loose and soft, and do not firmly support the blood-vessels, as amongst the cellular tissues on the loins or underneath the shoulder, in the lungs, and occasionally in the brain, extravasations of bloody serum take place, suddenly producing, when occurring externally, soft diffused swellings, which crackle with gas evolved from the decomposing blood. The strength rapidly fails, the pulse becomes small, quick, and imperceptible, and death usually follows in a few hours.

Many persons, led away by the name of inflammatory fever, by which the disease is often called, consider it to be of an inflammatory character; but this is disproved by its sudden onset and rapid progress, and especially by the absence of inflammatory appearances, which are only developed in those cases which survive for several days, and in which the extravasated blood, acting as a foreign body, excites inflammation in the living tissues with which it lies in contact. The disease, as first taught by the late Mr Barlow, closely resembles apoplexy; the extravasation, however, not being confined to the brain, but occurring wherever the blood-vessels lie unsupported in a soft loose structure. Young animals, rapidly growing, with their blood-vessels thin, weak, and uncondensed, are its subjects. The best of the herd, manufacturing as they do the largest quantity of rich stimulating blood, often fall first; whilst animals whose growth, after weaning, or from any other cause, has experienced a check, and which are beginning to thrive again, are also especially prone to suffer; probably because the blood-vessels, not having recovered from the previous weakness, in which they participated with the system at large, give way when subjected to the increased pressure of larger quantities of richer blood. Exposure to cold and wet during the long autumnal nights is a fruitful source of the disease, apparently by disturbing the balance of the circulation, and driving the blood in undue quantity towards the internal organs, where extravasation may take place, or a vital reaction ensue; and the blood, thus returned with unnatural force towards the surface, breaks through the vessels already weakened by the continued exposure.

Treatment.—When the disease is thoroughly established, when crackling swellings are apparent externally, or distressed breathing indicates extravasation into the lungs, treatment is all but useless. Give to a strong calf, six months old, about six ounces of Epsom salt, an ounce each of ginger and sweet spirit of nitre, with a quarter of a pound of treacle and a pound of water; repeat the quantity every six hours, until the bowels respond; administer, besides, every two hours, a glass of gin, whisky, or sweet spirit of nitre, and a drachm of carbonate of ammonia in cold gruel; and if the swellings are external, scarify them deeply and freely. If the animal is noticed before any swelling is apparent, and whilst the pulse is full and not very quick, there is more hope of success. Bleed freely, give the purgatives as above recommended, repeat the dose every four hours, and withhold solid food until the bowels act freely.

Whenever a case occurs amongst a herd, give the remainder under two years old a laxative dose of salts, ginger, and treacle, repeated every week, until all fear of the malady is past. Blood-letting, although frequently recommended, is not in such cases so effectual as laxatives. Vary frequently the food and pasture; give small quantities of boiled linseed or oil-cake, which appear to aid materially in warding off the disease, probably by keeping the bowels and skin in good order; and insert a seton in the dewlap, which limits the formation and richness of the blood. There is no better preventive of quarter evil than a seton, when properly put in, when the calf is three or four months old. The practice, although long pursued by a few breeders, has not been so generally adopted as it deserves to be. Its importance has been sensibly set forth by Mr James Macgillivray, V. S., Rayne, in his prize report on quarter evil, in the Transactions of the Highland and Agricultural Society for January 1862. From observations, including 6454 calves, Mr Macgillivray shows, that in stocks and localities subject to the complaint, one calf in every six was lost from blackleg, whilst by setoning the mortality is reduced to one in 300. The seton must not, however, be expected to do away with the necessity for good management. In the successful rearing of healthy young stock, a carefully regulated diet is most essential; a small daily allowance of cake begun before weaning is a great help. Never at any time must they be allowed to retrograde in condition, but, without undue forcing, they must be kept steadily and constantly growing; and by the middle or end of September all calves and year-olds should be housed during the night, and have an allowance of good dry food. Quarter evil is not contagious. Amongst sheep its treatment and prevention are the same as in cattle.

Splenic Apoplexy, although long familiar to continental veterinarians, has only been recognised in this country during the last five-and-twenty years. It attacks both cattle and sheep, selecting as its victims adult rather than young animals. Like congestive fever, it appears to result from the rapid manufacture of insufficiently elaborated blood, probably faulty in the healthy proportion of some of its constituents. It usually attacks good, well-bred cows, turned out of the dairy to feed, or bullocks in the stalls, freely forced with the best of provender. It appears on rich alluvial pastures, where the grass is abundant and nutritious, and the stocking light; but even in grazings where it most prevails, bulls and rams are often fed with perfect immunity from its attacks. Cattle and sheep that have been previously stinted, and are being rapidly pushed along, are especially liable to it. Professor Simmonds ascribes the outbreaks of the disease which occurred in the valley of the Yeo in Somersetshire, in

1861 and 1862, to the use of water contaminated by the washings of the yards.

Symptoms.—Splenic apoplexy usually comes on without much warning. Animals will occasionally be browsing, or standing apparently in the best of health, when suddenly they stagger, fall gasping, frothing at the mouth, and often convulsed, lie almost pulseless, and die sometimes within an hour. When the attack comes on more gradually, the beast is dull and shivering, moves stiffly, or staggers in its walk. Frequently there are evidences of abdominal pain, with the passage of green-coloured, badly-smelling feces, which are sometimes tinged with blood. The urine is scanty and high-coloured. The breathing is quickened and laboured; the pulse, at first quick and full, soon becomes indistinct and irregular. Sometimes the animal throws itself wildly about, and dies in convulsions, or passes into a condition of deadly stupor. Most patients die within six hours, few survive for twenty hours, and scarcely one-sixth of those affected recover.

The post-mortem appearances closely resemble those of quarter evil. The blood is everywhere dark-coloured, thin, and indisposed firmly to coagulate. Underneath the skin, especially along the back and belly, patches of extravasation will often be found. The muscles are dark-coloured, soft, and readily pass into a state of putrefaction, in which condition they have been known to cause in dogs and pigs serious disorder of the digestive organs, diarrhœa, and sometimes low fever. As the name of the disease would indicate, the spleen is found to be extensively disordered. It is engorged with black, semi-coagulated blood, is often enlarged to twice its natural size, and in cows weighs sometimes sixteen pounds. Its internal fibrous structure is soft and friable, and occasionally torn from the pressure of the blood forced into it. The liver is also soft and enlarged. In acute cases the small intestines are extensively engorged with blood, and patches of extravasation are found on and underneath the blackened mucous membrane.

Treatment.—So rapidly fatal is the disease, that there is seldom opportunity for the employment of remedial measures. In a chronic case, seen early, and whilst the pulse is full, strong, and tolerably distinct, a moderate bleeding may be tried. A full dose of opening medicine, conjoined with a prompt stimulant, should at once be given, all solid food withheld, cloths wrung out of hot water applied to the bowels and loins; and if the animal is dull and stupid, stimulants must be administered at short intervals, and cold water dashed over the head and neck, if possible, to provoke reaction. Splenic apoplexy is very usually connected with some faulty system of feeding; and hence, in devising measures for its prevention, especial attention must be paid to diet. It should neither be too sparing nor too abundant; a good supply of wholesome water must be provided; an occasional change of grazing appears to be sometimes useful; on rich pastures the grass should be kept well eaten down; on the pastures, as well as in the stalls and yards, rock salt should be placed, and a small daily allowance of oil-cake supplied; and on all lands where splenic apoplexy prevails, neither cattle nor sheep ought to be grazed, unless they are first setoned in the dew-lap.

DISEASES OF THE LOCOMOTIVE ORGANS—LAMENESSES.

FRACTURES. The bones of the horse are so strong and solid, so securely covered by the dense, tough, fibrous periosteum, and so well supported by muscles, tendons, and ligaments, that they are rarely fractured. In cavalry stables, and where bars are used instead of trevises, fractures of the hind limb, just above the hock, occasionally take place from kicks; whilst in English farm stables, where a number of horses stand together, usually without separation of any kind, such accidents also occur, and would be greatly more common were the horses in higher condition, and not so well accustomed to each other. Occasionally the bones of the pastern get cracked or broken in galloping.

Treatment.—Fractures of the spine are incurable; those of the long bones of the legs seldom repay the time, trouble, and expense required for their cure; but those of the head, ribs, haunch-bones, and pasterns may usually be profitably treated, especially if occurring in quiet-tempered, non-excitable subjects. When any of the bones of the limbs are broken, have the horse slung immediately, and, when practicable, apply splints and starch bandages, and allay undue inflammation, by keeping the parts constantly wetted with cold water. Fractures are rather more common amongst dogs than in horses or cattle, and the treatment consists mainly in bringing the bones into their places, and retaining them there by splints (which, in young or small animals, are conveniently made of gutta percha) and bandages.

STRAINS OR SPRAINS. The severe and continued exertion required of the horse, and that often before his structures have attained their full strength and solidity, render him very liable to strains. These consist of rupture of some of the minute fibres, which, arranged in fasciculi or bundles, make up the muscles, tendons, and ligaments. When strains are extensive, involving the whole or the greater part of a large tendon, it requires months fully to repair the injury—thus justifying the popular observation, that " a severe strain is as bad as a broken bone." To repair the breach, inflammation is established, with its accompaniments of heat, pain, and swelling; lymph is poured out, occasioning enlargement, and also, by separating the fibres from each other, shortening the affected structures, as is well seen in bad strains of the back tendons.

Treatment.—Wheresoever occurring, strains require much the same treatment. The parts must be fomented continuously for many hours with water about the temperature of 100°, or a thick woollen covering is placed over the part, and saturated freely with hot water every hour. Perfect rest, and, if possible, relaxation of the part, are so essential that in bad cases slinging is recommended. A laxative diet, with an occasional dose of medicine, is also advisable. In the slighter class of cases, cold water, if applied for several days, is useful; but unless it can be used continuously, hot is better. The stimulating oils and applications in common use often do much harm, for they are generally applied before the inflammation is subdued. When this is removed, as evidenced by the absence of heat and tenderness, but not till then, blisters and stimulating lotions are useful, by causing absorption of part of the exudation and the speedy consolidation of the remainder. After a time, gentle exercise is useful, and a run at grass, except in the case of high-spirited horses, which are apt to injure themselves galloping.

SHOULDER-SLIP. The muscles investing the shoulder-blade occasionally become strained, constituting shoulder-slip—an accident of more common occurrence in Scotland than in England, and usually resulting in young horses, from their placing their feet awkwardly when first put to double ploughing. The same thing also happens with young carriage horses that work too freely. The muscles usually affected are the antea and postea spinati, teres, and subscapularis. Tenderness, slight swelling, and occasional lameness are perceptible; and after a few days the affected muscles waste, the ridge of the shoulder-blade may usually be readily felt, and, having lost its support, the shoulder-joint is thrown outwards at every step, giving the animal a rolling gait. Order, in the first instance, rest and hot fomentations, and in a week or ten days a mild blister, repeated, if necessary, with gentle and gradually increasing exercise.

STRAIN OF THE FLEXOR BRACHII—the muscle which raises and advances the limb—is the most common form of shoulder lameness. It results in draught horses from unequal weight thrown upon one shoulder; in hunters or hacks, from struggling to extricate the limb from heavy ground; and in cavalry and artillery horses, in which it is common, from the evolution known as wheeling. The strain being in the deep-seated tendonous part of the muscle, heat and swelling are not very obvious; but steady pressure over the prominence of the shoulder causes the animal to wince; he bears little weight upon his limb, which is dragged and thrown out at every step.

Treatment.—In aggravated cases, have the horse slung; in all, tie him up by the head, so as to prevent the lying down and getting up which first relaxes and then stretches the injured parts. Fold a horse-cloth several times, place it round the breast, secure it there with girths and straps, pour in hot water every hour, and continue this treatment for several days or a week; then apply cold water in the same way for a few days, and when the lameness ceases, blister.

SHOULDER-JOINT LAMENESS. The most serious form of shoulder lameness consists of softening of the articular cartilage, with inflammation of the synovial membrane, and excessive secretion of unhealthy synovia, which produces bulging of the capsular ligament, detectible on pressure. The animal drags his toe and throws his leg outwards at every step. The treatment, which consists of blisters, setons, and firing, is unsatisfactory, for the cartilage is apt to be destroyed, and the underlying bone become ulcerated.

THE ELBOW-JOINT is not very subject to injury. Ulceration of the cartilage occasionally occurs, when distention of the joint is perceptible, and the horse knuckles over at the knee and fetlock, and cannot bring his weight upon the limb, but holds it in a state of semiflexion, and when made to go, "drops" at every step. Blisters and setons are prescribed. Fracture of the olecranon occasionally occurs. From calkins, lying on rough stones, or kicks, tumours sometimes appear on the point of the elbow, but may be readily removed by excision.

BROKEN KNEES.—When the scarf skin only is bruised, the deeper-seated structures remaining uninjured, the horse must be kept at rest, the part lightly bound by a broad linen bandage, which should be wetted at short intervals with cold water. This must be continued until all soreness and swelling are gone. When the hair roots are uninjured, no blemish remains, and until the hair grows, the baldness may be concealed by the use of a little burnt cork or lamp black and oil. The rapid growth of smooth hair is encouraged by rubbing the part daily with castor oil, and where it comes tardily, with an occasional dressing of diluted tincture of cantharides. When the hair roots are destroyed, a whitish bald scar will remain in spite of all hot oils and other vaunted specifics. Where there is much laceration, and gravel or dirt adhering to the parts, hot fomentations for a few hours, or a good bran poultice, will be advisable before beginning with the cold-water dressings.

When synovia comes from the wound, it may proceed either from the true knee-joint, or from the sheath of the large tendon that passes in front of the joint, and in bad cases it comes from both. The animal must then be slung, long splints placed on either side of the limb and behind, relieved by pads, but the wound itself left free for dressing or inspection. A simple poultice is applied until healthy granulations appear to plug up the opening; the parts are subsequently kept moist by squeezing a sponge full of cold water over them occasionally, or placing on them a linen rag wetted with cold water at intervals. Special care must, however, be taken never to wash away the protecting and emollient fluids naturally poured out, and which are infinitely more effectual than the healing ointments and salves in common use. This treatment is applicable to all cases of *open joints*, and is infinitely more rational and successful than rudely endeavouring, as is often done, to plug up the orifice with lime, alum, or any mechanical appliances. Removing weight and pressure from the injured parts by slinging, and keeping them in a fixed position by well-adjusted splints and bandages, prevent the restless jerking of the limb, the outpouring of the synovia, and the consequent dryness, irritation, and demand for more. Poulticing encourages the growth of healthy granulations, which speedily close up the wound; whilst subsequent cold-water dressings, as above advised, moderate the healing inflammation, and impart tone. A laxative diet, an occasional small dose of medicine, mashes containing occasionally a little nitre, and abstinence from corn, aid in maintaining the system in a healthy state. Hot oils, lotions, ointments, and everything of the sort, usually interfere with the natural healing processes, and materially retard recovery. No further interference beyond that above described is usually requisite, except where the granulations become too exuberant, and pass out beyond the surface, when they may be repressed by the gentle equable pressure of a linen bandage, or by touching them lightly with caustic. In chronic cases, where granulation is tardy, the judicious use of the hot iron or of some caustic, will generally increase the reparative power.

Thoroughpin of the Knee consists in an enlargement of the synovial cavity, through which the flexor tendons pass towards their lower insertions. It is most obvious on the inside of the limb, immediately above and behind the joint, but can be readily pressed outwards. It results from strain of a small ligament, which attaches the tendon to the arm-bone, and when it first occurs, causes swelling and lameness. The treatment consists in rest and fomentations, followed by blisters when the heat and tenderness are removed.

Splint is a bony enlargement, technically called an exostosis, situated usually below the knee, and between the large and small splint bones, generally on the inside of the limb, and most common in horses employed at fast work, and that have been much on the road whilst young. Occasionally they appear in young growing horses, almost without being observed, and seldom cause much lameness unless when rapidly deposited. When occurring on both sides of the limb, and especially when accompanied by bony enlargements about the pasterns, they indicate weakness, a tendency to bony growths, and a consequent liability to lameness. When immediately underneath the knee, the splint is most apt to interfere with the movements of the joint, and cause lameness. In all cases the evil commences in the periosteum—the tough vascular membrane investing the bone. Inordinate exertion, especially concussion, in badly-shaped limbs, drives to it an over supply of blood, the parts become hot and tender, and lymph is exuded from the inflamed vessels, and gradually converted into bone. The animal indicates these changes by his dropping gait, especially noticeable at the trot, and upon a hard road.

Treatment.—Whilst heat and tenderness continue, the parts must be kept constantly wetted with cold water. Saturate a piece of spongiopiline with cold water; secure it on the limb with a light bandage, and squeeze out and freshly wet it every hour; or, if practicable, let the horse stand for an hour several times a day up to the knees in a pool or stream of water. Allow perfect rest for ten days or a fortnight. When by such means the heat and tenderness are removed, apply a cantharidine blister, some of the ointment of the biniodide of mercury, or the hot iron. Such remedies condense and harden the bony deposit, but do not, as is generally thought, remove it. Perfect union shortly takes place between the large and small splint bones, the swelling becomes solid, the lameness disappears, and the splint, although still remaining, and, strictly speaking, constituting unsoundness, occasions, in well-formed limbs, no inconvenience.

Sore Shins occur in young horses too early subjected to severe exertions, as in training for the race course. It consists of inflammation of the periosteum. A diffused tender swelling rises on the front of the canon bone, and sore places appear on the shin, from which matter freely exudes. The outer surface of the bone dies, shells off, and comes away in small pieces, and if recovery takes place, new bone forms underneath. Cold applications and rest are the appropriate remedies. A case of a similarly diseased condition of the tibia of a two-year-old filly has come under my observation.

Strain of the Back Tendons is one of the most common accidents affecting the horse, and involves the perforans tendon and its check ligament. In the large proportion of cases, the ligament is first affected, immediately above its insertion into the tendon. Heat, pain, and lameness ensue ; and if the animal continue at work, other tendons and ligaments become involved, and permanent thickening and shortening of the limb ensue. The accident is most common in round-legged horses with small knees, and with the tendons so tightly bound down that they act at a mechanical disadvantage.

Treatment.—Envelope the limb in a piece of horse-rug folded several times, or in any other woollen bandage capable of retaining a quantity of water, and saturate it every hour with fresh supplies of water at the temperature of 100° or 120°. Continue this until all heat and tenderness are removed, and the animal appears to bear upon the limb ; substitute then cold for hot water, remove the bandage, and hand-rub the limb several times daily; and after a few days more apply a blister, which may be repeated, if necessary. As in similar cases, a laxative diet, without corn, and an occasional half-dose of physic, should be given.

The Suspensory Ligament is a strong ligamentous band fixed into the back part of the knee, passing down behind the canon-bone, and in front of the tendons, and attached to the pasterns and foot below. During standing, it supports the fetlock, and in action contributes that springiness of gait so noticeable in well-bred horses. In hunters, racers, and horses put to severe, rapid work when young, it is apt to be strained, especially where it divides immediately above the fetlock. The lameness comes on gradually, is not so acute as in strains of the tendons, but unless promptly treated by rest, cold applications, and subsequent blisters, it is apt to leave the parts weak, and liable to a second attack. Three months' release from all hard, fast work is absolutely necessary to ensure a perfect cure.

In leaping or galloping, the suspensory ligament is occasionally torn, either partially or completely, constituting the accident known as breaking-down. The fetlock comes nearly to the ground, the flexor tendons are usually strained, there is much swelling, pain, and fever, and the animal is never again available for fast work. In all bad cases, whether of one or both legs, the horse must be slung, the parts kept wetted with cold water for at least ten days, and a mash diet and laxative prescribed. After several weeks, and when all irritation and heat are removed, and the animal can rest upon the limb, release him from the slings, put on a high-heeled shoe, blister or fire, and allow several months' rest.

WINDGALLS are soft puffy swellings, varying from the size of a marble to that of a walnut, found in the neighbourhood of the fetlocks, depending upon the accumulation in the tendinous sheaths of an undue amount of synovia, or joint-oil, secreted to obviate the friction of severe fast work, and most frequent and serious in animals with long, oblique pasterns. Although at first soft, and easily reduced by wet bandages and a few days' rest, they by and by, from the continued irritation and friction of work, become harder, lymph is mixed with the synovia, and several weeks' rest, with blisters, biniodide of mercury, or mercurial charges, are required for their reduction. Indeed, in middle-aged horses, which have been at full fast work, windgalls, when once they have appeared, can seldom be permanently removed, but are apt to return whenever the animal again goes to fast work on the road.

NAVICULAR DISEASE, or GROGGINESS, consists in strain of the perforans tendon at the point at which it passes over the navicular bone. It is most common in horses of the lighter breeds, with narrow chests, upright pasterns, and out-turned toes. A short tripping, yet cautious gait, wiring in of the heels, wearing away of the toe of the shoe, wasting of the muscles of the shoulder, projecting of the limb whilst standing, infallibly mark the disease. No animal with badly-formed groggy limbs should be used for breeding purposes, for the disease is very apt to appear in the progeny, and in animals of such conformation is almost incurable. In slight cases, and where early noticed, it is possible, if not to cure, at any rate greatly to alleviate it; but where it continues for some weeks, the articular surface of the tendon becomes abraded, and the synovial membrane inflamed; whilst, as the disease still advances, the articular cartilage becomes eroded, and the bone ulcerated, when nature, to prevent the pain and irritation occasioned by the grating of the inflamed surfaces, sometimes unites the tendon and the bone.

Treatment.—In bad cases apply a poultice for several days, taking care to keep it soft and moist, and change it every six or eight hours. In all cases give a dose of physic and a mash diet; make the animal stand in soft clay, kept constantly cool and wet; shorten the toe, and at intervals of a fortnight, thin the sole, and apply a blister round the coronet. Setons and firing need not be used until blisters fail. A couple of months' run at grass is useful, especially if the ground is moist and cool. Division of the nerve going to the foot, by cutting off sensation, removes all lameness, and is useful in the case of animals used for slow work, or breeding purposes; but the disease, it is to be remembered, still remains as before, and at fast work is apt to get worse, for the animal, insensible to pain, uses the foot as if nothing were amiss.

Ringbones consist in a circle of bony matter laid down round the coronet—a natural effort to strengthen the parts, and enable them better to withstand too early work, or too great concussion. They are most common in the fore limbs of draught horses, with short upright pasterns, and small feet, or in the hind limbs of lighter-bred horses. Although they do not invariably cause lameness, they indicate disease, are, moreover, apt to extend, and therefore constitute unsoundness.

Side-bones are hard swellings, situated immediately above the quarters and heels, and resulting from the conversion into bone of the elastic lateral cartilages. They occur either on one or both sides, or in one or both limbs, and are most common in heavy draught horses with upright pasterns. Unless when of rapid growth, they seldom cause lameness.

Treatment.—Ringbones and Side-bones require the same treatment as splints and other bony enlargement, namely, cold applications, kept up steadily until heat and tenderness are removed, and succeeded by blisters or firing.

Sandcrack, as its name indicates, is a splitting or fracture of the horny fibres of the hoof, extending generally from above downwards. In the fore feet it generally occurs at the quarters, in the hind at the toe, and in all cases constitutes unsoundness. It causes lameness when extending to the quick, but not when superficial. It mostly occurs in weak, brittle, light-coloured feet, where the rasp is freely used at every shoeing, and often comes on suddenly, as the result of concussion on a hard road. The opening sometimes extends to the eighth of an inch, bloody serum exudes, and proud flesh sprouts from the crack. Such cases are difficult of cure. The horn must be thinned to the quick for half an inch on either side of the crack, poultices applied for a few days, and then the hot iron drawn across the upper part of the crack, so as to cut off the healthy parts above from the unhealthy below. The iron should go rather deeper than for ordinary firing, or nearly through the insensible horn; and if the crack does not extend all the way to the sole surface, the iron must also be used across its lower end, to prevent extension downwards. Wind three or four yards of waxed cord, or iron wire, tightly round the hoof, so as to hold the cracked surfaces to each other; and after a few days stimulate the growth of horn by a mild liquid blister, applied round the coronet, and repeated every fortnight.

Pricks are the most common of all injuries of the feet. The nails either wound the quick, when lameness is very shortly perceptible, or the nail merely presses on the internal parts, and lameness may not be apparent for several days. The foot must be carefully examined, the hammer and pincers being applied all round. The faulty nail must be withdrawn, and except in very slight cases the shoe removed, and the foot poulticed. With a small drawing knife follow up the nail hole, remove all discoloured horn, and leave vent for any matter that may be formed.

Corns are bruises of the sensible sole in the angle between the posterior part of the quarter and the bars, and mostly occurring on the inside of the fore feet. The hind feet owe their immunity to the greater strength of the heels, and their sustaining less weight. Two sorts of feet are especially subject to corns—those with deep slanting heels, which become doubled up between the shoe and the sole; and those that have wide, flat soles, and low weak heels, in which the pressure causing the bruise comes from above. From continuance of pressure, the interior sensitive villous surface is bruised and inflamed; serum and blood are poured out; the horn by and by becomes soft and discoloured; and the parts, weakened from the continued application of the exciting cause, continue to secrete unhealthy horn, even after the cause of the injury has been removed. Lameness is most obvious in trotting upon a hard road; the lame leg is brought as much under the body as possible, thus throwing the weight upon the outside heel; the shoe also is worn mostly on the outer side, the animal stands with the limb bent and the heel raised, somewhat in the same way as in grogginess. Corns, although constituting unsoundness, do not, in well-formed feet, materially reduce an animal's value, for, by careful shoeing, they may be gradually got rid of.

Treatment.—Pare out carefully the seat of corn, removing all reddened and diseased horn; reduce the crust of the quarter slightly where it is unduly strong, but leave the bars and frog untouched. They must be religiously preserved, especially in weak feet, to afford a wide bearing for the bar shoe that should afterwards be used. To soften the parts, apply in bad cases a poultice for a day or two, and a few drops of nitric acid when the horn is dry and scurfy; keep the hoof soft with soft soap and lard, or any emollient dressing (p. 450), and pare out the corn every fortnight. In horses subject to corns, shoe and pare out frequently; and, along with leather pads, use a bar shoe made with a wide heel on the inside quarter, and nailed only on the outside, or with one nail towards the inside toe.

Pumiced Foot.—As a consequence of laminitis, or founder, already noticed under skin diseases (p. 516), the sensitive laminæ, from which the hoof is in part secreted, become weakened, and produce an irregular growth of soft, spongy, light-coloured porous horn, which grows down, furrowed and uneven. The sole-crust, from the results of inflammation, is also soft, weak, and convex, constituting what is termed pumiced foot. The horse walks upon his heels; but although unfit for hard labour upon the road, may be rendered serviceable for farm work by the use of a bar shoe with a broad web, thick at its outer circumference, and gradually bevelled away towards its inner edge, leather soles, and a mild liquid blister applied at intervals of ten days to the coronet, to stimulate, if possible, a healthier growth of horn.

THRUSH or FRUSH consists in inflammation and ulceration of the sensitive surfaces within the clefts of the frog, with the consequent discharge of a fœtid muco-purulent fluid. It results from horses standing in foul damp stables, is often seen amongst colts in wet dirty straw yards, constitutes unsoundness, and frequently causes lameness. Carefully remove the diseased horn, insert into the cleft a pledget of tow smeared with tar, or a quantity of sugar of lead, sulphate of zinc, or calomel, and keep the feet scrupulously clean.

CANKER consists in a degenerate or depraved condition of that portion of the sensitive foot which secretes the horny frog and sole. An unhealthy, soft, spongy horn of rapid growth is produced, covered with fœtid, acrid, bloody serum. The cleft of the frog is usually first affected, and so long as the disease is confined to it, a cure is attainable. Often, however, it extends to the sole, and thence to the coronet, producing fungoid granulations, and breaking up the connection between the sensitive and insensible textures. It is peculiar to horses, is neither constitutional nor hereditary, but mostly occurs in heavy, coarsely-bred animals, kept in filthy, damp, badly-managed stables.

Treatment.—Remove all loose horn; allow free access for pent-up matter; cut away carefully, and without bleeding, the exuberant granulations, then wash with tepid water containing some sulphate or chloride of zinc; dry and dust the surface with slaked lime or oxide of zinc; apply tow saturated with tar and lime, and kept in firm contact with the parts by means of a leather sole or strips of hoop iron underneath a shoe lightly tacked on. Dress in this manner daily, keeping up the dry pressure for a week; and if little benefit appears, try in succession creasote, sulphuric acid, and dry sulphates of zinc or copper; for, as in other cases, a change of the remedy is often valuable. Counteract the fœtid odour by chloride of lime, Macdougall's disinfectant, or Condy's fluid.

QUITTOR, or the Pipes, is a fistulous wound about the top of the hoof, communicating with some abscess, ulcer, or other irritant within. It results from a prick, corn, tread, or other injury, leading to the formation of matter which, by neglect, accumulates underneath the hard hoof, and gradually works its way out at the coronet. The shoe must be removed, and the origin of the mischief sought for. If a prick or corn has been the cause, the dead or discoloured horn must be cut away, and a more natural and dependent egress provided for the matter. Poultices applied for a few days are useful, and if healing is tardy, inject daily a solution of twenty grains of corrosive sublimate to an ounce of spirit of wine, whisky, or gin. Except where the periosteum of the coffin bone is involved, a few weeks' patient and rational treatment will usually effect a cure. Avoid, however, injuring the sound parts by the use of violent remedies, such as the rude and painful process, once in common use, of filling the wound with powerful caustics, and thus "coring out the pipes," as the old farriers termed it. The great principle in the treatment of quittor, and of similar wounds, such as poll-evil and fistulous withers, is to remove as soon as possible the internal cause of irritation, and provide a sufficient dependent opening for the matter.

When quittor has been long continued and accompanied by much sloughing, the thick skin round the coronet is often so injured that it secretes a deficient quantity of soft weak horn, constituting false quarter—a condition which renders the horse unfit for anything except slow work, and which, although almost incurable, may be palliated by the use of a bar shoe and an occasional blister round the coronet.

Foot-Rot in Sheep, although probably existing from the earliest times, has become more prevalent during the last fifty years, chiefly owing to the greater weight of all varieties of sheep, and to their occupying soft, moist lowland pastures previously unreclaimed, or grazed only by cattle. The horn becomes overgrown, soft, and disposed to crack or tear; it turns inwards upon the sole, or the outer insensible covering of the sole is worn down. Sand and dirt insinuate themselves into the cracks and cavities, and irritation and inflammation of the sensitive laminæ are thus produced, causing swelling, heat, and tenderness of the foot, decided lameness, and the secretion of thin, badly-smelling pus. The inflammation sometimes extends to the biflex canal, producing an acrid discharge, and often an unhealthy ulceration, or to the coronary substance, causing irregular growth of faulty horn or sinuses, similar to those of quittor. Although all four feet may be affected, the disease is usually confined to one or both of the fore feet, and occasionally to one digit only. It always leaves the parts weak and prone to a subsequent attack, especially during hard frost or dry hot weather. The same foot or digit frequently suffers at short intervals; whilst the hoofs of those subject to the malady become large and soft, and this altered and weakened structure is transmitted to the progeny. Indeed it is a common observation, that a certain hereditary appearance of the foot predisposes to foot-rot. Occurring in connection with the vesicular or epizootic murrain already noticed (p. 518), foot-rot is decidedly contagious, but the ordinary variety just described is not contagious. The diseased matter from the feet is devoid of effect when rubbed into a sound foot; and even when applied to a bare or torn surface has no special action, and produces merely the same effect as the matter of any foul or unhealthy wound, or as exposure to cold, filth, and moisture. It may further be remarked, that one foot, or even one digit, is frequently affected without the other feet or digit becoming involved; and that sheep with foot-rot may be mixed with perfect impunity amongst a sound flock, provided they be upon good dry pasture, and have their feet properly attended to.

Treatment.—Whenever the first symptoms of lameness are observable, the sheep should be caught and the feet examined. All filth and dirt must be removed, as well as every loose, ragged, and unsound portion of horn. This is generally effected with a stout pocket-knife; but when the horn is extensively diseased, a fine-pointed drawing-knife is often useful in removing, as must be scrupulously done, all portions of horn separated from the laminæ. The feet must then be smeared with some approved dressing; and none appears more effective than equal parts of sulphate of copper, gunpowder, and lard. Another good formula consists of equal quantities of butter of antimony, and compound tincture of myrrh. Where the horn is soft and spongy, and the discharges acrid, a useful dressing is made with an ounce each of creasote, turpentine, and linseed oil. The subsequent application of tar is often of value in protecting the bared surface from filth and moisture, and the attacks of flies. When the interdigital skin becomes involved, it may be dusted daily with powdered oxide of zinc or sulphate of copper, or gently touched with a stick of nitrate of silver. Ulcers on the digital space, on the soles, or elsewhere, should be touched with nitrate of silver, diluted nitric acid, or a weak solution of the butter of antimony. Where they are tedious and unhealthy, a poultice is occasionally useful; fungoid granulations are sometimes successfully treated by being touched by the hot iron; dead and diseased horn must in all cases be carefully removed if possible without drawing blood. In most localities the disease may be entirely prevented, and in all its prevalence and severity are greatly abated by the simple expedient of carefully and systematically paring the feet of the whole flock regularly every six or eight weeks. In this way is removed the redundant horn which, from want of sufficient wear, becomes soft and cracked, and a fruitful cause of foot-rot.

Injuries in the Region of the Hip are not very common. Various fractures of the pelvis occasionally occur. Fracture of the neck of the thigh-bone is rare in horses, but more common in dogs, in which dislocation of the hip-joint is also frequent, causing stiffness and turning out of the hock. The prominent head of the thigh-bone is pressed in by the thumb of the one hand, whilst the other grasps the hock, and, giving a rotatory movement to the limb, the bone usually returns at once to its socket.

Strain of the psoas muscles usually results from travelling or galloping over heavy ground, or slipping on ice, and is recognised by the dropping of the hind-quarters at every step, the dragging of the limbs, and the tenderness notable when the hand is introduced into the rectum. Perfect rest, and rugs saturated with hot water applied to the loins, are the appropriate remedies.

Strains of the glutei muscles, forming the buttocks, occasionally occur from galloping or leaping, are indicated by large swellings over the haunch, and often by subsequent weakness, and are treated by rest and hot fomentations. The tendon of the gluteus maximus, as it passes over the great trochanter of the femur, is subject to strain, producing distension of the bursa, which lies between it and the bone, and causing the animal to step short with the injured limb.

Stifle Joint Lameness.—Young colts, on hilly hard ground, are apt, generally from wearing away of the toe, to have dislocation of the patella or knee-pan, which slides off the condyles at almost every step. Remove the animal to level ground, have him shod; and if the case is a bad one, with knuckling over at the fetlock, adopt Professor Dick's plan, of attaching a projection to the toe of the shoe.

Disease of the semilunar cartilages is most common on the inside; causes the limb to be held stiffly in advance of the other, and thrown outwards at every step; and produces, moreover, distension of the capsular ligament, which may be distinctly felt when weight is thrown upon the lame limb, by holding up the other. Rest and blisters are recommended, but seldom in confirmed cases with much benefit.

Thorough Pin is distension (or windgall) of the bursa of the flexor pedis tendon, and is situated immediately above the prominence of the hock, between the bone and the gastrocnemei tendons. It results from severe fast work, especially in young horses, with that faulty conformation known as sickle-hams; is at first soft, and easily reduced by rest and cold applications; but becomes, when of long standing, hard, owing to the exudation of lymph on the interior of the bursæ. Distension of the capsular ligament of the hock-joint, or bog-spavin, is occasionally mistaken for it, but is situated lower down, and cannot so readily be pressed from one side of the limb to the other. Bog spavins and thorough pins, however, often co-exist, for the irritation and pressure of serious bog-spavin are apt to induce distension of the contiguous bursæ of the tendons. Treat as for windgalls, with cold applications and pressure, followed up by blisters.

Curb consists of strain of the posterior straight ligament of the hock; causes tenderness and swelling on the inner and back part of the joint; occurs, especially in horses, with the os calcis short, and inclining forwards; and requires, like other strains, rest, cold applications, friction, and after a time blistering and firing.

Capped Hocks usually proceed from kicking; are generally indicative of vice; consist in infiltration of serum into the subcutaneous cellular tissue about the point of the hock; lead to thickening of the integuments, but seldom cause lameness. Their appropriate remedies are pressure, with wet bandages, blisters, or a little of the ointment of the biniodide of mercury, or, in bad cases, puncturing.

Bog-Spavin consists in distension of the hock-joint, with an excessive secretion of dark-coloured thickened synovia, mixed with lymph. The delicate synovial fringes which secrete the joint oil become red and vascular, and unduly active, and the fluid thus poured into the capsular ligament of the joint sometimes presses upon a vein (the saphena major), which becomes enlarged, and thus gives rise to the old title of Blood-spavin, still occasionally applied to the disease. It occurs in weakly, rapidly growing animals, sometimes without any apparent cause, but more commonly in those that have been put too early to work beyond their strength.

Treatment.—Suspension of work, gentle exercise, bandages kept cool and wet, occasional friction, with a laxative diet and a little nitre, should first be tried, and if unsuccessful, superseded by blisters, or, in extreme cases, by firing. In old hard-worked animals, especially cart horses and hunters, bog-spavin is more intractable, the supply of synovia is insufficient, and, from want of the natural lubricant, the fringes become irritated and inflamed. Similar treatment must be pursued, but firing and several months' rest are most serviceable.

Bone-Spavin is a bony enlargement on the antero-internal part of the hock, usually between the shank-bone and the cuneiform medium, and occasionally between the two cuneiform bones. Severe work, especially in young growing animals, with badly-formed upright hocks, occasions inflammation of the periosteum, extending soon to the bone itself, and causing the deposition of osseous matter.

Treatment.—In recent cases, apply cold, as directed for splint; but in protracted cases, when the joint is extensively affected, hot fomentations afford more relief, by promoting exudation. Where these do not succeed, blisters or firing, or the insertion of a seton, is advisable. The farriers' oils, and other remedies in vogue for this and similar lamenesses, act merely like blisters, and not, as is popularly believed, by extracting the bony deposit. Pain and lameness cease when the deposit is consolidated, and the limb becomes tolerably serviceable, although usually stiffened from the want of free movement between the small bones of the hock.

Horse-shoeing. Almost all diseases of the feet, and almost every stumble and fall during riding or driving, proceed either directly or indirectly from bad shoeing. Partly from inveterate habit, and partly from the notion that they thereby improve the appearance of their work, blacksmiths are greatly too fond of using both the drawing-knife and the rasp. The ground surface of the crust on which the shoe has rested requires, after the cautious removal of the shoe, to be gently rasped, to remove the ragged edges and any stubs of the nails; the sole, where it fits into the angle between the bars, and the posterior part of the quarters, occasionally requires paring out with the knife, which is again needed in a strong foot to level the crust and give it an equal bearing for the shoe. But this, in healthy feet, is all that is required either of the knife or rasp. The tough, horny, elastic frog must be left untouched, to fulfil its functions as an insensible pad, obviating concussion and supporting weight; the bars, valuable as they also are for the support of weight, must likewise remain intact; whilst the sole, which even high authorities advise to be thinned until it yields to the pressure of the thumb, must never, in ordinary circumstances, be meddled with. It is the natural protection of the delicate internal parts, is infinitely superior to the leathers and pads substituted for it, and if left in its natural integrity, will protect the animal from many a bruised sole, and his owner from many a breakdown. Further, to preserve the hoof tough and hard, affording firm holding for the nails, and free from sandcracks, interdict the use of the rasp, which removes the external unctuous portions of the crust, and leaves it brittle, weak, and porous. Most blacksmiths, when the shoe is put on and clinched down, rasp the surface of the crust freely all over to give the finishing polish to the job; but the practice is unnecessary and irrational, and ought to be discountenanced.

When the feet are strong and properly managed, as above directed, a plain shoe without seating answers well; care should be taken to avoid the common error of keeping it spare and short at the heels; the toe should be slightly turned up; heels are generally put on the hind shoes; the fullering or grooves for the nail holes kept wide and open; the nail-holes, three on the outside and two on the in, driven straight through, and never inclining inwards; and the shoe carefully fitted to the foot, and not, as is commonly done, the foot to the shoe. Horses for heavy draught are generally shod in Scotland with tips and heels, which afford increased firmness of tread, and greater power, especially when dragging heavy loads on steep inclines. To preserve the foot in a healthy state, the shoes should be removed every month.

Weak, flat feet—a defect of common occurrence amongst coarsely-made horses, especially when of a grey or light bay colour—require a seated shoe; and when the sole is very thin, it is sometimes advisable to throw extra weight upon the frog by using a bar shoe, that is, an ordinary shoe with a bar of iron welded from heel to heel. Leather soles may also be useful, or waterproof felt, which is preferable, as it does not become so soft and heavy when wet, or so hard when dry. Leather soles or pads are also often serviceable in abating the jar and concussion of high-stepping, fast-trotting horses, much driven upon the hard, unyielding streets of our large towns. Horses with corns should be shod with bar shoes and pads, or with a shoe having a wide inside web, or where the heel is sensitive and weak, with a three-quarter-shoe; the nails ought to be confined to the outer side, or only extend to the inside toe. Horses with ring or side-bones should have their shoes made easily and nicely fitted, to avoid jar; whilst those with strong concave feet, with high heels and a tendency to navicular disease, should wear light shoes turned up at the toes, should have the ground surface of the crust freely cut away, but the sole and frog left untouched.

With these few hints I leave this important subject, on which the student will find some excellent practical remarks in a small volume, entitled, "Notes on the Shoeing of Horses," by Lieutenant-Colonel Fitzwygram, 15th (the King's) Hussars; and in a paper on "Horse-shoeing," by Mr Miles, published in the Journal of the Royal Agricultural Soeiety of England, vol. xviii. Part ii., and reprinted in a separate form, priee 6d., by Mr Murray, Albemarle Street, London.

INFLAMMATION.

Inflammation oecurs in connection with so many diseases, attacks almost all parts of thc animal body, and constitutes, in one part or another, so many of the eases of every-day praetiee, that a correet notion of its general nature and phenomena is of the greatest practical importance. Without attcmpting the hopeless task of propounding a satisfactory definition, which fortunately is not necessary to enable us to eomprehend the eondition, I shall endeavour briefly to deseribe its more important phenomena, symptoms, and its usual terminations, adding a few words on its general causes and treatment.

Supposing the proccss of inflammation artifieially induced by rubbing a blistcr into the skin. The vessels at first contract, but shortly dilate, not only on the spot to which the blister was applied, but also for some distanee around it. These contractions and dilatations of the arteries appear to be produced by a reflex action of the spinal chord; and the law of the nervous system seems to be, that a slight stimulus induces contraction, and a powerful one dilatation; or, in other words, that slight stimuli cxalt vital funetions, whilst more powerful ones depress or altogether destroy them. From the dilatation of the vessels, and the larger amount of blood moving sluggishly through the part, it is suffused with a blush or redness, which, however, unlike that whieh afterwards appears, is removeable by pressure. This is the transition stage betwcen health and disease, the condition of *congestion*, also called functional congestion, and oeeurring in the feet after hard work, in the lungs after a smart gallop, and in external parts from smart continued friction, or the application of mild irritants. It may be aeeompanied by serous effusion and eonsequent swelling, which, however, is soft, and specdily re-absorbed. Dilatation and preternatural rcdness are thc only post-mortcm appearances.

Soon the cireulation through the dilated vessels bccomes obstructed, the globules aggregatc, causing stagnation, and this is the first organie ehangc—thc first decided declcnsion from health. Mr Listcr has satisfactorily shown, that this stagnation results from a lowcred vitality of thc tissucs. He finds that thc structures of the body, so long as they remain in a healthy statc, possess thc power of maintaining thc fluidity of the blood; that if, for example, a frog's limb bc enclosed in a ligature, and thcn amputatcd, the blood in the limb remains fluid, and the globules, so long as the vitality of the limb is unimpaired, exhibit no tendency to arrange themselves into rouleaux, as they do out of the body, or under the influence of active stimuli. Stagnation of the red globules, and their aggregation to form a clot, invariably follow whenever the vitality of a tissue is from any cause impaired or destroyed; and hence it is only logical to infer with Mr Lister, that those conditions of stagnation and aggregation, constituting, as they do, the essential characteristics of inflammation, and the appearances by which it is recognised after death, are, as in the same conditions produced artificially, the results of an impaired and lowered vitality. The clot thus formed obstructs the circulation, gradually increases, and the serum of the blood, with fibrine in solution, passes through the coats of the dilated and impaired vessels.

Accompanying and proceeding from these iuternal changes, are eertaiu external aud uotable appearances:

Heat, probably caused by the increased chemical action in the parts immediately arouud the inflamed spot, raising the temperature of the whole bulk of the blood by several degrees, as in cases of erysipelas in the human subject, from the normal standard of 98° to 104°.

Swelling, caused by vascular engorgement aud stagnatiou, aud subsequently by the exudation of serum and lymph.

Pain, caused by the increased tensiou and the disordered action of the uerves and nervous centres conuected with the part.

Redness, caused by the dilatation and engorgement, and sometimes, in a later stage, by the extravasation of blood globules.

To these phenomena, described as the signs of inflammation from the days of Celsus, may be added impaired or arrested secretion, causing the well-knowu dryness, so noticeable in the early stages of inflammation, depending, in the first instance, upou the impaired state of the parts, and subsequently upou the inaction of the spinal chord, and other nervous centres, produced (through reflex action) by irritation communicated from the inflamed parts. This irritatiou, wheu considerable, impairs not only the secretions of the inflamed part, but also of the system generally; hence the torpid bowels, the scanty secretion of urine, and dry skin, accompanying all serious inflammations. This arrested secretion, together with the pain, are the chief eauses of the accelerated pulse, and other symptoms of fever.

The terminations or consequences of inflammation vary with the intensity and site of the disease, the causes inducing it, and the general health of the patient.

Resolution, although often following congestion, cannot, in strict propriety, be included as a termination of inflammation, for inflammation can hardly be said to exist in the dilated and congested capillaries until there is aggregation of the globules and some outpouring of lymph. The same may be said of effusion of simple serum. It is a termination of congestion, and not of inflammation.

Exudation of lymph, I would regard as the first characteristic termination of inflammation. In healthy subjects the outpoured lymph speedily solidifies, as is well seen in the exudation occurring in open joints, or simple flesh wounds. In these cases it constitutes valuable reparative materials, which must by no means be removed or washed away, and into which, after a short time, blood-vessels and nerves extend from the contiguous living tissues. In the serous cavities, as in cases of pleurisy, it remains shut out from the air, remains longer fluid, and tends to form fibrous bands, producing adhesions. The lymph poured out on the mucous surfaces, in unhealthy subjects, in chronic cases, or where the inflammation has been so intense as to produce extensive destruction of tissue, is less plastic and fibrinous, and, gradually softening and breaking up, forms pus.

Suppuration, or the formation of pus, appears to be a natural effort to remove the products of inflammation when laid down upon the mucous surfaces, or where their presence would interfere with important vital functions. Occasionally the pus floats free amongst the tissues, as in the lungs, in the psoas muscles, or in open joints; and in such cases it is usually of a low and degenerate type, and apt to become absorbed, and exercise a depressing poisonous effect upon the system. More commonly, however, while the lymph in the centre of the inflamed spot is gradually breaking up and liquefying, provision is being made for its retention; the fibres of the lymph are arranged so as to form a membrane, with a smooth villous secreting internal surface. The contained pus gradually seeks to reach the surface of the skin, or a mucous membrane, and, by pressure, causing absorption, is thus evacuated. Pus, thus confined in a membrane, constitutes an abscess, and is well exemplified in the submaxillary tumour of strangles. Sometimes the abscess does not so easily discharge its contents, but communicates with the surface by a narrow canal, with walls of a membrane similar to that enclosing the pus, containing besides, in cases of long standing, hard fibrous tissue, and secreting a thin serous, and often badly-smelling pus. This is a sinus, such as occurs in many cases of quittor. Where a sinus becomes constricted at its external orifice, it is termed a fistula, such as occurs in poll evil, and bad cases of quittor.

Extravasation of blood occurs when the inflammation is acute and the vessels weak, and especially in connection with mucous or cutaneous surfaces. From congestion and obstruction the thinned, weakened coats of the vessels give way, thus allowing the blood globules to pass out along with the lymph.

Mortification, gangrene, or death of the part, occurs when the inflammation has been sudden and violent, and is seen in cases of inflammation of the udder and erysipelas. The part becomes dark-coloured from the decomposition of extravasated blood, any pain that may have been experienced is gone, and unless the dead part is very extensive, or the powers of life prostrated, there is laid down between the dead and living textures a layer of lymph, which, gradually softening and ulcerating, the dead part sloughs off, undergoing a natural, painless, and usually bloodless amputation. This is occasionally seen in veterinary practice, in cases where the udder has been violently inflamed. Death of a bone is known under the special title of *necrosis*.

Ulceration, although resulting from other causes, is also an occasional termination of inflammation, especially when occurring in subjects of a debilitated or depressed constitution. It occurs in the bowels in dysentery, in the nostrils in glanders, and consists in molecular death. The lymph, poured out as a consequence of inflammation, partakes of the faulty state of the system, is weak and deteriorated, unfit for organization, unfit even for the formation of healthy pus. It irritates and inflames the tissues with which it is in contact, and causes an indented sore with irregular edges, discharging thin irritating pus with the debris of the texture affected. This is an ulcer. Ulceration of bone is termed *caries*.

The Causes of Inflammation are, like those of other diseases, divisible into two classes,—*predisposing* and *exciting* causes. The *predisposing* causes are such as result from peculiarity of temperament, weakened circulation from disease, overwork, impure air, deficient nutrition, and the like. The *exciting* causes are such as act locally on the inflamed part, or generally on other parts. *Local* causes are also called *irritants*, and they may be either mechanical, chemical, or vital. These act directly. The second division of exciting causes acts indirectly, and may be illustrated by cold, the introduction of poison into the system, the sudden suppression of discharges which are natural or of long standing, the repression of cutaneous eruptions, etc., all of which produce inflammations. As to the manner in which these various causes act, there is, in the present state of our knowledge, much uncertainty, and this is not the place to enter into discussion on the subject. The really practical part of our business in the matter is, to bear in mind that whatever tends to lower any one of the conditions of healthy nutrition may bring on inflammation, and that when it has set in, instead of increased action we have decreased action to deal with, and that our practice must be such as will tend to enable nature to restore the lost balance.

Amongst the more common general causes of inflammation is exposure to cold, especially when heated and exhausted; as, for example, keeping a horse shivering out of doors to groom him, after a long winter's journey; or, worse still, washing him freely with cold water. Amongst the better cared-for class of horses, rapid alternations of temperature are frequent causes of disease. The horse, probably, with a nicely clipped or singed coat, stands in a stable at 60° or 65° warmly clothed, and has to turn out in bitter frosty or damp wet weather totally unprotected. Such a change is apt seriously to interfere with the healthy balance of the circulation, to drive the blood from the skin, and thus cause congestion of internal organs, to arrest important secretions, depress vitality, and thus become a fruitful source of such diseases as inflammation of the lungs, bowels, or feet. These and all other causes of inflammation act most rapidly and seriously upon debilitated and badly-managed animals, and select in such animals those parts which are weakest.

Inflammation established in one part is apt to travel to others continuous with, contiguous to, or anatomically resembling it. Thus the inflammation of cold in the head is apt to travel to the bronchial tubes or lungs; inflammation of the pleura spreads to the lungs, and *vice versa;* and rheumatic inflammation of the fibrous tissues of the joints is liable to involve the fibro-serous tissues of the pericardium, heart, and larger vessels. The intimate connection and sympathy between similar structures explains the extreme irritability of the bowels in cases of bronchitis and laminitis, and accounts for what is often termed metastasis, or the so-called transference of disease from one part of the body to another. Thus, during an attack of stomach staggers or enteritis, symptoms of founder sometimes present themselves; whilst founder, in its turn, is apt to be accompanied by inflammation of the pericardium. But in veterinary practice it is rare that the development of the second disease arrests the first; and although the symptoms of one or other may predominate, post-mortem appearances usually indicate that both run their course together. The metastasis, therefore, is in general more apparent than real, and must in the majority of cases be regarded rather as an extension than a transference of disease.

The treatment of inflammation necessarily varies with the different conditions under which it occurs. Of the many remedies employed, some act directly upon the part, others upon the general system. To a few of the most approved of each class attention is now directed.

Cold. When circumscribed, superficial, and accompanied by slight pain and throbbing, inflammation may often be put back, as the popular expression goes, by the persevering use of cold, which counteracts the dilatation of the vessels, and imparts tone to the surrounding parts. Such treatment is especially applicable to inflammation in bone and tissues of low organization, and to diseases and accidents about the limbs both of cattle and sheep, but is seldom so suitable as heat in the inflammation accompanying rheumatic cases.

Cold water, refrigerant or evaporating lotions, are in common use; but the cold, however produced, must be kept up steadily for at least several hours at a time, otherwise it is not only useless but even injurious, as it is apt to be followed by reaction. (See p. 86.)

Heat and moisture. When inflammation affects a considerable surface, involves not only the skin but the deeper-seated textures, has run on for some time unchecked, or is accompanied by much pain and throbbing, heat is preferable to cold, and either poultices or fomentations may be used, the former generally being more cleanly and convenient. The part is either fomented in the usual way with a sponge or piece of thick woollen cloth, or enveloped in a soft woollen substance, several folds thick, over which hot water must be poured at short intervals, and the heat and moisure thus kept up for several hours, when the part must be dried and protected from cold. Mr Haycock of Huddersfield advises steam instead of water, as being less apt to wet the surrounding parts, and to wash away valuable reparative materials. The heat and moisture, whether applied in the form of poultices, fomentations, or steam, diminish tension and favour swelling, and probably exercise besides, some soothing influence on the irritated nerves of the part. They are also valuable in hastening the liquefaction of lymph and the formation of healthy pus, and hence are useful in promoting the maturation and evacuation of abscesses. (See p. 85.)

Astringents act much in the same way as cold, and are applicable in circumscribed, superficial inflammation, such as that affecting the conjunctiva. (See p. 54.)

Blisters, and such other counter-irritants, appear to direct to the inflamed part a larger amount of blood and a healthier supply of nervous influence; they rouse as it were the slumbering vitality of the part, and when the more acute symptoms are past, are especially useful in removing the products of disease. In serious inflammation affecting internal organs, or even in arrested action of such organs, as in obstinate constipation, the application of hot water to the nearest external surface is attended with the best results, and appears to combine the advantages of fomentations in relieving tension and pain, and of blisters in determining to the part affected a better and healthier supply of blood and nervous influence.

Blood-letting was long regarded as the "sheet-anchor" in the treatment of inflammation, was often repeated several times, and used with a total disregard of its debilitating influences. Although very liable to abuse, it is nevertheless of value in the early stages of acute inflammation, especially of serous and fibro-serous textures, and where the pulse is full and strong, or slow and oppressed. In such cases it relieves the overloaded vessels, allays febrile symptoms and pain, and promotes the absorption of appropriate medicines. When the causes of the disease have been of a reducing character, when there is debility, low fever, or considerable exudation, blood-letting is very injurious. More detailed directions for its employment will be found in a former part of the volume (p. 58). Where there is much extravasation of blood on an exposed mucous or cutaneous surface, scarifying is beneficial in giving vent to the blood, and thus preventing sloughing, as in bad bruises or in erysipelas.

Sedatives, such as aconite, calomel and opium, antimony, colchicum, and digitalis, are used to reduce the fever and constitutional disturbance. (See p. 56.) To be effectual, they ought to be given more frequently than is generally done, as every hour, or at any rate every second hour. When five or six doses of any sedative have been given without producing any good, another should at once be substituted for it.

Purgatives, besides evacuating the bowels and thus removing crudities which are apt to cause and increase irritation, are also invaluable as depurative remedies, removing from the blood the products of inflammation or noxious matters accumulating from the arrestment of secretions (p. 34). They must, however, be used cautiously; for it is not a single violent movement that is required, but a regular and gently relaxed state which should be kept up by clysters (p. 86), a well-regulated diet, and an occasional half dose of medicine. Diuretics and diaphoretics are of similar service as depurative remedies (pp. 40, 43).

Saline Medicines, such as nitre, carbonates of soda and potash, common salt, and small doses of compounds of ammonia, should be given several times daily, and are of much advantage, probably by maintaining the solubility of the fibrine, and the activity of the secreting organs (p. 50). These remedies, unlike the sedatives, are valuable in all stages and all cases of inflammation. It cannot be too often or strongly insisted upon, that inflammation is a disease not of increased or heightened vitality, but of decreased and impaired vitality; and that we must therefore studiously beware of pushing too far the depletive and sedative remedies. In an acute attack of enteritis, the time for such treatment is usually past in six or eight hours; in acute pneumonia or pleurisy, in three and sometimes in two days. Saline medicines used from the outset must still be continued; but instead of the sedatives, must be combined with tonics and stimulants, to keep up the vital powers, and enable nature to get rid of the products of disease, in which depurative process essential service is rendered by keeping up the action of the several excreting channels by occasional diuretics and laxatives. This mode of treatment is requisite even from the commencement in most inflammatory affections of young and debilitated subjects, as well as in most cases of inflammation accompanying epizootics which cannot stand depletive or sedative treatment, and are best cured by the early use of tonics and stimulants, often advantageously combined with such anodynes as opium and belladonna.

Anodynes. When inflammation, whether local or general, is accompanied by great pain, anodynes, such as opium, belladonna, hyoscyamus and prussic acid, are often serviceable, probably in virtue of their soothing action upon the irritable nerves, and are advantageously used both externally and internally.

Hygienic remedies, or Regimen and Diet.—In the successful treatment of serious internal inflammations, there are certain hygienic remedies of equal importance with the medical remedies above detailed, and without which the best directed medical treatment is unavailing. From his stable or cow-house the sick animal must be moved to a loose box, clean, airy, moderately lighted, well littered, and kept at a tolerably uniform temperature of about 60°. The horse must be comfortably clothed, but not over-burthened, and his legs encased in flannel bandages, which should be removed several times daily, shaken, and after hand-rubbing of the legs, put on again. The clothing should also be removed at intervals, and the animal rubbed over. By the adoption of these simple remedies, and without any medicines whatever, I have frequently seen a sick horse's pulse fall six or eight beats per minute, in the short space of an hour.

At the onset of acute inflammation, the appetite is gone, and it is useless to offer food of any sort; but the animal is generally thirsty, and may have water which has stood for a little in his box, and which, although nearly cold, is by no means injurious, and is infinitely more agreeable and refreshing than the tepid water to which the poor thirsty beast is often restricted. If it does not render the water unpalatable, a little nitre or common salt may be added to it. As soon as the animal will eat, give small quantities of scalded bran, boiled barley, malt, boiled bruised oats, a few slices of carrot or mangold, a little green food, or any light, easily digestible food that the animal will take; vary the food frequently, give it often, and in small quantities at a time, never allowing more than is eaten up at once, and with relish. In carrying out these measures, it is of much importance to secure the services of a sensible steady person, well accustomed to horses, who will go about the patient quietly, and attend carefully to the amount of clothing, the temperature of the box, the feeding and other details of a similar nature, which the veterinarian cannot always personally superintend.

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THE END.

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