The specific action of drugs on the healthy system : an index to their therapeutic value, as deduced from experiments on man and animals

THE THERAPEUTIC ACTION OF DRUGS

BURNESS & MAVOR

THE

SPECIFIC ACTION OF DRUGS

ON

THE HEALTHY SYSTEM;

AN

INDEX TO THEIR THERAPEUTIC VALUE,

AS DEDUCED FROM

EXPERIMENTS ON MAN AND ANIMALS.

BY

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PREFACE.

My object in appearing before my professional brethren and the public, is to lay before them the results of a series of experiments conducted at various periods, in order to ascertain the true *therapeutic* value of each drug, from its *physiological* action on the healthy system. To the subject of therapeutics I have directed special attention, believing as I do that we know too little of such an important branch of our medical education; and I trust the work I now lay before the public will, at least to some extent, advance the science of therapeutics, and at the same time induce others to investigate the subject. The sooner diseases are treated on some scientific principle, and not by empiric remedies, the better for the patient, and the better for the credit of the profession.

I must take this opportunity of thanking Messrs. Mavor, 91, Park Street, W., for the means they so kindly placed at my disposal to enable me to complete my experiments; and as Mr. F. J. Mavor held similar views to my own, and had acted on them for years, we arranged to publish this work in our joint names, and to embody in it his experiments, and

the deductions that he draws from them in reference to the treatment of diseases of animals, as they are of benefit, not only to the veterinary surgeon, but also to the scientific man. We hope that this work will prove of use to both the medical man and the veterinary surgeon in their daily practice; for, by indicating the range of action of each drug, it places at their disposal a scientific principle upon which to found their line of treatment.

The portion of this work devoted to veterinary subjects has been contributed by Mr. F. J. Mavor; and he here takes the opportunity of assuring his professional brethren that it is with pleasure he now lays before them the results of his long experience and numerous investigations—investigations in which he has, at various times, been aided by many of his medical friends. Special thanks he feels are due to Dr. Winslow, Dr. Richardson, Dr. John Harley, and Dr. Althaus, also to Mr. Hemmingway, chemist, Portman Street, to whom he is indebted for obtaining pure and reliable preparations of the various drugs experimented with.

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Grosvenor Square, W.
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INTRODUCTION.

THE purport of this work may be briefly summarised thus—To point out that the full therapeutic value of each substance (*i.e.*, its value in the treatment of disease) is only to be determined by ascertaining the symptoms produced, and the parts influenced by each substance when introduced into the healthy animal economy; and that this is to be done by careful observation of cases where a substance has been introduced either by accident or intention, the quantity taken in each case, as well as the form and mode in which introduced, being also noted.

In the First Chapter, a few examples are adduced to show that each disease is characterized by certain primary symptoms peculiar to itself, due in most cases to some, as yet, unknown cause, specifically influencing some special parts or tracts; and in the same chapter various examples are brought forward, showing that there are various known

agents which influence primarily certain parts, and produce certain symptoms peculiar to each, when introduced into the healthy animal economy, and that this influence is due to their physical, chemical, or dynamical properties—whilst in the Second Chapter it is shown that the knowledge of the specific action of each substance thus gained, is a *key* to its therapeutic value. And at the same time allusion is made to the fact that each substance exerts a two-fold action upon the same parts, according to the quantity taken, and the state of the part—one, its physiological action; another, which, for want of a better name, may be called its restorative action—and it is indicated where it is advisable to use an agent in physiological or in restorative doses. Cases are also quoted to show that experience has already proved the truth of the above statements.

Chapter III. includes a few remarks on the form and mode of administering various substances for therapeutic purposes.

Chapter IV. is devoted to a few notes on temperature in health and disease, and the influence of various substances upon it.

The remainder of the work is devoted to setting forth the specific action of various drugs, as deduced from experiments, conducted, where possible, on man and animals by ourselves, and in other cases deduced from reports of poisoning in toxicological works; at the same time the therapeutic use of each drug is indicated in man and

animals, for we are convinced that when a certain drug influences special parts in the human body, it influences parallel parts in the animal body, both in the healthy and the diseased state, although not necessarily producing in all cases the same train of symptoms; in fact the diseases to which animals are subject are brought about in the same way as in man, viz., by some cause inducing primary derangement of some special parts or tracts; and that the same remedies which restore the functions of these parts or tracts in man, will serve the same purpose in animals, in the majority of cases.

We found our theory on the fact that all non-nutritious agents, whether formed in the body, or introduced by accident or intention, tend to pass out by some one or other of the eliminating tracts, and in their passage out they affect these tracts in virtue of their physical, chemical, or dynamical properties; and we mention here that we use the word tract in preference to organ for the following reasons, viz., that no agent primarily influences any special organ as a whole, but only influences some special part of it, and from its influence over this special part it may affect the function of the whole organ; for example, in rheumatism, the lactic acid is secreted from the blood by the fibrous tissues generally; hence we often get the fibrous tissue of the heart affected, and from this, impairment of the heart's function; but we cannot say that lactic acid acts primarily on this organ as a whole. Again, ergot influences the sympathetic system and the unstriped muscular

fibre, and hence acts on the uterus, especially when in the pregnant state, because this organ then contains a large proportion of this structure, but it has no direct influence over the serous or mucous coats of this organ. Arsenic again influences mucous membrane wherever this structure is situated in the body, because it is eliminated by that special tract.

At the end of this work we have added a few cases to illustrate clearly what we mean by specific treatment.

ERRATA.

Page iv	*read* "Hemingway"	*not*	"Hemmingway"
,, 9	,, "condition" of blood	,,	"conditions."
,, 41	,, "Aconitum"	,,	"Aconitus."
,, 46	,, "physiological" effects	,,	"physical."
,, 82	,, "℥ss."	,,	"℥ß."
,, 123	,, "Hydrargyrum *cum* Cretâ"	,,	"*with*."
,, 132,	Experiment *i*, *read* "Four ounces"	,,	"Fours."
,, 120	*read* Therapeutic "Uses"	,,	"Acid."
,, 124	,, "Hydrargyri Bichloridum"	*not*	"Hydrargyria Bichloridi."
,, 111	,, "Ferri" Iodidum	*not*	"Ferrum."
,, 107	,, "Iodide" of Potassium	,,	"Iodine" of.
,, 102	,, "Simarouba"	,,	"Simaronba."
,, 65,	Exp. *l*, *read* "$\frac{1}{19}$ grain"	,,	"1"

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SUBSTANCES WHICH ARE INDICATED IN THE TREATMENT OF DERANGEMENTS OF THE MOTOR CENTRES.

SUBSTANCES WHICH ARE INDICATED IN THE TREATMENT OF DERANGEMENTS OF THE SYMPATHETIC SYSTEM.

SUBSTANCES INFLUENCING THE CEREBRO-SPINAL SYSTEM.

THE

SPECIFIC ACTION OF DRUGS.

CHAPTER I.

THE SPECIFIC ACTION OF VARIOUS SUBSTANCES ON THE ANIMAL SYSTEM IN HEALTH.

In each disease we recognise some certain primary functional derangement of certain parts or tracts, brought about by some special cause, and in many cases secondary effects arising from this primary functional derangement.

For example:—In gout some cause primarily induces functional derangement of some portion of the nutritive system, by which uric acid is produced in excess, and as a secondary result, this uric acid combines with soda, and becomes deposited within the joints, and a fundamental cure can only be effected by removing the cause, and restoring the deranged function.

Again, there are many morbific agents of an organic nature which, when introduced into the animal economy, are eliminated therefrom by the various excreting tracts, not because any special power of nature is exerted to throw them out as poisons and dangerous to life, but simply as being non-nutritious, and therefore excrementitious material,

but in their passage through they not only become decomposed themselves, but have the power of inducing a tendency to decomposition of the various parts or tracts they come in contact with, thus rendering them also excrementitious. Hence we have primarily functional derangement of the excreting tracts, and eventually various secondary effects upon the general system.

This is evidently the case in zymotic fevers, and the difference in symptoms between the various fevers arranged under this title *may* be due either to a difference in constitution of the morbific agents, or *may* be due to the particular tract primarily affected, and the importance of that special tract in the animal economy; also upon this latter point will depend, to a great extent, the severity of the symptoms and the probability of recovery.

In reference to the acute infectious fevers we may recognize some specific cause or causes, which, by inducing disorganization of tissue and increased oxidation, raise the temperature above the normal, and interfering with the functions of the excreting tracts, tend to promote the accumulation of effete material in the system, and thereby give rise to various secondary complications. But there is another class of fevers known as the "*malarial*," in which the high temperature is due primarily to some definite cause inducing functional derangement of that portion of the system whose function it is to correlate the excess of heat generated in the healthy body into nerve force, and, as such, to render it latent; so the oxidation of the tissues still going on, the temperature of the blood will be increased to such an extent as to induce palsy of the heart and brain (unless by profuse sweating the excess of heat is carried off), and various secondary complications.

We will, however, allude at greater length to this subject under the article on "Temperature;" at present we merely wish to indicate by the above examples that in every disease primarily a special train of symptoms are evoked by some special cause, acting in each case on some special parts or tracts: in gout, upon the nutritive system; in acute infectious fevers, on the excreting tracts, and in malarial fevers, on the heat correlating system. And we will now show that the various agents used for remedial purposes exert an influence over special parts or tracts of the animal economy, and that the special range of symptoms produced by any one agent will vary according to the state of the body, the dose given, and the mode and form in which given, although in every case the same special parts or tracts will be more or less influenced.

The influence of various agents depends upon their physical, chemical, or dynamical properties, and in this chapter we purpose to adduce certain examples, to show that each agent introduced into the *healthy* animal economy, by influencing special parts or tracts, produces a train of symptoms peculiar to itself, and these symptoms we call the physiological effects of the special agent.

In reference to those agents which produce physical effects due to their external form or weight, it will suffice to mention woody fibre, hairs of mucuna pruriens (cowhage), and quicksilver, which, introduced into the alimentary canal, act merely as foreign bodies and irritants; and as they possess but little therapeutic interest, they require no further notice here; but there are various agents which produce physical effects on the body by their influence over the phenomena of endosmose and exosmose, causing, when introduced in solution into the body, endosmose of the serum of the blood,

or endosmose of the solution, according as the solution is concentrated or dilute.

Amongst those which cause endosmose of the serum, we have *concentrated* solutions of various salts, viz., phosphate of soda, nitrate of potash, chloride of sodium, tartrate of potash, sulphates of soda and potash, phosphate of potash, seidlitz-water, also concentrated solutions of various vegetable substances, as manna, extract of senna, tamarinds, cassia, resins of scammony and jalap, aloes, and castor oil, hence we find that when any of the above-mentioned substances are introduced into the alimentary canal in a concentrated form they cause purgation, but if we introduce a dilute solution (of less specific gravity than the serum of the blood) of either phosphate of soda, nitrate of potash, or chloride of sodium, we have endosmose of the solution, and by their action on the kidneys, excite diuresis; solutions of acetic, tartaric, citric, and sulphuric acids, of ammonia, of nitrate of strychnia, and of sulphate of quinia, hydrocyanic acid, laurel-water, and some mineral waters, act in the same way. Such substances as sulphuretted hydrogen neither undergo endosmose nor exosmose with the serum of the blood; and the efficacy of opium is due, to a great extent, to its power of putting a stop to the phenomena of endosmose.

Hence it is evident that the specific effect produced by many of the above-mentioned substances (whether purgation or diuresis) will depend on the specific gravity of the solution introduced into the alimentary canal; but there is still another point to be considered, viz., the alteration they produce in the specific gravity of the serum of the blood, and hence alteration in the condition of the blood corpuscles, for if the blood corpuscles are enlarged by distension, they

are unable to pass through tubes of the same calibre as before; moreover, if their contents are more dilute than usual, their endosmotic action on the chyle is lessened, and thus nutrition interfered with. The specific action of most of these substances is upon the fluids of the body, and, as already stated, the exact effect produced will vary according to the degree of concentration of the solutions, but in all cases it will be the specific gravity of the fluids of the body that will be primarily influenced, and from the changes thus produced, various secondary effects will be induced. But we have another class of substances, whose specific action is due to the mutual affinities which exist between them and the constituents of the tissues, and of the blood.

1. Chlorine, bromine, and iodine abstract hydrogen and unite with bases, and we find that iodine applied to the skin produces a brown stain, forming ioduretted hydriodic acid, and when introduced into the body, appears in the urine as hydriodic acid and iodide.

2. Sulphur and phosphorus combine both with oxygen and hydrogen, for when sulphur is taken into the stomach it is eliminated from the system in the form of sulphuric acid and sulphuretted hydrogen, while phosphorus appears as phosphorous acid, phosphoric acid, and phosphuretted hydrogen.

3. The acids (sulphuric, nitric, hydrochloric, phosphoric, and acetic) exert a specific action on the body by combining with bases, decomposing various salts, and uniting with, or decomposing, the organic constituents of the body; for example, the very dilute acids form with albumen and fibrine, compounds insoluble if excess of acid is present, but acetic and phosphoric acids form soluble compounds.

The concentrated mineral acids decompose most organic

compounds; the acids when absorbed into the blood are eliminated therefrom, but in their passage out they combine with various bases, and render various secretions acid.

4. The alkalies unite with acids, decompose some salts, and combine with or decompose the organic constituents of the body; form soluble compounds with albumen and fibrine, and when absorbed into the blood are eliminated by the excreting organs, rendering the secretions alkaline; also by forming an emulsion with fatty matters, they promote their passage through the different membranes.

5. Metallic salts. The specific action of these salts is due to a great extent to their chemical properties; for most of them form a compound with albumen, which is soluble in saline solutions. Sulphate of copper, nitrate of silver, bichloride of mercury, acetate of lead, and chloride of zinc all act in this way.

6. Tannic and gallic acid. Tannic acid forms insoluble compounds with gelatine and albumen, and also combines with fibrine; and when taken into the stomach unites with the constituents of the epithelium, and of the mucous membrane; becomes absorbed and is eliminated as gallic acid. Gallic acid is more easily absorbed than tannic acid, and does not form insoluble chemical compounds with gelatine or albumen, but appears in the urine unchanged.

7. Creosote, alcohol, and ether. The two first coagulate albumen, and creosote decomposes epithelium and other albuminous tissues. Alcohol abstracts water from the different tissues, and ether resembles alcohol in its action.

Thus it is that the primary symptoms produced by chemical substances are due to their effecting chemical changes in the composition of various parts of the body, and thus altering the *nature or quality of their vital action*,

and from thus influencing the function of one part, influence to a greater or less extent the function of other parts indirectly.

While a toxic dose will effect such changes in a part as to unfit it for any vital action, a lesser dose, applied to a diseased part, will, by removing that state of combination of the elements which excited diseased action, enable the normal process of nutrition to restore the healthy constitution.

It will now be evident from these examples, that each of the above-mentioned substances will exert a specific influence over those parts or tracts which contain those constituents for which they have an affinity.

Thus having indicated the specific action of those substances which produce physical and chemical effects, it now remains to show that those which possess dynamical properties also exert a specific influence (peculiar to each) on some special parts or tracts, by causing some alteration in the nature or quality of the vital action, and in many cases some change in the composition of the organic tissues. Some substances possess both chemical and dynamical properties.

In cases of poisoning, we have a substance introduced into the healthy animal economy in a toxic dose, and as in such cases we have all the physiological effects of the particular substance produced, we can, by noting the symptoms, arrive at a knowledge of what special parts or tracts are influenced. For example:—Arsenious acid, as a rule produces the following symptoms when swallowed:—"Faintness, depression, nausea, and vomiting, intense burning pain in the region of the stomach, which soon extends over the whole abdomen, the pain being increased by pressure. Diarrhœa soon sets in, accompanied with

tenesmus, and a feeling of heat and pain at the arms. Frequently there is great thirst, sense of heat and dryness in the throat, the urine is sometimes diminished or suppressed." Vomiting is excited by any substance taken into the stomach; the matter vomited is usually brown and turbid, sometimes mixed with blood. Pulse is quick, but small and irregular; sometimes there are cold, clammy sweats, but at other times the skin is hot; the heart's action is irregular, giving rise to palpitation; breathing short and painful; coma soon supervenes with paralysis, tetanic convulsions, or spasms in the muscles of the extremities.

Such are the usual symptoms if the quantity be large, but should the quantity be small and frequently repeated, or should a person survive for some time after a large dose, there are the following symptoms:—"Feeling of warmth or pain in the stomach and bowels, loss of appetite; thirst, nausea, and vomiting; relaxed condition of the bowels, with colicky pains; furred tongue, aphthæ of the mouth, various cutaneous eruptions, inflammation of the conjunctivæ with soreness of the edges of the eyelids; quick, small, and irregular pulse; frontal headache; coryza with profuse ichorous discharge; oppressed respiration with a dry cough; diminution or suppression of the urine; languor and want of sleep; the limbs become painful and trembling, subject to convulsions, benumbed, eventually paralysed; emaciation, anæmia, and death." In some cases the hair and nails fall off, and swelling of the face and feet is also present.

Now, keeping the above symptoms before us, we see that arsenious acid, in whatever way introduced into the system, exerts a specific influence, primarily, on the mucous membrane and the skin, as evinced by the deranged functions

of the alimentary and respiratory tracts and the skin; and, secondarily, upon the cerebro-spinal and sympathetic systems, indicated by the cramps, convulsions, paralysis, and the quick irregular small pulse, &c. (*vide* art. Arsenious Acid). Here we see a known substance introduced into the healthy animal, causing a special train of symptoms, by influencing special parts or tracts in exactly the same way as already indicated in disease, unknown causes, by influencing special parts or tracts, produce special symptoms.

We will now adduce a case of poisoning by "Aconite," and point out that it influences some special parts or tracts, producing a train of symptoms peculiar to itself. Given internally, aconite first causes tingling and numbness of the parts about the mouth and throat; warmth at the epigastrium, with nausea and vomiting; prickling and tingling of the extremities, followed by anæsthesia of the surface of the body, with, in many cases, inability to stand. The pupils are contracted, and there is dimness of sight; face and lip pale; surface of the body cold; pulse small, feeble, and irregular; heart's action weak and irregular, with præcordial anxiety; short, hurried breathing, and usually death by syncope. (In some cases, cutting pains are felt in the joints and muscles.) Such are the symptoms produced by a toxic dose; but in cases where a less dose has been given, reaction has set in, with the following symptoms: febrile heat, quick pulse, flushed features, increased respiration, profuse sweating, and pain especially in the joints and muscles. Thus it is evident the action of aconite is on the sensory nerves, as indicated by the prickling, &c., followed by anæsthesia, also upon the sympathetic ganglia, influencing the heart and vascular system, &c. (*vide* art. Aconite).

Having indicated, by the above examples, the mode in

which the specific action of any substance on the healthy body may be determined, it is only necessary to call the reader's attention to the various reports in toxicological works of cases of poisoning, by which he will see that each substance induces a train of symptoms peculiar to itself.

But before concluding this chapter we wish to call attention to the necessity of noting, not only the *quantity* of any substance that produces certain symptoms, but also the *form* and *mode* in which the substance is administered; for a substance may be introduced into the alimentary canal in such a form as only to excite topical effects, and to be eliminated from the system before sufficient has been absorbed to excite constitutional effects. And there is little doubt that it is to this fact we owe the various contradictory reports as to the physiological action of many substances. Or, again, it may be injected into the circulation, and in such a form as at once to produce constitutional effects. Thus, in order to gain a full knowledge of the specific action of any substance, it is necessary to introduce it into the body in different doses, forms, and modes, and, observing the effects in each case, take the totality of symptoms as the physiological effects of the substance.

In the next chapter it will be our object to show that, when we meet with deranged function of certain parts or tracts, we shall find that restoration to a healthy condition will be brought about by the same substance which we have found influences those special parts or tracts in the healthy body.

CHAPTER II.

THE THERAPEUTIC VALUE OF DRUGS, DEDUCED FROM THEIR SPECIFIC ACTION ON THE HEALTHY ANIMAL SYSTEM.

In the preceding chapter we alluded to the specific action of various substances on the *healthy* animal system. We have now to show that the same substance that influenced special tracts or parts of the body in their healthy condition, will influence the same special parts or tracts in their diseased condition, and will so act upon them as to restore them to their normal condition. But we must remember, when we wish to use any substance to restore the deranged function of any parts or tracts, by its specific influence over them, that doses *considerably* less than would be sufficient to produce the physiological effects of the special substance will serve, by effecting some alteration in the nature or quality of the vital action. Yet there are cases in which we wish to restore health by acting on the diseased parts indirectly; or, when we wish to eliminate the cause of disease, &c., then, in these cases, we give various agents in doses sufficient to produce more or less of these physiological effects. As, for example, we may use such substances as hydrate of chloral, or bromide of potassium, to produce

sleep; narcotics, to relieve pain; ipecacuanha, sulphate of zinc, &c., to excite vomiting; castor oil, to remove retained fætal matter from the bowels; ergot, to promote expulsion of the fœtus, or to cause contraction of the uterus, and prevent hæmorrhage, &c., &c.

Before passing on to quote instances in which experience has proved the inestimable value of specific remedies in such doses as act therapeutically, but not physiologically, we wish first to say that in this work, when allusion is made to the *toxic* doses of any substance, we mean the quantity that is sufficient to produce the full physiological effects, and cause death. And in those cases where we have not determined it ourselves by experiment, we take it as given in the toxicological works of Taylor and Guy. When we refer to using a substance for therapeutic purposes in a *physiological* dose, such a dose is meant as is given in works on materia medica as the medicinal dose. But, as stated already, when a substance is used for its specific action on the diseased parts or tracts, the dose must be *considerably* below the last-mentioned dose. The exact quantity of each substance to be given for this purpose is a point to be determined yet by experiment. The rule, however, is to give it in such a dose as will not produce physiological effects, and thus aggravate the disease.

We now pass on to quote instances where experience has proved, beyond question, the value of specific treatment, a line of treatment which many leading medical men fully admit the value of, and, to a certain extent, adopt, though they do not attempt to explain the *modus operandi*.

First. Arsenious acid has been used with great success in cholera, chronic diarrhœa, especially when attended with

gastrodynia. Various forms of dyspepsia, or gastro-enteralgia, accompanied by obstinate diarrhœa, in cases where there is functional derangement of the intestinal canal, and ejection of vitiated secretions and bloody mucus, combined with emaciation; in various forms of skin disease, its influence can be denied by none. In chronic inflammation of the eyes, catarrhal and strumous ophthalmia, bronchitis, hay-fever, asthma, chronic bronchitis, chronic catarrh, with much expectoration, and in phthisis, it is useful by moderating the diarrhœa, hectic-fever, and cough.

In all the above-mentioned cases we have the deranged functions (viz., the mucous and the skin) of special tracts restored by the agent which exerts a specific influence on them, as indicated in the preceding chapter.

For the same reason "Aconite" is, and has been, proven to be the best remedy in all febrile states, not dependent on blood poisoning or local inflammation (although even in these cases it subdues and controls various secondary complications), in acute rheumatism, in pleuritis, pericarditis, various inflammatory affections of the throat, otitis, in active hæmorrhage and congestions, as epistaxis, influenza, catarrhal croup, &c. (*vide* art. Aconite).

"Belladonna" is a most efficacious remedy in nocturnal incontinence, erysipelas, and the delirium of fevers.

"Digitalis." This drug's specific influence in strengthening a weak heart, and correcting its irregular action, is at the present day admitted by all.

"Ipecacuanha" is used in many forms of vomiting, dyspepsia, dysentery, and diarrhœa, also in asthma.

"Nux vomica" improves the appetite, promotes digestion, and relieves constipation; also useful in chorea and epilepsy.

"Bichloride of mercury." In dysentery, acute and chronic.

"Iodine and Iodides." In various chronic affections of the respiratory mucous membrane.

"Turpentine," by its topical action on the mucous membrane of the urinary tract, is useful in suppressions of urine and hæmaturia, also useful in the hæmorrhagic diathesis.

As it is our intention farther on to state, in detail, the specific action of each drug, both on the body in health and disease, it will be unnecessary at present to quote more instances to prove the truth of the theory set forth at the commencement of this chapter.

We will now allude to those cases where we use our agent in such doses as will produce physiological effects (either by its physical, chemical, or dynamical properties), and by either aiding the elimination of the cause of the disease, or indirectly acting on the diseased parts, restore the deranged functions. For example:

We administer such substances as ipecacuanha, sulphate of zinc, tartar emetic, sulphate of copper, &c., to promote vomiting, for the purpose of expelling poisons or undigested food from the stomach, and to expel foreign bodies lodged in the œsophagus, &c. We also use emetics in croup only where the impeded expiration causes us to infer that the glottis is becoming choked by false membrane, and when the child's efforts at coughing are insufficient to expel it. And in cases of inflammation of the respiratory tract, where we have dyspnœa, augmented by a collection of bronchial secretions which the patient is unable to cough up.

Again, we administer in physiological doses such agents as manna, cassia pulp, tamarinds, prunes, concentrated solution of bitartrate of potash, castor oil, &c., to cause endosmose of the serum of the blood (which effect is due to their physi-

cal properties, *vide* chap. i.), and thus evacuate the contents of the intestinal canal, in cases of retained feculent matter, undigested food, worms, and poisonous agents.

Concentrated solutions of salts, of the alkalies, &c., are useful, for the same reason, to promote the elimination of morbid agents contained in the blood, either absorbed poisons or retained principles which ought to have been evacuated by other excreting tracts. Also in dropsies by carrying out fluid, and promoting absorption. In torpid conditions of the alimentary canal, although various agents are used to produce cathartic effects, the relief obtained by them is only temporary, and it is decidedly a far better and wiser plan to use some agent, such as nux vomica, to act specifically on the alimentary tract, and restore the deranged function.

In cases where the cutaneous secretion has been checked, or where, for various reasons, it is advisable to stimulate the vital process of transudation, we use such agents as will excite vascular action, and influence the sudoriferous canals. For example, salts of ammonia, opium, and water alone or with wine. On the other hand, when the renal secretion has been checked, or where for various reasons it is advisable to stimulate the excreting functions of that tract, we use those agents which in physiological doses are absorbed into the blood, and by their topical action on the renal membrane, exert a direct stimulant influence on the kidneys, or we may indirectly promote the secretion of urine, by increasing the quantity of fluids taken into the stomach, and the agents which act in the first mentioned method are *dilute* solutions of alkalies, and the alkaline and earthy salts, and the various substances containing a volatile oil, as buchu, copaiva, cajuputi, juniper, &c.

In reference to the use of various agents to diminish secretion, it must be remembered that in most cases temporary relief only is obtained, and in many cases the evil is aggravated, by giving such agents in physiological doses (although it cannot be denied that agents possessing astringent properties are of great value when topically applied, to react chemically on the animal solids and fluids, in cases of profuse secretion from ulcerated surfaces, hæmorrhage, &c.), as their dynamical influence is to a great extent, if not altogether, a consequence of their chemical action. Hence in the great majority of cases where we have abnormal increase of the secretions, it would be the better plan to act on the parts or tracts deranged, and restore their functions by administering the agent which specifically influences those parts or tracts. It may be advisable in some cases to administer such agents as possess astringent or stimulant properties to remove some of the secondary effects produced by the functional derangement; but complete restoration to a healthy condition will be best effected by specific remedies, as for instance the carbonate of soda, magnesia, or potash, may be used as an antacid in heartburn or flatulence; but the deranged functions to which this acidity is due must be restored by specific remedies.

There remains yet another class of agents to notice, which are used in physiological doses to influence the uterus and the uterine functions; and as in cases of deranged function of this organ, there are usually so many causes tending to keep up the deranged condition, or so many complications induced by it, it is difficult to indicate the remedy most appropriate; however, we must be guided by circumstances, and when we meet with a case of amenorrhæa, co-existing with anæmia, we must administer chalybeates, while, where

we have congestion of the pelvic viscera, we must use agents to relieve this condition, and in all cases proper hygienic measures must be enforced, or according as the mucous, serous, or muscular coat is implicated we must use those agents which specifically influence those parts or tracts, for the so-called emmenagogues simply act by their influence over one or other of these tracts, directly or indirectly, and not by any specific influence on the uterus as a whole. Even the effects produced by ergot of rye on the uterus are solely due to its power of influencing the unstriped muscular fibres of the system generally. And the effects on the uterus are only more pronounced on account of the large amount of blood vessels and unstriped muscular fibres therein contained, especially in the pregnant state (*vide* art. Ergot). In experiments with, or in cases of poisoning by, ergot, the various symptoms produced all point to an effect primarily produced on the muscles of organic life (unstriped fibre), viz., the contraction of the blood-vessels (noted by Brown-Séquard), the dilatation of the pupils, the colic, &c., and in chronic cases, gangrene of various parts of the body; and it is on account of this specific power it is found so serviceable in various forms of hæmorrhage, purpura, and in paralysis dependent on chronic inflammation of the cord.

That a knowledge of the specific action of any substance is a key to its therapeutic value, and that various substances possess both a physiological and a restorative action as indicated by theory and proved by experience, has now been clearly demonstrated. At the same time, it will be seen that experience and theory indicate the advantage of giving a remedy in restorative doses, in cases of functional derangement of parts over which it has specific influence, when possible in preference to giving a physiological dose, and

running a risk of inducing a state of affairs worse than the original disease. As for instance such specific remedies as ipecacuanha, bichloride of mercury, arsenic, &c., are preferable and more successful in the treatment of various forms of diarrhœa and dysentery, than are the various astringents that are so often used, and so frequently fail in giving more than temporary relief.

CHAPTER III.

THE FORM AND MODE OF ADMINISTERING DRUGS FOR THERAPEUTIC PURPOSES.

In administering drugs for therapeutic purposes, it is highly important to introduce them into the system in the manner and form best adapted for obtaining the results aimed at; for it is a well-known fact that the action of a drug upon the system varies to a great extent, according to the form and mode of its introduction. Therefore we consider it will not be out of place in this work to offer a few remarks on this subject, and to give our reasons for preferring one method in one case, and another method in another case. In the first chapter we stated that certain substances acted on the system in virtue of their power over the phenomena of endosmose and exosmose, and we here again call attention to the necessity of giving these substances in a concentrated form when we wish to produce purgation, and in a dilute form when we wish diuresis. We also mentioned certain substances which acted on the system, chiefly in virtue of their chemical properties, and in reference to this class we consider that it is preferable to administer them in small and repeated doses, and in a dilute form, as thus we avoid the danger of producing chemical changes in the mucous

membrane of the stomach and its secretions, for there is no doubt the habit of giving *large* doses of the mineral acids and astringents to affect some distant part is wrong in principle; in many cases where such powerful chemical agents have been given, we find the teeth and stomach injured, and the digestive functions deranged by the topical action of the agent on these parts. Many cases of dyspepsia are no doubt due to the injurious effects thus produced. Moreover, when a large dose is given, it is soon eliminated from the system, while by giving small and repeated doses we ensure the absorption of the special agent, its continual circulation in the blood and hence prolongation of the effect; while, at the same time, we have the restorative action without the physiological or toxic.

These last remarks also apply to agents which act in virtue of their dynamical properties; for by small and repeated doses of such an agent as ipecacuanha we can control vomiting without producing the physiological effects of the drug. Digitalis used in the same way will strengthen a weak heart and relieve palpitation, and nux vomica will restore the functions of the bowels. In all these cases the change in the vital relation of the part deranged is gradually produced, and there is no danger of producing one disease while curing another, for these agents are rapidly eliminated from the system, and the physiological effects are not produced. It is only necessary to refer to the successful use of the so-called alteratives in many diseases to indicate the benefit of this plan. And, in fact these small doses act much in the same way as Dr. Pereira said small doses of arsenious acid acted (*vide* Opus, vol. i., p. 656), viz., they may be continued many days without any indication of their action on the system, *except the amelioration of the disease.* What

more can the physician require, and what more can the party most interested, viz., the patient, require?

There is another class of remedies which is worse than useless to give in large doses, as on account of their low diffusive power and comparative insolubility, only a small portion can be rendered soluble and absorbed into the system, and this but slowly; hence when large doses are given, the greater portion passes through the alimentary canal, unabsorbed and thus wasted. Examples of this class are—ferrum redactum, sulphur, sulphides, lime, &c., which should be given in small and repeated doses, and shortly before taking food.

Of course in those cases where we desire to produce for some special purpose the physiological action of a drug, as purgation, vomiting, diuresis, or diaphoresis, it is necessary to give it in a full dose, but, as already said, if we can cure a disease by using a drug in restorative doses, it is decidedly the best plan, as we avoid all risk of creating a greater evil than the one we seek to remove. In those cases where we wish for the rapid and energetic action of a remedy, it is advisable to administer it, when possible, in solution, as then the greater portion is rapidly absorbed; but when given in a solid state, absorption is longer in taking place, and in some cases a large proportion may pass through the alimentary canal and be eliminated before it can be rendered soluble and capable of being absorbed; for the same reason the soluble salts are more rapid and energetic, as a rule, in their action than the insoluble.

There are certain remedies which it is often advisable to introduce into the system by subcutaneous injection, such as morphia, atropine, strychnine, aconitina, quinine, ergot, &c., for by this mode we can, with a comparatively small

dose, and in a short space of time, produce more or less of the physiological effects of the drug, and, at the same time, we avoid the risk of deranging the digestive organs, or having the property of the drug altered by the digestive fluids. In all acute diseases, especially if attended with pain, we have no more valuable method than the hypodermic. For example, in pleurisy we can, by injecting subcutaneously morphia and atropine, at once relieve the pain, and in a short space of time subdue the disease; while in many other diseases we can relieve the pain by morphia, thus administered, and at the same time use appropriate means to remove the cause of the disease. In the treatment of diseases of animals, this method of introducing remedial agents into the system is invaluable, and will, we are sure, eventually supersede the boluses and drenches which are often *so* difficult to give, *so* difficult to take, and in some cases *so* little good when taken. By this method the special agent is at once introduced into the circulating fluid, and in a short time comes in contact with, and acts upon, the part or parts over which it has specific influence. And although at present comparatively few drugs have been used in this way, we doubt not that more will be added to the list, when we can prepare solutions of the active principles in such manner as they will not act as topical irritants.

It may not be out of place to mention here, that ergotine may be used subcutaneously for internal hæmorrhages, or purpura prepared as follows:—

Ergotine, grains 5,
Glycerine, 1 drachm;

12 minims to be injected twice a day.

Many other active principles might be prepared in the same way; if necessary, a small quantity of spirit may be used to effect solution.

In giving morphia in this manner, sickness is caused in some cases; but this is obviated if a small proportion (about 1-60th of a grain) of atropine be given at the same time; and in those cases where we wish to relieve pain, as in neuralgia, sciatica, &c., without producing sleep, it is a good plan to give a small quantity for a dose, and repeat at intervals of six to nine hours if required—say about 1-10th of a grain of morphia with 1-60th of a grain of atropine. By this means, we have the first dose eliminated from the system, to a great extent, before a second dose is given; and thus there never is sufficient in the system at one time to produce toxic effects. Of course the effects of the first dose should be allowed fully to pass off before giving a second dose. In those cases where we wish to produce sleep, it is the best plan to give a large dose at once, and thus obtain the physiological effect of the drug. Here we would remark that the readiest antidote to strychnine is the hypodermic injection of morphia, and *vice versa;* for, in an experiment on a dog, $\frac{1}{2}$ grain of acetate of morphia was given, and 2 hours after, when the full physiological effects of the drug were developed, 1-16th of a grain of strychnine was given, and in 40 minutes the dog had quite recovered.

In another instance, a horse was given $1\frac{1}{4}$ grain of strychnine, which induced rigidity of the muscles, &c., within an hour; then 10 grains of acetate of morphia was given, and in $1\frac{1}{2}$ hour the horse was nearly well and quiet; while $3\frac{1}{2}$ hours after taking the morphia, he had entirely recovered.

To another horse, 8 grains of morphia and 1 grain of strychnine were given at the same time. No effect was produced, except slight dilatation of the pupil.

The above experiments clearly indicate that, when given

in time and in sufficient quantity, morphia will act as an antidote to strychnine, and *vice versâ*. In concluding this chapter, it may be as well to remark that a half, or even a third, of the quantity of any drug required to produce a physiological effect when introduced into the stomach, will suffice when given subcutaneously.

CHAPTER IV.

NOTES ON TEMPERATURE IN HEALTH AND DISEASE.

In the healthy body, heat is generated by the oxidation of carbon, hydrogen (and to a certain extent) phosphorus and sulphur; portion of this heat serves to maintain the body at a certain normal temperature, portion is dissipated in the evaporation of water by the lungs and skin, and any excess is, in the healthy body, correlated into nerve force, and thus rendered latent; but in certain states of the system, the temperature rises far above the normal, and this is due to one of two causes, viz., either increased disorganization—*i.e.*, oxidation of the tissues of the body—or loss of the power of correlating the excess of heat into nerve force. In support of this theory, we advance the following arguments:—

1st. In malarial fevers, the temperature of the body, as ascertained by the thermometer, rises above the normal, and this rise is *followed* by a sense of chilliness, headache, oppressed respiration, impeded circulation, and general depression, these symptoms being evidently the consequences, and not the cause, of the increased temperature; for when free perspiration occurs, and the excess of heat is thus dissipated, these symptoms disappear, returning again, however, if the cause which destroys the correlating power is not removed.

In reference to the cause of malarial fevers, we here call attention to the fact that all evidence goes to show that these fevers are not due to the *presence* of any morbific agent in the air, but rather to the *absence* of some vital constituent, because—

(*a*) These fevers are endemic chiefly in marshy regions, and especially where heat and moisture favour the decomposition of vegetable matter, which decomposition must tend to *remove* from the atmosphere more or less of its vital constituents, rather than to add any deleterious substance;

(*b*) Malarial fevers are not introduced into other places by patients who have caught them in swampy regions;

(*c*) Malarial fevers are not contagious;

(*d*) Removal from the marshy district is, as a rule, attended with improvement in the patient's health;

(*e*) Whereas, there are many facts to show that in the acute exanthemata, exanthematic typhus, and other infectious diseases, there is some contagium vivum which reproduces itself in organisms affected with it, there is no evidence to show that any miasma vivum exists; in fact, all evidence points the opposite way.

As already stated, we are of opinion that where vegetable matter is decomposing, it removes from the atmosphere some vital constituent, be it oxygen or ozone, and by so doing produces changes in the circulating fluid, and thereby destroys the power of correlating heat, and this excess of heat, not being rendered latent or dissipated, raises the temperature of the blood, and induces palsy of the heart and nerve centres, with general derangement.

2nd. In broncho-pneumonia, pneumonia, phthisis, &c.,

there is increased oxidation of tissue, hence rise in temperature, the rise here being the consequence, and not the cause; for there is no doubt the disorganization of tissue precedes the rise in temperature, and regulates it, for when by any means we put a stop to the disorganization of tissue, we reduce the temperature.

3rd. In malarial fevers, where we have a high temperature, such agents as quinine reduce the temperature, and cure the disease; but in broncho-pneumonia, pneumonia, phthisis, typhoid fever, &c., quinine (as proved by Webber, Murchison, and Ogle) has only the power of effecting a temporary reduction in the temperature, and has no control over these diseases; yet such agencies as aconite, &c., by controlling and subduing inflammation, will moderate the severity of these diseases, and will to a great extent save the tissues, and thus lower the temperature.

Thus it is evident that a marked distinction exists between the cause of the rise of temperature in malarial fevers and in those diseases alluded to above; for in malarial fevers, high temperature means that the excess of heat generated in the body is neither dissipated nor correlated into nerve force, but is accumulating in the blood, and unless we restore the correlating power, and dissipate the excess of heat by inducing perspiration, various secondary results will follow; but in infectious diseases, &c., the high temperature means increased oxidation of tissue, which oxidation must be lessened by those agents which control inflammation, before we can reduce the temperature, and restore health —so decrease in temperature in malarial fevers (if permanent) means restoration of the correlating power; but in other diseases alluded to, it means subsidence of the inflammation and lessened oxidation.

It now remains to mention a few experiments which we have conducted, to show the influence of various drugs on the body in health and disease. The conclusion they have led us to is, that various non-nutritious agents introduced into the system in health, by producing deranged function, tend to raise the temperature; but when introduced into the system when the temperature is above the normal, tend to reduce the temperature to the normal standard by restoring the deranged function and removing the disturbing cause; although, as will be shown, there are certain agents which have the power of reducing the temperature below the normal, by their direct action on the blood. We will first refer to experiments which illustrate the power of certain drugs, when introduced into the healthy body, to raise the temperature.

(*a*) Half a fluid ounce of tincture of datura tatula with 10 ounces of water was given to a horse whose temperature was $99\frac{3}{5}°$; within two hours the temperature was $100\frac{1}{5}°$; three hours after it was $100°\,\frac{2}{5}$; and from this time it gradually fell.

(*b*) Four fluid ounces of the same drug, with four ounces of water, were given to a horse, whose temperature was $99\frac{4}{5}$; within seven hours the temperature rose to $100\frac{3}{5}°$ (*vide* art. Datura Tatula).

(*c*) Four grains of acetate of morphia were given to a horse, whose temperature was $99\frac{4}{5}°$; within five hours the temperature rose to $100\frac{3}{5}°$, and remained at $100\frac{2}{5}°$ during twenty-four hours.

(*d*) Quarter of a grain of atropine was given subcutaneously to a horse whose temperature was $99\frac{3}{5}°$, and within twenty-four hours the temperature rose to $100\frac{4}{5}°$, and did not fall to $99\frac{3}{5}°$ till the third day.

(*e*) In the experiment with strychnine and morphia, on a horse, mentioned in Chapter III., the temperature rose from 99$\frac{4}{5}$° to 101$\frac{1}{5}$°; while in another case, where one grain of strychnine with four grains of morphia was given, the temperature rose from 99$\frac{3}{5}$° to 100$\frac{3}{5}$°.

(*f*) In another instance, where one drachm of powdered opium, followed by $\frac{1}{4}$ of a grain of atropine, was given to a horse, the temperature rose to 105$\frac{3}{5}$°; this was followed by $\frac{1}{8}$th of a grain of atropine; the temperature did not fall below 104°, and the horse died.

(*g*) One drachm of bichromate of potash was given to a horse, and in three-quarters of an hour, the temperature rose from 100$\frac{1}{5}$° to 100$\frac{3}{5}$°, then 101$\frac{3}{5}$°, 102°, 104°, and after four hours it reached 106$\frac{1}{5}$°.

We now pass on to mention those experiments which illustrate the power of drugs to lower the temperature when above the normal.

(*a*) To a gray mare suffering from abscess in the pectoral region, due to a wound, was given on the

				Deg.
16th, at	5 p.m.,	$\frac{1}{4}$ gr. atropiæ sulphatis,	temperature	104$\frac{2}{5}$
17th, „	12 noon		„	103$\frac{1}{5}$
„ „	2 p.m.,	$\frac{1}{4}$ gr. atropiæ sulphatis,	„	104$\frac{2}{5}$
„ „	4 p.m.,		„	104$\frac{2}{5}$
„ „	8.15 p.m.,		„	103$\frac{3}{5}$
18th, „	11 a.m.,	$\frac{1}{4}$ gr. atropiæ sulphatis	„	
„ „	1.50 p.m.,		„	104
„ „	6.30 p.m.,		„	103$\frac{1}{5}$
19th, „	11 a.m.,		„	103
20th, „	12 a.m.,		„	102
21st, „	10.30 a.m.,		„	101$\frac{2}{5}$
30th, „	10 a.m.,	horse well	„	99$\frac{3}{5}$

In this case, the mare had $\frac{3}{4}$ gr. of atropine, given in $\frac{1}{4}$ gr. doses, and after each dose the temperature fell, and after the third dose it gradually fell to about the normal standard; after each dose the pupils were dilated, and mucous membrane of the mouth dry. It will suffice to detail this one case, but such cases are of daily occurrence; horses are seen suffering from various affections, and with a high temperature, which is soon reduced by treatment similar to the above. *Quinine* may be instanced as one of those drugs which are well known to reduce abnormal temperature.

Digitalis and aconite, by their power of subduing inflammation, possess the same power (Wunderlich).

In horses with influenza, fever, &c., the temperature often is 105°; $\frac{1}{2}$ drachm doses of tincture of aconite three times a day invariably succeed in reducing the temperature to the normal and curing the disease.

It now only remains to allude to an experiment which illustrates the power of a drug to reduce the temperature below the normal standard, the subject being a horse.

			Pulse.	Temperature. Deg.	Respiration.
Oct. 9th,	11 a.m.,	gave 4 oz. chloral, in water,	38	100	10
„	11.5,	fell down suddenly insensible,	96	100	12
„	11.15		—	—	16
„	11.20		50	100	—
„	11.30		48	—	—
„	11.35		48	—	24
„	12 noon		42	—	36
„	12.20	Awake	—	—	—
„	1 p.m.		—	—	36
„	1.20		—	$95\frac{2}{5}$	—
„	3 p.m.		36	$97\frac{1}{5}$	—

The history of the case is as follows:—At 11 o'clock, the above quantity of chloral was given, and almost as soon as swallowed, whilst the horse's mouth was being washed out, he suddenly fell down insensible, sighing frequently and perspiring freely; the pupils were fully dilated, all the muscles relaxed, complete anæsthesia of the whole body. Twenty minutes after, the pulse was 50°, feeble, in fact almost imperceptible. At 11.30, the pupils were smaller than normal, the pulse was 48° and stronger, the horse was coughing at intervals, breathing was heavy, quick, and spasmodic. Shortly after, he sank into a quiet sleep; at 12 o'clock, the breathing was short and quick, and the anæsthesia was passing away. At 12.30, he was awake, coughed, and discharged a quantity of thick white creamy froth through the nostrils: also passed dung. At 12.35, attempted to rise, but had little or no power over his legs, sighing still at intervals. At 12.45, again attempted to rise, but failed. At 1 p.m., pupils dilated, sleeping; breathing slow and heavy, relaxation of sphincters of bladder and rectum, passing urine and dung, skin cold. At 1.20, urine dribbling away, dung at anal opening, but no power to expel. At 3 p.m., restless, disposed to feed, shivering. At 4 p.m., he was on his feet, eating and moving about; still shivering, coat staring. At 6.20, still the same; next morning he was suffering from bronchitis, mucous discharge from nostril, and moist mucous râles distinctly heard all over chest; he was quite recovered in a few days.

Now it is evident from the symptoms in the above case, that the horse was suffering from the effects of chloroform; the chloral being mixed with a large quantity of water was at once absorbed and decomposed into chloroform and formic acid. Moreover, the smell of chloroform was per-

ceptible in the stable, and the symptoms were parallel to those which would be produced by an overdose of chloroform (*vide* art. Chloral). The reduction in temperature here was evidently due to the chloroform preventing perfect oxygenation of the blood, and there is no doubt that alcohol acts in the same manner. Although at various times numerous experiments were tried, we have considered it sufficient to confine ourselves to detailing the above, as they will serve to illustrate our argument.

CHAPTER V.

ACIDS, MINERAL.

Physiological Effects.

The concentrated mineral acids, when applied undiluted to any part of the animal body, destroy both the structure and life of the part, and cause inflammation and sloughing in the subjacent tissues; hence, when swallowed, there is more or less destruction of the parts about the mouth and throat, followed by pain in throat, stomach and bowels, with vomiting and purging, usually of bloody matter; and, from the shock thus caused to the general system, depression of the vascular system ensues, the ultimate result being dependent on the amount of injury done to important structures; but when introduced in a dilute form, and especially if long continued, inflammation of the alimentary tract, with griping pain in the bowels, attended with purging, or diuresis, is induced; eventually pain and heat in the throat and stomach, furred tongue, derangement of the digestive functions, a febrile state, and general emaciation.

Specific Action.

In a concentrated state, they act on the bases, salts and organic constituents of the body, in virtue of the chemical

properties they possess; and, for the same reason, in a dilute form, they produce the symptoms stated above, forming insoluble compounds with albumen and fibrine, combining with various bases, and decomposing many of the salts found in the different secretions poured into the alimentary canal to aid in the process of digestion; and by their passage into the blood, in combination with bases, they alter the specific gravity of the serum of the blood, and thus affect the phenomena of endosmose generally, and produce various secondary results, according to the state of the body.

The mineral acids generally are indicated:—

1. Topically Applied.

To effect the destruction of living parts, and, in a diluted form, to restore the functions of the mucous membrane, by acting on the various mucous tracts, and restoring the secretion of the parts; also they may be used to arrest hæmorrhage, and, as an injection, they are used to dissolve phosphatic calculi.

In a concentrated form they may be applied to sloughing phagedæna, and, in a more dilute form, to indolent ulcers &c.; and it will be found that nitric acid is most useful in all such cases.

2. Internally Administered.

They may be used to act upon the various fluids of the body, and to aid in the elimination of non-nutritious materials; hence they are especially useful in various toxœmic fevers. As these agents, as already mentioned, control the phenomena of endosmose and exosmose, they are useful in the treatment of derangement of the secretions of the alimentary tract and skin. Their value in the treatment of dyspepsia will be alluded to when considering the acids individually.

Most of the affections of the mucous membranes, both the alimentary and the respiratory, are under the control of these agents. They are especially useful in all cases where there is abnormal secretion; also in affections of the genito-urinary membrane, as they are eliminated to a great extent by this tract.

In derangement of the secreting cells of the liver, and in secondary syphilis, these acids, especially nitric and hydrochloric, are often of great benefit; in fact, it is often advantageous to give the two above-mentioned acids in conjunction.

NITRIC ACID.

Therapeutic Uses.

In restorative doses, is indicated in affections of the mucous membrane of the mouth and throat, such as stomatitis, aphthæ, and various forms of inflammation of the throat; in some forms of dyspepsia, with sour eructations, or, when the solids of the urine are in excess; chronic gastritis, and cardialgia; in diarrhœa, with mucous stools; also to restore the functions of various parts deranged in typhoid fever, scarlatina, diphtheria, whooping cough, in secondary syphilis, in chronic liver disease, and in scrofulous affections. It is advisable to give this agent freely diluted, and in such doses as will not act topically on the stomach.

Topical Use.

As an injection for phosphatic calculi, chronic leucorrhœa; as a direct application to condylomata, phagedænic sores, warts, sloughing sores, ulcers, with soft edges, and tendency to fungoid growths, in hæmorrhoids, and as a gargle in diphtheritic and ulcerated throat.

In all cases care must be taken to limit the action of this potent agent, so as only to act on the diseased parts.

SULPHURIC ACID.

Indicated in restorative doses in pyrosis, in dyspepsia, with acid eructations, chronic diarrhœa, and, like other mineral acids (by its power over the phenomena of endosmose), it is useful in hæmorrhages, and controls the sweating of phthisis, &c., and various passive mucous discharges; also in some skin affections, as lichen, prurigo, nettle-rash, and in phosphatic deposits in the urine.

Topical Use.

It may be used to suppress hæmorrhage; also as a gargle, in ulcerations of the mouth and throat, well diluted. As a caustic, it is not so useful as nitric acid, on account of its tendency to penetrate deep, and absorb water from the tissues. Hence, it is preferable to use nitric acid as an application to wounds caused by rabid animals, or poisonous serpents, &c.

HYDROCHLORIC ACID.

Indicated in restorative doses in the treatment of some of the sequelæ of toxœmic fevers, especially the various affections of the mucous membranes following typhus, typhoid fever, scarlet fever, &c.; also useful in ulceration of the buccal membrane. In some cases of dyspepsia small doses of hydrochloric acid, given a short time before food is taken, is often of great benefit; and this is especially so in those cases where one of the prominent symptoms is acidity. This remedy is also valuable in diphtheritic sore throat; also in ulcerated sore throat. Moreover, given alone, or in com-

bination with other remedies, hydrochloric acid is of great service in many scrofulous affections.

It is a very good plan, in many cases, to give this acid in conjunction with some bitter or aromatic tonic, such as gentian, quassia, chiretta, &c.

Topical Use.

In a concentrated form this acid *may* be used to remove warts, or as an application to sloughing phagedæna, but the same objection applies to this acid, as to sulphuric acid, and, in most cases, nitric acid is superior to either. In diphtheria it may be applied to the throat, and in ulceration of the mucous membrane of the mouth and throat it may be used as a gargle. In all cases, however, the mouth must be well washed out, as the acid is very apt to destroy the teeth. When applied to diphtheritic sore of the throat, or ulcerated sore throat from various causes, it is useful to use the acid mixed with honey, or thick syrup, by which plan it may be made to adhere for some time to the part to which it is applied.

Therapeutic Use in Animals.

These agents are also *very* useful in the treatment of many similar diseases occurring in animals, such as the various specific or toxœmic fevers, especially when one of the leading symptoms is inflammation of the throat and general derangement of the mucous membranes. As a gargle, they are highly valuable in laryngitis and inflammation of the fauces. We also meet with various forms of indigestion, attended with loss of condition, which rapidly improve when treated with some one or other of these acids, especially if tincture of gentian, or cinchona, be given at the same time. From their astringent properties, they may be used in hæmorrhages, both external and internal; for instance, in

hæmaturia and the disease known as "red water" in cattle; likewise in cases of venous congestion with hæmorrhage into the structure of the liver. In distemper in dogs the acid often can be used with beneficial effects.

They may be applied topically, in a concentrated form, to remove warty excrescences, flabby granulations (known as proud flesh), also to stimulate the healing of indolent ulcers, and they may be used to treat canker in the foot, and thrush; but when applied to the mouth they should be used in a somewhat more dilute form. Nitric acid will be found most useful in these cases, for the reason mentioned already, viz., it is not so liable to penetrate so deep as sulphuric and hydrochloric.

The two acids, nitric and hydrochloric, may be given together, especially in cases of indigestion, and as a tonic after cases of fever, also during pneumonia where there seems to be a tendency in the disease to run on to hepatization, often preventing this result.

ACID, PHOSPHORIC.

Physiological Effects.

This drug, to a great extent, in its action, resembles the mineral acids, especially when given in physiological doses; but if given for some time, and in smaller doses, it produces symptoms peculiar to itself, viz., diarrhœa, violent cough, pain in the bones, and a febrile state, with perspiration, and general depression of spirits; the urine becomes pale.

Specific Action.

To a certain extent, the same as the mineral acids; but, as the compounds formed by this acid with albumen and fibrine are soluble, and, moreover, as it enters into the com-

position of various tissues of body, it is a non-nutritious and excrementitious substance to the same extent as other acids; hence, its effects on the healthy system are not very marked, unless the dose be large enough to act as an irritant topically; but when there is deranged function, or malnutrition, the effects are more evident. In such cases its influence on the nervous system, the osseous structures, and the sexual organs, is evinced by the restoration of the deranged function, and the general improvement in the health.

Therapeutic Use.

In restorative doses it is indicated in physical or nervous debility, also in scrofulous caries of the bones. Being eliminated to a great extent by the mucous tracts, it is useful in chronic bronchitis, and is very useful to relieve the sweating of phthisis, also in general debility from sexual excesses. It may be here remarked that it is often preferable to give the phosphate, or hypophosphite of lime, in preference to the free acid.

HYDROCYANIC ACID (PRUSSIC ACID).

Physiological Effect.

When swallowed, this agent first produces a bitter taste in the mouth, followed by nausea, vomiting, and a feeling of heat in the stomach; immediately after the following symptoms set in, viz.: faintness and giddiness, with headache, and at the same time loss of muscular power, the respiration is difficult, and spasmodic pain is felt at the præcordia, with palpitation of the heart, the pulse is small, or nearly imperceptible in many cases, pupils usually dilated; these symptoms are followed by tetanic, sometimes epileptiform

convulsions and insensibility. In some cases when the dose is large, death follows almost immediately.

The following experiment was tried upon a horse :—

One drachm (fluid) of Scheele's prussic acid was injected subcutaneously, and no effect was observed until four hours after, when convulsive movements set in; the horse had great difficulty in standing, the pulse rose from 36 per minute to 90, but its calibre was very small, the buccal mucous membrane was pale, ears cold and clammy; in a very short time these symptoms passed off, and the pulse fell to 48 per minute.

In another case half a drachm of prussic acid containing 50 per cent of anhydrous prussic acid was injected subcutaneously into a horse; in less than a minute he fell to the ground, striking out his limbs in a violent and convulsive manner, the respiration being difficult and spasmodic, and within five minutes after the introduction of the prussic acid the animal was dead. After death the pupil was observed to be dilated and the eye glistening. The object in this case was to kill the animal as rapidly and painlessly as possible.

Specific Action.

This agent diffuses rapidly through the membranes of the body, and acts chiefly on the cerebro-spinal system, especially the medulla oblongata and motor nerves, but its primary action is to induce a spasmodic condition of the muscular coat of the arteries, and consequent arterial anæmia of the cerebro-spinal system, hence the epileptiform convulsions, &c. (In epilepsy, from some unknown cause, we have the same spasmodic condition of the arteries.) If the action of the

heart and respiration can be kept up, the agent is soon eliminated from the system, and recovery may take place in many cases.

Therapeutic Action.

In restorative doses, indicated in epilepsy (if recent), in acute spasmodic forms of asthma, in spasmodic cough, in tetanus chorea, in gastrodynia, accompanied with vomiting, also in enterodynia, and various forms of dyspepsia, where there is functional derangement of the sympathetic system, in palpitation of the heart; in administering this agent, it is necessary to give it in restorative doses frequently repeated, the more so as this agent is so rapidly eliminated from the system, and the effect it produces is very transient.

ACONITE (ACONITUS NAPELLUS).

Physiological Action.

When swallowed it induces, first, a sensation of tingling and numbness of the parts about the mouth and throat, feeling of warmth at the epigastrium, with nausea and vomiting, prickling and tingling of the extremities, followed by anæsthesia of the surface of the body, with, in many cases, inability to stand, contraction of the pupils with dimness of sight, face and lips pale, surface of the body cold, pulse small, feeble, and irregular, heart's action weak and irregular, with præcordial anxiety, short, hurried breathing, and usually syncope; but should the dose not be sufficient to cause death, reaction sets in with the following symptoms: febrile heat, quick pulse, flushed features, increased respiration, profuse sweating, and pain, especially in the joints and muscles.

1·100th of a grain of aconitine was injected subcutane-

ously in a horse with the following symptoms:—Increased flow of saliva, increased moisture of conjunctival membranes, glairy secretion from mouth, and paralysis of facial muscles, difficulty in swallowing, inflammation of buccal membrane, with increased secretion. Fæces passed eleven times within twenty-seven hours.

1·50th of a grain introduced in the same way produced in an hour the following symptoms:—Small irregular pulse, dry mouth, head drooping, followed by increased secretion of saliva, contraction of pupil, pulse small and soft, 50, loss of power of hind legs especially, horse restless, twitching of muscles of chest and abdomen. Fæces passed several times.

Half a fluid ounce of tincture of aconite with ten ounces of water, was given to a horse with the following symptoms:—An hour after the above dose was swallowed the temperature rose from $99\frac{3}{5}$ to $100\frac{1}{5}$, the secretion from the nasal membranes increased, horse restless, rubbing its nose against the wall, the jaws in constant motion, lips twitching, buccal membrane white, conjunctival membrane moist and injected, ears cold, coat staring, paralysis of facial muscles, legs very cold, horse looking dull and heavy, pupils contracted, dry, hacking cough at intervals, and glairy mucous about mouth, pulse slightly increased, but soft and irregular.

1·24th grain of aconitine dissolved in 20 drops of spirit of wine was subcutaneously injected into a colt on September 11th at 3.10 p.m., the respiration being 8 per minute and the pulse 55. At 4.20 the respirations were 5, and there was paralysis of the nasal muscles. At 4.35 the expirations were slow and prolonged, the inspiration spasmodic, pulse

irregular, and risen to 68, the horse restless. At 4.40 respiration irregular. At 4.50 horse restless, distressed, and slight loss of volition. At 5 p.m., respiration short, quick panting. At 5.10 pulse 84, horse very restless, pupils dilated slightly, considerable loss of volition, breathing very shallow, rapid and spasmodic, has passed fæces four times since 3.10 p.m., sweating freely, horse conscious, and no loss of sensation. 5.15 p.m., horse lying down, respiration 5 per minute. He attempted to rise, but was unable, only able to sit up on his hind-quarters, but continued to make great efforts to get up. At 5.25, intense spasm of all the external muscles, great distress, pulse small and quick, 68; suddenly fell down, muscles all relaxed, became quiet, breathing more natural, but pulse still small. 5.45, still down, sweating, restless, breathing quick again, ropy mucus in mouth, pulse 50. 6 p.m., pulse 32, but feeble; pupils normal size. 6.25, respiration slightly spasmodic, paralysis of the nasal muscles still present, pulse 47.

To another horse with pulse 38, on September 4th, at 3.20 p.m., half a grain of aconitine dissolved in one drachm of spirit of wine was subcutaneously given. At 3.44 pulse was 44, and a dry cough at intervals. At 4.20 pulse still 44, respiration extremely slow, almost suspended at times, great increase of saliva, and violent spasmodic retching on attempting to swallow, profuse perspiration, and difficulty in standing. 4.40, pulse quick and irregular, horse in great distress, opened trachea, which, however, gave no relief. 5 p.m., unable to stand, respiration at intervals easy, but very rapid, profuse perspiration, and great distress. 6 p.m., died.

P.M.—Heart empty, lungs emphysematous, stomach full of fluid, no rigor mortis observed.

Many other experiments were conducted with this drug, all producing symptoms the same, or nearly so.

Specific Action.

Aconite influences first the peripheral extremities of the sensory nerves, by acting on them topically as it circulates in the blood. It influences the iris in the same way, the same effects being produced, either when injected subcutaneously or when swallowed. It also influences the sympathetic ganglia, as indicated by decreased vascular circulation, with cold surface of body, the pale face, irregular action of the heart and pulse, and the changes produced upon the various secreting tracts. And in common with many other drugs, it tends to raise the temperature above the normal.

Therapeutic Use.

Indicated in restorative doses, in all febrile states not dependent on blood poisoning or local inflammation; and even in these cases it subdues and controls inflammation, and prevents the waste of tissue; hence useful in rheumatism, pleuritis, pneumonia, pericarditis, in active hæmorrhages, as epistaxis, &c.; in influenza and catarrh, in recent febrile dropsy, in erysipelas, catarrhal croup, inflammatory sore throat, nervous palpitation, suppression of natural discharges when from a chill (as suppression of the menses), laryngismus stridulus, croup and colic, angina pectoris, tonsillitis, acute sore throat, and in scarlet fever (conjoined with belladonna).

In Physiological Doses.

In sciatica, neuralgia, and chronic rheumatic pains—in lumbago and hyperæsthesia of the skin, it is useful both

internally and externally; also in hypertrophy of the heart and vascular excitement—in cardiac spasm.

Therapeutic Use for Animals.

This agent is exceedingly useful in the treatment of many similar diseases in animals; for instance, in half-drachm doses repeated three times a-day in influenza, in epidemic epizootic catarrhal fever, in specific or toxœmic fever, to subdue inflammation and limit the disorganization of tissue, in symptomatic and idiopathic fevers, in laryngitis, in bronchitis, in pleurisy, in pleurodynia, in inflammation of the feet generally known as fever in the feet, in inflammation of the small and large intestines and stomach, in congestion of the lungs, in pleuro-pneumonia, in pericarditis, in gastro-enteritis, in enteritis, in some forms of diarrhœa, conjoined with other appropriate treatment; in peritonitis, in hepato-peritonitis, in hepatitis, in splenitis, in nephritis, in phrenitis, in arachnoiditis, and in brain fever; also useful in the treatment of distemper in dogs. In fact this remedy should be used in derangements of the mucous tracts, and in all those cases where we desire to control the vascular circulation. Hence there are few diseases in which we cannot use this drug. Those mentioned above are quoted merely to indicate some of the special cases in which it may be used with benefit, and the names used are those commonly employed in the veterinary profession. Where it has been stated that they are of benefit in a certain disease in man, they are of course indicated in parallel diseases in animals. The tincture may be used, given in half-drachm doses, with about ten ounces of water; but in some cases it may be advisable to use aconitina, giving it by subcutaneous injection. The experiments above will serve to show what dose is necessary

to produce physiological effects. A less dose should be given in the majority of cases.

ALOES.

Physical Effects.

When swallowed in a full dose, this drug induces, after some time, a feeling of heat about the rectum, followed by purging, griping and tenesmus; and in many cases, where the use of this drug has been continued for some time, hæmorrhoids are produced, the irritation set up by this agent determining blood to the pelvic viscera; and it is from the congestion thus caused that the bladder and uterus are so often affected, and derangements of the uterine functions brought about. When this drug is injected into a vein, or applied to a blistered surface, it is soon absorbed, and produces purgation.

Specific Action.

As already mentioned, this drug belongs to the class of agents that produce endosmose of the serum of the blood, and hence purgation, when introduced into the alimentary canal; being but slowly absorbed, it passes through the stomach and small intestines, its action being to a great extent confined to the large intestines and rectum, and owing to the resin in its composition it (in common with all resinous substances) exerts a topical influence on the absorbing surfaces, and by acting on the ganglionic system induces reflex action of the spinal cord; hence the tenesmus, griping, &c.

When injected into a vein or applied to a blistered surface, it is absorbed, and eliminated by the bowels, and in the process of elimination, by its topical action, it induces purgation. That the griping and tenesmus is due to a great extent to

the resin contained in this drug is evident from the fact, that the watery extract does not produce this irritation, though still retaining the power of producing purgation. Many other drugs containing resin will be found to act in a milder manner when this resin is removed.

Therapeutic Use.

IN RESTORATIVE DOSES.

This drug is indicated in dyspepsia with chronic constipation (especially if given in combination with sulphate of iron, or extract of nux vomica). Also useful in some forms of dysentery, where there is tenesmus and a congested state of the pelvic viscera. This agent is especially useful in the treatment of the habitual costiveness of sedentary people, and in profuse menstruation, when given in restorative doses, care being taken not to produce the physiological action of the drug.

IN PHYSIOLOGICAL DOSES.

It is useful in the treatment of amenorrhœa and chlorosis, and should be given just before the menstrual period, as an adjunct to hygienic treatment. In females where there is often a torpid condition of the colon, this drug, given in combination with extract of nux vomica, usually succeeds in restoring the deranged function. In all cases the best preparation is the watery extract, and that for the reasons mentioned above. It is also advisable to gradually lessen the dose.

It may not be out of place to remark here, that the habit of depending on purgatives to regulate the bowels is a pernicious habit, and wrong in principle. The more scientific plan is to endeavour, by regulating the diet, and by the employment of some such agent as nux vomica, to restore the

perverted function. The custom of giving purgatives in every case, simply because the bowels are not acting, is absurd, for in many cases this is merely treating one of the most prominent *symptoms*, and neglecting the cause. How often do we meet with cases of fever, in which one of the earliest signs of a return to health is a restoration of the functions of the alimentary tract, which function was suspended until the disturbing cause was removed. Drugs possessing purgative properties are useful in many cases, but they must be used with judicious care, if we wish to avoid the risk of making bad worse.

Therapeutic Uses in Animals.

This drug is too frequently given in physiological doses to produce purgation, and by thus giving it there is the danger of producing various dangerous secondary affections. In restorative doses, in solution, this drug may be used to act on the kidneys in œdema of the extremities (swelled legs); also in inflammation of the sebaceous ducts of the heels, usually known as "grease;" also to remove certain skin eruptions when due to derangement of the digestive organs. In physiological doses it may be used after the administration of a vermifuge, to act as a purgative, in cases of worms, and may also be used where we require a purgative to unload the bowels. In conclusion, we may say that there are many remedies which will restore derangement of function in a better manner than aloes will, and we here enter a protest against the indiscriminate use of this or any other purgative.

ALUM.

Physiological Effects.

Dried alum applied to the mucous membrane, or to any part denuded of cuticle, corrugates the fibres of the parts and causes contraction of the small blood-vessels, thus producing paleness, which, however, is soon followed by irritation and redness. Alum itself acts to a certain extent in the same manner, but not so powerfully. When swallowed, it induces, by its topical action on the mucous membrane, at first, dryness of the mouth and throat, followed by nausea, vomiting, pain in the stomach, griping, and purging. The usual effect of a smaller dose is to lessen secretion.

Specific Action.

The action of this agent is due to its chemical properties of coagulating albumen, and forming an insoluble compound with gelatine; hence, it acts upon the fibrinous, albumenous, and gelatinous constituents of the tissues, and, by the changes it produces in their constitution, it alters the nature of their vital relation, and hence the secondary effects.

Therapeutic Use.

in restorative dose.

Alum is indicated in some forms of vomiting, where there is a catarrhal condition of the mucous membrane of the stomach, also in some forms of diarrhœa.

Topical Uses.

May be used to arrest bleeding from small vessels, as in bleeding from the nose, it may be applied in solution, or the

dry powder may be snuffed up; in the same manner in bleeding from the gums; also, in solution, in prolapsus ani of children, in uterine hæmorrhage, vulvitis, simple purulent ophthalmia, and, mixed with honey, in stomatitis and aphthæ, also, as a powder, to burns and scalds.

Therapeutic Use in Animals.

Alum powder, mixed with charcoal, may be used as an application to burns and scalds, or after firing in the horse, also to ulcerated surfaces. The alum coagulates the secretion, and prevents, or limits to a great extent, suppuration, and thus prevents blemishes.

Also in diseased sebaceous glands in the heels, commonly known as "grease," this agent may be applied in solution, or as an ointment. As a gargle it may be used in the treatment of thrush in the mouth, sore throats, also in eczema epizootica (commonly known as "foot and mouth disease") in the same manner as an application to the ulcerated gums, so often met with in dogs.

AMMONIA.

Physiological Effects.

The strong solution, topically applied, causes pain, redness, vesication, and eventually destruction of the part. When swallowed in a large dose it acts topically on the mucous membrane of the mouth, throat and stomach, causing burning pain, and is soon absorbed, causing coldness of the surface of the body, small, feeble pulse, pain over the abdomen, with diarrhœa; but in smaller doses it produces throbbing pain in the head, a feeling of heaviness, sometimes emetic effects, increased pulse, and cough, with in-

creased secretion of mucus; but as it is speedily eliminated from the system, its action is very transient.

CARBONATE OF AMMONIA.

This agent does not act so powerfully topically applied, but when swallowed, is soon absorbed into the circulation, and causes throbbing headache, pain, and heaviness, sometimes stupor, increased frequency of the pulse, and, in its passage through the various membranes, it causes increased secretion by its topical action.

Like other alkalies, it unites with acids, and combines with, or decomposes, the organic constituents of the body, forming soluble compounds. The effects produced by a single dose soon pass off, but, if long continued, it produces changes in the constituents of the blood, and a tendency to hæmorrhage, with wasting of the body.

Injected into the veins of animals, it produces increased action of the heart, dyspnœa, and convulsions. It is both rapidly absorbed, and as rapidly eliminated, to a great extent, by the lungs, and it thus acts on the bronchial membrane.

HYDROCHLORATE OF AMMONIA.

This salt's action on the system is more prolonged. When swallowed, it produces a sensation of heat at the stomach, headache, chilliness, a feeling of lassitude and prostration (soon followed by profuse sweating and irritation), increase of the secretions of the mucous membranes generally; the action of the heart is moderated, and if long continued, it causes vomiting, purging, and diminishes the plasticity of the blood.

In animals, whether injected into a vein, or swallowed

it causes vomiting, purging, and eventually convulsions and paralysis. This salt's action is slower in being produced, as it is not so readily decomposed, and eliminated from the system. Unless the dose be large, it does not produce marked effects.

Specific Action.

The local action of ammonia is due to its chemical properties, viz., it decomposes albumen and fibrine, and diffuses very rapidly through the animal tissues. And when absorbed, it acts topically on the various membranes it passes through, and alters, to some extent, the composition of the blood. The effects produced by carbonate of ammonia are due to the same cause, but are not so transient. Fulness of the circulatory system is soon induced, as this agent diffuses easily through the coats of the blood-vessels, and, by the alteration it produces in the blood, influences the functions of the ganglionic and spinal systems, causing stupor, convulsions, &c.

HYDROCHLORATE OF AMMONIA.

This agent does not produce the same chemical changes on the constituents of the body, as it only dissolves mucus, but does not coagulate albumen. But, as it diffuses readily, its primary effect is to produce fulness of the blood-vessels, and, in its passing through the secreting surfaces, to influence their function by its topical action on the organic nerves of the part.

SOLUTION OF AMMONIA.

Therapeutic Uses.

In restorative doses, largely diluted with water, is useful

in flatulence with acidity, in griping pains from the same cause (for the ammonia combines with the acid, and relieves at once), and in acid eructations.

IN PHYSIOLOGICAL DOSES.

In hysteria, nervous headache, in syncope, and in poisoning by sedative drugs, and to remove the effects of alcohol.

Externally, in many cases of stiff joints, &c.

SESQUI CARBONATE OF AMMONIA.

In the same cases as ammonia solution; also, in physiological doses, in chronic bronchitis, broncho-pneumonia, and in various toxæmic fevers.

AMMONIA, HYDROCHLORATE OF.

IN RESTORATIVE DOSES,

Indicated in chronic catarrhs, dysentery, peritonitis, pleuritis, &c., and in various chronic affections of the absorbent system and excreting tracts.

THERAPEUTIC USES IN ANIMALS.

In animals these substances may be used in similar cases; but in the diseases known as "hove" in cattle, and distension of the colon, by gas, in the horse, ℥ v. to ℥ x., in water, of the liquor ammonia, every two or three hours, will invariably afford relief by neutralising the acid gas.

In the same way as ammonia solution, or aromatic spirit of ammonia, is used, as a diffusible stimulant in man, it may be used for similar purposes in animals, especially after a chill; but it is a great error to persist in giving this active agent in catarrhal fevers and inflammatory diseases,

as it only serves to aggravate the original derangement, because, by its influence on the vascular circulation, it increases the tendency to congestion, whereas our object in such cases should be to reduce vascular excitement by such agents as aconite, &c.

Hydrochlorate of ammonia is indicated in congestion of the liver, with excessive secretion of bile, as, by its direct influence on the blood, it tends to remedy this. Applied topically, in solution, or in combination with camphor, it is of great use in stimulating absorption; hence useful in the treatment of distended bursæ about the joints and tendons, commonly known as "wind galls;" also in the treatment of splints, sprains to tendons and ligaments, and also to reduce chronic enlargements from blows or injuries.

ANTIMONY, SALTS OF.

Physiological Effects.

TARTAR EMETIC.

This drug, however introduced into the system, causes nausea, vomiting, purging, difficult and hurried respiration. When swallowed, it produces a metallic taste in the mouth, nausea, vomiting, heat, and pain in the stomach, and purging, followed by difficulty in swallowing, thirst, cramps, cold perspiration, and great debility, giddiness, insensibility, dyspnœa, prostration, syncope, spasms, tonic or clonic; and in cases where it has been taken for some time (or when topically applied), it causes a pustular eruption on the skin, mouth, œsophagus and small intestines, also enlargement of the glands, irritation of the larynx, bronchi and pulmonary tissues, and an inflamed and congested state of the lungs. The secretion of the respiratory mucous membrane is greatly

increased, as is also, in many cases, the secretions of the whole mucous tract. The effects will vary to a great extent, not only according to the dose given, but also according to the amount of vomiting produced. Small and repeated doses are eliminated by the mucous tracts, without producing vomiting.

Specific Action.

This agent when introduced into the stomach, affects the mucous membrane by its topical action, and by the gastric irritation thus produced, it induces vomiting; but when introduced direct into the circulation, it also induces vomiting, and this is probably due to the change it produces in the vital relation of the parts by which it is eliminated, to the splanchnic nerve, which transmits the sensation to the medulla oblongata, which is reflected back through the pneumogastric. In the process of elimination, it exerts a topical action on the mucous membrane and skin, in virtue of its chemical property of combining with albumen, with which it forms an insoluble compound in the presence of an acid. It also alters the nature of the blood, and to the changes thus produced the various secondary effects are due.

Therapeutic Uses.

IN RESTORATIVE DOSES.

This agent is indicated in nervous and sympathetic vomiting, in catarrhal croup, in bronchitis (especially in children), in pneumonia; also in various acute inflammations of the mucous membranes, such as tonsillitis, laryngitis, whooping-cough, acute catarrh; also in pleuritis, peritonitis, inflammation of the breast, inflammation of the

sheath of the tendons (whitlow), ecthyma; also in bronchitic asthma, in chronic bronchitis, attended with expectoration of thick, tenacious sputa.

IN PHYSIOLOGICAL DOSES.

Useful in all cases where we desire to produce vomiting, and at the same time nausea and depression of the system; but where we desire to produce speedy vomiting without these effects, sulphates of zinc and copper are the better remedies to use. This agent may also be used in some fevers to relieve excitement and delirium.

When required to produce vomiting, it should be given with but a small quantity of water, as we then limit its action to a great extent; for if given with much water, it is soon absorbed, and in the process of elimination from the bowels, it produces watery stools.

TERSULPHURET OF ANTIMONY

In full doses produces vomiting and purging; it may be used in restorative doses in catarrh of the stomach with acid eructations, attended with irregular action of the bowels; also in chronic skin diseases, especially occurring in those of a scrofulous diathesis.

THERAPEUTIC USES IN ANIMALS.

Tartar emetic is rarely used in animals to produce vomiting, hence rarely required in physiological doses, but in restorative doses, it may be used in various affections of the mucous membranes of the respiratory tract, as in man; also in febrile conditions; while the sulphuret of antimony may be used in the same doses in various skin eruptions,

falling off in condition, irregular action of the bowels; and is best used in combination with various salts of potash where we desire to act on the skin and kidneys, as in dropsical swelling of the extremities, due in many cases to loss of condition. The addition of a small quantity of charcoal is often advantageous.

ARSENIOUS ACID.

Physiological Effects.

Externally applied, it enters into chemical combination with some of the constituents (albumen, &c.) of the tissues, and decomposes the animal fluids.

When introduced into the system, it produces faintness, depression, nausea, and vomiting, intense burning pain in the region of the stomach, which soon extends over the whole abdomen, the pain being increased by pressure. Diarrhœa soon sets in, accompanied with tenesmus; frequently there is great thirst, sense of heat and dryness in the throat, and a feeling of heat and pain at the anus, the urine is diminished or suppressed, and vomiting is excited when anything is introduced into the stomach, the vomited matter being usually brown, and mixed with blood; pulse is quick, but small and irregular; there are cold, clammy sweats, and at times a febrile heat of skin, sometimes petechiæ; heart's action is irregular, giving rise to palpitation; respiration short and hurried; coma, with paralysis, soon supervenes; tetanic convulsions, or spasms of the extremities, often present.

But in cases where the action of the drug has been gradually induced, or where the subject has survived the

effects of a large dose, we have the following symptoms, viz.:—

A feeling of warmth or pain in the stomach and bowels, loss of appetite, thirst, nausea, and vomiting, relaxed condition of the bowels, and colicky pains, furred tongue, aphthæ of the mouth, various cutaneous eruptions, inflammation of the conjunctivæ, with soreness of the edges of the eyelids and œdema of the face, quick, small irregular pulse, frontal headache, coryza, with profuse ichorous discharge from nostrils, oppressed respiration, with dry cough, diminution or suppression of the urine, languor and want of sleep, wasting of the body; the limbs become painful and trembling, subject to convulsions, sometimes benumbed, then paralysed.

Externally applied, similar effects are produced.

Specific Action.

Primarily arsenious acid acts on account of its chemical properties, combining with albumen, entering into chemical combination with the constituents of the tissues, and also altering the vital action of the parts with which it comes in contact. When swallowed, it acts chemically on the mucous membrane of the stomach and alimentary tract; it is soon absorbed, and in the elimination, acts topically on the secreting tracts, &c., producing such changes in the composition of these parts and the fluids of the body, that the nature or quality of their vital action is altered. Hence, in toxic doses, we have the functions of the various secreting tracts deranged, such as the alimentary, the respiratory, the skin, the renal, &c.; and from the changes thus produced, various secondary derangements follow; but (as indicated

in Chapter II.) in those cases where we already have deranged function of these tracts, &c., arsenious acid (in a modified dose) induces such changes in their composition, that the removal of that state of combination of the elements which excited diseased action is effected, and the healthy constitution of the part is restored by the normal process of nutrition. Hence the value of this agent in the diseases enumerated below.

The secondary results are due to the effects these primary changes produce on the ganglionic centres; hence the difficulty in administering this agent for therapeutic purposes, *in anything but restorative doses*, to limit its action; we always run the risk of inducing some secondary effects, which are often more difficult to remove than the primary disease itself.

Therapeutic Uses.

Indicated in restorative doses in aphthæ, cancrum oris, malignant sore throat, chronic bronchitis, emphysema, hay fever, influenza, coryza, chronic or paroxysmal, bronchitic or dyspeptic asthma.

Dyspepsia, conjoined with irritable state of the stomach and vomiting, chronic ulcer or cancer of the stomach, cholera, chronic diarrhœa attended with gastrodynia, gastro-enteralgia accompanied with obstinate diarrhœa; in those cases where there is inflammation or ulceration of the alimentary tract, with ejection of vitiated secretion and bloody mucus, conjoined with emaciation; in toxœmic fevers, enteritic fever, &c.; in all periodic febrile conditions, intermittent fever, ague, neuralgia, in chorea, in purpura, in large white kidney, in some serious affections, as pericarditis and endocarditis, angina pectoris, dysmenorrhœa, conjoined with anæmia.

In conjunctivitis, catarrhal and strumous ophthalmia, chronic skin diseases, such as eczema, psoriasis, lepra, pemphigus, &c.; also in phthisis, to moderate the diarrhœa, hectic fever, and cough. Its range of action is the mucous tract, and the skin. As already indicated in Chapter II., it has been proved useful in derangements of these tracts.

Externally—to destroy warts, condylomata, and cancerous growths, due care being taken to prevent absorption.

Therapeutic Uses in Animals.

In animals this agent is indicated in skin diseases, due to derangements of the mucous membranes of the alimentary canal; also in chronic derangements of this tract, with falling off in condition, given in restorative doses; also in distemper in the dog.

Also indicated in restorative doses in various affections of the mucous tract, such as influenza, catarrh, bronchitis, broken wind, conjunctivitis, inflammation of the mucous membrane of the throat, in eczema epizootica in cattle (foot and mouth disease), in diarrhœa, especially in colts and dogs; also in cases of worms, after giving a vermifuge, some preparation of arsenic should be given for some time. Topically it may be applied as a paste to remove warty excrescences, care being taken to limit its action, and to prevent its absorption.

As is well seen in cases of poisoning by this agent, a substance may affect a special part or tract by its direct topical action in the process of absorption or of elimination, especially if the substance possess chemical properties; but in those possessing dynamical properties, the effects are usually produced through the special nerves of the part, the sub-

stance causing some change in the nature or quality of their vital action.

The mineral acids, alkalies, tannins, &c., are examples of the first class, and aconite, belladonna, digitalis, &c., of the second class.

It is unnecessary to adduce more examples here, as this matter is fully discussed in the body of the work.

BELLADONNA AND ATROPIA.

Physiological Effects.

In a full dose, the following train of symptoms are produced in the majority of cases. "Soon after introduction into the system, there is great dryness of the tongue, and of the parts about the mouth and throat—in many cases the tongue presents a dry, blanched appearance—there is great difficulty in swallowing. Sometimes spasmodic constriction of the throat, hoarseness, and a dry spasmodic cough, at intervals, dryness of the nasal membrane, and conjunctivæ, which are much injected. These symptoms are soon followed by great thirst, nausea, sometimes vomiting, the pupils are dilated, and there is indistinct and in some cases double vision, the speech is incoherent, there is also loss of the power of co-ordinating the muscles, staggering and difficulty in walking, noises in the ears, sleeplessness, delirium, and spectral illusions, palpitation of the heart, with a rapid, feeble, and compressible pulse, great weakness, and a tendency to syncope, flushing of the face, with headache, intolerance of light and sound, paralysis of the sphincter vesicæ, or frequent scanty micturition, going on to strangury and suppression of the urine. In many cases there is great heat and dryness of the skin, with a scarlet exanthematous rash. Similar

effects are produced, but more rapidly, by the subcutaneous injection of the active principle, atropia, and the following experiments will illustrate its action upon the horse in health.

(*a*) Half a grain of atropia was subcutaneously injected into a healthy horse, pulse 30, at 5 p.m. on the 28th. At 5.12, pupils were dilating, tongue becoming dry. At 5.20, pupils fully dilated; pulse 68, full, soft, and compressible. At 6, great restlessness, with muscular twitching. At 10 p.m., symptoms gradually abating. Next day the pulse was soft and easily compressible, but still high; fæces were soft, and coated with mucus; pupils were now normal.

(*b*) On the 28th, at 5 p.m., a quarter of a grain of atropia was given subcutaneously to a colt with pulse 36. At 5.15, pupils slightly dilated, tongue dry, pulse 50, colt gaping at intervals. At 5.30 pupils fully dilated, tongue very dry, and also buccal membrane, pulse 56. At 9, effect gradually passing off, pulse falling. Next day effects all passed off, fæces soft and coated with mucus.

(*c*) On the 4th, to a pony, 1-12th of a grain of atropia was given subcutaneously at 5.10 p.m., pulse being then 34 per minute. At 5.50, pulse was 40, pupils dilating, tongue drying. At 6.10, pulse was 44, tongue dry, with white creamy moisture at the edges; pupils fully dilated. At 6.25, pulse was 60, tongue becoming moist, pupils contracting. At 7.20, pulse was 56, pupils still slightly dilated, tongue slightly dry. At 8, pulse was 50, effects gradually passing off. At 9.20, pulse was 48. And next

day all the effects had passed off. Urine was passed several times during the experiment.

(*d*) One grain of atropia was given subcutaneously to a horse, producing dilatation of the pupils, dryness of the tongue, the frequency of the pulse was increased, and it became very soft and compressible. The horse was very restless, and there was a good deal of involuntary muscular twitching, especially of the muscles of the neck; conjunctivæ were injected, and the horse gaped and sighed at intervals. He had a staring, frightened look, and was easily startled, pawing the ground at intervals, and kicking out as if at some imaginary object. These effects all passed off by next day.

(*e*) To another horse was given, by subcutaneous injection, on the 22nd, at 3 p.m., two grains of atropia, pulse 36. At 3.10, pupils dilating, tongue dry, horse gaping, pulse quicker. At 3.15, pupils dilated, iris hardly visible, pulse 72, but much weaker, mouth dry, horse quiet. At 5.30, horse recovering, but slightly restless; pulse not so quick, but fuller; pupils dilated, tongue dry, at intervals spasm of the diaphragm, jerking of the muscles, disordered vision and illusions. At 11 a.m. next day the tongue was moist, pupils still dilated, the effects nearly all passed off; and same day at 7 p.m., the pupils were contracting, and horse was quite well.

(*f*) Two grains of atropia dissolved in one pint of water, was introduced into the stomach of a horse on

the 1st, at 3.30 p.m., pulse being 36 per minute. At 4.20 p.m., mouth and tongue becoming dry, and horse gaped at intervals; pulse was now increased to 60. At 4.50, tongue and buccal membrane dry, pulse 50. At 5.30, tongue becoming moist, staled; pulse 40. At 6.20, pupils only slightly dilated; pulse was now 40. At 7.30, pupils contracted when exposed to a strong light, and the effects were passing off; pulse was now 36.

(*g*) Four grains of atropia dissolved in one pint of water, was introduced into the stomach of a colt on the 3rd., at 3.45 p.m.; pulse was at the commencement 48 per minute. At 4.10, pulse rose to 60 per minute, tongue becoming dry. At 4.50, tongue dry, and pupils slightly dilated; pulse was 64. At 5.10, pulse was 60, other symptoms as before. At 6 p.m., pulse 64, tongue and buccal membranes dry, pupils still the same, and effects from this time gradually subsided.

(*h*) Same quantity given in the same way to a horse, produced a similar train of symptoms. The effects produced gradually subsided after two hours, the pulse rising within the first hour from 36 to 60, then gradually falling.

(*i*) To a mare was given one ounce of powdered belladonna root, with one pint of water, on the 3rd, in the same way. At 3.30, the pulse was normal, viz., 36 per minute. At 4.45, tongue was dry, pulse had risen to 44 per minute. At 4.50, tongue was gradually becoming moister, pulse 50. At 5.50, tongue now moist and pulse

had fallen to 40; and from this time the effects of the drug gradually passed off.

(*j*) To a colt was given one ounce of powdered belladonna leaves, with one pint of water, in the same way, on the 8th, at 4 p.m., pulse being then 44 per minute; and at 4.55, pulse was still 44 per minute. At 5.20, pulse was 56, and no effects were perceptible. At 6.25, pulse 50; from this time pulse gradually fell.

(*k*) In another experiment, one quarter of a grain of atropia was given, by subcutaneous injection, to a horse whose temperature was 99⅘. In two hours and twenty-five minutes after the temperature rose to 100⅕; and in six hours after the commencement of the experiment the temperature was 100⅘; and from this time the temperature gradually fell, but was not at the normal standard till the third day. In this case the pulse was not noted (*vide* Chapter IV.).

(*l*) $\frac{1}{100}$ of a grain was given to a bitch by subcutaneous injection, and the pulse rose in a short time to 120 per minute. After 14 minutes had passed, the pulse was 300, strong and regular; pupils completely dilated; tongue, mucous membrane of mouth and nose all dry. After half an hour, pulse was 260; after an hour, 230; mouth gradually becoming moister; passed urine. After one hour and a quarter, pulse 168, mouth now moist. After two hours and a quarter, pulse was 130, still strong and regular; pupils still fully dilated; no other effects were observed, the bitch running about as usual.

(*m*) $\frac{1}{6}$ of a grain was given, and in seven minutes the pulse was much quickened; in nine minutes the pupils were fully dilated, the tongue and mucous membrane of nose and mouth very dry. After twenty-seven minutes the bitch was rather unsteady on its legs. After one hour she was partially blind, pulse exceedingly quick, over 300. She lay down and dozed for a short time. After one hour and a half, heart action was quick and tumultuous; she had difficulty in walking; there seemed to be disordered vision. After three hours, pulse still very quick but regular; respiration 18, sighing at intervals. After five and a half hours, mouth becoming moister, pulse still very quick, but bitch more active. After 11 hours, pulse 140, regular; pupils still very much dilated; effects gradually passing off. Urine was passed several times.

Several other experiments were tried with belladonna, and atropia, but as the results were the same in most respects, it is unnecessary to give them here. We will, however, detail three experiments which show the action of belladonna and opium given together.

(*a*) On the 15th, to a mare was given two ounces of extract of belladonna, and two ounces of tincture of opium, at 4.30 p.m., the pulse being then 34 per minute. At 4.50, pulse was regular, full, and 72; pupils fully dilated, and tongue very dry, mare gaping at intervals. At 5.10, passed urine freely; pulse was now 64. At 6, passed urine, mare very restless, pulse 60. At 7, pulse soft, passed urine, tongue very dry, pupils fully dilated, mare very restless. At 7.20, urinating freely, quieter

now, ate a small quantity of hay, but had some difficulty at first, owing to the dry state of the tongue and mouth. At 7.30, urinating freely, restless again, pulse 66. At 7.50, effects gradually passing off; still eating hay, but seemed to have some difficulty in bending her neck, and deglutition at first produced spasm; tongue was moist, mare fed at intervals, but refused water all the night. Next day, at 11 a.m., pupils still slightly dilated, other effects all passed off.

(*b*) On May 8 was given, subcutaneously, 2 grains of atropia and 4 grains of morphia, to a stallion. At 4 p.m., pulse was 36. At 4.10, pulse was 60, and the pupils were dilating. At 4.12, pupils fully dilated, only a ring of iris visible. At 4.20, pulse 68, horse in a delirious state, great twitching of muscles. At 4.30, pulse 72, horse very excited. At 4.40, tongue dry, horse very violent, pulse now 80. At 5, conjunctivæ injected, pupils fully dilated, horse very delirious, and perspiring freely. At 5.20, still the same; and at 5.25, restlessness suddenly abated, pulse full and strong, and muscles rigid. At 5.45, horse very restless, irregular movements of the extremities. At 6.15, restlessness suddenly ceased; pulse feeble, irregular, 82; great distress, profuse perspiration, constantly passing urine. At 6.45, still passing urine, pulse 92. At 7.15, quiet sometimes, then restless, pulse 90, tongue dry, pupils dilated, still passing urine, perspiring freely, the conjunctivæ not so much injected now. At 7.35, pulse full, regular, and 88; horse quiet and sleepy, tongue very dry, still passing urine, effects passing off. At 12 midnight, horse was quiet, and took food as usual. On

the 9th, at 9.30 a.m., pupils were still dilated, pulse was regular and 44, fæces passed were coated with mucus.

(*c*) On the 10th, to a colt was given, by subcutaneous injection, at 5.45 p.m., one grain of atropia, pulse being then 46. At 5.50, pupils dilating. At 5.55, pupils fully dilated. At 6 p.m., tongue now very dry, pulse 35. At 6.30, great restlessness and muscular twitching, tongue very dry, pulse regular, 35, colt, gaping and sighing at intervals, pupils fully dilated; fully under the influence of the atropia. Then in the same manner was given, at 6.30, 3 grains of morphia, with 30 minims of water. At 6.40, pulse small, 76; general nervous excitement, pupils still dilated. At 7, nervous excitement increasing, pulse small, irregular, and very quick; the animal in great distress. At 9, delirium excessive, profuse perspiration, pupils dilated, pulse quick, irregular, and scarcely perceptible; urinating freely. At 11.33, lying down, effects seem to be passing off. Next day, at 10 a.m., pulse regular and natural in force, 30; tongue moist, feeds as usual, but pupils still dilated, and pulse slow, indicating that the effects of the atropia had not passed off. At 4 p.m., pupils contracting, pulse 50, but regular.

These three experiments serve to show that the morphia or the opium tends rather to increase and prolong the effects of belladonna or atropia. And the last-mentioned was conducted to show that morphia, given to an animal under the influence of atropia, would increase the distress and raise the pulse, while, as already mentioned, morphia will counter-

act the effects of strychnine. When belladonna is applied to one eyebrow, or when the spray of a solution of atropia is applied to one eye, it will dilate the pupil of that eye without affecting the other pupil, until sufficient is absorbed into the circulation to act topically on the other pupil.

Specific Action.

All the above-mentioned experiments go to show that the specific action of this agent is primarily on the vascular system, the mucous tracts, and skin generally, and especially on unstriped muscular fibre, affecting all these parts through the changes it produces in the quality or nature of the vital action of the sympathetic system. Its direct and topical action on the unstriped muscular fibre of the body is evinced by the immediate dilatation of the pupil when this agent is applied to it. And in the same manner when absorbed it relaxes spasm, &c. From the changes it thus produces, arise the various secondary effects. The experiments detailed already show that whereas this agent in a small dose, by acting on the sympathetic, stimulates the heart's action and increases the secretion of the mucous tract, yet in a large dose it will diminish the force of the heart's action and the vascular circulation, and tend also to diminish secretion.

Therapeutic Uses.

in restorative doses.

Indicated in congestive headache, and in all brain affections dependent on irritation of the ganglionic system; also in infantile and puerperal convulsions, in erysipelas, erythema, scarlet fever, acute hydrocephalus, chorea, delirium of fevers, enteric fever, in pneumonia, in inflammation of

the throat, quinsy, &c., in suppression of urine, desquamative nephritis after scarlet fever, in acute and chronic nephritis; in nocturnal enuresis, in catarrhal and strumous ophthalmia, in otalgia, in laryngismis stridulus, in whooping-cough.

IN PHYSIOLOGICAL DOSES.

Indicated in neuralgia, sciatica, lumbago (both given internal and externally applied), spasmodic asthma, in colic, gastrodynia, in rheumatism, in gout, in acute epilepsy. Hypodermically to relieve pain and spasm, especially in conjunction with morphia, as in neuralgia, sciatica, lumbago, rheumatism, pleurisy, pleurodynia, &c.

TOPICAL USES.

It may be employed as a liniment or ointment in pleurodynia, lumbago, neuralgia, sciatica, pleurisy, &c.; also to lessen inflammation, and to prevent suppuration; also to check the secretion of milk, where required; to dilate the pupil, and relax the tension of the parts in various affections of the eye, as ulcer of cornea, iritis, conjunctivitis, &c.; likewise useful in the treatment of leucorrhœa, spasmodic stricture of the urethra, and of the sphincters of the bladder, uterus, or rectum, and, according to Brown-Séquard, in paralysis dependent on chronic inflammation of the cord. Sidney Ringer also strongly recommends the use of the liniment of belladonna to prevent excessive perspiration, and it is especially useful to control excessive perspiration from the hands and feet. Also in colic of the intestines, a poultice containing belladonna, applied to the part where the pain is felt, is of great benefit, and succeeds in relaxing the bowels, and thus aids in the removal of hardened

fæces, which so often are the cause of colicky pains. Tincture of belladonna may be given at the same time internally.

Therapeutic Uses in Animals.

Belladonna may be used in similar affections in animals, and is a most valuable remedy in the treatment of all the affections of the mucous membrane mentioned already, such as fever, idiopathic or symptomatic, specific or toxœmic fevers, strangles (*i.e.*, suppuration of the salivary glands), bronchitis, pneumonia, pleuro-pneumonia, colic, gastro-enteritis, in some forms of diarrhœa, pericarditis, and endocarditis, spasm of the diaphragm; asthma, commonly known as broken-wind; congestion of the lungs, and in various local congestions; sore throats, catarrhs, and both internally and locally; in conjunctivitis and iritis; also in nephritis, lumbago, rheumatism, and pleurodynia. Externally applied, in the form of a poultice, belladonna is a valuable application to relieve pain in inflamed joints, or in wounds of the joints; and atropia in solution may be employed as a spray to ulcerations of the cornea, from injury or other causes; also in conjunctivitis and iritis, to relax the tension of the part. Atropia subcutaneously injected is one of the best forms of administering this drug in acute disease; it at once relieves the pain in cases of lumbago, sciatica pleurisy, pleurodynia, colic, enteritis, gastro-interitis, spasm of the diaphragm, myalgia, &c., and in these cases it may be given in conjunction with morphia, to prolong the effects, and prevents the nausea so frequently produced by morphia given alone in the canine and feline species, as well as in man; also in conjunction with strychnine, it has been used with great success in the treatment

of tetanus in the horse, and it seems to prolong the action of the strychnine in these cases; besides in many cases of paralysis due to effusion in the cord, this agent has proved in many cases of great benefit.

In the case of a gelding affected with paralysis, on the 30th, at 3 p.m., 1 grain of nitrate of strychnine, and $\frac{1}{4}$ of a grain of sulphate of atropia, were given subcutaneously, temp. 100°, pulse 32. At 3.10, the pupils commenced to dilate. At 3.20, pupils fully dilated, tongue slightly dry, temp. $100\frac{2}{5}$°, pulse 32, muscles were observed to be slightly rigid. At 5.30, pupils dilated, tongue dry, muscles less rigid, and control over them improved, temp. 101°, pulse 60. At 6.30, tongue moist, pupils dilated, rigidity almost gone, considerable nervous excitement all night, temp. 101°, pulse 50. 31st, at 11.30 a.m., tongue feverish, horse rather restless, temp. 101°, pulse 36. At 5.30 p.m., tongue clean, bowels relaxed, control over muscles improved to a great extent, temp. $100\frac{2}{5}$°, pulse 46.

To a mare suffering from pain, due to injury to foot, was given 1 ounce of extract of belladonna in 1 pint of water. At 4 o'clock the pulse was 50; at 4.20, 40; at 4.35, 48; at 4.50, 54; at 5.15, 60; at 6.20, 50. She then passed urine freely. No other symptoms were produced; but the pain was much relieved.

BISMUTH, CARBONATE AND NITRATE OF.

Physiological Effects.

Pain in stomach, vomiting, purging, tension and swelling of the belly, giddiness, delirium, cramps of the extremities, and insensibility, in some cases violent palpitation, inter-

mittent pulse, hiccup, laborious breathing, and suppression of urine; but a very large dose is required to produce any very marked effect.

Specific Action.

Primarily on the alimentary tract on account of their chemical properties, and producing secondary effects through the ganglionic system, but the quantity absorbed is small, as they are very insoluble.

Therapeutic Uses.

IN RESTORATIVE DOSES.

Indicated in gastrodyna and cramps of the stomach, in pyrosis and cardialgia, and vomiting, in sub-acute gastritis and gastralgia, especially when an irritable state of the mucous membrane exists, in intestinal catarrh; especially of children during dentition, in the premonitory diarrhœa of cholera, in the diarrhœa of phthisis, in cancer, chronic ulcer, and chronic inflammation of the stomach, also in dyspepsia, where there is much flatulence. Externally as a drying powder in some skin diseases, where there is excessive secretion.

CAMPHOR.

Physiological Effects.

The effects of this drug are but transient; in full doses it causes lassitude and depression, yawning with chilliness, gradual insensibility, followed by convulsions and delirium (this in a two scruple dose).

It has caused languor, depression, delirium, numbness, tingling and coldness of the extremities, followed by quick pulse, difficult respiration, convulsive fits, and in some cases profuse sweating.

Four ounces of spirit of camphor (*i.e.*, 160 grains of camphor) have caused burning heat of skin, frequent full hard pulse, redness of face, heaviness of the head, sense of heat in the stomach, then intense headache, giddiness, and sweating, in some cases strangury. In another case it caused dimness of sight, giddiness, and convulsive fits, pulse frequent and scarcely perceptible, extremities cold, general exhaustion, and suppression of urine.

Specific Action.

This substance is absorbed into the blood, and is eliminated by the mucous membrane and skin, chiefly the respiratory and the renal; and in its passage through these membranes it acts topically on them. It also influences the vascular system, as evinced by the depression, chilliness, &c., produced by larger doses, and the increased vascular circulation, diaphoresis, &c., induced by small doses; and it is to its influence on the vascular system that the secondary effects alluded to are due. The effects produced depend on the mode in which given.

Therapeutic Uses.

in restorative doses.

Indicated in acute catarrh with frontal headache (both inhaling it and taking it internally), influenza in summer, diarrhœa and choleraic diarrhœa, in chordee, strangury, and dysuria, in nervous irritability, in congestive head-ache, with giddiness and wakefulness, and delirium of fevers.

in physiological doses.

In hysteria, spasmodic affections, and in chronic rheumatism, &c.

As its action is but transient, it is necessary to give it in

repeated doses. It is best given in the form of an emulsion. Camphor inhalations are useful in congestion of the nasal mucous membrane. In solution it is valuable as an application to stiff and painful parts, also in rheumatism.

Therapeutic Uses in Animals.

INTERNAL USES.

This active agent, when administered to animals, should always be given in restorative doses, and as our object is to ensure its rapid absorption and remote action, and not its topical action on the stomach and bowels, it should therefore be given in very dilute solution. It is indicated in the treatment of colds, coughs, fevers, rheumatism, some forms of neuralgia, and it may be given as an adjunct to other remedies.

EXTERNAL USES.

In solution to disperse serous abscesses, sprains, bruises, &c., and it may be used in combination with aconite, opium, or belladonna, in the treatment of muscular rheumatism, neuralgia, lumbago, rheumatic arthritis, gout, and affections of a similar nature. Also in combination with muriate of ammonia, in the form of a powder, to treat sprains and bruises of ligaments and tendons, likewise to disperse chronic enlargements of the joints, and bursal distension, commonly known as wind galls, in splints (inflammation of the periosteum), sore shins, &c.

CANNABIS INDICA.

Physiological Effects.

Exhilaration, inebriation, with a kind of delirium, followed by sleep, pricking feeling in the limbs, with numbness and

eventually anæsthesia, dilatation, but not paralysis of the pupil, and a peculiar cataleptic state, in some cases venereal excitement. The resinous extract sometimes produces irritation of the bladder and urethra, with scalding and painful micturition, as it is eliminated with the urine.

Specific Action.

On the cerebro-spinal system, causing some alteration in the nature or quality of the vital action. The resinous extract probably topically irritates the genito-urinary mucous membrane, whilst the preparation used in India being an extract of the active principle by some fatty material, does not produce these topical effects. The effects of this drug are not well understood, owing to the difficulty in getting a pure specimen.

Therapeutic Uses.

in restorative doses.

Indicated in nymphomania and satyriasis. It should be given suspended in mucilage.

in physiological doses.

In neuralgia, spasmodic cough; but as it is difficult to get a pure specimen, it is rarely used.

CANTHARIDES.

Physiological Effects.

Topically applied, it causes pain, heat, redness, and swelling, followed by serous effusion. Sometimes erythematous pustules are produced around the blistered surface.

When swallowed, cantharides in a full dose causes difficulty in swallowing, burning pain in the stomach, nausea, vomiting, tenderness at the epigastrium, extreme thirst,

griping, and tenderness of the abdomen, purging generally of blood, pain in the loins, with burning pain and tenderness in the hypogastric region, spasmodic contraction of the bladder, with constant desire to urinate, but inability to do so, only blood is passed. Priapism in the male, and in the female local heat and pain. These symptoms are followed by pain in the head, giddiness, delirium, convulsions of a tetanic character, then coma, pulse hard and frequent, skin hot, respiration quick. In some cases it causes a cutaneous pustular eruption. In a somewhat lesser dose it causes heat in throat, stomach, intestines, and respiratory tract, burning sensation in the bladder, and pain in the loins, increased desire to urinate, the urine is passed however with difficulty, is scanty and bloody, pain is also felt in the urethra, pulse is quick, skin hot, and respiration hurried. Externally applied it has increased the quantity of albumen in the urine.

Specific Action.

Cantharides acts topically on the organic nerves of the various eliminatory tracts, however introduced into the system, but its chief influence is upon the genito-urinary tract. The secondary effects mentioned above are but the natural sequences of derangement of the functions of these tracts. This agent, whether externally or internally used, acts topically on the capillaries, so altering their vital relation to the blood, that they allow of exosmose of the serum, and in some case of the blood itself, hence its action on the skin and the malpighian corpuscles of the kidneys, &c. It is probable that the great topical irritation may be due to a great extent to the fact that the active principle is insoluble in water.

Therapeutic Uses.

IN RESTORATIVE DOSES.

Indicated in acute nephritis and cystitis, in strangury, suppression of urine, and hæmaturia from acute congestion, and in dropsy after scarlet fever. In chordee, gonorrhœa, gleet, ardor urinæ, in cases of kidney disease, where the patient is passing albumen and blood, in spermatorrhœa from urethral irritation. In chronic skin diseases, as eczema, psoriasis, and lepra. Externally in burns and scalds. Also in alopecia.

Therapeutic Uses in Animals.

INTERNAL USE.

Indicated in dropsy—the result of acute disease—in strangury, and in hæmaturia, commonly known as "red water," occurring in cattle. It may be given in restorative doses.

EXTERNAL USE.

As a vesicant in the form of ointment, or liniment; but the preparations of iodine in most cases are preferable.

CASTOR OIL.

Physiological Effects.

Taken internally, either swallowed or injected into the veins, castor oil causes purgation, and in some cases griping; but when given by the mouth, it passes rapidly through the bowels, little, if any, being absorbed.

Specific Action.

By its physical power over the phenomena of endosmose, it induces endosmose of the serum of the blood, hence pur-

gative; its action is principally on the alimentary canal, being eliminated by that tract.

Therapeutic Uses.

In the early stage of diarrhœa, and to unload the bowels, especially after surgical operations about the pelvis, or in irritable conditions of the alimentary canal. It is best given in combination with liquor potassæ, which increases its purgative action, or it may be suspended in mucilage.

CROTON OIL.

Physiological Action.

Topically applied, it causes redness, also pustular or vesicular eruption, with swelling, and is sometimes absorbed, causing purging, swelling of the face, and vesicular eruptions on different parts of the body. When swallowed, it causes, by its topical action, burning taste in the mouth and throat, nausea, followed by watery stools and increased urination in a very short time after being taken; and if the dose be excessive, there is great vesicular depression, with cold sweats, debility, dyspnœa, and asphyxia. The effects produced will depend on the quantity absorbed, for the greatest effect is produced when injected into the veins.

Specific Action.

This agent is eliminated by the alimentary tract and the skin, and influences these tracts topically, however introduced into the system.

Therapeutic Uses.

IN RESTORATIVE DOSES.

Indicated in choleraic and watery diarrhœa; also internally and externally in some pustular skin eruptions.

IN PHYSIOLOGICAL DOSES.

Sometimes required to cause purgation in epilepsy, coma, mania, and similar cases.

CHLORAL, HYDRATE OF.

Physiological Effects.

In the horse, ʒi. was given, and half an hour after ʒß. more, producing sleep for several hours. The following morning ʒii. were given, and produced no effect. In another horse, ʒiv. were given, with ʒx. of water; half-an-hour after this, the horse was restless, but drowsy, passing fæces frequently. In an hour and twenty minutes after taking the dose, the horse was sleepy, purging, and pupils dilated; and in an hour and a half after this, the horse was slightly delirious, and it gradually became less restless and more sleepy. In man, a full dose produces deep sleep, sometimes anæsthesia, temperature lowered; in some cases faintness, cold limbs, rapid, weak intermittent pulse, sense of sinking at the præcordia, delirium wandering, prostration, dyspnœa, and a feeling of depression and sleepiness remain for a day or two. If the tendency to sleep be resisted, great excitement and restlessness ensues. In some cases, in which chloral has been taken for some time, it has produced cerebral exhaustion, and a state resembling imbecility, with numbness and paralysis of the extremities.

Vide experiment Chapter IV., in which the effect of this agent in reducing temperature is shown by an experiment on a horse.

Specific Action.

There can be little doubt that Liebreich is correct in stating that the alkali of the blood decomposes this agent, and chloroform is formed; and it is evident that the effects produced will be regulated by the amount of chloral decomposed, rather than by the quantity taken. For a large quantity may be taken, and the greater portion eliminated from the system before it has undergone decomposition; but in cases where it is given in repeated doses, the effects *may* be kept up for a long time, and the blood be kept saturated with it. So that the formation of chloroform may continually go on; and in these cases the chloroform evolved may be readily detected in the breath. It is to the slow evolution of chloroform that the effects are due; for the oxidation of the blood is lessened, as well as the evolution of carbonic acid. It sometimes produces urticaria when taken for some time. The effect is more rapidly produced if given with a large quantity of water (*vide* the above experiments and Chapter IV.). Its action is primarily on the blood, and hence on the brain and nerve-centres generally.

Therapeutic Uses.

in physiological doses.

Indicated in those cases where we wish to produce sleep or allay pain (and is best given in small and repeated doses), in delirium tremens, in acute mania, in neuralgia and sciatica, convulsions of children, in sleeplessness, especially if from cerebral excitement.

In all cases to aid its hypnotic effect, it is necessary to

keep quiet, otherwise it induces restlessness and excitement; and it must be remembered that its constant use decidedly does harm by producing mal-nutrition of the brain and nerve-centres.

It has been used in small doses with success in urticaria. Externally it may be used as a local anæsthetic, for which purpose any of the following may be used:—

(*a*) ʒß of hydrate of chloral and ɱxl. of water.

(*b*) ʒß of camphor, ʒß of hydrate of chloral, and ʒii. of glycerine.

(*c*) ʒiii. of hydrate of chloral and ℥iii. of olive oil.

(*d*) ʒß of camphor, ʒii. of chloroform, and ʒß of hydrate of chloral.

CINCHONA AND QUININE.

Physiological Effects.

Cinchona topically applied acts as an astringent to the mucous membranes. When swallowed in a full dose, it produces a dry and bitter taste, and increases the flow of saliva. In the stomach it combines with the free acid, and is rendered soluble; but owing to its topical action on the secretions, it causes nausea, vomiting, loss of appetite, thirst, in some cases constipation, and in others purging; but the portion rendered soluble is absorbed, and produces increased action of the vascular system, dry tongue, throbbing headache, and giddiness; the head-ache is chiefly frontal, and is of a dull, heavy character; face is flushed, eyes suffused; pulse is increased in frequency, but lessened in force; there is also tinnitus aurium, deafness, dimness of sight, and a state resembling intoxication; this is followed by sweating.

Quinine (not containing tannin) does not act as a topical

astringent; but it produces all the other effects of cinchona. It is soon absorbed into the blood, and is eliminated to a great extent with the urine. In common with other bitters, it increases the secretion of the mucous surfaces; but, in addition, it has a specific influence over the white corpuscles, also destroying septic germs, arresting putrefaction and fermentation, and, in the healthy body, lowering the temperature in a slight degree; and, according to Dr. Ranke, it lessens by one-half the excretion or formation of uric acid. Quinine is not easily destroyed in the body, and is not eliminated for some time; for in one experiment, 4 grains were taken, and detected in the urine at intervals during 66 hours; and in another case, 2 grains continued to be eliminated during 77 hours. Piorry states that quinine lessens the size of the spleen in disease and also in health; and, considering the constant increase in the size of the spleen in malarious fevers, &c., the attendant rise in temperature, the influence of quinine over the white corpuscles, its power of reducing both the temperature and the size of the spleen, we are inclined to advance the theory already alluded to, that in health the excess of heat generated in the system is correlated into nerve force, and thus the temperature always remains the same; but in certain diseases some unknown cause interferes with this function, and the heat set free by the oxidation of the tissues not being rendered latent, increases to such an extent as to induce palsy of the heart or brain, unless, by profuse sweating, the heat is carried off; at the same time, the constitution of the blood is altered, and the spleen's function of elaborating the plasma of the blood and forming new corpuscles, is deranged; but quinine restores the power of correlating heat, the temperature falls, and the function of the spleen is restored (*vide*

Chapter IV.). In support of this theory, we call attention to the fact that quinine, though it may affect a temporary reduction of temperature in typhoid fever, pneumonia, &c., it has no power to cure these diseases, as in these cases the increase of temperature is due to increased tissue disorganisation, and not to the impairment of the power of correlating heat. For a full discussion of this question, see Chapter IV.

Quinine in 20 grains dose has caused pain and heat in the gastric region, nausea, griping, purging in some cases, constipation in others, increased frequency and fulness of the pulse, furred tongue, headache, giddiness, disorder of external senses, somnolency, and a kind of delirium.

Specific Action.

Cinchona acts primarily in virtue of one of its chemical constituents—viz., tannin—on the mucous surface; but, besides, it acts, on account of the quinine, &c., contained in it, upon the blood and the white corpuscles; this it probably does by its influence on the phenomena of endosmose, the various secondary effects being due to the changes thus induced. All the symptoms indicate that its influence is primarily on the blood, and hence on the various secretions. Quinine introduced into the healthy system, is eliminated to a great extent with the urine.

Therapeutic Uses.

These agents are indicated in remittent fever, intermittent fever, ague, neuralgia (especially if due to malaria); in malnutrition, atonic dyspepsia, passive hæmorrhage, profuse menstruation; in convalescence of acute and chronic diseases,

fevers, hæmorrhage, and profuse discharges; in diarrhœa, protracted headaches of a congestive character, sweating, and in hæmaturia. In continued fevers and toxœmic fevers, it is not of so much value, except as a general tonic after the acute stage has been passed.

Therapeutic Uses in Animals.

In physiological doses.

Useful in low fever, in diarrhœa, in hæmaturia, in some forms of influenza, catarrh, distemper in dogs, in inflammation of throat from cold and wet; also as a tonic after acute diseases, or in the treatment of various epizootic diseases, in conjunction with other remedies.

As a gargle, with the mineral acids, it is very useful in sore throat, strangles, and croupy inflammation of the throat.

COLCHICUM.

Physiological Effects.

When swallowed in a full dose it produces an acrid taste in the mouth, much irritation of the fauces, nausea, vomiting, and purging (the vomited matter consisting of mucus, sometimes blood, the stools also being slimy and often bloody), accompanied with cutting pains in the belly, tenesmus, small, slow, feeble pulse, cold feet, frontal pains, copious sweating, and often pain in the muscles and joints, and often weakness of the limbs (in some cases suppression of urine, and purging of copious liquid stools). In smaller doses it increases the secretion of the alimentary canal, and also of the skin, with decrease in the volume, and frequency

of the pulse. Topically applied to the skin, or mucous membrane, it sometimes causes redness, with watery discharge from the mucous membrane.

Specific Action.

This agent acts topically on the blood-vessels (altering the nature of their vital relation to the blood), hence on the secreting tracts, viz., the alimentary and renal mucous membrane and the skin, and, by reflex action of the ganglionic system, acts on the cerebro-spinal. Hence its influence is primarily on the vascular system and the secreting tracts.

Much the same effects are produced by this drug whether swallowed or injected into the veins.

Therapeutic Uses.

Indicated in restorative doses in watery diarrhœa. In gout, this agent is useful to relieve the vascular congestion (induced by the urate of soda deposited in the tissues), and thus allays the pain, and cuts short the paroxysm, but is powerless to prevent a recurrence of the attack, or to remove the condition on which this disease depends. It is also useful in articular rheumatism for the same reason, especially in chronic cases, and in various rheumatic pains; also in the various neuralgic and inflammatory complications in the gouty or rheumatic diathesis.

COLOCYNTH.

Physiological Effects.

In man, when swallowed in a full dose, this drug causes violent dysenteric purging, with griping pains, the stools being mixed with mucus and blood; and in some cases

there is extreme tension and tenderness of the abdomen, followed by dimness of sight and delirium.

Two drachms, given to a dog, caused violent vomiting and purging. In the horse, the following experiments were made with the active principle, "Colocynthine":—

(*a*) Eight grains of colocynthine, dissolved in one drachm of spirit of wine, were injected subcutaneously, and, soon after introduction, the eyelids began to droop, the horse presented a general dull appearance; this was followed by a state of restlessness; the pulse was slow, and the fæces were passed twice during the experiment.

(*b*) Two grains of the same substance were introduced into another horse by subcutaneous injection. Five minutes after, the horse commenced urinating, and passing fæces at intervals during the next two hours and a half; the pulse rose 14 beats, the respiration was quickened, at the same time general depression and drowsiness set in, the horse hanging its head; the bowels gurgled a great deal, and purgation continued, more or less, till next day.

Specific Action.

Owing to its physical power over the phenomena of endosmose and exosmose, it produces endosmose of the serum of the blood, and thus, when introduced into the alimentary canal, purgation; also, by inducing reflex action of the ganglionic system, it influences the peristaltic action of the bowels. Its principal action is upon the intestinal canal.

Therapeutic Uses.

in restorative doses.

Indicated in watery diarrhœa or dysentery, also in colic. May be used, in some cases, in physiological doses, to produce purgation.

CONIUM.

Physiological Effects.

In man, whether injected subcutaneously, or swallowed, this drug and its active principle, conia, produce the following train of symptoms: loss of the muscular power, commencing in the extremities and passing upwards, loss of the power of deglutition, paralysis of the respiratory muscles, then asphyxia, the muscles of the eyeball are affected, hence impaired vision, and, in some cases, coma, delirium, and convulsions.

When given in small doses, and long continued with, it causes dryness in the throat, feeling of heaviness in the head, frontal pain, giddiness, and, in some cases, scaly eruptions.

Succus conii was given to a horse, and produced a state of general depression, head and ears drooping, eyelids fallen down. Shortly after this the horse tumbled down, and, after some stumbling, got on his legs again, but he still seemed to have very little control over his legs. These effects remained for about two hours.

Dr. J. Harley, in his able work on "The Old Vegetable Neurotics" (p. 5), gives the following experiment with succus conii:—

"To a man, aged 57, of powerful muscular development was

given the succus conii, in doses increasing from three drachms to an ounce. The medicine produced no appreciable effect until the quantity was increased to six drachms. This dose was followed, twenty minutes after taking it, by sudden giddiness, and so much weakness of the legs as rendered the patient incapable of walking, and he was obliged to lie down. There was an aching pain across the eyebrows, and mistiness of vision. He could hardly raise the eyelids, which seemed pressed down with a heavy weight, and he was disposed to fall off to sleep. After twenty minutes, he got up and walked a mile, but the legs were so weak they could hardly support him; the knees tended to fall forwards, and his gait was tottering. An hour and a half after the dose, the effects had almost entirely passed off, and he felt as if nothing unusual had happened to him."

The following experiment was conducted by Messrs. Mavor with conia:—

To a horse was given, by subcutaneous injection, on the 22nd, at 3.36 p.m., ♏vi. of conia in spirit and water; pulse 43. At 3.44, passed fæces; pulse 44. At 3.55, a little secretion from nostrils. At 4.15, erection of penis. At 4.57, injected same way ♏viii. of conia. At 5.23, passed fæces; pulse 44. No other effects observed.

Specific Action.

First upon the peripheral extremities of the motor nerves, then upon the trunks, and eventually on the motor centres. And these it influences by its topical action on these parts, altering the nature and quality of their vital action. It has no direct influence on the sympathetic system, or the sensory nerves.

Therapeutic Action.

in physiological doses.

Indicated in irritation and convulsions from dentition, in chorea, in paralysis agitans, in tetanus, exhaustion and irritability of the sexual organs, ovarian irritation, laryngismus stridulus, in some forms of epilepsy, also in various spasmodic affections.

Therapeutic Uses in Animals.

Useful in tetanus. The succus should be given in doses of ten to sixteen fluid ounces, in the horse, where it is possible to introduce it into the stomach by the mouth; but where the jaws are so firmly fixed as to render this impossible, the succus may be warmed and injected into the rectum, or the active principle, conia, may be subcutaneously injected, the only objection to this mode being the liability of this agent to act as a topical irritant to the part, and to set up suppuration, but this effect may be obviated, to a certain extent, by mixing it with glycerine. The following experiment was tried on a horse suffering from an attack of tetanus:—

The horse, when first seen, had the jaws firmly closed, and they resisted all attempts at separation; the muscles of the neck were also rigid, and the horse had great difficulty in moving its head, and was perfectly unable to bend its neck. The pulse was 42. Pupils normal. Temperature $100\frac{2}{5}$. At 12 noon, gave, by subcutaneous injection, ♏xv. conia, dissolved in half a drachm of spirit. At 12.7, jaws opened slightly (2 in.), could eat some hay; pulse 36. At 12.15, eyelids drooping. At 12.25, ate some more hay, could raise

his head easier. At 12.50, eyelids drooping very much, conjunctivæ moist, eats freely; pulse 36. At 3 p.m., signs of rigidity returning, passed fæces three times since 12. At 5.35 p.m., gave ɱxx. conia, in the same manner as before.

Next day the horse was much better, and quite recovered under the use of strychnine, introduced hypodermically. There was, however, a good deal of suppuration where the conia was injected. Further experiments are required to fully test the value of this drug in tetanus and kindred affections.

COPPER—SALTS OF.

Physiological Effects.

Applied to the mucous membrane, or to a part of the external surface denuded of skin, these salts combine with the albumen and form an insoluble compound, and thus by entering into chemical combination with the tissues, alter their vital action. Introduced into the system in a full dose, they produce nausea, vomiting, griping colicky pains in the stomach and bowels, the abdomen becomes painful and distended, purging and tenesmus, followed by violent headache, cramps in the thighs and legs, hurried and difficult breathing, small, quick, irregular pulse, intense thirst, cold perspiration and coldness of the limbs, great weakness and prostration, stupor, coma, and generally convulsions, and in some cases paralysis of motion and sensation. In cases where these salts have been administered for some time in small doses, they produce functional derangement of the alimentary canal, a febrile state with hot skin, thirst, headache, furred tongue, prostration with rapid small wiry pulse, and in some cases great weakness, tremors, and paralysis. In most cases the prominent symptoms are colicky pains,

frequent vomiting, bloody and slimy stools, attended with great tenesmus.

Specific Action.

Primarily their action is due to their chemical properties, for externally applied they enter into chemical combination with the tissues, and alter their vital action, and in the same way when introduced into the system they first combine with mucus of the stomach, and by the change thus produced, the vital action of the mucous membrane is altered, hence by reflex action of the ganglionic centres, nausea and vomiting are induced, and in the process of elimination from the system by the alimentary tract, they act topically on the mucous membrane, hence the various symptoms enumerated above, which are due, primarily, to the altered vital action produced by these changes of the parts, and next to the reflex action of the ganglionic centres. The various secondary effects on the nervous system are thus due to the change they produce in the fluids of the body. Jaundice has occasionally been produced by salts of copper given in large doses. The acetate of copper is very variable in its action.

Therapeutic Uses.

in restorative doses,

Indicated in chronic diarrhœa—in the diarrhœa of phthisis; in cases where we suspect ulceration of the intestines, chronic enteritis attended with diarrhœa, emaciation, depression of spirits, moist tongue, and frequent pulse, chronic vomiting. In spasmodic asthma, croup and whooping cough, chorea and epilepsy, the sulphate being the best preparation to use.

IN PHYSIOLOGICAL DOSES.

To induce speedy vomiting, and in croup to promote the expulsion of the false membrane.

EXTERNAL USES.

In gonorrhœa, gleet, and leucorrhœa, to ulcers with soft spongy granulations, in chronic ophthalmia, in superficial ulcerations of the buccal mucous membrane, and to repress bleeding from small vessels, especially useful in aphthæ, thrush, ulceration of the gums. If used in substance, or the strong solution, it destroys the vitality of the part to which it is applied; but when used in a more diluted form, it acts as an astringent and stimulant. ℈i. to ʒi. of water especially useful in chilblains.

COPAIBA.

Physiological Effects.

In common with the oleo resins, this substance produces in a full dose a sensation of warmth at the stomach, nausea, vomiting, and sometimes purging, irritation of the urinary passages, frequent micturition, sensation of burning in passing urine, sometimes strangury, bloody and scanty urine, pulse full and frequent, skin hot, thirst and headache, and the appearance of an eruption on the skin like urticaria, also increased secretion from the bronchial mucous membrane. Under the influence of copaiba the urine is increased in quantity, and is turbid, but this turbidity is not due to the presence of albumen.

Specific Action.

In common with the various oleo resins, this substance acts topically on the skin and mucous membranes, especially

on the genito-urinal and bronchial in the process of elimination. And in large doses induces such a change in the vital action of the capillaries as to cause exosmose of the serum of the blood, and functional derangement of the ganglionic system. The odour of copaiba may be perceived in the breath and in the urine.

Therapeutic Uses.

in restorative doses.

Indicated in gonorrhœa, catarrhus vesicæ, leucorrhœa, bronchial catarrh, and in some cases of chronic diarrhœa and dysentery. Also in conjunction with sulphur, in the treatment of hæmorrhoids, and in chronic inflammation of colon and rectum. It will be sufficient to say here, in reference to the resinæ generally, that their physiological effects are to a great extent the same as copaiba, and their specific action is upon the vascular system, through the ganglionic, and on the mucous membranes and skin, and they are indicated in functional derangements of the secreting tracts generally. The most useful are guaiacum, the turpentines, benzoin, balsam of Peru and tolu, assafœtida, galbanum, ammoniacum, myrrh, &c.; they are useful in the treatment of derangement of the functions of the mucous tract, especially the respiratory, but when used care must be taken that they are not given in such doses as will irritate the mucous membrane of the stomach. Some of them act as stimulants to the vascular system; but as we possess more efficacious remedies, it is unnecessary to dwell longer on this class.

DIGITALIS.

Physiological Effects.

When swallowed in small doses it causes nausea, increase in the secretion of urine, also increase in the frequency of the pulse, rendering it at the same time weak and irregular; there is also frontal headache, with dryness of the mouth, weakness of the limbs, and more or less dimness of vision.

But when given in a full dose to a healthy person, the following train of symptoms are usually induced: nausea, and very often vomiting, with diarrhœa; the pulse is slow, feeble, and irregular; there is often syncope, or a feeling of faintness; the extremities are cold; also profuse cold sweats, with a dull, heavy, throbbing headache, dimness of sight, and vertigo; there may be increase of the secretion of the urine at first, but it is soon followed by suppression, sometimes stupor, delirium, and convulsions. Taylor (p. 746) quotes a case in which a healthy robust young man filled a quart pitcher with the fresh leaves of this drug, and poured on them as much boiling water as the pitcher would hold; of this strong infusion he took a teacupful on going to bed, which caused him to sleep soundly. In the morning he took a second cupful, the infusion now being much stronger, of course, and he then went to his employment. He soon felt dizzy and heavy, and began to stagger, lost his consciousness, and at length fell down in a state of syncope. On being conveyed home, he vomited severely, and suffered extreme pain in the abdomen. When visited he was conscious, complained of great pain in his head, the pupils were dilated, and the surface was cold, pallid, and covered with a copious perspiration; the pulse was low, about 40 in the minute; three or four pulsations being succeeded by a com-

plete intermission of several seconds, and each stroke, though weak, was given with a peculiar "explosive shock." There was still great pain in the abdomen, with incessant and violent vomiting, diarrhœa, suppression of urine, and an abundant flow of saliva. Brandy and ammonia, with warmth, were applied, and after a reaction had commenced, purgatives were administered. The man slowly recovered, but the pulse presented its peculiar beat and weakness for several days, and during this time the man could not bear the upright position.

Eulenberg and Ehrenhaus applied a solution of digitaline (one fourth of a grain to an ounce of water) to a frog's heart after its separation from the body. The contractions increased in force, but every now and then a pause occurred in its beatings.

To a colt was given by subcutaneous injection, at 2.43 p.m., two grains of digitaline; pulse 48. At 2.48, restless pawing the ground. At 2.53, restless, passed fæces. At 3.25 pulse 51. At 3.45, standing very quiet, tongue and buccal membranes slightly dry; pulse 42. At 4, still standing very quiet. At 4.15, looked sleepy, erection of penis. At 5.15, passed fæces and urine. At 5.20, passed fæces again. At 5.35, still quiet, erection of penis. No other effects were observed in this case.

Specific Action.

The primary effect of digitalis when absorbed into the blood is upon the ganglia and the ganglionic system, and this view is especially supported by the experiments conducted by Eulenberg and Ehrenhaus; hence it influences the heart, the vascular system, and the mucous membranes, especially the alimentary and the renal.

Therapeutic Use.

IN RESTORATIVE DOSES.

Indicated in simple enfeeblement of the heart, especially if there is a tendency to syncope with great dyspnœa, likewise in irritable heart, with irregular pulse, in dilatation and hypertrophy of the heart; in valvular disease of heart, especially when attended with dropsy and small secretion of urine; in palpitation of the heart—in fact in all cases where we wish to strengthen the action of a weak heart, or remove irregular action of the heart, in dropsy especially when occurring after scarlet fever.

IN PHYSIOLOGICAL DOSES.

Indicated in epistaxis, hæmoptysis, in some forms of valvular disease of the heart, where we wish its sedative action, in some cases of hypertrophy of the heart, in aneurism, &c., in mitral obstructive disease, and in delirium tremens. Also in all cases where the heart's action is too powerful, and we wish a direct sedative, or where we wish to lessen the frequency of the heart-beats. In those cases where indicated in a restorative dose, a small quantity of the infusion should be given every hour till relief be obtained; but when given in physiological doses, three or four in a day will suffice. The tincture, and even the infusion, (unless made from fresh leaves) are both very uncertain in their action.

Therapeutic Uses in Animals.

IN PHYSIOLOGICAL DOSES.

Indicated in congestion of the brain or stomach, staggers, and in megrims.

IN RESTORATIVE DOSES.

In influenza, palpitation, and some febrile affections, as a diuretic in dropsy and in palpitation of the heart.

[The different effects noted by different observers when experimenting with this drug are due to a great extent to the uncertain strength of the preparations used, but, moreover, it is very probable that this drug (like tobacco) possesses the power of penetrating membranes and rendering them unfit for endosmose, and thus the membrane acted on becomes permeable, and yields to that liquid which exercises the greatest amount of pressure. Hence we find one experimenter giving a small dose, probably well diluted, and producing marked effects (as here we may expect all to be absorbed); while another experimenter, with an excessively large dose, does not succeed in producing such marked effects as we might expect (a great part being thrown off by vomiting and purgation). This discrepancy may be due to the reason mentioned above. And we would here observe that the comparative impunity with which large doses of digitalis may be given in delirium tremens, is probably to be accounted for by the changes which the alcohol, previously taken, has made in the vital condition of the blood corpuscles and membranes of the body, these alterations tending to prevent absorption.

What tends to confirm this view is the custom of treating cases of snake-bites, successfully, by giving the patient large quantities of alcohol, to prevent absorption of the poison (as well as to act as a general stimulant).

However, till we have some preparation whose strength we can depend on, or till we ascertain by experiments with the active principle, it is difficult to say what the exact physiological action of this drug is.]

ELATERIUM.

Physiological Effects.

Whether swallowed or injected subcutaneously, this drug causes vomiting and excessive purging of watery stools, with severe griping. Topically applied to the mucous membranes, and even the skin in some cases, it causes inflammation, and in some cases ulceration.

Specific Action.

Primarily on the vascular system, and hence on the mucous membranes, especially, when swallowed, on the alimentary tract, in the process of elimination. Its irritant action may be due to a great extent to its resinous nature and insolubility in water.

Therapeutic Uses.

in restorative doses.

Indicated in watery diarrhœa.

in physiological doses.

Useful in the form of a pill in dropsy, especially when dependent on renal disease; also in dropsy attendant on heart disease.

ERGOT.

Physiological Effects.

Swallowed in a full dose, this drug causes a feeling of nausea, dryness of the throat, thirst, pain in the stomach, colic, diarrhœa followed by a feeling of weight in the head, giddiness, and in some cases stupor and dilatation of the pupils, also increased frequency and fulness of the pulse, copious perspiration and flushed countenance. If taken for

some time in small doses, it gradually produces giddiness, a feeling of weariness, contraction of the muscles of the extremities, loss of sensibility and convulsions, also in some cases dry gangrene of the extremities. It also causes powerful contractions of the uterus (especially when in the pregnant state), and sometimes even produces hæmorrhage.

Specific Action.

Primarily on the ganglia and ganglionic system; hence on the unstriped muscular fibres and the vascular system, and by the changes it thus produces, inducing various secondary effects on the cerebro-spinal system (*vide* Chapter II.).

Therapeutic Uses.

IN RESTORATIVE DOSES.

Indicated in senile gangrene, in paralysis of the bladder, in irregular action of the muscular wall of the uterus, in after-pains, also to check the tendency to abortion.

IN PHYSIOLOGICAL DOSES.

In hæmorrhage, purpura hæmorrhagia, in tedious labours, to stimulate contraction of the uterus, to control post partum hæmorrhage; also in congestion of the vessels of the spinal cord, in hæmoptysis, in paraplegia, and incontinence of urine.

Therapeutic Uses in Animals.

IN PHYSIOLOGICAL DOSES.

Introduced into the stomach, or given hypodermically, useful in hæmorrhage, purpura hæmorrhagia, cellulitis; also as a parturient, given as an infusion.

GALLIC AND TANNIC ACID.

Physiological Effects.

Applied to the mucous membranes, they contract the small blood-vessels and lessen secretion (especially tannic acid). Tannic acid taken internally causes constipation, and is changed into gallic and pyrogallic acid, and as such appears in the urine.

Gallic acid does not act so energetically when topically applied, but acts on the fluids of the body when absorbed; and both, when taken in full doses, cause constipation, but no other marked effects.

Specific Action.

Tannic acid acts on account of its chemical property of coagulating albumen, gelatine and fibrine, and, as it is not probably absorbed till it is converted into gallic acid, it acts chiefly on the mucous membranes. Gallic acid only acts on the fibrine, and hence its influence is chiefly on the circulating fluid, and on the mucous membranes in the process of elimination, as evinced by its causing constipation and diminishing secretion.

Therapeutic Uses.

in physiological doses.

Tannic acid is indicated in all cases where we have profusely discharging sores, in ozæma, etorrhœa, eczema, many throat affections with relaxation, superficial ulceration and mucous discharge, aphthous sore throat, relaxed throat with hoarseness, ulcerative stomatitis, in some forms of diarrhœa, hæmorrhoids with prolapsus ani, gonorrhœa, gleet, leucorrhœa, both internally and externally applied.

Gallic acid best in hæmoptysis, hæmatemesis, and hæmatura. In physiological doses where we wish a remote astringent, as a less quantity can be given than would be required of tannic acid. It is best administered in solution, as it does not exert much topical action on the stomach.

Externally solutions of tannic acid may be used to suppress bleeding from small blood-vessels; also to repress excessive secretions from mucous surfaces, as gleet, leucorrhœa, &c.

GENTIAN.

(QUASSIA, SIMARONBA, CHIRRETA, &c.)

These substances may all be considered under one head, as they are to a great extent similar, for they all act principally on the stomach and alimentary tract, and by their topical action increase the secretion of mucus, and the vascular circulation. On the healthy body they do not produce very marked effects, except when given in very large doses, when they produce nausea and vomiting. But in derangement of the digestive organs they may be used with great benefit, especially in combination with other treatment. For instance, they improve the appetite in convalescence from acute diseases, and in dyspepsia due to want of tone of the stomach.

The aromatic bitters, such as cascarilla, orange and lemon peel, may also be considered under this head, and may be used in similar cases. They, however, contain, in addition to a bitter principle, a volatile oil, and hence are useful in the treatment of cases of acidity and flatulence. Others, again, contain in addition some tannic acid, such as chamomile, which is useful not only in dyspepsia and flatulence, but also in diarrhœa, especially that form so common in children, and usually attended with griping.

GALLS.

(CATECHU, KINO, OAKBARK, LOGWOOD.)

These all act in virtue of their containing tannic acid, and may be used in similar cases, especially in some forms of diarrhœa and dysentery when chronic. The action of logwood especially is more prolonged than the pure tannic acid. They are also useful as gargles in relaxation of the parts about the throat, and as injections in leucorrhœa and gleet; and the ointment of galls is valuable in the treatment of hæmorrhoids.

HYOSCYAMUS (HENBANE).

PHYSIOLOGICAL EFFECTS.

In a full dose, this drug acts in many respects like belladonna, causing at first dryness of the mouth and dry spasmodic cough, and decrease in the frequency of the pulse; this is soon followed by increase in the frequency and fulness of the pulse, general excitement, flushing of the face, feeling of weight in the head, giddiness, pupils dilated, dysuria and incontinence of urine, injection of the conjunctivæ, more or less loss of muscular power, and difficulty in walking; in some cases there is double vision, sleepiness, delirium and hallucinations. In cases where a large quantity of the leaves or root have been eaten, there has been in addition, insensibility, coma, and a state resembling insanity; coldness of the surface, cold perspiration, loss of power in the legs alternating with tetanic rigidity and convulsive movements of the muscles, pulse small, frequent, and irregular, respiration deep and laborious.

Dr. J. Harley, in his work on the "Old Vegetable Neuro-

tics," gives the following experiment with the sulphate of hyoscyamia on a man:—

"Gave $\frac{1}{8}$th grain, subcutaneously. After 20 minutes, pulse accelerated 26 beats, of undiminished volume and power; pupils $\frac{1}{8}''$; conjunctivæ a little injected; tongue uniformly dry; both palates dry and glazed; dull, heavy and sleepy, and very giddy; reeled much in walking. The giddiness and dryness came on 12 minutes after the injection. After 40 minutes, pulse accelerated 24 beats. After 50 minutes, pulse accelerated 12 beats; eyes suffused, eyeballs restless, face hot and flushed; looked very heavy; had slept, and great somnolence continued; mouth still moist. After one hour and a quarter, pulse fallen to 9 beats below the initial rate, regular, and of undiminished power and volume; pupils $\frac{1}{7}''$; sideways $\frac{1}{5}''$; face less flushed; mouth quite moist, but the throat was very dry, and during the last hour a dry tracheal cough was present; very giddy and sleepy still, but he was able to walk with care and a little support; frequently yawned and sighed. After $2\frac{1}{4}$ hours, pulse decreased 18 beats, regular, softer, and of good volume; pupils $\frac{1}{6}''$; sideways $\frac{1}{4}$ nearly; injection of eye and flushing of face disappeared; the somnolency was now passing off. After 3 hours, pulse decreased 21 beats, being now 53, regular, and of natural volume and power; pupils as at $2\frac{1}{4}$ hours; conjunctivæ and face natural; mouth moist; the giddiness and somnolency entirely passed off; no headache or any other after effects, except dryness of the mouth and throat. He now walked a distance of four miles. 3 ounces of succus hyoscyami, or 2 ounces of the tincture, produced effects exactly equivalent to those recorded above." (*Vide* Opus, pp. 325, 329.)

Specific Action.

In many respects the same as belladonna, but it has greater influence over the motor centres and cerebrum. It also influences the vascular system and mucous tract to some extent, through the sympathetic system.

Therapeutic Uses.

IN RESTORATIVE DOSES.

Indicated in the cerebral excitement of children, especially when there is great restlessness and sleeplessness, likewise in delirium tremens, in nervous and dry spasmodic coughs, in the delirium of fevers, in involuntary nocturnal urination, and in asthma.

IN PHYSIOLOGICAL DOSES.

May be used as a sedative in vascular excitement, in convulsions in children during dentition, in neuralgia, in nephritis, in spasmodic affections of the uterus, bladder, and urethra, and convulsive affections; in chordee, ardor urinæ, and vesical irritation.

The succus is the most certain preparation to use, and should not be given with liquor potassæ, as, according to Dr. Garrod, the fixed alkalies decompose the active principle.

IODINE, AND IODIDE OF POTASSIUM.

Physiological Effects.

Iodine in a full dose, produces coryza, frontal headache, lachrymation, injection of the conjunctivæ, dryness of the throat, irritation of the air passages, with cough and dyspnœa. The following effects have been induced by the use of iodine.

viz., Impaired digestion, emaciation, sweating, diarrhœa, and hectic fever, salivation, and wasting of the mammæ and testes.

Catarrh of nasal membrane and frontal sinuses, dry cough, hoarseness, aphonia and chronic inflammation of the throat, inflammation of the serous membrane, with effusion, eruptions on the skin of an erythematous, papular, and pustular character, tremor, twitching and convulsive movements, terminating in paralysis, derangement of sensation, deranged vision, partial deafness, and depression of spirits.

Headache, sense of fulness, giddiness, drowsiness, with epistaxis, tumultuous action of the heart, intermittent pulse, weakness, loss of appetite and vomiting. In some cases salivation and soreness of the mouth.

The physiological effects produced by iodide of potassium are analogous to those produced by iodine. In a full dose it causes nausea, vomiting, pain and heat in the stomach, and purging, sometimes diuresis, but does not act so energetically as free iodine. It sometimes causes salivation and increased secretion from the nasal and conjunctival membranes, headache and wakefulness. It is soon eliminated from the system even when given in large doses; hence the dose often requires to be repeated to produce the physiological effects.

IODINE.

Specific Action.

Both the effects produced by this agent in the healthy body, and in various diseases, indicate that its action is primarily on the blood, hence on the fluids of the body. It acts in virtue of its chemical properties, abstracting hydrogen and uniting with bases, appearing in the urine and other secretions, as hydriodic acid, iodine and iodate; also upon the glands, and the mucous and serous membranes in the process of elimination.

IODIDE OF POTASSIUM.

As this salt is very soluble, it is soon absorbed into the blood, and therefore acts less on the stomach, &c. It diffuses readily, and is soon eliminated by the urine. On account of its physical properties, it will cause endosmose of the serum of the blood, or *vice versâ*, according to the degree of concentration of the solution given. It is, however, probably soon decomposed after introduction into the stomach.

Therapeutic Uses.

The vapour of iodine is useful in coryza, catarrh, chronic bronchitis, bronchorrhœa, diphtheria, laryngitis, spasmodic asthma, and in salivation.

IN RESTORATIVE DOSES.

Indicated in scaly diseases of the skin, as lepra, psoriasis. In chronic enlargement of the liver, in the diarrhœa, vomiting, and hectic of phthisis; in chronic cutaneous eruptions, especially in scrofulous children, chronic rheumatism; in inflammation of bones, or periosteum, the consequence of syphilis; in chronic rheumatic arthritis.

IN PHYSIOLOGICAL DOSES.

In tabes mesenterica, in mammary, ovarian, and uterine tumours, and bronchocele.

IODINE OF POTASSIUM.

IN RESTORATIVE DOSES.

Indicated in articular rheumatism, dropsies, hydrocele, periosteal nodes due to syphilis, in secondary or tertiary syphilis, in lead poisoning, and coryza.

IN PHYSIOLOGICAL DOSES.

Indicated in scrofula, chronic diseases connected with induration and enlargement of various organs, also to promote the absorption of effusions.

EXTERNAL USES.

In chronic rheumatism, gout, pleurisy, synovitis, bronchocele, lupus, myalgia, indurated glands, erysipelas, and as an injection in hydrocele, white swelling, ovarian tumours (after being tapped), large abscesses, &c.

IRON AND ITS PREPARATIONS.

The action of the various salts of iron depends upon their solubility or insolubility. Thus the soluble salts combine with albumen, and act as topical astringents, whilst in the stomach, and a portion is absorbed; but in the intestines the unabsorbed portions are changed into sulphides, and act sometimes as purgatives, and are evacuated by the bowels, giving to the fæces a black colour. The insoluble preparations are eliminated to a great extent unchanged, excepting a portion which is acted on by the acids of the stomach, and is absorbed into the blood, and effects some alterations in its composition, especially increasing the proportion of the red corpuscles. Some preparations also act topically on the mucous membranes, in virtue of their power of coagulating albumen, and if their administration is continued for some time they induce plethora, throbbing pain in the head, irritation of the stomach, sometimes vesical catarrh; but as the action of the preparations of iron vary so much, it will be best to consider them in detail.

FERRUM REDACTUM (REDUCED IRON).

When taken into the stomach is mostly dissolved by the free acids there, and is to a great extent absorbed into the blood. It exerts no topical astringent action, but is useful in all those maladies attended with deficiency of the red corpuscles, &c., as anæmia, chlorosis, amenorrhœa, dysmenorrhœa, menorrhagia, scrofula, rickets, &c. This agent should be given at meal times, and in small doses, and frequently repeated, otherwise if a large dose is given, the greater portion is eliminated by the bowels before it is rendered soluble and capable of being absorbed.

FERRI-CARBONAS SACCHARATA (SACCHARATED CARBONATE OF IRON).

Acts in much the same way as the above preparation, and exerts little topical action on the membranes. It is useful in the same cases, and especially useful in neuralgia, anæmia, &c., but as ferrum redactum is less bulky, and also perfectly tasteless, it is perhaps the best preparation to give to children.

FERRI SULPHAS (SULPHATE OF IRON).

Applied to the mucous membranes, it enters into chemical combination with albumen, and contracts the small blood-vessels and lessens secretion. Taken internally, it exerts the same action on the stomach and alimentary canal, but a certain portion is converted into sulphuret, and if the dose be large, may cause purgation, and in some cases uneasiness at the epigastrium, nausea, and vomiting; but in small doses it

causes constipation. It also acts like other ferruginous salts, and is useful in physiological doses in cases where we have immoderate discharges from mucous surfaces, with a relaxed flabby condition of the parts, in passive hæmorrhage, in chronic bronchitis, leucorrhœa, chronic mucous catarrh, amenorrhœa, anæmia, and diarrhœa. Locally applied to stop hæmorrhage, to check discharge in leucorrhœa, &c. As a certain portion of the sulphate is changed into sulphide, there is no doubt that some of the effects produced are due to the new preparation, especially the effects upon the mucous membrane.

TINCTURA FERRI PERCHLORIDI (TINCTURE OF THE PERCHLORIDE OF IRON).

This preparation of iron being in a soluble form is readily absorbed into the blood, but it first exerts a powerful astringent effect (in virtue of its chemical properties) on any mucous membrane it may come in contact with, and when absorbed it is eliminated by the mucous membranes, and thus acts on them, however used. It enters into chemical composition with the tissues, and decomposes animal fluids. If given in large doses, it inflames the mucous membrane, disorders the digestion, and produces irritation of the urinary tract, with increased desire to pass water, the fæces being coloured black, owing to the conversion of portion of this preparation into sulphuret.

IN PHYSIOLOGICAL DOSES.

It is useful in hæmorrhage from the stomach, in diphtheria, both given internally and topically applied; in erysipelas, chorea, and some forms of anæmia.

IN RESTORATIVE DOSES.

In retention of urine from spasmodic stricture, gleet, leucorrhœa, passive hæmorrhage from kidneys, uterus, and bladder.

EXTERNALLY USED.

To spongy granulations, to ulcers, to stop hæmorrhage, and as an injection in gonorrhœa and gleet.

FERRUM IODIDUM (IODIDE OF IRON).

This agent possesses the combined properties of iron and iodine; in full doses it causes uneasiness at the epigastrium, nausea, headache, copious black stools, and increased urination; it is probably decomposed in the stomach, and the iron eliminated by the mucous membrane, and the iodine is found in the urine (*vide* Art. Iodine). It is useful in scrofulous and strumous affections of the glandular system, especially in cachectic subjects; also in secondary syphilis. The syrup is the best form.

FERRI PERNITRAT (PERNITRATE OF IRON).

Resembles the perchloride in its action, and is useful in chronic diarrhœa, leucorrhœa, hæmatemesis, uterine hæmorrhage; used both internally and externally.

[The organic salts of iron, such as ammonio-chloride, ammonio-citrate, and potassio-tartrate, have but little astringent action, and as they can be prescribed with alkaline preparations, are devoid of disagreeable flavour, and not liable to derange the stomach, and soluble in water, they are useful where we wish to administer iron for some time to children.]

FERRUM REDACTUM (REDUCED IRON).

Therapeutic Uses in Animals.

This is a very valuable preparation in cases of anæmia, especially in young animals, as it is sufficient to give a few grains daily in their food; large doses are useless, as they are not absorbed into the blood, but passed out with the fæces.

FERRI SULPHAS (SULPHATE OF IRON).

Useful in the following affections, viz., catarrh, strangles, nasal gleet, and excessive discharge from the mucous membranes, its value in these cases being due to a great extent to the sulphate being decomposed into sulphide, and then acting specifically on these tracts, as indicated under Article Sulphur.

Likewise useful as a tonic during convalescence from acute diseases, and in anæmia, &c.; also as an adjunct to other remedies in the treatment of farcy, glanders, and other derangements of the lymphatic system.

Externally applied, this salt is useful to stimulate indolent ulcers, to check excessive secretion, and as an injection into the frontal sinuses, in the treatment of nasal gleet, after the operation of trephining, and into fistulous wounds.

FERRI PERCHLORIDUM (PERCHLORIDE OF IRON).

This preparation, possessing great astringent properties, is very useful in hæmorrhage from the stomach and bowels, in epistaxis or bleeding from the nose. And topically applied, to arrest superficial hæmorrhage, or to stimulate the healing of wounds, and promote granulation.

IPECACUANHA.

Physiological Effects.

Inhalation of this substance in the form of powder, causes in most people sneezing, with coryza, great dyspnœa, spasmodic cough, and increase in the secretion of the bronchial tubes; in most cases there is also a feeling of weight and constriction about the chest; these symptoms are followed by copious expectoration and frontal headache, with injection of the conjunctivæ. When taken internally in a full dose it causes nausea, vomiting, pain at the pit of the stomach, and, according to the amount taken, more or less relaxation of the bowels, with the passage of slimy stools; in many cases there is spasmodic coughing, and congestion of the bronchial tubes. Emetina introduced by subcutaneous injection into a rabbit, at first produced no very marked symptom, except the animal seemed duller than usual; next day, however, it died. On making a post-mortem examination on the body, great congestion of the bronchial membrane was discovered, and at the part where the emetina was introduced signs of inflammation were visible. Ipecacuanha, when applied for some time to the skin, will in many cases produce redness, and a papular eruption. Magendie gave emetina in doses of one-half to two grains to cats and dogs, causing at first vomiting, then sleep. In doses of from six to eight grains it caused vomiting, sleep, and death took place. The same effects were produced whether given by the mouth, in a vein, into the pleura, into the anus, or into the muscular tissues. The post-mortem examination revealed inflammation of the pulmonary tissue, and of the whole of the mucous membrane of the alimentary canal.

Two grains of pure emetina are sufficient to kill a dog,

and 1-12th of a grain will produce vomiting. Large doses require to be given to produce any very marked effects on the bowels, and if vomiting does not occur the effect is more marked.

Specific Action.

Primarily on the sympathetic system, and hence its influence over the vascular system and the mucous membranes; it also acts directly, or probably indirectly, through the sympathetic on the pneumogastric nerves.

Therapeutic Uses.

in restorative doses.

Indicated in the treatment of the vomiting of pregnancy; in vomiting occurring at the menstrual period; also in the vomiting of children, especially when there is catarrh of the stomach—(here arsenic may be given also)—and diarrhœa, in dysenteric diarrhœa where the stools are slimy, in acute and subacute gastritis; and as Sidney Ringer says in his work on therapeutics, it is especially useful in pregnancy, where, besides the nausea and sickness, there is much heartburn, and perhaps great flatulence, and in these cases this drug may be used alternately with nux vomica; likewise useful in the morning vomiting of drunkards, where there is derangement of the gastric mucous membrane; to remove or lessen the vomiting of whooping cough, and to allay vomiting of partially digested food, occurring after meals. In all these cases it is a good plan to use alternately with the ipecacuanha, such agents as arsenic, nux vomica, &c. Especially useful in the treatment of various derangements of the respiratory mucous membrane, such as bronchitis, in which disease it lessens the excessive secretion of mucus,

and tends to aid in the removal of viscid sputa; also in asthma, in bronchitic asthma, and in some cases of hæmorrhage.

IN PHYSIOLOGICAL DOSES.

As an emetic to unload the stomach, &c. Also in whooping cough and cramp, but in croup the sulphate of zinc or copper is better; also has been used with success in dysentery, either in acute or chronic cases.

KREOSOTE.

Physiological Effects.

Topically applied, it irritates and destroys the tissues. When swallowed it causes nausea, vomiting, diarrhœa or dysentery, micturition and strangury, colouring the urine black, vertigo, headache, often lasting several days, and insensibility.

When injected into a vein it coagulates the blood, causing vertigo, stupor, and asphyxia.

specific Action.

Its topical action is owing to its union with albumen. It is absorbed into the blood, and acts upon the mucous membranes in the process of elimination, and like all substances acting chemically, it produces such an alteration in a part as to modify its vital relation to the system generally, hence the various secondary effects. It also acts directly on the blood, and hence on the various secretions.

Therapeutic Uses.

IN RESTORATIVE DOSES.

In some forms of chronic vomiting, diarrhœa and dysentery, gastrodynia, and flatulence.

EXTERNALLY.

To burns, scalds, ulcers, and caries of the teeth.

LEAD — SALTS OF.

Physiological Effects.

When applied to the mucous membranes, or to a portion of the surface denuded of skin, they combine with the albumen of the secretions, or of the tissue, and form insoluble compounds, at the same time contracting the small blood-vessels. When introduced into the stomach they act topically on the secretions and the mucous membrane, and if the dose be large, and an active preparation be used, such as the acetate, then inflammation of the stomach is induced, with vomiting, burning pain in the stomach, with great tenderness over the epigastric region; and these symptoms are usually followed by violent colic, constipation, scanty urine, cold sweats, cramps of the lower extremities, numbness and paralysis, great prostration, giddiness, convulsions, and coma. However, with a large dose the symptoms are generally confined to the alimentary tract, as either vomiting removes the greater part, or death ensues before absorption can take place; but where these salts have been given in small and frequently repeated doses, they usually produce colicky pains in the bowels, with constipation, the formation of a blue line at the edge of the gums, due to the deposition of the lead in the form of a sulphide; rheumatic or crampy pains, especially in the lower extremity, wasting of muscles, usually commencing in the extensors of the arms, and in severe cases, wasting of the body generally; then these symptoms may be followed by paralysis, and epileptiform convulsions.

In these cases the lead combines with albumen in the stomach, but being soluble to a certain extent in the free acid present in this viscus, is dissolved, and is then absorbed, and becomes deposited in an insoluble form in the various tissues of the body, where, by altering the constitution of a part, it impairs its function.

Specific Action.

The changes they produce when topically applied are due to their chemical properties—viz., of combining with albumen and fibrine—and when absorbed, they act on the blood and fluids of the body in the same way. Moreover, when deposited in the tissues, they alter the quality and nature of their vital action, and thus induce various secondary affections. Their action is principally on the mucous membrane, the muscular tissue, and hence on the blood-vessels, &c.

Therapeutic Uses.

in restorative doses.

In diarrhœa and dysentery, to relieve purging in tubercular disease of the intestines, in phthisis, hæmoptysis, and hæmatemesis; but in all cases it is better to use other and safer agents, as often various secondary effects are produced by the salts of lead, which are difficult to remove. The acetate is the best preparation to use for internal administration.

External Uses.

The acetate may be used in solution in case of eczema with profuse discharge, and in many similar diseases of the skin; and in the same way in excessive secretion from

mucous surfaces, such as vulvitis, gonorrhœa, gleet, leucorrhœa, &c.

LOBELIA INFLATA.

Physiological Effects.

The effects produced by this drug resemble in many respects those produced by tobacco; for, given in a full dose, it produces nausea and severe vomiting, sometimes purging, copious perspiration, tendency to syncope, feeble intermittent pulse, giddiness, headache, contraction of pupils, general feeling of faintness, prostration, and in some cases convulsions.

Specific Action.

Primarily on the sympathetic system, hence on the vascular circulation, as evinced by faintness, feeble and irregular pulse, the copious perspiration, and prostration; also to a certain extent, for the same reason, on the involuntary muscles of the body.

Therapeutic Uses.

IN PHYSIOLOGICAL DOSES.

Very often useful in asthma during the paroxysm; it removes the spasmodic condition of the muscular fibres, and relieves the dyspnœa, and may be used to relieve dyspnœa when dependent on bronchial congestion; likewise useful in whooping-cough, laryngismus, stridulus, and croup, alternated with other remedies; for used alone, it will not as a rule suffice to cure these diseases.

LIME AND ITS PREPARATIONS.

Physiological Effects.

Caustic lime (having a strong affinity for water), when applied to the mucous membranes, or a part where the cuticle has been removed, attracts water from the tissues, and more or less destroys the vitality of the part.

The carbonate and lime water are not so energetic in their action; they, however, act chemically on the animal tissues and secretions, altering to a certain extent their vital condition; and applied topically, they tend to lessen secretion from mucous surfaces, &c. When taken internally, they neutralise free acid in the stomach and alimentary canal, and also diminish the secretions of these parts; hence in large doses they cause thirst, constipation, feeling of uneasiness at the stomach, disordered digestion, sometimes vomiting; but as only a very small quantity can be absorbed, owing to their slight diffusion, power, and comparative insolubility, the action of these agents is limited to a great extent, and no other very marked effect is produced by them on the healthy body. But when given in repeated small doses, insufficient to excite topical irritation, a certain portion is absorbed, and its beneficial effects are best seen in cases of malnutrition.

Specific Action.

Primarily, in virtue of their chemical properties of decomposing albumen and fibrine, and their affinity for water, they exert their influence over the mucous tracts with which they come in contact, and change the nature of their secretions; when absorbed, they do not tend to deranged function,

as they do not act as foreign bodies, being constituents of the body, unless the quantity absorbed be very great. Their influence is probably chiefly on the lymphatic system, when absorbed. Like other alkaline substances, they neutralise free acid in the stomach and alimentary canals.

THERAPEUTIC ACID.

In Restorative Doses.

Especially useful in cases of malnutrition in children, such as scrofula, rachitis; also in the treatment of enlarged glands, tabes mesenterica, &c. In all these cases it should be given more as an article of diet, with the object of supplying a valuable constituent of the body, whose absence is to a great extent the cause of the disease in many cases.

Physiological Doses.

In chronic vomiting and diarrhœa with acidity, in flatulence and colic. Lime water is especially useful in the treatment of the diarrhœa of young children, given with boiled milk. In the same manner it may be used to treat the diarrhœa of young animals, given in boiled milk.

External Use.

To check excessive secretion, it may be used in skin diseases; it relieves, at the same time, itching; also an application to burns and scalds. The carbonate may be used as a drying powder where required.

MAGNESIA AND ITS PREPARATIONS.

The effects produced by these substances depend to a great extent, not only on their solubility, but also on the com-

pounds they form with acids in the body. The majority of the preparations, when introduced into the stomach, combine with any free acid there present, and then in their passage through the bowels they excite slight purgation; and this effect is due chiefly to the new compound. In some cases magnesia acts as a topical irritant, and excites contraction of the bowels, if large quantities are given, moreover there is a danger of it accumulating in the bowels.

Specific Action.

Chiefly upon the acids of the body in virtue of its chemical properties.

Therapeutic Uses.

They are useful as antacids in heart-burn, in flatulence, and diarrhœa of children; also where there is an excess of acid in the blood and urine, as in gout and rheumatism. The best preparation to use is the solution of the bicarbonate of magnesia, which is free from the objection of bulk and tendency to accumulate.

These remarks apply to magnesia, its carbonate and bicarbonate, with their preparations.

MERCURY AND ITS PREPARATIONS.

Physiological Effects.

Many of the preparations of mercury enter into chemical composition with the tissues, and decompose the fluids of the body; they also enter into combination with albumen. When taken internally in a full dose (the soluble salts) cause a feeling of burning and tightness in the throat, violent vomiting and purging, irritation of the urinary passages, even

suppression of urine, pulse small, frequent, respiration difficult, extremities cold, salivation, drowsiness, stupor, coma, tremors, and twitching of the muscles, sometimes paralysis. If given in a less dose we get increased secretion from the glands of the alimentary, urinary, and respiratory tract, and the skin, the mucous follicles of the mouth, and the salivary glands, conjoined with a febrile state, purging, and various eruptions of the skin, ulcerations, neuralgic pains, paralysis, and emaciation.

Amongst the various symptoms produced by this agent, we have irritation of the mucous membrane of the mouth and throat, sponginess of the gums, with tendency to bleed, inflammation, ulceration, and sloughing of the large intestines, dysentery, conjunctivitis, coryza, inflammation of the bronchial mucous membrane, scanty urine, with albumen, and little urea, irritation of the bladder and urethra, inflammation of the peritoneum and arachnoid, vesicular and pustular eruptions on the skin, deep-seated pain felt at the periosteum, tremors, loss of memory, delirium, coma, and paralysis. The insoluble salts of mercury must first be dissolved and absorbed into the blood before they produce the above effects, but in many cases a great portion passes through the intestinal canal without being absorbed, hence larger doses of the insoluble salts often are required to produce the physiological effects.

Specific Action.

All the above symptoms tend to show that mercury acts topically in virtue of its chemical properties, and when absorbed it so acts on the albumen and fibrine of the blood, as to alter the vital nature of this fluid, and in the process of elimination through the glands, alimentary and renal

tracts, it again acts topically on these parts, and from the alteration it produces in these important parts, it gives rise to various secondary complications.

General Therapeutic Uses.

in restorative doses.

Indicated in syphilitic papular eruptions, rupia, impetigo, syphilitic ulceration of the mouth, stomatitis, salivation, subacute periostitis, mumps, malignant sore throat, chronic ulcers of the throat, chronic ulcers and dysentery of the large intestines, torpid liver, diarrhœa in children with slimy and offensive stools, nephritis, albuminuria, gonorrhœa, gleet, rheumatism, chronic skin disease, inflammation of the throat in scarlatina, vomiting and diarrhœa in children. Externally to indurated and chronically inflamed parts, to syphilitic sores, &c.

It will now be necessary to consider the various preparations of mercury in detail.

HYDRARGYRUM AND CRETA.

This is a useful preparation for children where we have irregular and disordered action of the bowels, with acidity, the stools being green and watery, especially if given at an early stage. Also in syphilis infantum, infantile cholera, and in strumous affections of children.

CALOMEL,

Being insoluble, is not absorbed till it is rendered soluble, hence the effects produced will not depend so much on the dose given, as on the amount rendered soluble and absorbed. It is useful in restorative doses in some cases of portal congestion, and in skin diseases, in addition to those mentioned already.

It may also be used to unload the bowels, and by acting indirectly, to relieve portal congestion. Externally useful in syphilitic sores—sores at the anus of children, ulcers, &c., its influence here being due to its chemical properties (best used in conjunction with lime-water).

HYDRARGYIA BICHLORIDI (CORROSIVE SUBLIMATE).

Topically applied, it causes destruction of a part, and enters into combination with albumen and fibrine. Internally in a full dose, by its topical action, it causes burning pain in the mucous membrane of the mouth and stomach, nausea, vomiting, sense of constriction, pain in the stomach, extending over the abdomen, with tenderness, violent purging, with bloody stools, flushed countenance, quick small pulse, cold sweats, thirst, short and difficult respiration, with dry cough, urine suppressed, stupor, coma, convulsions, diminished sensibility of the body, paralysis, and in some cases salivation.

In smaller doses it causes warmth at the stomach, nausea and purging, frequent pulse, perspiration, and increased urination, and, if long continued, salivation. As it is readily absorbed, its primary action is on the albumen of the blood, and in the process of elimination, on the alimentary and renal mucous membrane, and also the glandular system.

Useful in restorative doses in chronic diarrhœa, with watery stools, in the diarrhœa of typhoid fever, in dysentery, acute and chronic, with slimy bloody stools, and tenesmus. Also in disordered function of the alimentary tract, characterised by flatulence, pale, clay-coloured stools, emaciation, and in scaly skin diseases, periosteal affections, syphilis, and scrofulous affections.

Externally Used.

To ulcers, chronic skin diseases, acne-syphilitic ulcers, ulcers of the throat, chronic discharges from mucous membranes, goitre, &c.

NUX VOMICA AND STRYCHNINE.

Physiological Effects.

When taken internally causes general uneasiness, restlessness, and soreness of the limbs, shooting pains down the back and limbs, twitching and quivering of the muscles, tetanic and paroxysmal contractions of the muscles, the body being rigid whilst the paroxysm lasts, and the respiratory movements arrested, face bloated and livid, eye staring and prominent, jaws clenched, pupils dilated, increased sensibility to external impressions, the mind quite clear. The fit lasts about a minute or so, and may be brought on by the slightest touch; in some cases erection of the penis. If given in smaller doses, it induces a sour taste in the mouth, tightness and feeling of distension at the stomach, constipation, with an inclination to go to stool, spasmodic colic, nausea, and sickness, dry cough, feeling of tightness at chest, loss of appetite, and a febrile state.

Specific Action.

Are soon absorbed, and produce some alteration in the nature of the vital action of the motor centres, and also the ganglionic system, hence their action on the coats of the blood-vessels, the muscular coat of the intestines, and the muscles of organic life generally. Nux vomica, like bitters in general, increases the secretion of mucus, when introduced

into the stomach, but its action upon this viscus is most evident when the digestive functions are deranged; it then acts as a restorative.

Therapeutic Uses.

in restorative doses.

Indicated in all cases of depression of the nervous system, headache and dyspepsia; especially in congestive headache, intermittent fever, spasmodic colicky pains, constipation, asthma from digestion, chorea and hysteria dependent on gastro-intestinal derangement, cardialgia, pyrosis, dry coryza, dry spasmodic cough, irritable bladder, morning sickness of pregnancy, spasmodic stricture, acute gastric catarrh, sick headache, chronic catarrh of the stomach, and depression consequent on over-stimulation.

in physiological doses.

In paralysis of the bladder, spermatorrhœa, paraplegia, and motor paralysis.

The tincture of nux vomica is best in cases where we wish to continue its use for some time in restorative doses; and strychnine where we wish to produce some of the physiological effects of the drug.

Therapeutic Uses in Animals.

in restorative doses.

Indicated in gastro-enteritis, in constipation, in retention of fæcal matter in the colon, in impaction of food in the abomasum (usually known as fardel-bound), also in impairment of the digestive functions, in relaxation of the mucous membrane of the mouth and throat, with excessive secretion, also in tetanus, alone or alternated with conia, as already stated.

IN PHYSIOLOGICAL DOSES.

Indicated in the treatment of muscular paralysis generally, also in that form of paralysis which so often follows parturition, commonly known as "dropping after calving," and in those cases where we suspect effusion into the cord; it is often of great benefit to use this agent in conjunction with atropine, likewise useful in the early stage of paralysis of the laryngeal muscles in horses, commonly known as "roaring."

In those cases where we wish to continue the use of this drug for some time, it is preferable to use the tincture of nux vomica, but if we desire the physiological action, we would administer the alkaloid strychnia, and it may be given readily in solution by the stomach, or should we desire a rapid effect, it can be given subcutaneously. We may here remark that a subcutaneous injection of strychnia more readily, more certainly, and in a shorter space of time, restores deranged function of the intestinal canal, than any of the active purgative medicines which are so commonly used in such cases; and, moreover, we avoid the risk of either causing rupture of the bowels by inducing violent peristaltic action, or of causing exhaustion of the system generally.

The following experiments were tried with strychnine and morphia, on the dog and horse; they serve to show that strychnine counteracts the action of opium, and *vice versâ*:—

(*a*) Half a grain of acetate of morphia was given by subcutaneous injection to a dog, at 4.50 p.m.; temp. 101°, pulse 70. At 6.50, dog sleeping, saliva dropping

from its mouth, no power over its hind legs, temp. 99°, pulse 70. At 7, gave $\frac{1}{2\frac{1}{3}}$ grain nitrate of strychnine; shortly after, the flow of saliva ceased. At 7.10, sleepiness passed off, dog walked about, temp. 98°. At 8, dog quite lively. Next day, 10 a.m., dog quite well, temp. $100\frac{4}{5}°$.

(*b*) Half a grain of acetate of morphia was given subcutaneously to a dog, at 5 p.m., temp. 101°, pulse 70. At 5.40, dog drowsy, flow of saliva increased, temp. 99°, pulse 68. At 6.15, dog very sleepy, saliva dropping from mouth, temp. $97\frac{3}{5}°$, pulse 60. At 6.50, gave $\frac{1}{16}$ grain strychnine, temp. 97°. At 7.5, violent rigidity of muscles, breathing rapid, heart's action very weak. At 7.10, breathing very quick, temp. 98°. At 7.20, rigidity subsiding, dog very drowsy. At 7.30, attempted to rise, but was unable, flow of saliva ceased. At 7.40, able to rise and run about, dog rather nervous, easily startled, temp. 97°. Next day, all effects passed off.

(*c*) Gave 1 grain of strychnine and 4 grains of acetate of morphia subcutaneously to a horse, at 11.30 a.m., temp. $99\frac{3}{5}°$, pulse 32. At 1.10 p.m., muscles more or less rigid, temp. $100\frac{2}{5}°$, pulse 40. At 3.40, rigidity subsided, temp. $100\frac{3}{5}°$, pulse 44. At 6.15, effects passing off, temp. $100\frac{2}{5}°$, pulse 38. Next day, 12 noon, effects passed off, temp $99\frac{4}{5}°$, pulse 34.

(*d*) Gave 8 grains of acetate of morphia and 1 grain of nitrate of strychnine to a horse subcutaneously, at 10.45 a.m., temp. 100°, pulse 40. At 11.45, no effect, except slight dilatation of the pupils, temp. 100°, pulse

40. At 2.10 p.m., no effect, except slight decrease in the frequency of the pulse, temp. 100°, pulse 36. At 4.30, no effect, pulse same as at commencement of experiment, temp. 100⅕°, pulse 40.

(*e*) Gave 1¼ grain of nitrate of strychnia, at 3.10 p.m., temp. 99⅘°, pulse 40. At. 4 p.m., rigidity of the muscles, temp. 100⅘°, pulse 44. At 4.5, gave 10 grains of acetate of morphia, by subcutaneous injection. At 4.10, rigidity subsiding. At 4.15, rigidity nearly all passed off, horse rather restless and excited. At 4.30, rigidity and excitement subsiding, temp. 101°, pulse 48. At 5.30, horse quiet, temp. 101°. At 7.30, slight increase of saliva, horse restless at intervals from effects of morphia, temp. 101⅕°, pulse 54. Next day, all effects passed off.

OPIUM AND MORPHIA.

Physiological Effects.

A full dose produces giddiness, drowsiness, and stupor; pulse small, quick, irregular at first, succeeded by perfect insensibility; the person lies motionless, eyes closed; can, however, be roused by a loud noise, and answer questions, but soon relapses; breathing slow, pupils contracted. At a later stage, coma sets in, features becomes ghastly; pulse becomes slow, small, feeble, nearly imperceptible; respiration slow and stertorous, skin bathed in perspiration, cold and pallid, countenance livid; in some cases, nausea and vomiting; all the secretions are lessened, except the skin.

The effects produced by various doses may be arranged as follows:—Excitation of the vascular system, fulness and

rapidity of pulse, exaltation of mental faculties, soon followed by drowsiness, depression, sleep, and perspiration, coma, contracted pupils, diminution of the general sensibility; and for some time after, headache, nausea, loss of appetite, thirst, and constipation.

Diminishes the secretions of the whole alimentary tract, thus causing dryness of the mouth and throat, constipation, thirst, and checks digestion, allays hunger, diminishes the excretion of bile, &c.

If coma sets in, the pulse becomes weak and slow; if convulsions, the pulse is hurried.

Lessens the contractile power of the muscles; diminishes the sensibility, and lessens the secretions of the respiratory tract; diminishes the contractile power of the urethra and bladder.

The following experiments were tried with morphia on horses:—

(*a*) At 10 a.m., gave 4 grains of morphia subcutaneously, temp. 99⅘°, pulse 36; at 12.20, temp. 101°, pulse 64; at 2.40 p.m., temp. 100⅗°, pulse 56; at 4.10, temp. 100⅖°, pulse 56; at 5.15, temp. 100⅖°, pulse 56; at 6.20, temp. 100⅖°, pulse 50; next day, 10 a.m., temp. 94⅘°, pulse 56.

(*b*) At 3.50 p.m., to a colt gave 3 grains subcutaneously, producing no effect.

(*c*) At 3.50 p.m., to a horse gave 3 grains subcutaneously, producing no effect.

(*d*) At 5.10 p.m. to a colt gave 12 grains subcutaneously,

pulse 36. At 5.30, muscular twitching and rigidity. At 5.45, great restlessness, perspiring slightly, delirious, pulse 70. At 7 p.m., still the same, mouth moist. Next day, 4 a.m., effects passing off, 11 a.m., quite recovered, pulse 36.

(*e*) At 5.10 p.m., to a horse was given 12 grains subcutaneously, pulse 44. At 5.15, erection of penis, and emission of semen, gaping. At 5.30, head drooping, horse drowsy, breathing slowly and snoring, pulse 72. At 8.10, restless at intervals, some drowsiness still, pupils slightly dilated, conjunctivæ injected, increased flow of saliva, slight perspiration, pulse 96. At 12, effects passing off, took food and water. Next day quite well.

(*f*) To a horse was given thirty-six grains subcutaneously. At 9 a.m., pulse 36. At 9.15, horse sleepy, pulse full, pupils slightly dilated, eyelids closed, eats slowly at intervals, pulse 96. At 9.25, staggered when he moved, nervous and excited. At 9.45, very drowsy, resting against the wall, moves about slowly at intervals. At 10, muscular twitching and rigidity, pupils fixed and dilated, eyelids tremulous, respiration slow, sighing at intervals. At 12, great restlessness, and delirium. At 4 p.m., effects passing off, but horse much exhausted. Next day, pulse 75, regular and soft, pupils moderately dilated, but contract when exposed to strong light, conjunctivæ and nasal mucous membrane congested, tongue moist, still slightly drowsy.

(*g*) To a horse, twelve grains of acetate of morphia

were given by the mouth. No effects produced except acceleration of pulse; pulse rising to 60. The pupils were slightly dilated, and the horse somewhat restless.

(*h*) Four drachms of powdered opium accelerated the pulse sixteen beats.

(*i*) Fours of laudanum produced no effects.

From the above experiments, it is evident that the prominent effects of this drug on the horse are on the cerebro-spinal and sympathetic system as an excitant, and but to a slight extent as a sedative.

We have already (under art. Belladonna) quoted several experiments showing that the action of opium or morphia is rather increased or prolonged by belladonna and atropine, than otherwise when given in conjunction, or given when the effects of the opium are fully developed.

Specific Action.

On the cerebro-spinal system and the sympathetic, hence its influence over the vascular system and the mucous membranes. Under the influence of this drug some change is produced in the nature and quality of the vital action of the nerve centres, to which change is due the various secondary effects.

Moreover, some of the effects of this drug are due to its power of influencing the phenomena of endosmose.

Therapeutic Uses.

IN RESTORATIVE DOSES.

Indicated in dyspepsia, especially when connected with alcoholism, in gastrodynia with heartburn, in acute stage of

fevers when much stupor present, with burning heat of skin, restlessness, and more or less suppression of urine, in paralytic retention of urine, in headaches of a congestive character, with flushing of the face and throbbing frontal pain, in delirium with tremors and prostration, in chronic constipation, lead colic, and in delirium tremens.

IN PHYSIOLOGICAL DOSES.

Indicated in all cases where we wish to induce sleep, diminish inordinate muscular contraction, or to diminish the sensibility of the body, and thus alleviate pain. Also where we wish to produce relaxation of the muscular fibres of the intestines (as in colic), or of the gall-duct to permit the passage of a calculus, or to diminish inordinate secretion as in diarrhœa and dysentery, acute or chronic.

In vascular excitement, as after hæmorrhage, in acute pain or spasm, in spasmodic stricture, and in spasmodic asthma; in typhoid fever, with much excitement and sleeplessness; to diminish the sensibility of the bronchial membrane, and thus to allay hacking cough, and counteract excessive secretion, and in the second stage of catarrh; but there are better agents for this purpose. In the passage of renal calculi, or to diminish irritation of the bladder; likewise to relieve pain, spasm, or morbid irritation of the sexual organs; in some cases to promote perspiration and relieve excessive sensibility of the skin. In the treatment of delirium tremens, heart disease, with much dyspnœa, &c.

EXTERNAL USES.

To allay pain in neuralgia, hæmorrhoids, pleurodynia, myalgia, sciatica, lumbago, inflamed joints, &c.

Therapeutic Uses in Animals.

in physiological doses.

Indicated in all cases where there is excessive and acute pain, as from external injury, or in pleuritis, pleurodynia, acute rheumatism either of the joints or the muscles, laminitis, lumbago, sciatica, peritonitis, enteritis, &c. Indicated in many spasmodic affections, both to relieve the pain, and to relax the spasm, such as colic, spasmodic action of the diaphragm, &c., and in relaxed state of the bowels, diarrhœa, &c.

The active principle morphia may be readily given by subcutaneous injection, and where it is desirable to prolong the effects, this end may be attained by giving atropine at the same time; moreover, the atropine prevents the nausea, which so commonly follows the administration of morphia. This mode of administration is especially useful in such affections as pleuritis, spasmodic colic, peritonitis and laminitis, as, being introduced at once into the general circulation, the pain is almost instantly relieved.

In all cases where we wish the physiological action of the drug, it is a good plan to administer "morphia" by subcutaneous injection, and to prevent the nausea which so often is caused by morphia when introduced in this manner, it is advisable to give a small quantity of atropia at the same time. We can by this means at once relieve the pain of sciatica, neuralgia, lumbago, and also relax spasm in colic, &c., or by giving atropia and morphia in restorative doses, in this way, we can cure such affections as pleurisy, pleurodynia, myalgia, &c. It may be introduced into the system dissolved in water, or, better still, dissolved in glycerine, and when introduced thus, it rarely, if ever, causes any local irritation. In short, in all cases where the physio-

logical action of opium in relieving pain and inducing sleep is required, this mode of introduction should be adopted, as being the best suited to attain the result aimed at, by the shortest and surest route, and at the same time the risk of deranging the functions of the stomach and bowels is avoided. It is unnecessary to note in detail the various diseases in which this drug is of benefit, as we have already alluded to the general indications for its use (*vide* Chap. III.).

POTASSÆ BICHROMAS (BICHROMATE OF POTASH).

Physiological Effects.

The following experiments were tried on a horse with this agent:

(*a*) Gave twenty grains of bichromate of potash. Temp. 101°, pulse 32. No effect was produced by this dose.

(*b*) Gave one drachm in solution by the mouth on the 29th, at 12.15 p.m., temp. $101\frac{1}{5}°$, pulse 36; at 1, temp. $100\frac{3}{5}°$, pulse 36; at 2, temp. 102°, pulse 36; at 3.15, temp. 102°, pulse 36; at 5.40, temp. 104°, pulse 60. The conjunctivæ were very much injected, the parts about the throat inflamed, much cough, and increased secretion, horse refused food, and was constantly urinating. Respiration 44. At 9 p.m., temp. 106°, pulse 66.

(*c*) 12.25 midnight. Gave one drachm and a half, temp. $101\frac{1}{5}°$, pulse 36. At 8 a.m., temp. $104\frac{1}{5}°$, pulse 40; at 12.20, temp. $104\frac{2}{5}°$, pulse 40; at 1.15, respiration 20, throat much inflamed, coughing, conjunctivæ much injected, discharge of yellow mucus from nostrils,

tongue very dry. Symptoms resembling those of influenza. Temp. $104\frac{3}{5}^{\circ}$, pulse 40.

In man a full dose causes increase of the secretions of the mucous surfaces, the discharge being sometimes of a pustular character, also inflammation of the mucous membrane of the throat, great coryza, hoarseness, cough and dyspnœa, often nausea, vomiting, and dysenteric purging, papular eruptions on the skin, which assume a pustular character, and sometimes ulceration, inflammation, and ulceration of the nasal mucous membrane, with sneezing and fœtid mucous discharge, the stools are sometimes scanty—clay-coloured, the urine is purulent or totally suppressed, and the periosteum is swollen and painful. Topically applied to the skin it acts as a caustic, often causes pustular sores, which slough, and painful ulcers are thus formed, which are very difficult to heal. In some cases it causes, by its topical action when swallowed, inflammation of the stomach, followed by vomiting, dyspnœa, paralysis, convulsions, and death.

Specific Action.

Topically applied to the tissues, it alters their constitution, and more or less destroys their vitality; and when absorbed, it is eliminated by the mucous tract and the skin, and influences these tracts in its passage through. It deranges the function of the sympathetic system, and by reflex action, influences the cerebro-spinal system, increasing the respiration, and causing coughing, &c.

Therapeutic Uses.

in restorative doses.

Indicated in syphilitic sore throat, chronic rheumatic

pains, periostitis, chronic catarrh and ulcerations of the alimentary tract, acute coryza, influenza, croup, chronic bronchitis, and in some hepatic affections, in syphilitic eruptions, &c.

EXTERNAL USES.

As a caustic to warts, syphilitic excrescences, fungous growths, nævi, ulcers, &c. In all such cases it is very useful, as its action may be limited.

Therapeutic Uses in Animals.

IN RESTORATIVE DOSES.

Indicated in the treatment of strangles, of farcy, of glanders, of chronic catarrh, of the nasal mucous membrane, of cellulitis, and derangement of the lymphatic system. In the early stage of farcy, or glanders, it may be considered a specific and certain remedy.

POTASSIUM AND ITS PREPARATIONS.

Topically applied, the caustic salts, from their strong affinity for water, power of decomposing fibrine and albumen, and their high diffusive power, are destructive to the animal tissues generally.

LIQUOR POTASSÆ.

Internally, in a large, or in repeated doses, combines with the free acid in the stomach, alters the chemical properties of the gastric secretion, and thus interferes with the digestion of albuminous substances. When absorbed, it renders the blood more alkaline, and the fibrine less plastic; it is eventually excreted with the urine, rendering it alkaline.

Injected subcutaneously, it causes great muscular weakness, appearing first in the extremities, dyspnœa, convulsions, and lessens the force and frequency of the heart's action.

THE CARBONATE AND BICARBONATE.

Act much in the same way, but are not so powerful.

THE ACETATE.

Is decomposed into a carbonate, and, as such, is eliminated with the urine. If the solution given is denser than the blood, purgation ensues, and it is carried off by the bowels; if less dense, it is eliminated with the urine.

CITRATE.

Acts in much the same way.

THERAPEUTIC USES.

The solution of potash may be used as a lotion in skin diseases, attended with itching and acrid secretions.

The caustic potash may be used as an escharotic.

The carbonate, or dilute solution of potash, in cases of inordinate acidity, in the lithic acid diathesis, in irritable condition of the urinary tract, ardor urinæ, rheumatism, gout, cystitis, and gonorrhœa.

Acetate is useful in acute rheumatism and gout; it probably promotes oxidation in the blood, and enables effete material to be removed by the kidneys.

POTASSÆ TARTRAS (TARTRATE OF POTASH).

In the blood is converted into a carbonate, and as such

eliminated with the urine; but if the solution be concentrated, it causes purgation, hence if required as a lithontriptic, the solution must be dilute.

POTASSÆ BITARTRAS (CREAM OF TARTAR).

This salt is only partially decomposed into a carbonate, and in a dilute solution is eliminated by the kidneys, and in a concentrated, by the bowels, causing watery stools by its power of increasing the flow of serum from the intestinal vessels, and retaining it there (it being rather insoluble); hence useful in dropsy, hæmorrhoids, and prolapsus ani, &c. In restorative doses, it lessens vascular excitement, and aids in the elimination of effete material, hence useful in fevers.

POTASSÆ SULPHAS (SULPHATE OF POTASH).

Acts much in the same way, and is useful as a mild laxative in congested states of the pelvic viscera, hepatic disorders, and hæmorrhoids.

MAGNESIA SULPHAS (SULPHATE OF MAGNESIA).

In a dilute solution is eliminated by the kidneys; but in a concentrated solution, by the bowels. As it is rather insoluble, and hence not readily absorbed, its action is to a great extent limited to the alimentary canal. Is useful in congestion of the portal circulation.

The remarks apply to a great extent to the parallel salts of soda, which, however, as a rule, are not so active. The phosphate of soda, however, in addition to the usual action, seems to prevent the metamorphosis of tissue. There still remain two salts of potash which, from their important

therapeutic action, must be considered more in detail—viz., chlorate and nitrate of potash.

POTASSÆ CHLORAS (CHLORATE OF POTASH).

This salt is eliminated from the system without undergoing any change; it seems to increase the flow of saliva, and hence acts topically on the buccal membrane. It is useful in restorative doses in ulceration of the mucous membrane of the mouth, aphthæ, stomatatis, salivation; in follicular and phagedænic ulcerations. May be used as a gargle.

POTASSÆ NITRAS (NITRATE OF POTASH).

In a full dose causes nausea, vomiting, furred tongue, severe pain at pit of stomach, purging, trembling of the limbs, scanty urine, giddiness, convulsions, lowering of the heart's action, tendency to syncope, insensibility, palsy, lessened frequency of pulse, and feeling of chilliness.

Specific Action.

This salt also passes off by the urine unchanged; and as it influences the phenomena of endosmose, the effects will vary according to the strength of the solution. When absorbed, it influences the blood corpuscles and the constituents of the blood, and hence the various secondary effects on the nervous system.

Therapeutic Uses.

Indicated in restorative doses in congestions, chronic rheumatism, lumbago, and to aid in the elimination of various effete materials through the kidneys.

Therapeutic Uses in Animals.

CARBONATE OF POTASH.

This salt may be used to counteract acidity, and relieve flatulence; also in cases of diarrhœa dependent on acidity.

CHLORATE OF POTASH.

This salt is sometimes used with benefit in cases of malignant fever, attended by sore throat, both given internally and used as a gargle. Also in strangles, catarrh, nasal gleet, in thrush, eczema epizootica, ulceration of the gums, and in ulcerations of the mucous membrane of the mouth generally.

NITRATE OF POTASH.

As a diuretic in some cases, and in swelling of the extremities. This agent is frequently used to lower the heart's action in various inflammatory affections; but we are inclined to believe the same result, where required, may be more safely and more efficaciously obtained by the use of aconite, belladonna, digitalis, &c.

SULPHATE OF MAGNESIA.

May be used in restorative doses to act upon the bowels in slight derangements of that tract; but the indiscriminate use of this agent as a purgative is decidedly wrong, especially when given to remove impaction of food in the stomach and intestines of animals. In these cases, the real evil to be remedied is the loss of the muscular power of the intestines, and the diminished secretion, which functions such agents as strychnine, belladonna, or aconite, soon restore without danger, while with purgatives we run the risk of rupturing the bowels and destroying the animal.

POTASSIUM (BROMIDE OF).

Physiological Effects.

In a full dose, or continued for some time, it causes dull, heavy headache, with giddiness, drowsiness, stupor and sleep; depression and impaired mental power, anæsthesia, especially of the parts about the throat, and impairment of the generative functions; sometimes causes a papular eruption which soon becomes pustular. If long continued with, it causes more or less mental depression, with headache and drowsiness.

Specific Action.

Its primary action is on the vascular system, and hence on the nerve centres; hence its value in epilepsy and brain excitement from over study, &c.; also, on account of its chemical properties, it influences the constituents of the blood, and the phenomena of endosmose.

Therapeutic Uses.

in physiological doses.

Indicated in simple whooping-cough where not much catarrhal symptoms, in laryngismus stridulus, and in most cases of a spasmodic character; also in some chronic skin diseases.

In epilepsy, in a physiological dose, this drug is most valuable, controlling the severity and lessening the number of attacks. The best plan is to give 20 grains in the morning and 30 at night, and gradually lessen the dose; it is also advisable to intermit the use of the drug for some time. It is also useful in nymphomania, and puerperal mania, espe-

cially at the menstrual period; in throbbing headache from over-work. It is useful in all cases of sleeplessness with headache, giddiness, in delirium, acute mania, congestion of the head, menorrhagia, nervous convulsive diseases dependent on uterine irritation, and spermatorrhœa.

In many cases, especially in the convulsive affections of children, whooping-cough, &c., 1 to 2 grain doses of the bromide of ammonium, given at short intervals, often prove of great benefit.

In small doses, it causes a feeling of warmth in the stomach, increases the frequency of the pulse, raises the temperature of the skin, and causes increased perspiration and urination.

PHOSPHORUS AND PHOSPHATES.

Physiological Effects.

Thirst, vomiting, pain and heat at the epigastrium, diarrhœa, tenesmus, pain in the joints, hectic fever, frequency of pulse, and temperature of skin increased, congestion of the pulmonary tissue. In chronic cases it induces fatty degeneration, especially of the liver, producing yellowness of the skin and conjunctivæ, general prostration, petechiæ and hæmorrhage, then stupor, coma, and in some cases convulsions. Kidneys also undergo fatty degeneration, hence we have scanty urine, albuminuria, and, finally, uræmic symptoms—the same change is produced in the heart; also progressive paralysis and morbid excitement of the sexual organs.

The fumes are well known to cause caries and necrosis of the jaws, irritation of the conjunctivæ and respiratory tract.

PHOSPHATES.

As the phosphates form so large and so important a part of the animal tissue, they are highly useful in various diseases, such as rickets, &c.; but, as they diffuse but slowly, only a small quantity can be absorbed at once; hence they produce but little visible physiological effects. These remarks apply chiefly to the phosphate of lime, for the phosphate of soda acts to a great extent like other saline substances, both diffusing rapidly and being soon eliminated by the kidneys or bowels. The phosphate of lime is useful, in restorative doses, in rickets, chronic wasting diseases, abscesses, scrofula, caries, chronic diarrhœa (*see* Lime).

Specific Action.

Phosphorus, by its chemical action, influences the blood and mucous membranes, and by changes it produces in the condition of a part, it affects its vital relation. (It is eliminated as phosphorus acid, phosphoric and phosphuretted hydrogen.) It especially affects the muscles and bones. The phosphate of lime acts to a great extent like the salts of lime, but is more readily absorbed.

Therapeutic Uses.

in restorative doses.

Phosphorus is indicated in the diarrhœa of phthisis, pneumonia, in malignant jaundice, fatty heart, atheroma of the arteries, mollities ossium, softening of the brain and spinal cord, nephritis—in atomic conditions of the cerebro-spinal system and muscular weakness in children, irritable weakness of the sexual organs induced by excessive venery, in-

cipient caries, purpura, functional paralysis, adynamic fevers with prostration and emaciation, hectic fever—progressive spinal paralysis, marasmus, general debility, chronic catarrh, arthritic hemicrania, broncho-pneumonia, phthisis, pulmonatis in the early stage, gastro-enteritis with emaciation, ulceration and fistulous ulcers.

PHOSPHORIC ACID.

Acts in many respects like the mineral acids already alluded to, but is not astringent, as it forms soluble compounds with albumen and fibrine, and, if continued with for some time, it causes cough and expectoration, passive congestion, especially in the extremities; pain in the bones, a febrile state with profuse perspiration, followed by diarrhœa, depression of the mental powers, and pain in the generative organs. It is useful in cases of physical and nervous debility with profuse perspiration (in restorative doses), also in phthisis to alleviate the diarrhœa, sweating and hectic, in spinal weakness, in scrofulous caries of the bones, in chronic bronchitis with night sweats and purulent expectoration, in pneumonia, in diarrhœa, in seminal emissions, spermatorrhœa, and leucorrhœa.

PODOPHYLLUM.

Physiological Effects.

In a full dose it causes vomiting, purging, griping pain, evacuations consisting of glairy mucus, tenesmus, and in some cases prolapsus ani and salivation; and when injected it produces similar effects in many respects.

Specific Action.

This agent, like many of those containing resin, acts specially on the alimentary tract and its glands, and, in a full dose, induces reflex action of the ganglionic nerves—hence the griping and tenesmus, for when injected it purges without pain.

Therapeutic Uses.

in restorative doses.

In the diarrhœa of typhoid fever, in idiopathic enteritis, dysenteric diarrhœa, prolapsus ani, in excessive excretion of bile with head-ache, &c., chronic diarrhœa with griping pain, in children with distension of belly, colicky pain, and irregular action of bowels.

in a physiological dose.

In congestion of the portal system, &c.

SILVER AND ITS PREPARATIONS.

Physiological Effects.

Topically applied, nitrate of silver enters into chemical composition with the tissues, and decomposes the animal fluids; hence, according to the strength of the solution, or the length of time it is left in contact, it acts as an astringent, vesicant, or caustic.

When taken internally, it causes pain in the stomach, nausea, vomiting, purging, and in some cases epileptiform convulsions; also deep-seated head-ache, with restless sleep and vertigo. The oxide is not so active topically, but when absorbed acts much in the same way.

Its effects on the nervous system are chiefly seen in those

cases where, having been given in small and long-continued doses, it has been absorbed.

Specific Action.

The action of nitrate of silver is chiefly due to its chemical property of coagulating albumen and fibrine; hence it acts on the skin and mucous membrane, but when taken into the stomach it is soon changed into albuminate and chloride, and as such eliminated by the bowels. It is as an albuminate or chloride that it is absorbed, and as such produces changes in the constitution of the blood; hence the various secondary nervous complications.

Therapeutic Uses.

IN RESTORATIVE DOSES.

Indicated (in the form of pill, thus lessening the energy of its local action) in paraplegia, chorea, and epilepsy.

IN PHYSIOLOGICAL DOSES.

In solution, so as to get its topical action on the stomach, it is useful in chronic vomiting connected with chronic ulcer, or cancer of the stomach; also in some forms of dyspepsia, gastrodynia, pyrosis, and where there is morbid sensibility of the stomach, in chronic gastritis; also in acute and chronic diarrhœa, acute and chronic enteritis. Where we do not wish the topical action of the membranes, the oxide is the best preparation.

EXTERNALLY.

Useful in preventing blistering from burns or scalds; in herpes labialis, eczema, erysipelas, ulceration of the buccal membrane, the early stage of inflammation of the throat; chronic sore throat, gonorrhœa and leucorrhœa, chronic oph-

thalmia, and the strong solution or solid form in spongy granulations, warts, chancres in the early stage, indolent ulcers, herpes zoster, ulcers on larynx, and in croup—in fact, in all cases where it is desirable to destroy the vitality of a part, and at the same time alter to some extent the vital relation of subjacent parts, and thus either prevent destructive changes in the part or enable nature to restore its healthy constitution by the normal process of nutrition.

SENEGA.

Physiological Effects.

When taken internally, it causes a feeling of heat at the back of the tongue and throat, increased flow of saliva, burning sensation in the stomach, nausea and vomiting, griping pain in the bowels and watery evacuations, urination with pain, skin moist. Senegin causes, in addition, sneezing and dyspnœa, and induces a congested state of the bronchi.

Specific Action.

When absorbed, it is eliminated by the mucous membranes, and, in virtue of its containing resin and a volatile oil, &c., it acts on the vascular system and on the mucous tract topically, inducing (in a full dose) increased action, but at last functional derangement. Senegin given to a rabbit caused congestion of the bronchi and pulmonary tissue, with death of the animal.

Therapeutic Uses.

Indicated, in restorative doses, in chronic bronchitis in old people, in emphysema, albuminuria, chronic catarrh, rheumatism, and dropsy.

RHUBARB.

Physiological Effects.

In a full dose it purges first, then causes constipation; in smaller doses it acts like the bitter tonics on the alimentary mucous membrane.

Specific Action.

On the alimentary tract, purging being due to its resinous constituent, and the constipation to the tannic and gallic acid.

Therapeutic Uses.

in a physiological dose.

In the early stage of diarrhœa, especially in children, when due to some irritant.

in a restorative dose.

It is useful in atonic dyspepsia and in diarrhœa, improving the appetite and restoring the tone of the stomach.

SAVINE (JUNIPERUS SABINA).

Physiological Effects.

Topically applied it produces inflammation and vesication. Internally given it causes vomiting, purging, pain in abdomen, in some cases salivation, bloody urine, strangury, and inflammation of the uterus with hæmorrhage. It sometimes causes pain in the joints.

Specific Action.

On account of its resinous nature it acts as an irritant, in a full dose, upon the mucous membranes, but it also, like turpentine, possesses a volatile oil which acts on the vascular and ganglionic systems; hence its influence on the pregnant uterus, kidneys, &c.

Therapeutic Uses.

in restorative doses.

Indicated in ovarian and uterine excitement, menorrhagia, metorrhagia, metritis, in some arthritic affections, and rheumatic gout.

in physiological doses.

In amenorrhœa chlorosis, where there is a torpid condition of the uterine circulation; also in chronic rheumatism.

Externally to remove venereal warts.

STRAMONIUM.

datura stramonium and d. tatula.

Physiological Effects.

In a toxic dose it (D.S.) causes flushed face, dilated pupil, great dryness of the throat, spasmodic dysphagia, injection of conjunctivæ, diminished sensibility, loss of control over the muscles, delirium, hallucinations (sometimes convulsive movements), followed by insensibility. In a less dose it causes dryness of the throat, thirst, nausea, giddiness, dilatation of the pupil, disturbed vision, head-ache, a delirious state, perspiration, and sometimes increased action of the kidneys.

DATURA TATULA.

℥i. with ℥x. of water was given to a horse, pulse 36, temperature 99⅜°, respiration 8. The following symptoms were observed within an hour—restlessness, urinated and passed fæces once, dry cough at intervals, pulse and respiration normal as at first; temperature at the end of the hour 100⅕. Three hours and a half after this, temperature 100⅖, pulse 38; then gave ℥i. of datura tatula in ℥vi. of water, and in 35 minutes pulse rose to 40. Next day gave same horse ℥iß. with ℥vi. of water (temperature 100⅕, pulse 36, respiration 8); in an hour pulse rose to 54, temperature 100⅖, mucous membrane of conjunctivæ, nose, and mouth injected; in six hours all effects passed off, temperature 100⅖. Next day gave to same horse ℥iii., and ℥iv. of water (pulse 36, temperature 100⅓); in half an hour there was a greenish discharge from nostrils, coughing at intervals, tongue and buccal membranes dry, pupils dilated; in an hour after, temperature was 100, pulse 34, nasal membranes dry, twitching of facial muscles and gaping, pupil less dilated and tongue moist; next morning all effects passed off.

Three days after, the same horse had ℥iv. with ℥iv. of water. The effects produced were dilation of the pupil, dry mucous membranes, coughing, twitching of facial muscles, sighing, with shallow respiration; temperature rose from 99* to 100⅕; pulse was small, soft, and compressible, and rose four beats.

Specific Action.

These two drugs influence primarily the sympathetic system, hence their influence over the secreting tracts and vascular system, and unstriped muscular fibre, as indicated

by their dilating the pupil either when topically applied or when swallowed.

Therapeutic Uses.

in restorative doses.

Indicated in acute mania and delirium tremens, in epilepsy, chorea, and nymphomania.

Inhalation of the smoke, especially of datura tatula, is especially useful in spasmodic asthma; it soon produces increased secretion from the bronchial mucous membrane, and by its action over unstriped muscular fibre relieves the spasm.

in physiological doses.

They are useful (but not to the same extent as belladonna) in enterodynia, sciatica, and tic-douloureux.

SULPHUR AND ITS PREPARATIONS.

Physiological Effects.

Sulphur, when introduced into the system, being comparatively insoluble, is eliminated therefrom to a great extent by the bowels, but a certain portion is eliminated by the kidneys and skin as sulphate, sulphuret, and sulphuretted hydrogen. In the bowels it is converted into sulphide, and often causes colicky pain, and constipation alternating with diarrhœa. When absorbed, it is eliminated by the mucous membranes, and by its topical action causes increased secretion from the bronchial membranes, often burning pain in the urethra and rectum; also various papular and vesicular eruptions on the skin, which may become pustular. It also seems to produce congestion of the pelvic viscera.

Specific Action.

By its topical action on the alimentary canal it increases the flow of mucus, and when absorbed it acts on all mucous tracts in the same way, viz., by stimulating (in a full dose) the vascular system, and hence increasing their secretions. It is probable that sulphur can only enter the blood when changed into a sulphide, or when in combination with hydrogen as sulphuretted hydrogen.

Therapeutic Uses.

Topically applied in scabies, it is useful to destroy the itch insect, and is also useful in the treatment of acne, &c.

INTERNALLY.

In small and repeated doses (so that it may be absorbed), it is useful in boils, strumous ophthalmia, chronic catarrh and bronchitis, chronic eruptions of the skin, psoriasis, impetigo, eczema, &c., in rheumatic swelling of the joints, and in scrofula.

In a larger dose in hæmorrhoids and in chronic constipation.

SULPHIDES.

Physiological Effects.

When introduced into the stomach portion is decomposed by the free acid present in this viscus, and sulphuretted hydrogen is evolved, and some of the effects produced are due to this gas.

If sulphide of potassium be given in a large dose, it produces the following symptoms—acrid taste in the mouth, burning pain in the throat and stomach, followed by vomit-

ing, purging, great depression, feeble pulse, faintness, convulsions, and sometimes a state of sopor.

Given in a less dose it causes nausea, vomiting, purging, with a feeling of warmth in the throat and stomach, dry cough, dyspnœa, &c.

Externally applied it causes a papular or vesical eruption.

Specific Action.

Primarily upon the mucous membranes and the skin, both in the process of absorption and elimination, and either the sulphides themselves, or their compounds they form in the body, alter the nature and quality of the vital action of the blood, for the sulphuretted hydrogen penetrates the membranes and the corpuscles, and renders them unfit for endosmose, inducing an anæmic condition and a depression of the nervous system, as evidenced by the nausea, head-ache, convulsions, &c.

Sulphuretted hydrogen, respired pure, produces at once insensibility, with depression of all the vital powers. And if breathed in a dilute form for some time it induces giddiness, sickness, and debility, emaciation, a low, febrile state, and delirium. And that the affect is upon the blood is evident from post-mortem examinations in fatal cases, where the blood is found to be black, and the muscles dark; also the putrefactive process soon sets in. Of course less marked effects are produced by the sulphides, owing to the comparatively small quantity absorbed from the bowels, and present in the general system at one time.

Therapeutic Uses.

IN RESTORATIVE DOSES.

In dyspepsia, due to derangement of the mucous follicles, in chronic catarrh, in follicular sore throat, in chronic bronchitis, and especially useful in promoting the suppuration of abscess, and also in correcting the tendency to their formation; likewise in the treatment of strumous enlargement of the glands, and to improve the condition of scrofulous children, suffering from indolent abscesses. May be used in many skin diseases in preference to sulphur, and are often of benefit in chronic rheumatism and gout.

EXTERNAL USES.

Either as a lotion or dissolved in a bath, they are especially useful in chronic rheumatism, gout, and stiff joints; also in many skin diseases, as chronic eczema, pityriasis, lepra, scrofulous affection of the joints, and properly used they are the most efficient cure for scabies.

Therapeutic Uses in Animals.

IN RESTORATIVE DOSES.

Indicated in the treatment of derangements of the mucous membranes, such as catarrh, bronchitis, influenza; also in suppuration of the glands, such as "strangles," farcy, and glanders, and in these cases it may be alternated with bichromate of potash; likewise in chronic rheumatism, and swollen joints, and in many skin diseases, given internally and externally applied. As already stated, this substance and sulphur should be given in comparatively small doses, when we wish their remote action, as they are only absorbed to a small extent, the greater part passing off by the bowels.

SULPHUROUS ACID AND SULPHITES.

Physiological Effects.

Inhaled, sulphurous acid produces in a concentrated form spasm of the glottis, and in a more dilute form it causes coughing, a feeling of heat and pain at the chest, with congestion of the mucous membranes; this is followed by giddiness, dyspnœa, and insensibility.

The sulphites and hyposulphites, when introduced in the system, are slowly decomposed, and in the process of elimination they induce congestion and increased secretion of the mucous tract and skin.

Specific Action.

Upon the mucous tract and the skin, and to a certain extent on the blood, in common with the sulphurosa generally. The acid is a powerful deoxidizer.

Therapeutic Uses.

Sulphurous acid may be used as recommended by Dr. Dewar, in erysipelas, wounds, sore nipples, bruises, chilblains, &c., applied in solution; and inhaled, in cold, influenza, tonsillitis, malignant sore throat, laryngitis, chronic bronchitis, asthma, croup, &c., or it may be employed in the form of spray. The fumes of burning sulphur are also recommended in the treatment of rheumatism, gout, &c. The acid we can testify is a certain remedy in all skin diseases depending on the presence of fungi, such as ringworm, favus, tinea tonsuraus, and scabies.

The sulphites or hyposulphites are useful in pyæmia, malarial fevers, vomiting connected with sarcinæ ventriculi,

chronic cutaneous affections, and gouty and rheumatic affections. Externally applied these salts relieve irritation of the skin, especially the excessive perspiration and itching of the inner part of the thighs.

Externally applied this acid is an infallible remedy for ringworm, mange, and many skin diseases occurring in animals.

TABACUM (TOBACCO).

Physiological Effects.

In a full dose this drug causes nausea, vomiting, and purging, with a sinking sensation at the pit of the stomach. This is followed by faintness, weakness, relaxation of the muscles, tremors, syncope, or a tendency to. The heart's action is slow and weak, dyspnœa, cold clammy sweats, pallor of skin; sometimes convulsions, paralysis, and in extreme cases, death. In less doses it induces a feeling of heat in the throat and stomach, nausea, giddiness, with increased secretion from the kidney and bowels. The following experiments were tried on horses with nicotina:—

(*a*) Gave by subcutaneous injection, to a horse, at 1 p.m., one minim in ten minims of water. At 1.15, he passed urine and fæces, standing quiet, staring about, passed fæces again; pulse 36. At 1.45, had erection of penis, commenced feeding. No other symptoms.

(*b*) Gave two minims in twenty minims of water, subcutaneously, at 2.20 p.m.; pulse 36. At 2.50, excessive secretion from eyes and nostrils, pulse full, respiration slow and laboured, with considerable perspi-

ration; pulse 36. At 3.40, pulse feeble, erection of penis, passed dung several times, pupils very slightly contracted; pulse 34. Effects gradually passed off.

(*c*) Gave to a colt subcutaneously, at 6.55 p.m., two minims with ten minims of water. At 7.5, very restless, shaking his head, biting his sides and chest. At 7.25, dunged, skin warm and moist, continued eating. At 8, effects passing off.

(*d*) Gave to a colt by subcutaneous injection, at 3.20 p.m., six minims of nicotina; pulse 42. At 3.30, very restless, passed fæces, trembling of hind extremities. At 3.50, mouth dry, pupils contracted, passed fæces; pulse 52. At 4.8, erection of penis. At 4.18, passed fæces again, sighing at intervals. At 4.25, passed fæces again.

(*e*) Gave to a colt by subcutaneous injection, at 3.33 p.m., twelve minims of nicotina in one drachm of water; pulse 38. At 3.36, trembling of hind limbs. At 3.47, passed fæces, pupils contracted; pulse 43. At 3.50, passed fæces. At 3.55, passed fæces, erection of penis, sighing at intervals. At 4, trembling, dull heavy appearance. At 4.5, pupils much contracted, trembling very much, passed fæces; pulse 53. At 4.10, perspiring very much about neck and fore legs. At 4.13, perspiring very freely, passed mucus per rectum. At 4.20, very uneasy, attempted to lie down, evidently spasm of bowels. At 4.30, restless, passed mucus per rectum; pulse 60. At 4.45, lying down, evidently suffering from abdominal pain; when he got up he rested

on his haunches, dunged, fæces coated with mucus, urine passed involuntarily. At 5.20, slight trembling, eating; pulse 40. At 5.45, effects passing off; pulse 36. At 8, pupils still contracted.

(*f*) Gave a horse by subcutaneous injection, at 9.52 p.m., twelve minims nicotina; pulse 52. At 9.58, very restless. At 10.10, passed fæces, walking round his box. At 10.30, passed fæces, slight secretion from conjunctival mucous membrane and nostrils, perspiring freely; pulse 60. At 11.15, lying down, biting flanks and legs, sighing at intervals. At 12.30 a.m., still lying down, was made to rise, breathing quick and catching, erection of penis, eating; pulse 66.

(*g*) To same horse gave next day thirteen minims, at 8.30 a.m.; pulse 60. At 8.35, very uneasy, passed fæces. At 8.55, passed fæces, pupils contracted, increased secretion from conjunctival and nasal mucous membrane; pulse 60. At 10 passed small quantity of fæces, much glairy mucus, no perspiration; pulse 60. At 10.45, lying down. At 11.30, passed fæces. No other effects observed. The nicotina by its local action caused suppuration at the place where injected.

Specific Action.

This drug acts upon the cerebro-spinal system, especially the motor tract, also upon the sympathetic system, hence its influence over the vascular system and mucous tract, as indicated by the increased secretions, &c. From the experiments quoted above, it is evident that this agent in full doses

tends to increase the secretions and to contract the pupils, and it is probable that, if long continued with in small doses, it will lessen the secretions, and in these respects it differs from belladonna.

Therapeutic Uses.

in physiological doses.

Tobacco has been used in constipation and in colic, but we possess more certain and safer remedies; it has also been used with success in retention of urine from spasmodic stricture, likewise in dysuria.

It is sometimes useful in spasmodic asthma, but there is such a difference in the various preparations, that it is generally an uncertain remedy; still we are inclined to believe that in restorative doses it would be of great benefit in deranged function of the sympathetic system. Further experiment is, however, necessary to ascertain its full therapeutic value. We, however, quote the above experiments to indicate its physiological action.

TURPENTINE.

Physiological Effects.

Applied to the skin it causes redness, heat, and an eruption of a vesicular character.

Given internally it causes a sensation of heat at the stomach, sometimes sickness, loss of appetite, griping pains in the bowels, and purging.

In a somewhat less dose it is absorbed, and causes increased desire to urinate, heat and pain in the urethra, pain and heat in the lumbar and hypogastric regions, albumi-

nuria, hæmaturia, and sometimes complete suppression of urine, the frequency of the pulse is increased, the muscular power depressed, exquisite sensibility of the lower extremities, acute headache and giddiness, and a state resembling intoxication. The odour of the turpentine may be detected in the breath and perspiration, and it gives to the urine a peculiar odour of violets.

Specific Action.

In a large dose it may pass through the alimentary canal unabsorbed, but when absorbed it acts upon the sympathetic system, hence upon the mucous tracts and skin, especially the bronchial and renal. It is probable that it undergoes some change in the system before it can be eliminated by the renal mucous membrane. It also influences the vascular circulation like the oleo resins and camphor.

Therapeutic Uses.

in restorative doses.

Indicated in simple renal congestion, with or without suppression of urine, in purpura hæmorrhagica, in acute nephritis, in Bright's disease, in cystitis, in gonorrhœa and gleet, in acute catarrh of the bladder, in tympanites, and colic.

External Use.

In chronic rheumatism, sprains, sciatica; also in some cases of burns and scalds.

VERATRUM, ALBUM AND VIRIDE.

Physiological Effects.

In a full dose they cause vomiting, copious watery purging, and spasmodic colic, tenesmus, and sometimes bloody evacuations, burning sensation in the intestines, small, slow, and almost imperceptible pulse, dull, heavy, frontal headache, faintness, cold sweats, general coldness, giddiness, disordered vision, dilated pupil, spasmodic jerking of the muscles, convulsions, prostration, and insensibility.

Locally they cause sensation of pricking, followed by coldness. Applied to the nose, they cause violent sneezing.

Specific Action.

These agents are soon absorbed into the blood, and are eliminated therefrom by the mucous surfaces and the skin, and act topically on them in their passage out, inducing, in a full dose, hyperæmia and increased secretion; they also act upon the vascular system and the heart by influencing the sympathetic system, hence the various secondary effects produced by a full dose, viz., the headache, faintness, giddiness, prostration, &c.

The active principle, veratria, is not so liable to cause purging, &c.

Therapeutic Uses.

in restorative doses.

Indicated in choleraic diarrhœa, diarrhœa from dentition, typhoid fever, watery diarrhœa, chronic bronchitis, spasmodic asthma, vomiting, and diarrhœa, with colicky pains. Veratrum viride is especially useful in toxœmic fevers, also

in infantile remittent fever, relieving the head symptoms, and vascular derangement, also in acute rheumatism, neuralgia, sciatica, and lumbago, gout, pneumonia, congestive headache, pyrosis, puerperal fever, acute nephritis and cystitis; also in palpitation of the heart. May be used locally in neuralgia, &c.

In fact, it is indicated in all febrile states to control vascular excitement, and in derangements of the mucous tracts from the same cause.

ZINC AND ITS PREPARATIONS.

Physiological Effects.

Topically applied, some, as the chloride, sulphate, and acetate, enter into chemical composition with tissues and decompose the animal fluids, and therefore act as caustics, the carbonate and oxide, having less affinity for water, merely act as astringents. Taken internally, the more active preparations, by their topical action on the stomach, cause pain and vomiting, also diarrhœa; this is followed by prostration, coldness of the extremities, fluttering pulse, fainting, and convulsions, but if given in less doses and the effects gradually induced, or if the milder preparations are used, we get dimness of sight, weakness of the limbs, trembling, and jactitation, neuralgic pains, rigors, sweating, and nausea, loaded tongue, constipation, emaciation, coldness and œdema of the extremities, weak, slow, thready pulse, and epileptiform convulsions.

Specific Action.

Primarily on account of their chemical property of combining with albumen and fibrine, and their affinity for water,

they act topically on the parts they come in contact with, and producing changes in their constitution, alter their vital relation, and when absorbed into the blood, they affect the constituents of this fluid to a great extent in the same way, and hence produce the various secondary effects already detailed.

Therapeutic Uses.

IN RESTORATIVE DOSES.

Indicated (especially the milder preparations, which may be absorbed without producing topical effects) in progressive paralysis of the insane, in epilepsy, chorea, neuralgia, and some forms of hysteria. The oxide is useful in gastrodynia and diarrhœa.

IN PHYSIOLOGICAL DOSES.

The sulphate is useful to induce vomiting in cases of poisoning, and in croup. Where we desire speedy vomiting and as little constitutional depression as possible.

EXTERNALLY.

The oxide and carbonate are useful in chronic skin diseases, with profuse discharge, as eczema, impetigo, and in excoriations. The sulphate in solution may be employed in chronic ophthalmia, indolent ulcers, and ulceration of the mucous membrane. The chloride in the same way in gleet, gonorrhœa, leucorrhœa, &c.

CASES.

CASES.

We consider it will not be out of place here to quote from our notes a few cases, to illustrate what we mean by specific treatment.

Specific Treatment in Man.

(*a*) This patient, when first seen, was suffering from acute griping pain in the abdomen, great looseness in the bowels, being obliged to go to stool nearly every hour, and passing little but mucus. He had no appetite, was feverish, and much depressed. He stated he had been more or less relaxed in his bowels for the last few days.

Treatment.—Belladonna was given in restorative doses every hour, till the pain was relieved; and then liquor arsenicalis was given every hour, in restorative doses; at the same time he was directed to limit himself to milk diet. Next day he was free from pain, and so well that he wished to go to business, but, the weather being wet, he was recommended to remain at home till the following day. He was then quite recovered.

(*b*) This patient, for the last two days, had been passing slimy, bloody stools every second or third hour;

there was a great deal of tenesmus, and much prostration.

Treatment.—Liquor hydrargyri bichloridi was given in restorative doses every hour, and at intervals a small quantity of boiled milk. Next day the patient was much better, and on the third day quite recovered.

(*c*) This patient was a child suffering from purging and vomiting, the stools being slimy and offensive.

Treatment.—Ipecacuanha was given in restorative doses till the vomiting was relieved, when liquor arsenicalis was given every two hours; at the same time the milk given to the child was directed to be boiled first. Under this treatment the child recovered.

(*d*) The following case was inflammation of the bronchial mucous membrane, occurring in a child a few months old. The following treatment was adopted: restorative doses of tartar emetic, and ipecacuanha, given alternately every second hour, the child being warmly clothed and kept in a room, the temperature being maintained constantly above 60°; and at one period, when the cough assumed a spasmodic character, preventing the child getting any sleep, and making her very restless, bromide of ammonium was given with marked benefit. Under the above treatment, the case recovered.

(*e*) The following was a case of the same nature, in an adult, and was attended with much febrile disturbance: the treatment adopted was restorative doses of

tincture of aconite, and tartar emetic, every second hour alternately.

(*f*) In the following case the patient was elderly, and in addition to the inflammation of the bronchial mucous membrane, there was a tendency to asthma, the treatment adopted was, at first, aconite and tartar emetic, but afterwards ipecacuanha was given with marked benefit.

(*g*) In the following case the patient had been ill for some time, complained of want of appetite, dull, heavy pain after taking food, tongue was furred, bowels were irregular in their action. She stated she was in the habit of taking a large quantity of hot tea, gruel, &c. The patient derived great benefit under the following treatment, viz., restorative doses of nux vomica and liquor arsenicalis.

(*h*) In the following case the patient had been subject to irregular action of the bowels, which he had endeavoured to remedy, unsuccessfully, by the use of various nostrums. Under the following treatment the deranged function was restored, viz., restorative doses of tincture of nux vomica and sulphur.

(*i*) This patient was a child suffering from looseness of the bowels, passing very slimy stools, great emaciation and weakness, conjunctivæ very pale, and child very dull and listless. Lime water and boiled milk was given, till the looseness was removed; then ferrum re-

dactum, in grain doses, was given twice a day, with marked benefit.

(*j*) In the following case the patient had been spitting up bright florid blood, especially after any violent exertion, but not in any very large quantity. In this case perfect rest was enjoined, and physiological doses of gallic acid.

(*k*) This patient, a young child, was suffering from ulceration of the buccal mucous membrane and tongue, with great restlessness, fever, and difficulty in sucking. A solution of chlorate of potash in syrup was applied topically, and a small quantity given internally. Under this treatment the ulcers healed, and the child's health improved.

(*l*) This patient was suffering from acute pain in the supra-mammary region, which came on suddenly, and was increased by deep inspiration; the pain was so acute that the patient could not endure the weight of the bedclothes, but was much relieved by firm and gradual pressure. Flannels dipped in hot water were kept constantly applied, and aconite was given every half hour in restorative doses. Next day the patient was well.

(*m*) This patient was feverish, complained of an acute cutting pain in the left side, which was increased by deep inspiration, coughing, or pressure; the temperature was 103°, the pulse hard and quick, flushed cheeks

and great restlessness. On examination, at first, a friction sound was perceptible. Solution of morphia was subcutaneously injected. Aconite was given every half hour in restorative doses, and warm flannels applied round the chest. Under this treatment, the temperature fell to the normal, the pain subsided, and the patient recovered.

(*n*) This patient was suffering from acute pain in the left inguinal region, bowels had been constipated for some time, and there was dulness on percussion, and evidently retained fæcal matter. Extract of belladonna was applied topically, and tincture of belladonna given internally, alternated with restorative doses of tincture of nux vomica. Under this treatment, the functions of the bowels were restored, the pain subsided, and the patient recovered.

(*o*) This was a case of ringworm, which was cured in a few days by the topical application of one part of sulphurous acid and three parts of glycerine.

(*p*) This patient had for some length of time been subject to fits of spasmodic asthma, complicated with various dyspeptic symptoms; the dyspnœa at times was very severe, but the patient complained most of the violent fits of coughing occurring at night when in bed; careful attention was paid to dietetic treatment, and infusion of calumba with tincture of nux vomica was given before each meal; but the greatest benefit was derived from a ten-grain dose of bromide of potassium at bed-time, which was repeated during the night

when required; by this means the spasmodic coughing fit was averted, and a comfortable night's rest obtained.

(*q*) This patient, a child, was suffering from intense headache, hot dry skin, pulse hard and quick, tongue dry, bowels costive, restless and sleepless, and at times delirious, always worse towards evening, chilliness and rigors preceding the exacerbation. In this case tincture of aconite in restorative doses was given every hour alternately with liquor arsenicalis, and tincture of hyoscyamus at night, given as required. After the first day or two the child slept well, and the febrile symptoms abated, the functions of the bowels were restored, and with proper dietetic treatment the child recovered.

(*r*) In this case the patient when first seen was suffering from acute abdominal pain, increased by pressure, pulse quick, tongue white and dry, bowels had been confined for the last three days; restorative doses of tincture of belladonna and nux vomica were given alternately every half hour, and hot flannels applied to the abdomen. On the second day the bowels acted, the pain had subsided, and on the third day the patient was well.

(*s*) This patient, who was naturally of a delicate constitution, had had a very tedious confinement, attended with much post-partum hæmorrhage when first seen; she was very weak, face and conjunctivæ very anæmic, pulse slow and soft, complained of pain in the left side, tongue dry, and skin hot. Ferrum redactum in two-grain doses was given three times

a day, and warm flannels applied to side. A few doses of aconite were given, and strict attention paid to diet. Under treatment she gradually recovered.

(*t*) This patient had been vomiting blood at intervals, especially after the ingestion of food, and was very weak and anæmic. Perfect rest was enjoined, and dilute sulphuric acid and quinine were given in physiological doses, with ice and water. Afterwards tincture of perchloride of iron in restorative doses was given for some time.

(*u*) This patient stated that he had for many years been subject to severe attacks of sciatica, and when first seen he was in great pain; so $\frac{1}{6}$th grain of morphia and $\frac{1}{60}$th grain atropine were injected at once; within ten minutes the pain had subsided. The same quantity was given at bed-time, and as there was a history of rheumatism, iodide of potassium was given, and he was directed to take a hot air bath once a week, especially if any premonitory signs of an attack: he has however, been well since.

Specific Treatment in Animals.

(*a*) A horse with the following symptoms:—"Pulse 40, temperature 100°, discharge from eyes and nostrils, attended with sneezing," was treated with restorative doses of sulphide of potassium and belladonna, and in a few days was restored to health.

(*b*) A horse with the following symptoms:—"Pulse full and quick, temperature 104°, skin cold, tongue dry,

saliva acid, loss of appetite, conjunctivæ injected, respiration hurried and laboured, and excessive discharge of yellow mucus from nostrils," was treated with aconite and belladonna in restorative doses (with for the first day carbonate of potash), and a few doses of atropine hypodermically injected; under this treatment the temperature was soon reduced to 101°, and at the same time a hot water compress was applied to chest and sides. There being some slight derangement of the alimentary mucous membrane, a few restorative doses of liquor arsenicalis were given, and in a few days the animal was well.

(*c*) A mare with the following symptoms:—"Temperature 106°, pulse 48, hot skin, furred tongue, bowels confined, fæces coated with mucus," was treated with restorative doses of nitrate of strychnia, aconite, and belladonna, and in a few days the deranged function of the bowels was restored, and the temperature was again normal.

(*d*) The following case was that of a horse that had been driven some considerable distance during a heavy shower of rain; on being put into the stable he refused food, and they gave him a full dose of aloes and calomel, as it was concluded the liver was out of order. The horse not improving under this treatment, I was sent for fourteen days after, and found the animal with the following symptoms:—Skin harsh, dry, and very sensitive, hair falling off in patches, pulse small and quick, conjunctivæ injected and tongue clammy, with an offensive smell; great falling off in condition, with loss of

appetite, and bowels very irregular. The following treatment was adopted, viz., restorative doses of liquor arsenicalis and belladonna within twenty-four hours, skin less sensitive, and under this treatment he quite recovered. For some time the skin had been so sensitive that the horse would not allow himself to be touched, and the irritation was so great that he was continually wandering round the box, rubbing himself day and night.

(*e*) A mare with the following symptoms:—"Quick, full pulse, temperature 104°, conjunctivæ injected, tongue extremely dry, bowels constipated, no fæces having passed for forty-eight hours, extreme pain, as indicated by the animal rolling itself about on the ground, perspiring freely," was cured by the following treatment. Hot fomentations to abdomen, restorative doses of nitrate of strychnine and belladonna every four hours by the mouth, and a few doses subcutaneously injected. In a few hours pain had entirely subsided, and in forty-eight hours the animal was quite well, the bowels having acted freely, and thus relieved the distended colon.

(*f*) A horse with the following symptoms:—"Hard, quick pulse, temperature 105°, tongue dry and furred, breathing quick and oppressed, legs wide apart, respiration performed almost entirely by the abdominal muscles, the animal evidently in great pain," was thus treated. Cold water compress with camphor and belladonna applied to chest, and restorative doses of morphia and atropine subcutaneously injected; by this means the

pain was soon relieved, and after a few doses of aconite and belladonna, the animal recovered.

(*g*) This horse had been exposed to cold and wet, and when first seen was rolling about, evidently suffering great pain in the abdomen; a physiological dose of atropine and morphia was at once injected subcutaneously, which immediately relieved the colic.

(*h*) This animal when first seen was suffering from great pain, with spasmodic action of the diaphragm, and evidently in great distress, breathing very quick; a physiological dose of atropine and morphia, injected subcutaneously at once, and repeated twice at an interval of seven hours; within twenty-four hours he was quite well.

(*i*) This animal was suffering from farcy; the nasal mucous membrane was ulcerated, the near hind limb much swollen, and the lymphatic vessels both of this limb and of other parts of the body were much inflamed and ulcerated. He was treated with restorative doses of bichromate of potash and sulphide of potassium, given alternately. In a few days, the ulceration of nasal mucous membrane was healed, and the condition of the lymphatic system much improved. In a few weeks, the animal was quite well and in good condition. This is but one of many successful cases so treated.

(*j*) This horse was suffering from pleuritis, with great twitching of the muscles, especially of one side; pulse 56, tongue dry, breath fœtid, and no appetite. Cold

water compress was applied, and opium and belladonna given by mouth. Next day he was somewhat better, but tongue still very dry, and respiration laboured. Injected subcutaneously 2 grains of acetate of morphia in the morning, and when seen in the afternoon the mouth was moist, the twitching of the muscles had ceased, and the animal was feeding. Next day he was quite well.

(*k*) This horse had been suffering for some time from ophthalmia, and when first seen solution of atropine was applied to the eye in the form of spray; under this treatment and a subcutaneous injection of $\frac{1}{12}$ of a grain of atropine, he was much improved within a week.

(*l*) This horse was suffering from rheumatism in the off-shoulder, with twitching of the muscles and lameness. Injected subcutaneously 2 grains of acetate of morphia. Next day he was much improved; repeated the dose. The third day he was nearly sound, and no twitching; and by the fourth he was quite sound.

(*m*) This horse was suffering from tetanus, supposed to be due to an injury to knees, received some time back. On the 9th, at 11.55 a.m., injected subcutaneously ♏x. of conia, with $\frac{1}{2}$ a drachm of spirit of wine; soon after this, he seemed to have more power over the muscles of his jaws. At 5.35 p.m., animal restless, had passed fæces three times since 11.55 a.m.; injected ♏xv. conia. At 11 p.m., feeding, eyelids drooping, more control over the muscles of jaws and neck; injected

another ɱxv. On the 10th, 9.35 a.m., animal much improved; injected ɱxx. conia, repeated the dose at 1.15 p.m., and at 5.42 injected ɱxl.; at 6.15, pulse 36, soft. On the 11th, has considerable control over his muscles, the tetanic rigidity nearly gone, and the animal feeding well. For the next three weeks, restorative doses of strychnine were given three times a day, when he was discharged quite recovered. N.B.—The injection of the conia caused local suppuration, which, however, soon healed up; it would perhaps be better to give the conia in glycerine.

(*n*) This animal, a mare, had partial paralysis of all the limbs, and had the greatest difficulty in standing; when made to run, she invariably fell down. No cause could be ascertained; but it was stated that she had been quite well till within the last few days. She was treated with restorative doses of strychnine and belladonna three times a day, and within three weeks she was much improved, and shortly after was discharged recovered. She has remained well since.

(*o*) In this horse the muscles of the right side of the face were paralysed, and there was also loss of sensation in the right side of the lips; there was a history of an injury to that side of the face. At the same time, the animal was suffering from mucous derangement from exposure to cold and wet in an open field. The treatment adopted was restorative doses of belladonna and strychnine, and arsenic for a short time; also belladonna liniment was applied externally. The animal entirely recovered, and has remained well.

(*p*) In this horse, the hair in various parts of the body was falling off in circular patches, each circle consisting of small, cup-shaped, dry, yellow crusts (tinea favosa); there was severe itching, the animal being very restless and continually rubbing itself. The parts were first well washed with soft soap, then a mixture, one part of sulphurous acid and two parts of glycerine, was applied every day. After a few applications, the parasite was completely destroyed, and the skin restored to a healthy state.

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