A handbook of therapeutics / by Sydney Ringer.

Contributors

Ringer, Sydney, 1835-1910.

Publication/Creation

London : H.K. Lewis, 1874.

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Edwin Lankester Esq
November 1875

With F. H. Norman's Kind regards

A HANDBOOK

OF

THERAPEUTICS.

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LONDON:

PRINTED BY H. K. LEWIS, 136 GOWER STREET, W.C.

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PREFACE TO FOURTH EDITION.

In this, the fourth edition, I have endeavoured to incorporate the important discoveries and new information of the year which has passed since the publication of the previous edition. Thus I have added chapters on Phosphorus, Croton-Chloral, Hamamelis, and have considerably augmented many other chapters. Beyond this I have merely to say that I have kept as closely as possible to the original plan of my book, and that I have again to acknowledge my indebtedness to my friend, Dr. George Bird.

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PREFACE TO SECOND EDITION.

In preparing a new edition of his Handbook,—specially intended for students and young practitioners,—the Author has endeavoured to make his Work as practical as possible.

Therefore he has been content to state the symptom or group of symptoms which may suggest a medicine, and to indicate the way of administering it, and, as a rule he has omitted the various speculative explanations concerning the mode in which medicines effect a cure.

The present edition has been carefully revised, and much additional matter has been incorporated with it. The Author has again followed Buchheim's arrangement in describing the action of medicines; and in tracing the behaviour of any drug, its effect on the body is noted in the following order;—the skin, the mouth, the stomach, the intestines, the blood, the remaining organs, and finally the elimination of the medicine from the system. While, however, the Author has followed Buchheim's convenient arrangement, it is but right to say that in other respects this Work differs essentially from that of Buchheim.

The Author is anxious to express the great obligation he is under to his friend Dr. George Bird, who has assisted in revising this edition of the Handbook, and has increased its usefulness by many valuable suggestions.

THERAPEUTICS.

OXYGEN.

Oxygen is, as yet, but rarely employed in Medicine. It has been recommended in the non-febrile forms of phthisis, and is said to be of especial service in derangement of the stomach of phthisical patients. It is harmful in inflammatory fever and febrile phthisis, increasing, it is said, the fever and favouring hæmoptysis.

According to Beddoes and Demarquay, it is useful in asthma; but if co-existing with heart-disease they disadvise its employment.

In anæmia, from loss of blood or suppuration, some consider that oxygen increases appetite and digestion, and improves the strength.

Demarquay asserts the remedial power of oxygen over some forms of diabetes; and states that he has reduced the sugar in the urine by one half, the diet remaining unchanged.

This gas is useful as a local application to atonic painful sores, but produces no effect on healthy sores. In senile gangrene administered as a gaseous bath, for an hour or longer at a time, and repeated six or eight times a day, it is said to be of the greatest use. The results are these:—the livid red changes to a rose colour, warmth returns to the tissues, sensation is restored, pain mitigated, and the disease is checked and sometimes even cured.

ON THE INTERNAL USE OF WATER.

Toothache may often be greatly lessened and even removed by rinsing out the mouth for some minutes with water as hot

as can be borne; but sometimes cold succeeds better than hot water.

Although perhaps not strictly relevant to our present subject, a few remarks may be made here conveniently on the drinks best suited to fever patients. To them thirst is most importunate and distressing, often causing much restlessness and irritability, these in their turn often increasing the fever. The urgent thirst must therefore be allayed; but if left to themselves to satiate their craving, patients will always drink to excess, which is very liable to derange the stomach, impair digestion, produce flatulence, and even diarrhœa. Theory and experience both show that drinks made slightly bitter and somewhat acid slake thirst most effectually. A weak infusion of cascarilla or orange-peel, acidulated slightly with hydrochloric acid, was with Graves of Dublin a favourite thirst-quelling drink for fever patients. Raspberry vinegar is a useful drink. Sucking ice is very grateful. Sweet fruits, although at first agreeable and refreshing, must be taken with care and moderation for they often give rise to a disagreeable taste, and are apt to produce flatulence or diarrhœa. There is no advantage in "curtailing beyond a moderate degree the amount of water drunk by diabetic patients. The urine and sugar may by this means be lessened, but the general distress is increased" (Roberts). Prout recommends tepid drinks in the thirst of diabetes.

Water is necessary both for the digestion and solution of food, but an insufficient as well as too large a quantity are alike harmful. It is well known that the character of the fermentations is dependent on the amount of water which is present. For instance, with sugar, if there is but little water present, no fermentation will take place; while on the other hand, with excess of water, acetous instead of vinous fermentation is set up. It is more than probable that the quantity of water taken with the food may, in a similar way, affect the changes which it undergoes in the stomach. This much is certain, that by drinking habitually with the meals an excess of water, dyspepsia is often aggravated, and on the

other hand this affection appears in some cases to be connected with an insufficient quantity of fluid. Flatulent dyspepsia is often traceable to excess of drinking at meal-times.

It is easy to understand that too much water taken with the food impairs digestion, simply by diluting the gastric juice, and so weakening its solvent power. The popular idea proves to be correct, that drink should be taken chiefly at the end of the meal, when it serves many useful purposes. It then aids the passage of the peptones from the intestines to the blood, and so favours the continuance of digestion, it being considered that these peptones hinder that process until they pass from the intestines. Moreover, indigestible substances only partially dissolved, are thus carried through the pylorus into the intestines, and there subjected to further digestion or are eliminated with the motions, thus removing a source of irritation from the stomach. The prevailing, perverse modern practice of tea-drinking a short time before dinner cannot be too strongly condemned; several hours ought to elapse between the early tea and the dinner.

But in our desire to avoid the ingestion of too much drink, we must be careful not to err on the side of too great abstinence, for it has been shown that a due amount of water favours the secretion of the gastric juice, and promotes the passage of the peptones into the blood. Iced drinks at mealtime are often harmful by constringing the vessels, and preventing the secretion of the due amount of gastric juice.

Chomel described, and Dr. Thorowgood recently narrated, some cases of this kind: a form of dyspepsia called by him "indigestion of fluids," characterized by uneasiness after drinking, and a splashing noise heard on percussing the stomach or shaking the body even when the patient has taken no drink for some hours. This complaint is best treated by drinking as little as is compatible with comfort and only some time after a meal.

Warm water, or various infusions, as chamomile tea and mucilaginous drinks, are employed to promote vomiting after the administration of an emetic. The quantity of fluid taken

for this purpose should not be too large, otherwise the stomach becomes distended, its muscular walls paralysed, and vomiting is impeded instead of promoted. From half a pint to a pint is sufficient.

The action of water in the intestines is similar to that in the stomach, and its presence is necessary for the absorption of the digested substances in this part of the canal.

A glass of cold water taken early in the morning is to some persons a purgative. The cankery taste, hot sensation in the mouth and lack of appetite for breakfast experienced by many persons on waking, may generally be removed by drinking half a tumbler of pure cold water half an hour before breakfast. Diarrhœa is often increased or maintained by a too free indulgence in fluids.

After free water-drinking, the water, but not the solids, of the fæces is increased. Water, tepid or cold, is employed for evacuant injections into the rectum.

Water passes readily into the blood, but with some limitation. When from any cause the system has undergone great loss of this fluid, water is absorbed with much avidity, and by its rapid passage into the circulation may materially affect the blood, to such an extent indeed that it is said sometimes to destroy cattle by the rapid destruction of the blood corpuscles by osmosis. But when the amount of water in the blood is already large, the absorption of a further quantity from the stomach and intestines is much diminished.

Excess of water is eliminated in various ways. Some, as we have said, passes off by the intestines; some is thrown off by the skin and lungs; but most is excreted by the kidneys. The chief part is eliminated in six hours, but after strong exercise much is retained in the muscles for a time considerably longer.

Copious drinking exerts a further action on the urine than that just mentioned; for not only is the urinary water increased, but other constituents, as urea, phosphoric and sulphuric acids, and chloride of sodium. The augmentation of these constituents, with the exception of the chloride of sodium,

is permanent, but with respect to this salt it is only temporary, for after a while its amount falls below the quantity excreted in health, and thus the previous increase is balanced; and water must therefore, in respect of common salt, be considered merely a temporary eliminator. The case is different, however, with urea, phosphoric and sulphuric acid; for during water-drinking the increase of these is permanent, giving rise not only to their increased elimination, but to their increased formation, which can happen only from augmented disintegration of substances containing nitrogen and sulphur. If water-drinking exerted only a disintegrating influence, it would lead merely to loss of weight; but simultaneously with this rapid disintegration a corresponding increase of assimilation takes place in the same tissues; whence it happens that water taken under certain precautions may increase both construction and destruction of tissue; and so act as a true tonic, improving the vigour of body and mind. These considerations afford an explanation of the benefit often derived from the "water treatment" in hydropathic institutions.

The effects of water-drinking vary in different people. The disintegration spoken of is greatest in weakly persons, on whom it may produce almost a febrile state. Disintegration is greater in children than adults, and greater perhaps in women than in men. A high temperature of the water, or of the external air, increases its influence. Bodily exercise produces the same effect. (Parkes *on Urine.*)

COLD.

Cold, according to the way it is employed, is a refrigerator, a tonic, an excitant, a depressant, or an anæsthetic. In the present place it is proposed only to speak in general terms of the effect of cold on the body, reserving for a subsequent place the remarks in detail, on ice, cold water, and the various cooling appliances by means of which heat is abstracted from the body.

By the application of cold, heat is withdrawn from the body, and both the surface and deep parts are cooled. The general cold bath may be made to produce a very considerable reduction of the heat of the surface, reaching 10° Fah. in the trunk, and considerably lower in the extremities. It might be supposed that the general cold bath is capable of reducing the heat of the body's surface for a considerable time, but this is not the case; for the heat is very speedily restored to the skin of the trunk, although for some hours longer the extremities may remain cold. In a few minutes the temperature in the axilla almost recovers itself, although the bath may have been continued at a temperature of 60° half an hour or longer.

Of course, it is not here maintained that heat is not abstracted from the body; but, as will be shown at another place, the loss is so rapidly restored, that in health the cold bath is unable to depress the skin's temperature for any length of time.

Cold sponging, so often employed in fevers with such evident relief exerts a very slight and transient influence on the heat of the body, as may be ascertained by aid of the thermometer; hence the sense of comfort derived from the sponging cannot be ascribed wholly, or even in part, to its refrigerating influence.

This relief may be due to the removal of impurities which perhaps irritate the skin, or annoy by their odour, and by mitigating the parched condition of the surface; for it is well known that a skin both hot and dry is a source of much greater discomfort than if it is moist even though hotter. Sponging the surface with tepid water, by restoring moisture to the parched skin, gives marked comfort to the patient.

The foregoing remarks apply only to the surface of the body; but the general cold bath will likewise effect a reduction in the temperature of the internal organs. This reduction, never very great, is restored even more quickly to the deep than to the superficial parts, so that as might be inferred, the general cold bath is still less efficient as a refrigerator of the

internal than the superficial organs. The general cold bath therefore, in fever-free people, must rank very low as a refrigerator.

It is however otherwise with the body whose temperature is unnaturally raised by fever. It is now ascertained that the immersion of fever-stricken patients in the cold bath, or packing them with the cold sheet, will effect a considerable and durable reduction of the temperature. Whether this is effected by abstraction of heat, or by preventing its unnatural formation, it is impossible at present to decide.

Cold, as is well known, is a powerful tonic when judiciously employed. A cold climate and cold bathing are tonic and bracing. The explanation of its tonic action is probably found in the following considerations. During exposure to cold the body's loss of heat, as tested by the thermometer, is by no means a measure of the quantity withdrawn. It has been shown by many observers, that at such times increased combustion occurs, whereby much of the lost heat is compensated, and the temperature maintained or soon restored. This increased oxidation of the tissues is demonstrated by the greatly increased quantity of carbonic acid thrown off by the lungs on exposure to cold. Now the most vigorous health is best maintained by a rapid construction and destruction of tissues within certain bounds, provided these two processes are fairly balanced. By exposure to cold, more oxygen is absorbed by the lungs, and more oxidation of the tissues takes place, thus greatly promoting the processes of destruction and reparation. How is this effected?

In nutrition, apart from the nerves, we have three factors, the nutritive plasma, the tissues, and oxygen. When food is taken, digested, and introduced into the blood, both formation and destruction of the nitrogenous tissues begin, formation being limited by destruction. When the destruction of tissue ceases, the further assimilation of the nutritive materials of the blood comes likewise to an end. These destructive changes take place in proportion to the amount of oxygen absorbed, and when this gas is exhausted, many products of

destruction remain only partially oxidised, further disintegration of the tissues ceases, and assimilation is suspended (Parkes).

Under exposure to cold, oxygen being abundantly absorbed, the effete products in the blood are first consumed, and that important fluid is purified, and more fitted for the nourishment of the body; next, by its consuming action on the tissues, oxygen promotes the cycle of changes just described, food is taken and assimilated, and thus destruction and construction of the tissues proceed rapidly, creating great physical vigour. Thus it is that cold climates are invigorating.

When applied locally, cold may act as a local tonic (see Douche); but if too long continued, or if the cold is excessive, it depresses the part; for, by contracting the vessels, it lessens the supply of blood to the tissues, and thereby diminishes in them cell-growth and tissue-change. If the intense cold is applied for some minutes, sensation is abolished, and cold thus applied becomes an anæsthetic. If the cold is too long continued, the part dies and becomes gangrenous.

Applied suddenly and locally, cold may act as an excitant, as is shown by the following examples:—

The cold hand applied to the abdomen excites contractions in the parturient womb. A little cold water smartly sprinkled over the face of a swooning person is a popular way of exciting breathing, and restoring consciousness. The same treatment is efficaciously employed to establish breathing in weak or apparently still-born children, or in persons over-dosed with chloroform, or in the narcotism from opium or tipple.

After these general remarks on the effects of cold, we shall speak next in some detail of the employment of cold water, by means of the common and sea bath, shower bath, the douche, and cold affusion.

COLD BATH.

Cold water may be employed on account either of its moisture, its temperature, or both. If we require merely moisture, and temperature is of no consequence, tepid or warm water is both preferable and more agreeable. Cold water is generally employed to abstract heat either from the whole surface of the body, or from some particular part of it, or to produce general or local excitement and shock.

As the skin absorbs neither the water of the bath, whether it be warm or cold, nor any substances, soluble or insoluble,* which may be added to the water, it follows that whatever bodily effect baths may produce, must be explained by their direct action on the skin.

In our remarks on the general cold bath we shall speak mainly of cold sea-bathing, this being a far more powerful medicinal agent than the general simple cold bath, although the action of both is identical, the difference in their effects being one merely of degree. As we proceed we shall point out in what respects they differ, and how these differences affect the body.

On entering a cold sea bath a sensation of depression is at first experienced, great or little, according to the coldness of the water. The skin becomes pale and shrivelled, and presents the familiar appearance called "goose-skin," a condition produced by the contraction of the skin, and the consequent protrusion of the hair roots and follicles. There is general shivering, with some blueness of the lips, nose, and prominent parts of the body. The temperature of the skin is considerably reduced; the pulse is quickened; the breathing becomes

* Dr. Stillé asserts that some absorption of substances dissolved in the bath occurs in the cold but not in the hot baths, and Dr. Amory confirms this statement concerning bromides, for in a cold bath he says a "small amount may be absorbed" but none in a hot one of 96° to 106° Fah. The quantity absorbed, however, is far too small to invalidate the foregoing statement concerning the action of baths.

convulsive and sobbing as the water rises to the chest, especially if the bath is entered slowly. The system soon becoming roused to meet and resist the depressing effects of cold, in a few seconds a sensation of general exhilaration ensues. The skin becomes ruddy, and glows. The breathing becomes full and easy; the pulse rather quick and strong; the spirits are exalted, and the bather feels increased vigour, both of mind and body. If now he quits the bath, or before the period of exhilaration ceases, this buoyant condition endures more or less for the rest of the day, and the bath thus acts as a tonic to the system.

On the other hand, if the bath is prolonged, depression again supervenes. The bather feels cold, shivers, becomes blue and numb in the more exposed and smaller parts, whence, on account of their size, warmth is more readily withdrawn, and a sensation of depression and wretchedness seizes him. Baths prolonged to this injudicious extent often produce disagreeable results, which may continue for hours, and even days, inflicting serious damage to the health, the greater if the patient is weak or growing. For many hours after the bath he complains of general languor, with a repugnance to exercise, whether of body or mind. His temper is fretful and morose. His circulation is feeble and languid. He suffers from sinking at the epigastrium, with loss of appetite, chilliness of the surface, with cold extremities. It need scarcely be said that consequences like these are to be most carefully avoided; yet, unless minute directions are given these evils will be risked, so great is the prevailing ignorance and error on the subject of bathing.

If the exposure to cold, as in the cold bath, is continued beyond this point, or if the cold is severe, great depression and a sensation of utter misery set in, followed shortly by heaviness and drowsiness, which deepen into coma, till a kind of apoplectic state is reached, and asphyxia from paralysis of the muscles of respiration ensues, and consequently death.

It would thus appear that baths, on the one hand, are very powerful tonics, while, on the other, if unwisely used, they

cause great depression of the bodily powers, and produce serious mischief. The superiority of sea baths has been placed beyond mere surmise; for it has been established by direct experiment, that a sea bath acts far more powerfully on tissue metamorphosis than the simple water bath; that while the process both of destruction and construction of tissue is increased, construction is augmented in excess of destruction, so that an actual increase in weight takes place as well as an increased vigour of the functions of the body. But since sea air acts in the same way, it is difficult to determine to what extent improved health results from sea climate or sea baths.

The cold bath is almost universally employed for its tonic virtues. To obtain this wished-for result, the bath should be discontinued at the time it causes general exhilaration, for the system then appears to be roused into action to resist the depressing influence of cold, and this general healthful stimulation, if the bath is now discontinued, remains. For, whilst taking the bath, and probably for some time afterwards, oxidation of the tissues is increased. The blood is purified of effete products, and the processes, construction and destruction of tissue, on which vigour of both mind and body depends, are intensified.

Bathing therefore increases appetite, improves digestion and the assimilation of food.

The bath, then, in the strictest and fullest sense of the word, is a tonic.

Used in accordance with the rules to be immediately laid down, the good effects of the bath become soon apparent in the improved condition of the patient. He gains in weight; his complexion becomes ruddy and clearer; his muscles, especially if exercise is conjoined, gain in firmness and strength; any mental debility arising from deficient nutrition of the nervous system speedily improves, and he is soon restored to mental and bodily vigour.

The important question arises, How can we best obtain these invigorating effects from baths?

Our object clearly is to secure the greatest possible amount of stimulation, and to ensure the persistence as long as possible of the increased vigour of nutrition. To obtain the greatest degree of stimulation we must duly apportion the temperature and duration of the bath to the strength of the patient; to ensure the continuance of nutritive vigour as long as possible, the patient should leave the bath at the time of general exhilaration and stimulation, and before the next stage, that of depression, begins.

The patient, if very weak, manifests but little functional energy to resist the depression from the cold. If this is intense, there may be no stage of stimulation, but, depressed from the first, the patient may remain so for a long time. Weakly persons are thus often seriously injured, and even their lives endangered, by cold bathing.

The depressing effects of a cold bath are proportioned to its coldness and duration. The colder the water, the greater depression it occasions, greater, too, when the water is in motion than when at rest. Moreover, the longer the period of immersion the greater is the depression the bath produces.

Thus, in giving directions concerning sea-bathing, we must have regard to the strength of the patient, the temperature of the water, and the duration of the bath.

If the patient is weak and much prostrated by previous illness, the bath must not be too cold, nor continued too long, and the water should be at rest.

Here it will be convenient and profitable to consider in what respect sea differs from simple water baths, and to explain the superiority of sea baths as a tonic.

1st. In sea water we have various ingredients dissolved.

2nd. The variations in its temperature in the varying seasons of the year are much less than those of river water; and, lastly, while the sea is always more or less in motion, river water is comparatively at rest. The salts in solution are supposed to act as invigorating stimulants to the skin, so that patients who cannot bathe in simple water without suffering great depression, are enabled to bathe in sea water with

great benefit. Moreover, as the temperature of the sea never falls very low in winter, sea-bathing may often be continued late into the autumn, or even into the early winter months.

The motion of the waves increases the depressing effects of the bath; but if the bather is strong enough, it also increases the ensuing reaction; and thus while more bracing to the strong, it is at the same time highly exhilarating.

These guiding principles borne in mind, we shall at all times be able to give correct answers to the various questions patients may put to us concerning bathing. One most frequently asked by a patient about starting for a watering-place is, How long shall the bath be continued?

Our answer must be regulated by the strength of the patient and the coldness of the water. If the water is cold, or the patient very weak, out-door sea-bathing must at first be forbidden, and a tepid bath substituted, the temperature of which should be slowly reduced until that of the sea is reached. Then, if the day is fine and the sea calm, the bath may be taken in the open air. Though it may be considered safe for the patient to bathe in the sea, yet if he is very weak and unaccustomed to bathing, the stay in the water must be very brief. For a weakly person it will often suffice to allow two or three waves to pass completely over him, and then he should at once quit the water, and wipe himself thoroughly dry, using plenty of friction to the skin. As strength increases, and he becomes accustomed to the effects of the water, the bath may be continued for a longer time, but it is seldom advisable for a convalescent to bathe longer than from five to ten minutes. Some patients, nay, even some healthy persons, can bear a sea-bath every other day only.

Then as to the time of day best suited for bathing. On this subject the greatest ignorance prevails. It is currently believed to be best to bathe before breakfast. Yet this practice is not without risk even for the robust, who are often made by it very ailing and fatigued for the rest of the day.

As we have before said, our object in using the bath is to obtain stimulation, as energetic and as prolonged as possible.

We must therefore choose that time of day when the body is most refreshed, invigorated, and nourished. These conditions, it might be thought, exist during the early morning hours after a sound and refreshing sleep. It must be recollected, however, that before breakfast the body has undergone a prolonged fast of several hours, and is in want of food, without which the bodily functions may be very readily depressed. Theory and practice thus speak against this period for bathing, and both point to a time between breakfast and dinner as most appropriate.

This leads us to the consideration of another question; namely, how long a time, after a meal, should be allowed to elapse before a bath may be taken; and, after a bath, what time should pass before food should be taken. Now cold bathing produces a great shock to the skin and system generally. Any powerful mental or bodily impression is sufficient to arrest, or to check for a time, many of the functions, even if they are in active operation. This is the case with digestion. Any great excitement, as is well known, can stay this process more or less completely, and the cold bath is generally sufficient to arrest it entirely; therefore an adequate time should be allowed to elapse before the bath is taken, to permit the almost complete digestion of the breakfast, that is, an interval of about three hours. Nor, for the reason just explained, should the bath be employed immediately before a meal; for, if this rule is broken, little or no gastric juice is secreted, and food lies half-digested in the stomach.

And for a reason somewhat similar, the bather should not be under the influence of any great emotional excitement, for in such a state the nervous force of the system (on which there appears to be set a limit) is directed strongly in one channel, and no nervous stimulation follows on the application of the bath. Bathers thus excited often feel languid, cold, shivering, and much depressed. Obviously for the same reason children must be coaxed, not dragged against their will, into the water. In early life there is often much terror of bathing.

If, in spite of this, the child, while screaming with fright, is forcibly dragged into the sea, very ill effects may follow ; for, no stimulation occurring, the child may remain often for days depressed and ill.

Is there any age rendering sea-bathing dangerous, and to be prohibited ?

It is generally accepted that young children,—say under two years of age—being very impressionable, ought not to undergo the shock of a cold sea bath. At the other extreme of life, when the powers of the body are enfeebled and incapable of very active reaction sea-bathing is inadmissible, for it is well known that the heat-forming power in old people, is very much reduced. Moreover, undue vascular excitement may prove dangerous ; the vessels in the old, being often brittle from degeneration, if any unusual strain is brought to bear on them, are in danger of giving way, and causing apoplexy.

From the foregoing remarks it will have been gathered that fatigue is a condition strongly adverse to cold bathing. It is seldom advisable for weakly persons to take a bath on the day following their arrival at the sea-side, even if other conditions are favourable. It is advisable to wait till all fatigue is recovered from.

Does pregnancy forbid sea-bathing ?

If a woman has had several miscarriages, has aborted, or if of an excitable temperament, or if pregnancy is far advanced, then baths may be expected to do harm, and perhaps produce abortion. But under other circumstances, and with due regard to the conditions just laid down, both mother and child will be benefited by bathing. Nor, if she has been accustomed to the practice, need a woman discontinue bathing at the menstrual period, although it is always inadvisable to begin at such a period, as the shock may check or arrest the secretion, and thus induce, perhaps, many months of amenorrhœa.

In the choice of coast, and the time of year, we must have regard to the vigour or debility of the patient. If not very

weak, the health being only a little injured, then a rugged coast, where the sea is rough and boisterous, should be recommended as both profitable and agreeable to the bather. However, should the health be much broken, then a smooth sea is preferable, and, in a cold climate, the summer months are the only suitable time.

Exercise taken while bathing soon induces fatigue and even exhaustion; wherefore, weakly patients must be cautioned in this respect. Another evil should be guarded against: on leaving the bath, invigorated by it, a patient is in danger of taking too much and too active exercise, thus unduly fatiguing himself, and so undoing the bath's good effects. The amount of exertion permitted must be strictly in accordance with the patient's condition, who, if weak, should take only horse or carriage exercise.

During a course of sea-bathing, the hair sometimes falls off, which naturally excites much anxiety, especially in women; but their fears may be quieted by the assurance of its growth in greater luxuriance than ever. Other troubles may arise. For instance, constipation, more or less obstinate, sometimes follows bathing: but this need not lead to the discontinuance of the bath. The constipation should be removed by exercise, a regulated diet, and, these failing, by purgatives. Greater troubles, dyspepsia and diarrhœa, sometimes occur during sea-bathing. The bather's habits, as the hour of the bath, the time spent therein, and other particulars must be investigated, and any indiscretion checked; yet, notwithstanding every care, in every particular, dyspepsia or diarrhœa, or both, may happen; in which case the bathing must be temporarily or permanently discontinued. Even the sea air is sufficient to produce these troubles in some constitutions.

Restlessness at night is another untoward symptom sometimes attributable to sea-bathing. Many individuals, no doubt, find that living too near the sea's edge often produces broken, sometimes sleepless nights. On the shores of the Mediterranean, especially along the Riviera, this is notably

the case. On removal inland, a mile or thereabouts, this restlessness vanishes. Broken rest may often be traced to dietetic irregularities, or to the late hours of retiring to rest. A late and heavy meal will sometimes cause restlessness, which ceases to recur on the substitution of an early, light, and easily digestible one. Some patients mar their rest by taking stimulants shortly before bed-time, while, on the other hand, others cannot sleep without taking some "nightcap" stimulant.

Bathers should plunge into the water at once, and not stand hesitating till they become cold and shivering, a state which should be carefully avoided. If needful, a short brisk walk should be taken just before the bath, to warm the surface and extremities.

Simple and Sea-water Cold Baths.—The effect of cold is to lessen in proportion to its degree the perspiration. A cold bath checks cutaneous secretion at first, but soon afterwards this secretion is considerably augmented, and more so after sea than after simple water-bathing. Driven from the skin, the blood flows to the internal organs, and congests them. The kidneys partaking of this congested state, explains probably the frequent occurrence of a small quantity of albumen detectible in the urine during the bath; after the bath, the albumen speedily disappears.

The effects of cold baths on tissue change have already been pointed out, and those statements will receive confirmation in the following remarks, relating to the influence of sea baths on the constituents of the urine. Baths augment the quantity of urea and sulphuric acid of the urine. It has been doubted whether this increase exceeds the limits of the natural healthy variations, and whether the experiments are sufficiently numerous to prove the point in question. It is not to be expected that the increase of tissue change would at once be greatly augmented, nor that it would be increased at any time beyond the maximum amount of health; consequently the increase of urea in its turn would not exceed the maximum quantity of health. But surely if the amount of urea is

for some time maintained at its maximum, this alone would prove the influence of baths, so far as they could be expected to operate, and would show that sea-bathing increases disintegration of the nitrogenous tissues.

The power of sea baths to promote tissue change, and increase the separation of urea by the kidneys, may be demonstrated in another way.

The increased consumption of food induced by the use of cold baths must either be stored up in the body or be separated as urea by the kidneys. Now although the weight of the individual taking baths undoubtedly increases, still this augmentation is not commensurate with the increase of nitrogenous matters ingested; there must be then under these circumstances an additional separation of urea by the kidneys; but if the prevalent idea is correct, that all nitrogenous matters must first be transformed into tissue before they can be disintegrated and reduced to urea, it follows that tissue change is likewise promoted by sea-bathing.

Beneke's observations lead to the same conclusion. When food was taken just sufficient to maintain the weight of the body at a fixed point, he found that baths immediately reduced the weight of the body, a loss certainly due to heightened disintegration of the tissues. But this increased consumption being accompanied by increased appetite, and by increased assimilation, more food was taken and the body gained in weight. Baths, it is said, increase the quantity of uric acid, although this is lessened by sea air; but on this point observations are as yet insufficient.

The urinary water is temporarily and often greatly increased, but the whole day's urine is lessened in quantity, probably from the subsequent excessive elimination by the skin. In Beneke's observation the intestinal secretions were also large, and some water may have escaped in this way.

It is scarcely necessary to occupy much space in a description of the cases in which sea-bathing may be usefully employed. In chronic illnesses, with debility, sea-baths will yield the best results; but it is useful especially to convales-

cents from acute diseases, to those whose health has been broken by over-work, by residence in towns with a too sedentary employment, or injured by excesses of various kinds. It is a question of much importance whether phthisical persons should take sea baths, and our answer must be qualified by the circumstances of the case. When the disease is chronic, the temperature being little or not at all elevated (little or no fever), when indeed the case is one of fibroid degeneration of the lungs, without active deposition of tubercle or scrofulous pneumonia, sea baths may be permitted, due regard being paid to the rules laid down.

SHOWER BATHS.

The forcible impact of water upon the body, and the impression it makes on the nerves, or, to use the general expression, the shock it produces, is sometimes very great, being often sufficient to produce considerable depression and languor lasting many hours, sometimes days, even when the bather is strong and healthy.

It is a remedy not much used, patients, indeed, generally manifesting great repugnance to the shower bath. The sponge bath, or the local douche, may in general effectually supply its place.

In the sponge bath we have presented all the conditions of the common bath. Like it, the sponge bath is cleansing, bracing, invigorating; and their action on the body is identical.

The sponge-bath is often employed not merely for its tonic effects, but on account of the shock it causes to the nervous system.

Laryngismus stridulus is more successfully treated by cold sponging than by any other means. The practice of confining little children to the house in a warm close room, sousing them in warm baths several times a day, is a most injurious plan, and inevitably aggravates the severity and

frequency of the crowing breathing.* No matter how severe the attack, the practice of cold sponging twice or thrice daily, according to the severity of the case, will scarcely ever fail at once to influence the disease. So prompt is its action, that children in whom the attacks occur perhaps hourly during the day, and even oftener at night, are frequently instantaneously freed from them. At all events, a decided improvement always occurs, the intervals being much prolonged; and it rarely happens that the complaint resists this treatment more than two or three days. The mother should be directed to keep the child out of doors for the greater part of the day, no matter how cold the weather; indeed, the colder the better. Children attacked by laryngismus are seldom more than a year old, and at this tender age it might be feared that they would run great danger of catching cold from the foregoing treatment; but no such fears need be entertained. With proper precautions the youngest children may be sponged with perfect safety several times a day. Nor do they catch cold even in the coldest weather when carried out of doors; but children prone to bronchitis had better be kept indoors when the weather is very severe, and should undergo only the cold-water sponging. After a very extensive experience of this treatment the author has rarely witnessed the simultaneous occurrence of a cold in children suffering from laryngismus; and even then the catarrhal symptoms were insignificant. When promptly used, this treatment frequently saves the child's life, preventing not only the crowing breathing but the partial convulsions in the form of carpo-pedal contractions and squinting and general convulsions, the dangerous symptom in this disease. Laryngismus, when fatal, generally destroys the child by exciting an attack of general convulsions. At certain times of the year, among the poorer

* This disease is sometimes accompanied, and is apparently induced by laryngitis, indicated by hoarse voice. In such cases cold sponging must be cautiously used as it often, though by no means invariably, increases the laryngitis and therefore the laryngismus.

classes, laryngismus is one of the most common causes of convulsions, which not uncommonly prove fatal.

Dashing cold water over the child is the surest and speediest way of arresting a paroxysm of crowing breathing. At the onset of a paroxysm cold water should be dashed on the child's face; and if this does not at once arrest the attack, the water should be applied to the whole body. Fortunately laryngismus prevails in the early spring, and at a time, therefore, when the cold weather affords a ready source of cure. Since laryngismus is usually cured at once by this treatment, and rarely lasts more than a few days, it is obvious that it does not act as a mere tonic, although in this respect it is very useful, because laryngismus generally attacks weak, sickly, and rickety children.

Any irritation aggravates laryngismus, and impedes its cure. Hence, if the relief from cold sponging is less marked than might be expected, some source of irritation should be sought for and removed. The gums, if swollen, red, and hot, must be freely lanced and the openings maintained, for if the cuts close up, the irritation recurs; thus it is necessary to lance the gums several times, at a few days' interval. Worms must be removed, and the faulty state of mucous membrane favouring their production treated. At the cutting of each tooth, some laryngismus is apt to recur, in spite of cold sponging, which, however, will always prevent the relapse becoming severe. When the tension of the gums is removed, and the tooth set free, the fit ceases. Irregularities of the bowels, as diarrhœa, constipation, flatulence, &c., tend to increase the frequency of crowing, and to render the case less amenable to the cold sponging.

In the treatment of chorea, cold sponging, several times a day, holds also deservedly a very high place. Whether its efficacy is due solely to its tonic properties, or whether the shock plays any part in promoting the cure, it is at present impossible to decide. Of the value of this treatment there is no question, yet circumspection must be exercised, or the patient may be made worse by it. It must be avoided if there

is any rheumatism, which is generally made worse by cold sponging, thus inducing an increase of the choreac movements. If there is no fever, and no pain in any of the joints, then cold sponging may be reasonably expected to yield most satisfactory results. In the treatment of rickets, cold sponging, by virtue of its tonic properties, holds a very high place. Here again care must be observed, or we may do the child much harm. Such patients, we must remember, are not only often very weak, but are very impressionable on accouut of their tender years, and for these reasons it is important to adapt the application of the cold sponging to the patient's condition.

The method adopted by the author is the following:—If old enough to stand, he directs the child to be placed up to the ankles in warm water before a good fire; then the patient is to be sponged all over, except the head and face, for a time varying from two to five minutes; after which the skin is to be carefully wiped dry and well rubbed with a soft towel. If weakly, the child may be replaced for a short time in the warm bed, with the object of encouraging reaction. The sponging should be administered as soon as the child leaves its bed; but if very weak or unaccustomed to the sponging, it is advisable to give a light and early breakfast about an hour beforehand. There is another excellent method of administering cold sponging to weak persons or to timid children, and therefore a plan to be adopted when this agent is used in the treatment of chorea. The water should at first be tepid, then its temperature should be gradually reduced by drawing off the warm water and substituting cold, so avoiding the shock, but obtaining the tonic virtue of the bath. This method succeeds admirably with children, who are often much frightened by the bathing, and sometimes scream so violently as to lead the friends to fear an attack of convulsions.

In the case of adults in impaired health the use of cold sponging is very invigorating. It is useful in anæmia, leucorrhœa, amenorrhœa, spermatorrhœa, and in that low nervous state induced by working in hot, close, ill-ventilated rooms, or during the night, etc., etc.

If the weather is cold, the water should at first be made a little warm, afterwards lowering the temperature daily. The depressing effects on the weak may generally be prevented by taking a little light food about an hour before the bath, and by returning to bed for half an hour after its completion, to restore warmth to the skin and extremities.

Before closing this subject, it may be useful to advert to a condition, not uncommon, in infants, which may be improved or even removed by cold sponging, night and morning. An infant suffers from impaired health frequently waking up at night from "a catch in the breath." For some unexplained reason, it cannot for a time get its breath, and wakes up with a loud snore. This is a condition altogether different from laryngismus stridulus, for the fault appears to lie in the soft palate, not in the larynx; moreover it is not due to enlarged tonsils, as this "catch in the breath" occurs in children of tender age, long before this morbid condition of the tonsils takes place.

Affusion and the Douche.—Cold water thus applied impinges on the body with considerable force, and the resulting nervous impression is correspondingly great. The water is directed against the body in a full stream, and sometimes it is applied to every part of the surface in succession. The depression it produces is too great to admit of the frequent employment of the douche. It is generally modified, and the cold affusion is used in its place, cold water in pailfuls being dashed over the surface of the body. This application is recommended for persons struck down and rendered unconscious by sunstroke. Many years ago cold affusion was employed in the treatment of the acute specific fevers, and was especially recommended in scarlet fever. This mode of treatment comes to us sanctioned by the authority of many of the ablest physicians of the past generation. Yet in the present day the reaction against all energetic treatment is so great that this means is now very rarely adopted. Fears are expressed lest serious consequences should ensue; but if the affusion is employed at the right period of the disease, no apprehensions

need be entertained. The experiences of Currie and Jackson abundantly testify to this. The time for its use is during the first few days of the fever, when the skin is hot and the rash bright red.

Currie and Jackson recommended that the patient should be stripped, and that four or five gallons of very cold water should be dashed over him; and when the heat of the surface returns, this process may be repeated again and again. Under this treatment the fever diminishes, and is sometimes, it is stated, even extinguished.

The douche and affusion are generally employed for their local effects. To arouse persons from the stupor of drunkenness, or that of opium poisoning, they are of the greatest service, being unequalled by any other treatment when a certain stage of the poisoning has been reached. An overdose of these agents induces stupor more or less profound, when the movements of respiration, at first languidly performed, soon stop, and death by asphyxia results.

At this most critical stage, cold affusion, or the cold douche, applied freely to the head, is generally sufficient to remove the conditions within the skull on which the stupor depends, and to restore the consciousness, when the breathing simultaneously becomes again natural, and for a time at least, the fear of a speedily fatal termination is set at rest. The water should be poured on the head from a good height, so as to obtain as great a shock as possible. The pulse and general state of the patient being watched, the vigour of the application must be regulated by the information obtained from these sources. The breathing becomes deeper and more frequent, the lividity and bloated aspect of the face soon disappears, while the pulse grows in strength. It may, and does, indeed, often happen that relapses occur, when the affusion must be again and again employed, so as to sustain life long enough to admit of the elimination of the poison. If promptly and efficiently applied, life may be saved even in the most unpromising cases. It is all important to ply the water abundantly for some time, and from a good height. Some time

may elapse before any good effects become visible, but if the pulse and breathing improve, or become no worse than before the douche was tried, its application should be continued, and perseverance will often be rewarded by success.

Many cases of furious maniacal delirium may be quieted by the cold douche. It must be borne in mind that the douche is a powerful remedy, which makes it necessary to watch carefully its effects on the strength of the patient. To obviate excessive depression, it is an excellent method to place the patient in a warm bath, and apply cold to the head in the manner just described.

The severe pain in the head, met with in the acute specific fevers, or that resulting from gastric disturbance, is relieved very gratefully and effectually in the way recommended by Dr. Hughes Bennett: "A washhand-basin should be placed under the ear, and the head allowed to fall over the vessel, by bending the neck over the edge; then a stream of cold water should be poured from an ewer gently over the forehead, and so directed that it may be collected in the basin. It should be continued as long as agreeable, and be repeated frequently. The hair, if long, should be allowed to fall into the cold water, and to draw it up by capillary attraction." The ice-bag may be conveniently substituted for this application. He agrees with Graves, that in some cases very hot water acts more successfully than cold.

The cold douche is also an excellent local tonic to individual parts of the body. It may be employed to remove that stiffness in joints remaining after slight injuries, or resulting from rheumatism or gout, and salt may advantageously be added to the water. The force of the douche's impact on the affected part, with the duration of its application, must be regulated by the condition of the tissues. If very weak, it is better at first to play the water in the neighbourhood of the injured or weakened joint. In spermatorrhœa much good may be effected by the free application of cold water to the perinæum and buttocks several times a day, and by the suspension in cold water of the testicles for a few minutes night

and morning. The same treatment is useful in varicocele. Dr. Fuller and Dr. Spender recommend douching joints affected with rheumatic arthritis for one or two minutes with cold water, or water slightly warmed in winter, and then rubbing them till they are warm and dry.

Injections of cold water, about 60°, night and morning into the vagina are useful to prevent the recurrence of leucorrhœa after it has been checked by appropriate treatment. A cold-water injection every morning before going to stool cures piles in many cases, and is always a useful addition to other treatment. Many persons, especially women, are troubled with cold feet. This ailment, most common at night, and often preventing sleep for many hours, is best treated by immersing the feet nightly, for a few minutes, in cold water, rubbing them whilst in the footbath dillgently with the hands until they become warm and glowing, when they should be clothed in thick over-large woollen socks.

THE TURKISH BATH.

This bath combines many of the properties of the hot and cold bath. It is used for its bracing and depurating effects. The body, subjected to great heat, is made to perspire copiously. If the bath ended here, more or less weakness would ensue; but at this stage cold water is freely applied, whereby the body is braced, its functions stimulated, and the tonic effects of the cold bath are obtained. The Turkish bath, at each stage of the process, cleanses the system; the perspiration carrying off, and the cold consuming, by increasing oxidation, many effete and noxious substances in the blood.

Dr. Goolden recommends these baths in gout, rheumatism, sciatica, Bright's disease, eczema, and psoriasis. He asserts that they benefit bronchitis, the cough of phthisis, the aching of muscles from unusual exertion, pains in the seat of old wounds, colds in the head, quinsies, and common winter coughs. The disposition to catch cold may be obviated by

a course of these baths. The cold sponge bath, and packing with the cold wet sheet, may be employed for the like purpose.

It is not amiss here to caution persons prone to colds, that the general habit of over-clothing increases this disposition. This cold-catching tendency may be obviated by using a moderate amount of clothing, and taking a cold sponge bath every morning, or the Turkish bath once or twice a week.

A patient with previously healthy lungs on catching cold is troubled for some time with chronic catarrh, accompanied by considerable expectoration and some shortness and oppression of breathing. The Turkish bath in such cases generally affords prompt and great relief, checking the expectoration and easing the breathing. A course of Turkish baths, say one every second or third day, is very useful in bronchial asthma and emphysematous asthma. This treatment subdues chronic bronchitis and renders the patient less liable to catch cold.*

A Turkish bath taken at the commencement of a feverish cold cuts short the attack, removes the aching pains, and hoarseness if present is at once either cured or greatly relieved. If the cold has lasted several days, the bath is still very useful, though its good effects are less striking. The remains of a general severe cold, as hoarseness, cough with expectoration, lassitude, are all benefited by the Turkish bath. Whilst in the hot chamber the voice generally becomes quite clear and natural, though the hoarseness may afterwards return in a slight degree; but usually it continues to improve and in a day or two becomes natural, the recovery being aided by a repetition of the bath. In more obstinate cases several baths may be required, and if the voice greatly improve in the hot chamber, this may be taken as a proof that

* A large Chamois leather waistcoat reaching low down the body and arms, and worn over the flannel, affords great relief in bronchial asthma and emphysematous bronchitis. This jacket is extremely warm and protects the chest against the vicissitudes of weather.

the bath will benefit, even though the hoarseness returns to a great extent after the bath.

The Turkish bath is serviceable to persons who, after dining out, not necessarily having over-indulged, suffer next day from malaise and slight indigestion. A course of Turkish baths is very benefical to town-dwellers leading a sedentary life, who are apt to become stout with soft and flabby tissues, especially if they live freely, who are easily tired, suffer from lack of enery and some mental depression. Their muscles become firmer, the fatness decreases, and they acquire more spirit and energy.

A course of Turkish baths is useful for patients whose health has broken down by residence in a tropical climate, and who suffer from general debility, enfeeblement of mind, dull aching pains in the head and broken sleep. The author has heard patients suffering from jaundice, acquired in a tropical climate or from malaria, speak very highly of the beneficial effects of Turkish baths; but it is necessary, as indeed it is with all persons whose health is much broken, to caution them against the too vigorous application of the bath. The patient should leave the hot chamber as soon as the skin perspires freely, and should not plunge into the cold bath but be douched with slightly tepid water, especially in cold weather.

Many fear to use the Turkish bath lest they should catch cold, and one often hears complaints of a cold coming on after a bath. So far from tending to give cold, these baths, as we have said, obviate the tendency to catch cold, and fortify delicate persons with a cold-catching tendency. If ever the bath produces a cold, it is owing almost always to the bather leaving the bath house too soon, whilst his skin is still perspiring freely, and his hair perhaps is soaking wet.

Again, it is not unusual to hear complaints that the bath has induced considerable depression, or even exhaustion, lasting perhaps several days; but here again, the fault rests with the bather. The bath must be adapted to the strength of the patient, and it is always prudent to take the first bath

circumspectly, the bather not staying too long in the hot chamber, and the bracing application must last only a few seconds, and the water must not be very cold, even if the first bath causes some depression, this need not happen afterwards, partly because the bather has become acccustomed to the bath, and partly because he knows how to adapt it to his strength. Yet it must be admitted that some persons even with every precaution cannot take a Turkish bath without much depression.

Acute rheumatism and acute gout have been treated with these baths; but as in most instances the severity of the pain renders it impracticable to take such patients to a Turkish bath, a modified substitute for it, shortly to be described, may be taken at home. The acute pain of gout, it is said, disappears in the hot chamber, to return in a diminished degree soon afterwards.

In subacute and chronic gout the Turkish bath is particularly valuable, but, as might be expected, it is not in all cases equally serviceable. In long-standing cases in which the attacks have occurred so frequently as to distort the joints by deposits, and patients are perhaps liable to repeated relapses, and are scarcely ever free from pain, the effiacy of the bath, though striking, is less apparent than in milder and more tractable forms; yet even in these cases, by diminishing the frequency and severity of the relapses, and by removing the pervading sensation of invalidism, affords considerable relief. The Turkish bath is perhaps more efficacious than other remedies in a case of the following kind:—A patient, often inclined to stoutness, complains of slight and fugitive pains; the joints, but little swollen, are merely stiff, and a little red and hot. The gout often affects many parts in succession—the joints, the head, the back, and perhaps some of the internal organs, as the bladder, etc. During an attack the patient complains of *malaise*, and his complexion often becomes dullish. The tissues are often soft and flabby, and in spite of judicious diet and abundant exercise he may be seldom free from some evidence of gout, sufficient to annoy

but not to disable him for work. In a case like this the Turkish bath is of great advantage. After one or two baths the pains, the swelling, and the *malaise*, dissappear, the joints become supple, and after a time, the baths being continued, the complexion loses its sallowness, the tissues become firm, and the undue stoutness undergoes diminution. On discontinuing the baths, the gouty symptoms will often recur, to disappear again on the resumption of the treatment. A gouty patient may advantageously supplement the action of the Turkish bath by drinking certain suitable natural alkaline waters.

The Turkish bath is useful in the various kinds of chronic rheumatism.

A patient who, in damp weather or during an east or north east wind, suffers from stiffness and pains in several of his joints, will find much benefit from a Turkish bath. The shoulder joint is often affected, the pain and tenderness being frequently limited to a small spot.

Again a patient without any previous history of rheumatism finds his shoulder set fast, is unable to move it, except to a limited extent, without great pain. Here again the pain and tenderness may be very limited. In such a case a Turkish bath generally affords great relief. Galvanism too, even one application, will often entirely remove or greatly lesssen the pains and stiffness. Again the Turkish bath gives much relief in mild and chronic rheumatoid arthritis, and often retards the disease. The bath often relieves lumbago.

Mr. Milton has found the bath useful in allaying the tormenting itching of prurigo unconnected with lice.

It may happen from various circumstances that the regular Turkish bath is not available when one or other of the following modifications of it may be substituted:—the patient, quite naked seated on a wicker chair, with his feet on a low stool, is enveloped in two or three blankets, the head alone being exposed, and a large-wicked spirit lamp is placed under the chair. In about a quarter of an hour perspiration streams down the body, and this secretion may be increased

by drinking plentifully of water, and by placing a pan of water over the lamp. When the patient has perspired sufficiently, the blankets are quickly removed, and one or two pailfuls of cold water are poured over him; or if this affusion is too heroic for him he may step into a general bath at 80°, or better still a few degrees lower. Dr. Taylor, of Nottingham, finds this treatment useful in obstinate skin affections, rheumatism, catarrh, syphilis, and in removing stoutness arising from an inactive life. The instrument makers now supply convenient forms of the domestic Turkish bath.

Dr. Nevins highly recommends the following contrivance in the treatment of acute rheumatism. "It consists of the employment of the very first of steam baths, even when the patient is so helpless that it is impossible to move him from the bed on which he is lying. These steam baths relieve the pain, and check the distressing perspiration; in a degree he has failed to obtain by any other mode of treatment. They are administered in the greatest ease in the following manner:—A couple of common red bricks are to be placed in an oven hot enough for baking bread, and in half an hour or little more they are sufficiently heated for the purpose. The patient's body linen having been previously removed, these two bricks are to be folded up in a piece of common thick flannel, thoroughly soaked in vinegar, and laid on two plates; the one is to be placed about a foot distant from one shoulder, and the other about equally distant from the opposite leg, and the bedclothes are then to cover the bricks and the patient closely round the neck. A most refreshing acid steam bath is thus obtained; and the supply of steam may be kept up, if necessary, by removing one brick and replacing it by another hot one kept in reserve. When the patient has been in the bath for fifteen or twenty minutes, the bedclothes and plates should be removed, and *the patient instantly mopped all over, very rapidly, with a towel wrung out of cold water*, and then should be quickly rubbed dry. Dry warm linen must be put on at once, and dry bedclothes must replace those which were on the bed previously. The under sheet can be removed, and

a dry one substituted, by fastening the corners of the dry sheet to those of the damp one; very little difficulty is generally met with in simply drawing the old sheet from under the patient, when the dry one follows it, and is left in its place. The patient generally experiences great and speedy relief from this bath. The exhausting sweats are usually diminished, and the necessity of opium much lessened. The change of body linen can be easily accomplished by tearing the night shirt open from top to bottom, down the back. The steam bath and subsequent cold douche should be continued after the patient is able to walk about, as they contribute to the healthy action of the skin, and promote free mobility of the joints." After the patient is able to get out of bed, the bath may be administered in the manner previously described.

ON PACKING WITH THE COLD WET SHEET.

Packing with the cold wet sheet, although at present but seldom employed, is undoubtedly a very efficacious treatment in many diseases.

In his work on hydropathy, Dr. Johnson recommends a mattress for the patient to lie on, with a pillow to support his head; "upon the mattress, and extending over the pillow, two blankets are spread, and over this is spread a sheet wrung out as dry as possible with cold water. The patient lies down on his back, perfectly unclothed, with his head comfortably placed on the pillow: an attendant now approaches, say on the patient's left, and first puckering the blanket from the back of the head down to the back of the neck, reaches across his chest, seizes the right upper corners of the blanket, and brings them tightly across under the chin to his own side (the left), and tucks them well and evenly under the left shoulder, where it joins the root of the neck, and under the point of the same shoulder. He now reaches across the body again, and brings over all the rest of the right sides of the

blankets to the left side of the patient, and then proceeds to tuck them well and evenly under the left side, beginning where he left off, at the point of the left shoulder, and proceeding quite down to the heels. The patient is now entirely enveloped in one half of the blankets, and the attendant finishes the operation by passing over to the right side of the patient, and then proceeding to tuck the left sides of the blanket under the right side precisely in the same manner as we have seen him tuck the right sides of the blanket under the left side of the patient. The attendant, standing on the right side of the patient's legs, finally insinuates his left hand under the backs of the ankles, lifts them up, and then with his right hand turns back the lower ends of the blankets under the heels." The wet sheet should reach to the ankles, and "be wide enough to overlap in front of the body about eight or twelve inches; over the whole, four or five blankets are placed, and pressed down close to the sides."

This treatment is useful in specific fevers and acute inflammatory diseases. It has long been employed in scarlet fever, and should be used from the beginning and throughout its course. In moderate attacks it is sufficient to pack the patient for from thirty to fifty minutes; but if the fever is very high, if the rash comes out slowly, imperfectly, and is of a dull colour, if the patient is restless and wanders, the packing must be continued an hour or longer, and be repeated three or four times a day. This treatment developes the rash, greatly reduces the fever, quiets the pulse, renders the skin moist and comfortable, and abates the restlessness and wandering. A short time after the application of the wet sheet, it commonly happens that a patient, previously restless and wandering, falls into a quiet refreshing sleep, and awakes calm and free from delirium. Its influence on the pulse and temperature is striking; the pulse in a few hours falling fifteen to twenty beats in the minute, and a repetition of the packing greatly reduces the fever. On suppression or recession of the rash, when serious symptoms arise, the packing is especially indicated. The cold sheet will bring out a brilliant rash gen-

erally followed by immediate improvement of the patient's condition. After each packing it has been recommended to dash two or three pailfuls of cold water over the patient. During the whole course of the fever a cold wet compress, renewed every three hours, should be worn round the throat; and if, on the decline of the fever, the tonsils remain large, or there is chronic inflammation of the fauces or larynx, this application, renewed less frequently, or applied only at night, may be continued till these conditions are got rid of. The compress should be composed of linen several times folded and fastened round the throat by a piece of dry linen of several folds. Cold packing has been beneficially employed in other fevers and in acute inflammations, as measles, small-pox, pneumonia, pleurisy, rheumatism and gout.

In acute rheumatism, when on account of pain, the patient cannot be moved, only the front of the body must be packed; and a wet cold compress, renewed every two or three hours, should be wrapped round each of the painful joints. If the prejudices of the patient's friends prevent the use of the cold sheet, the body should be sponged with tepid or cold water several times a day, using soap if the perspiration is abundant and foul. In addition to the sponging, the wet cold compress, as previously described, should be applied to the painful joints. There can be no question of the superiority of this treatment over that of swathing the patient in flannel clothes, and covering him with blankets to make him sweat. To avoid the supposed danger of catching cold these woollen clothes are worn day after day, till, saturated with putrefying perspiration, the stench sickens and de-appetizes the patient, and a crop of irritating miliary vesicles is engendered, which breaks the patient's sleep.

In pneumonia some pack only the chest, and renew the cold applications hourly, or even oftener. This treatment, it is said, removes the pain, quiets the pulse, calms the breathing, and reduces the fever.

When, as often happens, the patient's friends object to the cold packing from fear of "inflammation" or of "turning the

disease inwards," the sheet may be wrung out with tepid water, when, by the time it is spread for the reception of the patient, it will be sufficiently cooled to answer the purpose.

A pedestrian will find it an agreeable restorative immediately after great exertion, preventing stiffness and aching of the muscles, to strip and wrap himself in a dripping wet cold sheet, well rubbing himself afterwards. If stiffness, nevertheless, occurs, it may be removed by taking a few drops of tincture of arnica.

Cold or tepid packing is useful in the summer diarrhæa of children.

THE INFLUENCE OF COLD APPLICATIONS IN FEVERS.

The large amount of investigation regarding the action of cold applications in fevers made during the last fifteen years in Germany induces the author to devote a separate chapter to this subject.

These investigations confirm the conclusions of Currie and Jackson, and add precision to our knowledge concerning the employment and effects of cold to the surface. This treatment has been employed in typhus, typhoid, and scarlet fevers, measles, and other febrile diseases. More recently Dr. Wilson Fox and others, have cured patients suffering from the hyperpyrexia occasionally observed in rheumatic fever, a condition owing to its sudden onset and rapid course hitherto regarded as almost necessarily fatal.

The cold has been applied in various ways, by means of the general cold bath, affusion, packing, sponging, and by the use of ice.

Brand, to whom the revival of this hydropathic treatment is chiefly due, has largely employed it in typhoid fever. In mild cases he uses cold wet compresses, or frequent washing with cold water, or repeated packings in a cold wet sheet, or a warm bath gradually cooled. In severe cases he recommends

affusion, the shower bath, or the general cold bath. He generally places the patient in a sitz-bath and pours water of 50° to 55° Fah. over his head and shoulders for ten or fifteen minutes; he wraps him afterwards unwiped in a sheet and covers him over with a coverlet, and applies to his chest and stomach compresses wrung out of iced water; but if the patient complains of cold he covers the feet more warmly or applies hot bottles to them.

Hagenbach employs a general cold bath of 68° to 77° Fah. for ten to twenty minutes, and if their is much delirium, or coma, he at the same time pours cold water over the patient's head. He disapproves the frequent cold washings and packings, asserting that they abstract but little heat and fatigue the patient.

The method employed by Ziemssen and Immerman is the most agreeable to the patient, and being equally efficient it is the treatment most likely to be generally adopted. They immerse their patient in a bath of 95°, and in the course of twenty to thirty minutes, gradually cool it to 60° Fah. by the addition of cold water. This bath is agreeable to fever patients. These observers do not employ affusion as it is so much disliked by the patient, nor cold compresses since these do not affect the rectal temperature. They find, however, that cold packings do reduce the temperature of the rectum. For young children and old persons the severity of the application must be apportioned to the strength of the patient. Brand wraps a child in a wet sheet, and placing it on a table pours cold water over its head. For children and the aged, Hagenbach employs for half an hour a warm bath gradually cooled by the addition of cold water to 86° or 75° Fah. Weakly patients should be well rubbed on leaving the bath. Hagenbach adopts this treatment whenever the temperature rises above 102° Fah., while Brand recommends it whenever the temperature mounts above 103° Fah.

The repetition of these processes must be regulated by the subsequent course of the fever. If in three or four hours the temperature again rises to 103° Brand repeats the affusion.

In most cases he finds that six affusions are enough, and afterwards he applies cold cloths wrung out of water at 60° Fah. two or three times a day; these applications, provided the temperature does not rise higher thau 100° Fah., being made smaller and applied less frequently as the case progresses. In very severe cases the affusion must be employed every two hours. If the patient is comatose, and the foregoing treatment fails to restore consciousness, he applies a cold affusion of 45° Fah. to the head every half hour.

Dr. Stöhr recommends the continuance of this treatment in typhoid fever, to the middle of the third week; but it may be required longer, and here the thermometer is the test.

Ziemssen and Immerman find that with their plan four or five baths are necessary on the first day and that subsequently two or three daily will suffice, their repetition, however, being regulated by the information afforded by the thermometer. They prescribe the bath at 6 a.m., 1 to 3 p.m., and at 7 p.m. Ziemssen and Immerman found, as might be expected, that in typhoid the degree of cooling and its duration differed according to the patient's age, and the severity of the case. Thus they find the usual reduction is 3·6° Fah. in children and 2·5° Fah. in adults. In severe adult cases, however, the temperature falls only 1·8° Fah. and the effect of the bath is least evident in cases where the morning remission is slight. In severe infantile cases they found that the temperature recovers its former height in six hours, in adult cases of moderate severity in seven hours, and in severe adult cases in six hours and a half, and in cases with slight morning remissions in three hours.

A single bath often effects a considerable reduction of the febrile temperature. Thus, Mosler reduced the temperature in a case of typhoid 7° Fah., and Dr. Wilson Fox, one of his interesting cases of rheumatic hyperpyrexia, 12·4 Fah.

Dr. Wilson Fox's exact and continuous observations on some cases of rheumatic hyperpyrexia, adds precision to our knowledge of the effects of cold baths. He has shown that the fall of temperature continues even six or more degrees, 40

or 50 minutes after the discontinuance of the bath. It is important therefore to observe the temperature in the rectum while the patient is in the bath and to remove him before the temperature is too far reduced, lest too great a reduction might lead to collapse. This indeed appears sometimes to occur, for we read of cases becoming cyanotic, although German observers aver that this is not important and advise the application of warm bottles to the extremities. Still the author is convinced that it is important to avoid so depressing an effect as he has seen a child suffering from scarlet fever, killed by an over-energetic employment of cold.

German observers have shown conclusively that this treatment greatly reduces the mortality of typhus and typhoid fever. Thus Brand treated 170 cases of typhus without a single death, and Bartels treated 30 cases of typhoid fever without a single death. The mortality of Hagenbach's typhus patients was 5 per cent. provided the cases were treated early, and Dr. Stöhr reduces the mortality of his patients from 30 to 6 per cent., and the results he thinks would have been still more favourable could he have treated some of his cases earlier. Dr. Wilson Fox, and more recently Dr. H. Weber, Dr. Greenhow, Dr. Thompson, and others, have shown that we can often cure those very grave cases of rheumatic hyperpyrexia, to which no doubt most of the fatal cases of rheumatism are attributable—an invaluable addition to our knowledge. Admirable as this advance in treatment undoubtedly is, yet unfortunately, it has not proved quite so successful as was at first expected, several patients having died in spite of it.

Not only does this treatment reduce the excessive heat of fever but it allays the nervous symptoms and limits the wasting, and Brand says it also prevents meteorism, bleeding, and lessens diarrhœa in typhoid. On the other hand, Hagenbach and Jurgensen assert that this treatment does not lessen the meteorism and diarrhœa in typhoid fever, nor reduces the size of the spleen, nor the dicrotism of the pulse. All observers agree that cold baths do not shorten the course of

typhoid, typhus, and other acute specific fevers, but Brand asserts, while Hagenbach denies that they shorten the stage of convalescence.

This treatment rarely, if ever, induces either bronchitis or pneumonia, and the co-existence of either does not contra-indicate the use of cold baths.

Ludwig and Schröder find that this treatment of fevers greatly reduces the quantity of carbonic acid exhaled by the lungs and the solid constituents of the urine, and thus lessens tissue change; a very singular fact, since cold baths in health have the very opposite effect. Dr. Fox observes, that sometimes the rectal temperature rises a little directly the patient is placed in the bath, and Dr. Fiedler and Hartenstein point out that immediately after the bath the axillary is much lower than the rectal temperature, but after half an hour this is reversed, the rectal temperature becoming from 1° to 2° Fah. lower than the axillary, and so continuing during three-quarters of an hour.

ICE.

Ice is frequently applied to abstract heat, to check bleeding, to allay inflammation, and to destroy sensation. The ice broken up with the help of a large needle into small fragments, is enclosed in a bladder or thin india-rubber bag, first squeezing the air out of the bag, which, after filling to about one-third its capacity, should be tied at its mouth, on a cork so as to afford a purchase for the twine. The ice bag may then be adapted to almost any shape, and fitted to the inequalities of the body, and, if required, may be fashioned into a sort of cap for the head.

This cap is often applied to the head in tubercular and simple meningitis, and to allay the severe headache of the early stages of acute fevers. Sometimes the ice bag is laid on the epigastrium to ease the severe pain and vomiting of chronic ulcer, or of cancer of the stomach. It may be applied

to the vulvæ when these parts are affected with prurigo; other treatment, however, is generally to be preferred.

A lump of ice is sometimes inserted into the uterus, or pushed into the rectum, to arrest uterine hæmorrhage after delivery.

It is used internally for a variety of purposes. Sucking ice allays the thirst, and is very grateful to fever patients. It is likewise sucked to check bleeding from the mouth or throat, stomach or lungs. To check bleeding from the stomach, small pieces should be swallowed.

Few means are so successful in combatting acute inflammation of the tonsils or throat as the constant sucking of ice. Tonsillitis, the sore throat of scarlet fever, and other acute specific throat diseases, even diphtheria, are much benefited by this treatment. It often proves most grateful, allaying the heat and pain, and checking the abundant secretion of mucus which is so annoying from the constant hawking and deglutition it occasions. In diphtheria, and indeed in all inflammations of the throat, the good effects of ice are most marked when it has been adopted at the very beginning of the attack. The ice should be sucked as constantly as possible, and be continued till the disease has fairly declined.

Ice is employed in the same way to allay the nausea, sickness, and pain of disease of the stomach.

Ice may be applied to an inflamed and prolapsed rectum or uterus, to reduce the inflammation and swelling, so as to enable these parts to be returned to their proper place.

Some apply ice to the head in delirium tremens, and in the convulsions of children.

After an operation for piles or fissure of the anus, pain may be dulled or even removed by the application of a small bladder or india-rubber bag of ice.

M. Diday strongly recommends the local application of ice in painful affections of the testes as neuralgia and blenorrhagic orchitis. Two pigs' bladders partially filled with ice are applied one under, the other over the testes, the neighbouring parts being protected with napkins. The pain in orchitis is

at first rather increased but soon declines and in a few minutes altogether ceases. The ice applied continuously for 24 to 48 hours, removes the pain in many cases permanently. If any tenderness on pressure remains, the pain will return and the ice must be continued, being required in some cases, three, four, and even five days. On discontinuing the ice, wet cold cloths should be used to permit the tissues to return gradually to their normal temperature.

Two parts of finely pounded ice with one part of common salt produce cold sufficient to freeze the tissues and to deprive them of their sensibility. This mixture largely used by Dr. Arnott is confined in a gauze bag, and placed in contact with the skin till its sensation is abolished, and it has a leathery feel and a shrunken tallowy appearance. If applied too long, this mixture may vesicate; but this will not occur unless it is applied more than five or six minutes. This application is employed to prevent the pain of minor operations, as extraction of the toe-nail, and opening abscesses. Dr. Arnott recommends it in chronic rheumatism, erysipelas, lumbago, and to wounds. In chronic rheumatism it should be applied for six minutes to the diseased joints, to be then replaced for a short time by pounded ice, to prevent inflammation from a too rapid return of heat to the tissues. An attack of lumbago may be often cured by freezing the skin over the painful part. Dr. Arnott asserts that when applied to wounds it prevents inflammation without hindering union by first intention.

When applied for some hours, it destroys sensibility, to such a degree that chloride of zinc paste may be applied in sufficient quantity to destroy the tissues for a considerable depth, without inducing pain or inflammation. The ether spray so conveniently and rapidly used in the manner introduced by Dr. Richardson is now generally preferred for the purpose of freezing the tissues.

A single application of the ether spray will often remove lumbago;* sometimes sciatica, and those frontal headaches

* The pain and stiffness of the muscles of the back in lumbago may often be removed instantaneously by running a needle an inch or more into the

commonly called nervous, arising either from mental or bodily fatigue. Frontal headache, too, dull and uniform in character, lasting many days, occurring not uncommonly after excitement or an acute illness, as erysipelas, a severe cold, or a sore throat, often succumb to ether spray; but it is generally requisite to freeze the skin of the forehead.

ON THE SPINAL ICE BAG AND THE SPINAL HOT WATER BAG.

The profession is indebted to Dr. Chapman for the introduction of these applications, and for a rational explanation of their action.

Concerning the spinal ice bag, Dr. Chapman says, "I have proved by numerous experiments that cold applied to the back, not only exerts a sedative influence on the spinal cord, but also on those nervous centres which preside over the blood-vessels in all parts of the body. The *modus operandi* of this influence on those centres, and its effects, may be thus stated: 1st. It partially paralyses them. 2nd. By means of the partial paralysis thus effected it lessens the nervous currents in the vaso-motor nerves emerging from the ganglia or nerve centres acted upon and stimulating the muscular fibres surrounding the arteries influenced. 3rd. By thus lessening those currents, it lessens the contractile energy of the muscular bands of the arteries to which those currents flow, and by doing so facilitates the dilatation of the arteries themselves. 4th. By thus inducing the condition of easy dilatability in the arteries acted upon, it enables the blood, which flows in the direction of least resistance, to enter them in greater volume and with greater force than before.

painful part; when the lumbago is double, this almost painless operation should be performed on both sides of the loins. Inserted along the course of the sciatic nerve the needle generally affords instant and marked relief even in very chronic cases of sciatica. This treatment indeed, sometimes cures, as if by magic, severe and long-standing cases. The passage of an interrupted galvanic current will speedily relieve lumbago.

These effects are analogous to those obtained by Claude Bernard, who, on dividing the cervical sympathetic nerve, found that the parts supplied with this nerve, through the dilatation of the vessels, received an increased supply of blood, with a proportionate augmentation of their vital properties. Chapman says, "Those phenomena which Professor C. Bernard produced in the head of an animal by section of the cervical sympathetic, I have induced in the head, thorax, abdomen, pelvis, and four extremities of man, by the application of ice to the different parts of the back."

To supply an increased afflux of blood to any part of the body, Dr. Chapman applies the ice bag to various parts of the spine; to the neck and between the shoulders, when more blood is needed for the head; to the upper part of the back, for the chest and arms; to the lower part of the back, for the abdomen, pelvis, and legs. Dr. Chapman says:

I. "*Muscular tension is diminished by the application of ice along the spine.*" In support of this statement he asserts that the ice bag will prevent the cramps of diarrhœa and cholera, and is useful in laryngismus stridulus, chorea, tetanus, infantile convulsions and epilepsy, and "in prolonged muscular rigidity due to acute or chronic disorder of the nervous centres."

II. "*Sensibility is lessened by the application of cold along the spine.* This is proved conclusively by my experience, which has been considerable in the treatment of neuralgia."

III. "*Secretion is lessened by the application of cold along the spine.* I have assured myself by experience in numerous cases of the truth of this proposition. Morbidly excessive sweating, bronchorrhœa, the excessive action of the alimentary mucous membrane constituting the chief cause of diarrhœa, excessive action of the kidneys, leucorrhœa, and spermatorrhœa, I have restrained over and over again by cold properly applied to the appropriate part of the spine."

IV. "The peripheral circulation, and consequently bodily heat, is increased by ice applied along the spine." He narrates the following singular cases in confirmation of this proposition: "A woman, aged sixty, who for more than twenty

years had always been cold to the touch, even over her shoulders and bosom although she was warmly clothed; and her feet were habitually and extremely cold." After using ice during three weeks, several hours a day, the whole surface of the body, including her feet, became wonderfully warm. She was extremely astonished by the increase in the temperature of her body, as well as by the subsidence of every symptom from which she had suffered for so many years; and when she called upon me a week after the treatment had ceased, her newly acquired increase of general circulation, denoted by her increased warmth, still continued. Case 2 of this series affords a remarkable proof of the proposition in question: The patient, a man, aged fifty-six, who seemed nearly seventy, suffering from paralysis, epilepsy and other grave troubles, complained that he was always "cold all over;" that he suffered especially from coldness of the feet, even in the hottest weather, and was obliged, as his wife said, "to sit near the fire in summer." Within one week after the treatment, which was continued three months, this patient had become warm all over—especially the feet. Within a month he said, "I feel as well as possible; but very hot, very hot." In this case, after the ice had been left off for some days, the patient became cold again."

Dr. Chapman asserts that ice applied along the lower dorsal and lumbar vertebræ, by increasing the amount of blood supplied to the pelvic organs, promotes menstruation, and will even restore the monthly flux when suppressed. By increasing the flow of blood to the legs, the ice bag proves very useful to persons harrassed with cold feet; a few minutes after the application of the ice, the author has often witnessed the feet become comfortably warm.

Dr. Chapman asserts that ice applied along the spine is extremely useful in cholera and tetanus, in sea-sickness, and the vomiting of pregnancy.

As might be inferred the physiological effects produced by heat to the spine are the opposite to those induced by cold. Dr. Chapman says that "1st. The temperature of the sympa-

thetic ganglia being raised, the flow of blood to them becomes more copious, and the functions consequently become more energetic than before. 2nd. Their nervous influence passes in fuller and more powerful streams along the nerves emerging from them, and ramifying over the blood-vessels which they control. 3rd. The muscular bands surrounding those vessels stimulated by this increased nervous afflux to contract with more than their usual force, diminish proportionably the diameter of the vessels themselves. 4th. The diameter of the vessels being thus lessened, the blood flows through them in less volume and with less rapidity than before: indeed, it is probable that, while the nervous ganglia in question are made to emit their maximum of energy, many of the terminal branches of the blood-vessels acted upon become completely closed." The temperature of the hot-bag should not exceed 120°.

Dr. Chapman employs heat along the spine to contract the blood-vessels, and states that, if properly applied, it will not only lessen but arrest the menstrual flow. As the result of his experience, he asserts that it will arrest menorrhagia and bleeding from the nose and lungs. In bleeding from the nose or lungs, the hot spinal bag must be applied along the cervical and upper dorsal vertebræ; in menorrhagia, along the lower dorsal and lumbar vertebræ.

WARM AND HOT BATHS.

The effects of heat on the body are, of course, for the most part, the opposite of cold. By surrounding the body with a temperature higher than its own, destruction of the tissues by oxidation is considerably lessened. Moreover, experiment has shown that increased heat impedes or destroys the electric currents in the nerves, whence it may be fairly presumed they are less able to conduct impressions either to or from the brain. These two considerations may perhaps account for the enfeebling influence of heat on the body.

On the General Warm Bath.—This bath if not too hot, is at first highly pleasurable, but throbbing at the heart and in the large vessels soon comes on, with beating in the head, and a sense of oppression and anxiety. However, when perspiration breaks out these sensations are much lessened, or altogether cease. If the bath is continued, the foregoing sensations return, accompanied by geat prostration, even to the extent of fainting. The pulse becomes greatly quickened and enfeebled, while the temperature of the body is raised very considerably, and, if the heat of the bath is great, may reach to even 104° Fah., that is, to a severe fever height.

Warm baths are employed in Bright's disease to increase the perspiration for the purpose of lessening the dropsy, and carrying off from the blood any deleterious matter retained in it by the inaction of the kidneys. But discretion must be used for they greatly reduce the patient's strength, increasing the anæmia, and so may actually augment that general anasarca, to remove which the bath was employed.

Much of the dropsy of Bright's disease is due more to anæmia, than to the presence in the blood of poisonous excrementitious substances. As baths increase both the weakness and anæmia, it is obvious that if injudiciously employed they will augment the general dropsy.

In the cases now referred to, warm baths are administered with the hope of passing off by the skin either urea or the products which if properly oxidized would form urea, and so freeing the system from poisonous agents. It is doubtful if warm baths can effect this elimination, since it appears to be almost certain that, in health, no nitrogenous substance finds its way from the blood through the skin. Still there can be little doubt that, under certain conditions, these baths often give great relief to the patient. If our object is to withdraw poisonous matters from the blood, it is time enough to act when there is reason to expect their existence; but when no noxious symptoms indicative of blood-poisoning, as headache and drowsiness are present, baths are simply harmful.

The general warm bath is of signal service for children

affected with either simple or inflammatory fever. If a child is not very weak, a bath used night and morning, for a time varying from five to ten minutes, soothes and quiets, and is often followed by refreshing sleep. It is generally difficult to employ the general warm bath in the febrile diseases of grown-up people; but in its stead, sponging with hot water often induces perspiration, calming at the same time the restlessness of the patient, and favouring sleep. The same means will soothe the restlessness of convalescence and induce sleep.

The warm bath mitigates or removes the pain of colic, renal, biliary, or otherwise. Whether its effects in relaxing spasm are induced through its soothing influence on the skin, or from weakness caused by the bath, it is difficult to say; the bath certainly seems to ease the pain before any noticeable weakness is produced. In skin diseases of various kinds the general warm bath is invaluable. In psoriasis, eczema, icthyosis, urticaria, lichen prurigo, and scabies, it may generally be employed with benefit. It is especially useful in the acute stage of eczema and psoriasis. Rain or boiled water should be used; but if these are not available, the water should be made more soothing by the addition of a small piece of common washing soda, gelatin, bran, or potato-starch. These baths allay inflammation and itching. The body must be dabbed dry with soft towels. Flannel should not be worn if there is much itching, and scratching should be prohibited.

It has been recommended to keep a patient suffering from severe burns immersed for days in the warm bath; this treatment is said to ease pain, diminish suppuration, promote the healing process, and to lessen the contraction of the cicatrix.

As a means of obviating the various symptoms occurring at the change of life, Dr. Tilt recommends the general warm bath of 90 to 95° Fah. for an hour once a week so as to promote free perspiration.

The local warm bath is used for a variety of purposes. It

is hardly necessary to refer to the common household practice of putting the feet into hot water just before going to bed, to induce general perspiration, and so relieve catarrh. The hot foot-bath or the sitz-bath is of great service when the menstrual flow is either deficient or absent. To this bath mustard may be added with advantage; but, as the late Dr. Graves insisted, it should be used only at the menstrual period. This mustard bath employed nightly, or night and morning, for six days, commencing one or two days before the period begins, is a very useful auxiliary to other treatment, and often succeeds in establishing menstruation. This sitz-bath is often effectual, when sometimes, from exposure to cold or from other circumstances, this flow is suddenly stopped, to the patient's great annoyance and suffering.

Dr. Druitt points out that by sponging the body with very hot water, the excessive perspiration of phthisis may be diminished for some hours.

Hot water to the legs and feet often removes headache, and according to Dr. Graves, relieves distressing palpitation.

Langenbeck asserts, that, after an amputation, if the stump is kept immersed in a warm bath, it will avert pyæmia.

Sponging the face, temples, and neck with water as hot as can be borne, often relieves the headache of influenza, catarrh, and of other diseases.

The *hot-air bath* very often succeeds in promoting free perspiration. If it is highly desirable to establish a free flow of perspiration, the hot-air bath may be preceded by the general warm bath.

Vapour baths are used for the same purpose. Less depressing than the general warm bath, they produce much less elevation of the temperature of the body, which probably explains their difference in this respect.

PEROXIDE OF HYDROGEN.

Peroxide of Hydrogen has been used both internally and externally. It whitens the skin or mucous membranes, and excites a pricking sensation, and, in delicate structures, as the conjunctiva, a slight amount of inflammation.

According to Dr. Stohr, on adding peroxide to venous blood, pretty active effervescence occurs. The solution soon becomes yellowish red, then pale yellow, and in five or six minutes from the beginning of the experiment, colourless, and afterwards a white flocculent coagulum settles. The corpuscles themselves, when treated with a strong solution, become irregular in outline, and do not form rouleaus. Added to pus, much gas is given off, and the mixture becomes turbid with white flocculi. Many of the corpuscles are shrunken or altogether destroyed.

Applied to abraded surfaces, covered with blood or pus, the solution of peroxide behaves in the manner above described, the surface becoming ultimately covered with a thin layer of coagulated albumen. The solution, it is said, is applied with decided advantage to chancrous sores, healing them in half the ordinary time. The sore is to be washed with the solution three times a day, and to be continuously covered with lint moistened with it. Open buboes have been treated successfully in the same manner. The solution is said to destroy the specific character of a chancrous sore.

Internally, it is reputed to be a disinfectant and slightly stimulant.

CARBON. ANIMAL CHARCOAL.
„ WOOD CHARCOAL.

Carbon, in proportion to its porosity, absorbs many gases in considerable quantity; and wood, being more porous than animal charcoal, its absorbability is greater.

Charcoal does not absorb all gases in an equal degree; for it has little power in this respect over hydrogen, while it absorbs a considerable amount of oxygen, a large quantity of sulphurretted hydrogen, and a still greater proportion of ammonia. Charcoal is much used on account of this property as a disinfectant, to remove bad smells, or to prevent the air in rooms becoming contaminated by the effluvia from foul ulcers. Its non-volatility renders it very inferior to chlorinated lime or chlorine gas for purifying air, since it can act only on the air immediately in contact with it.

It is more effectual in absorbing the offensive gases given off by foul sores, and is generally employed in the form of a poultice, mixed either with bread or linseed-meal. Bread, being more porous is to be preferred, as it permits the gases to permeate the substance of the poultice, and so to come in contact with the particles of charcoal.

It may reasonably be doubted if, after becoming thoroughly moistened and its pores filled with water, the charcoal does not lose its capacity to absorb gases and so to act as a deodorizer. It is certain that charcoal poultices often fail to act in this manner. Charcoal may act by preventing decomposition, for, taken into the stomach after being mixed with water, and its pores filled or obstructed, it still prevents flatulence, an effect not due to absorption; it must therefore act by arresting fermentation or decomposition. A thoroughly efficient mode of employing charcoal, is to fill a small flat muslin bag with it, in a finely granulated form, and to place it over the poultice covering the sore.

Charcoal poultices are reputed to change the condition of sloughing or gangrenous wounds, making them cleaner and more prone to heal. But it is very doubtful if charcoal possesses such a property.

How does charcoal destroy smells depending on noxious gases? It has been stated in a previous page that it is endowed with the property of condensing many gases in its pores, and some accept this property as a sufficient explanation of its action. Others assert that the oxygen condensed

and accumulated in the pores of the charcoal, combining with the other gases with which it comes in contact, breaks them up and destroys their ill odour.

Of more practical importance is the question whether the carbon becomes inert by use, thus losing its property to condense gases or to destroy them. Buchheim is probably right in stating that the carbon becomes inert, but others assert that if kept dry, it retains its properties unimpaired for many years: at all events exposure to a dull red heat restores its gas-absorbing power.

Charcoal is likewise employed as a disinfectant, and Dr. Stenhouse has devised a charcoal disinfecting respirator, which, no doubt, is protective against many gases, but at present no evidence exists to show that charcoal will destroy the organic matters which propagate disease, although acting like a filter it may prevent their entering the system.

Charcoal, by its chemical or mechanical action, possesses the property of carrying down from solutions many colouring matters, many bitter substances, alkaloids, and mineral substances. Hence Dr. Garrod advises its administration in poisoning by corrosive sublimate, arsenic, morphia, strychnia, belladonna, etc., but at present this treatment of poisoning has not found much favour with the profession. Charcoal also precipitates the colouring matter of urine, carrying down at the same time all the uric acid, and some of the urea in solution. The sugar of diabetic urine is unaffected by charcoal. As a precipitant of the above named substances, animal charcoal freed from it earthly impurities is found to be the most efficacious, on account, it is said, of its more finely divided state.

Charcoal is employed with much success in some diseases of the stomach. It is said to ease the pain in chronic ulcer, and of neuralgia of the stomach. It is markedly useful in flatulence. In the majority, if not in all cases, intestinal flatulence is the result of gases generated by fermentation. The symptoms accompanying flatulence, however, are not always alike, and their various combinations afford indications for

treatment. Sometimes "the wind" is produced in enormous quantities, with great rapidity, producing distension, eructation, and mental depression; the patient complaining only of these symptoms; not of pain nor of acidity. This enormous production of wind, irrespective of other symptoms, prevails chiefly among middle-aged women, especially at the change of life. Sometimes during pregnancy and suckling, and seldomer in the course of phthisis, this condition is met with. It is often very difficult to check the formation of wind, but vegetable charcoal is one of the best remedies for this purpose. Sometimes after a few mouthfuls of food the wind is formed in a quantity so large that the patient is constrained to cease eating: here the charcoal should be taken immediately before each meal. Another patient is not troubled with the wind till half an hour or longer after food: here the charcoal should be taken soon after the meal. Five or ten grains of charcoal is generally enough, and if this dose fail, it seldom happens that a larger one succeeds. Supposing charcoal to fail in cases like these just described, we have another efficient resource in the sulpho-carbolates or carbolic acid.

At other times profuse formation of wind is accompained by acidity. Charcoal, administered as above described, will generally obviate both these symptoms; and sulpho-carbolates and carbolic acid, although less successful than when acidity is absent, will often prevent the production of both wind and acidity.

Some persons after meals are troubled with a little wind, acidity, and a sensation of weight at the pit of the stomach. Charcoal will relieve these cases; but nux vomica, in five-minim doses of the tincture, taken a few minutes before meals, is to be preferred. In the treatment of flatulence it must never be forgotten to direct the patient, as far as possible, to abstain from those kinds of food prone to fermentation. Sugar and starchy foods must be avoided or sparingly eaten, and thin well-browned toast, on account of the carbonization of its surface, may be substituted for bread. The meals should be very moderate, the food well masticated, and drink-

ing postponed till the meal is nearly finished, or still better, till an hour after its completion. Tea is very obnoxious to flatulent patients.

Most of the charcoal passes away with the fœces; a little, it is stated, finds its way into the blood aud lymphatics.

For internal use, wood is preferred to animal charcoal. It is often advantageously mixed with equal quantities of bismuth, when flatulence is combined with acidity and pain.

CARBONIC ACID GAS.

It is asserted that this gas applied to the eye relieves the pain and photophobia of scrofulous ophthalmia, and that injected up the vagina it eases the pain of ulceration of the os uteri and of cancer and neuralgia of the uterus. According to Sir J. Simpson, the inhalation of this gas benefits in chronic bronchitis, asthma, and irritable cough.

Carbonic acid gas is generally employed dissolved in water. Natural waters containing a large quantity of carbonic acid are used externally in chronic gout, chronic rheumatism, and many chronic skin affections. Carbonic acid is an excitant of the skin, producing tingling, redness, and a sensation of warmth, increasing the flow of the perspiration, but after a time acting in some measure as an anæsthetic lessening the sensibility of the skin, and removing or diminishing pain.

Carbonic acid water is employed in painful and irritable conditions of the stomach. It eases pain, and checks vomiting. It is an excellent plan to mix it with milk, which often previously rejected, is then generally retained. Then lime water may profitably be substituted for carbonic acid water in diarrhœa with irritability of the stomach; but with constipation carbonic acid water is much to be preferred.

NITROUS OXIDE GAS.

Of late this gas has been extensively used as an anæsthetic. To Mr. Clover, the highest English authority on all matters pertaining to the administration of anæsthetics, the author is indebted for the following remarks:—

Preparation.—Nitrous oxide is made by boiling nitrate of ammonia in a glass retort. The gas and steam thus formed are passed through water to remove any of the higher oxides of nitrogen, and the gas collected in a gasometer.

Nitrous oxide is now prepared on a large scale, and condensed in iron bottles. It is sold in the liquid form by Messrs. Coxeter, and by Barth and Co. The contents of the bottle are easily measured by weighing. A gallon weighs about three-tenths of an ounce.

Effects on Animals.—Dogs and cats obliged to breathe the pure gas are killed in a few minutes; after making the usual efforts to get free they become insensible, make slight convulsive movements, and then breathe stertorously. The breathing always intermits before the heart's action fails. If the animal is brought into pure air when the intervals of breathing are not more than thirty seconds, it always recovers. The recovery is attended with panting respiration.

Administration.—In producing anæsthesia by nitrous oxide, it should be remembered that it is to be given pure, and without any admixture of air. The time required to fit the patient for the operation is to be reckoned, not from the commencement of inhalation, but rather from the time when the lungs are finally deprived of all atmospheric air, after which I believe that every patient is ready for the operation in a very few seconds. The gas may be conveyed by an inch tube either from the gas-holder or from an air-proof bag, holding not less than two cubic feet of gas. If the compressed or liquid gas be used, it must first be conducted from the iron vessel into an air-proof bag. Care must be taken not to allow the liquid gas to escape so rapidly as to produce cold

enough to freeze the gas, and so for a time to stop the supply. The mouth-piece may be made so as to be held between the teeth; but this plan necessitates the pinching the patient's nostrils and compressing his lips against the tube, which is objectionable. In spite of this a restless patient will sometimes draw in a little fresh air, which will keep him for the next half-minute either conscious or in such a state that he will struggle against the operation.

I find the apparatus which I have used for several years for giving 4 per cent. of the vapour of chloroform answer equally well for giving nitrous oxide. With the view of overcoming the liability of air to get accidentally under the mouth-piece during forced respiration, and for economising the quantity of gas used, I have added to the mouth-piece a supplemental bag, holding about two hundred cubic inches, connected to the mouth-piece by a three-quarter inch tube and stop-cock. A portion of the expired gas escapes through the expiring valve, and during inspiration the gas is supplied partly fresh from the larger bag, and partly from the supplemental bag. It answers the same purpose, and it is more convenient, to place a lever under the inspiring valve, so that the action of the latter can be stopped. Having applied the face-piece, the patient should be directed to inhale *freely* rather than rapidly, and to empty his chest at each expiration, so that he may get rid as speedily as possible of the residual air in his lungs. Pure gas is so free from taste and smell that it is very readily respired; he should be told that he will hear ringing sounds, and experience a sense of general pulsation, but that he has only to continue breathing freely to procure the wished-for sleep. After four or five respirations the stop-cock of the supplemental bag, which has hitherto been kept empty, should be opened to receive a portion of the expired gas, and again supply it at the next inspiration. If there is no supplemental bag, the lever just mentioned should be pressed upon. The apparatus of Mr. A. Coleman is for the purpose of purifying the expired gas from carbonic acid; it consists of a metallic vessel containing half a pound of slaked lime,

and placed on a table near the patient. This vessel is connected on one side with the gas bag, and on the other, by means of a tube two feet in length, with the face-piece. It is not provided with any valve, so that the bag should be gently pressed during the first four respirations; and after this the expiring valve is fastened down, so that there may be no loss of gas afterwards; I do not think it possesses any practical advantages. Lividity of the face is soon observed; this is not a sign of insensibility, and may be disregarded; the eye soon becomes fixed, and if the conjunctiva is touched, the eyelids contract feebly or not at all; the pupil at this stage is of its normal size. Pinching the skin will now produce no signs of pain; a single tooth, not firmly fixed, may be removed, and such small operations as do not prevent the continuance of the inhalation may be commenced; but it is necessary for enabling the operation to be continued for more than a few seconds without raising the patient to a struggling condition, that other symptoms should be produced. Convulsive twitching of the hands and oscillations of the eyeball next occur, and at the same time, or soon after, the respirations become slower, and are accompanied with a snoring noise. If breathing should cease for fifteen seconds, the chest and abdomen should be pressed upon two or three times. The pulse should always be carefully watched during this part of the administration, lest syncope should occur, in which case the patient should be placed in a horizontal position, and be freely supplied with fresh air. The pulse remaining regular, and the pupil being only moderately dilated, the gas may be continued notwithstanding the convulsions mentioned, and although the breathing begin to be slow; but if the pupil dilate widely, or if the breathing intermit, the gas should be immediately withdrawn. It is astonishing to witness the degree of resuscitation afforded by a single full inspiration of air, so that if it is intended to keep up the anæsthesia, not more than one full inspiration of air should be allowed if the pulse continue distinct. Gas should be given for five or six respirations, and be again intermitted. In dental operations,

on account of the mouth being open, the anæsthesia can be sustained for a limited time only. I have sometimes prolonged it by continuing to supply gas through the nostrils by means of a cap fitting closely over the nose, or by means of a tube held in the mouth; but in most cases the operator has time to extract several teeth before consciousness recurs, and it will generally be found to be the best plan to allow the patient, after one or more teeth have been removed, to awake sufficiently to be able to rinse the mouth, and then to give the gas again. A piece of wood should be placed between the jaws to keep them open, and it should have a string attached to prevent its slipping down the throat. An instrument made of vulcanite and in shape like a small telescope, with a spiral spring inside, is better, as it will retain its position even if the patient try to talk. The piece of string should be attached to the middle part of this instrument and not to the small cap screwed on at each end, in case the cap should become loose. In consequence of this accident having occurred, I have contrived an improved form of this gag, consisting of only two pieces of vulcanite, which are fastened together by a double piece of silk so that they cannot separate in being used. Most patients are glad to inhale again and again. Many persons find the sensation experienced very agreeable; some appear to suffer as from nightmare; it is very rare to have any complaint made of headache. Some persons suffering from headache have awaked from the sleep of nitrous oxide without any. It is doubtful if vomiting ever occurs from a single inhalation of nitrous oxide; but when blood has been swallowed, sickness of short duration has been produced. Such vomiting and prostration as we witness after chloroform and ether is unknown. As previously stated, there is nothing unpleasant in the smell or taste of this gas; indeed, it is hardly to be distinguished from common air, when absolutely pure; but some patients from timidity resist breathing, and so produce a sensation of tightness in the chest. Hysterical patients, when only half under the influence of the gas, are liable to have an attack of hysteria, but it is of short duration,

and most of such cases may safely be left to themselves. These subjects may present threatening symptoms when they cease breathing. In a case of this kind a patient is said to have ceased to breathe for two minutes. She had not taken enough gas to prevent her struggling against the dentist, and was either faint from the violent efforts she had made, or else was just conscious that the medical men were nervous about her, and was actuated by the desire of being an object of interest, so common in patients of this class. She had held her breath, or taken it so very softly as to seem not to breathe at all. The fact that the colour of the lips had improved, and that the pulse had rallied, and was going on with regularity, were signs that the nitrous oxide had nearly left the system. The laughing and gesticulation formerly witnessed in experiments with laughing gas is now seldom seen; and when it happens to occur, we can generally account for it by the patient not having inhaled gas sufficiently pure. It was then given by means of a bladder and small tube, through which the patient breathed backward and forward; the gas would thus be diluted with some eighty cubic inches or more of residual air in the lungs, and a further dilution would be likely to occur through an involuntary or voluntary effort on the patient's part to obtain air.

I have on many occasions availed myself of nitrous oxide as a preliminary to the administration of ether or chloroform.

Some persons have a great repugnance to the taste of these agents, and put themselves to much distress in holding their breath to avoid it. Five or six respirations of gas are sufficient to blunt the sensibility of the air passages and enable the patient to respire freely. The after effects of ether or chloroform, as might be expected, remain the same. The administrators should know that if panting respiration occur (as it often does when after inhaling gas the patient begins to breathe air) it is not safe to give these anæsthetics as freely as in ordinary breathing.

Those persons who are frequently engaged in giving anæs-

thetics will find it useful to have an arrangement of their apparatus, by which on turning a stop-cock the supply of gas is made to pass through a chamber containing ether, and having a water jacket to keep up the temperature of the ether. This is especially of use for prolonged dental operations, as the anæsthesia is by its means easily kept up for two minutes. Of course the patient should be carefully watched for signs of failing heart, or failing respiration, as the resuscitation would be impeded by the amount of narcotic vapour in the chest.

Physiological Action.—It appears to produce its anæsthetic effects by preventing the oxidation of the nervous centres, and this chiefly by depriving the blood of its supply of free oxygen. Although there is more oxygen in nitrous oxide than in air, it is chemically combined with nitrogen, whereas air is a mixture of nitrogen with free oxygen. The effect of a moderate quantity of nitrous oxide, so long as the influence of the atmospheric air last inhaled remains, is exciting; but as soon as the oxygenating property of the blood is lost, the functions of the nervous system fail, and if fresh air be not quickly supplied, they cease, and the animal dies.

But although the inhalation of this gas deprives the blood of oxygen in an available form, it does not prevent the escape of carbonic acid; for if the expired gas is passed over lime water, or over hydrate of lime, as in Mr. Coleman's apparatus, the lime is found to have taken it up, and to be converted into carbonate of lime. A further confirmation of this is afforded in contrasting the effect of inhaling the same gas again and again from a bladder of small size. In this case the anæsthesia approaches slowly, is accompanied by excitement, and there is more or less headache complained of afterwards, which rarely or never occurs from breathing pure nitrous oxide.

The functions of the brain proper cease before those of the medulla oblongata, hence we have loss of consciousness before the respiration fails; and the functions of the medulla are abolished before those of the ganglia presiding over the

heart, and hence failing respiration occurs before failure of the heart's action.

Only one death is known to have occurred within an hour of inhaling the gas. This case was one of extensive phthisis, and it has been supposed from this case, and from the lividity induced by the gas, that persons with delicate lungs are not fit subjects for taking it. If extensive disease of the lung exists, it would be imprudent to use it in the present state of our knowledge; but I have given it where I have believed only a moderate lung disease existed, and observed that in these cases no untoward symptoms were produced. Persons liable to syncope would seem to be unfit subjects, but many such patients have taken the gas without serious consequences having occurred.

I have known no signs of mischief to the brain follow the inhalation. I have given it successfully to several persons who were the subjects of epilepsy.

Pregnancy is not a bar to its use; but in such cases it should be given with caution.

The danger of death from blood getting into the trachea would be as great, or greater, than when chloroform is given. The patient would unfortunately show no signs of it, as the lividity which *might* tell of it would, of course, not be distinguishable from that of nitrous oxide.

From all that I have seen of the administration of anæsthetics, and from the accounts published of the cases where they have been followed by a fatal result, it appears to me of little importance what is the age, temperament, or disease of the patient, in estimating the danger of using them. The young and old, feeble and strong, fat and thin subjects, have all on some few occasions died from them. On the other hand, we have witnessed the successful administration of chloroform, etc., in the advanced state of phthisis, heart disease, etc. The only reasonable hope of security lies in carefully preventing an overpowering dose, or the prolonged exhibition of a milder one, after symptoms of failing lungs or heart have shown themselves.

SULPHUR.

Sulphur dusted on the skin produces no effect on it, but mixed with lard or other unctuous substances, and rubbed in, it excites a slight degree of inflammation, on which account sulphur ointment has been applied to indolent sores to stimulate them to a healthier and more healing condition; but more efficient ointments for such a purpose have superseded sulphur ointment, which is now almost entirely restricted to the cure of itch. The object is to destroy the insect (*acarus scabiei*) and its ova, for it is on the presence of this animal that itch depends. A knowledge of their habits suggests the means best calculated to destroy them. The female, as soon as impregnated, burrows obliquely under the skin, and day by day deposits her eggs till she dies. The male remains a wanderer on the surface, and is easily attacked and killed by the ointment. To reach and destroy a female and her eggs, it is necessary to break up the burrows where these lie concealed, and to lay them bare to the action of the sulphur ointment. The destruction of the burrows is easily effected by the liberal use of soap and water, which removes the superficial and dead cuticle, and exposes the animal and its ova.

Various methods of sulphur treatment are in use, but it is sufficient here to record only a few.

M. Hardy claims that his method will cure in four hours. He first orders the body to be subjected for half an hour to a friction of soft soap, which cleanses the skin and lays bare the burrows. Then follows a warm bath of an hour's duration, during which the skin is well rubbed to complete the destruction of the burrows. Then the skin is well rubbed all over, except the head and face, unless in the rare instances when these parts are attacked, with an ointment composed of two parts of sulphur, one of carbonate of potash, and eight of lard. One such course effects a cure.

This rather severe method not unfrequently irritates, in-

flames, and chaps the skin, and is, therefore, inapplicable for delicate skins, especially if much eczema or inflammation is present, which would undoubtedly be much aggravated by such vigorous treatment.

It is often sufficient to subject to this treatment only certain parts of the body, where the rash is most apparent, and to apply the ointment to other parts in a milder manner.

If the skin is delicate, much irritated, or inflamed, a mild soap may be substituted for soft soap, and an ointment without alkali and with less sulphur, while the time of the applications should be shortened, and the several washings and inunctions, repeated on successive nights, should replace the one continuous severe application. The ointment should be left on all night.

The simple ointment of the Pharmacopœia, containing no potash or other alkali, and little irritating to the skin, is in most instances sufficient. The patient should be directed to take a nightly warm bath, and to rub the skin with soap, bland or strong, according to the condition of the skin. After wiping the body thoroughly dry, the ointment is to be well applied to the skin, by the fire-side, just before bed-time, and to be washed off on the following morning. In three days the patient is usually cured.

The irritation set up by the parasite and its eggs excites sometimes more or less eczema and impetigo, when the foregoing treatment, although it would cure the itch, would certainly aggravate these accompanying eruptions. To avoid this complication, Hebra recommends a milder ointment of a different composition; namely, of chalk, 4 oz.; of sulphur and prepared tar, each 6 oz.; of common soap and lard, each a pound. In this preparation the various constituents serve each a distinct purpose. The chalk helps mechanically to remove the dead cuticle and to break up the burrows. The tar serves the twofold purpose of diluting the sulphur and acting beneficially on the eczema, while the soap and lard further effect the dilution of the sulphur; and the soap, by virtue of its alkali, checks the weeping from the red, raw,

eczematous eruption. The application of this ointment, accompanied with the use of the warm bath, is employed twice in the day. In three days the cure is complete.

After the itch is cured, it often happens that even the mildest ointments excite and increase the eczema and other eruptions produced by the scabies. It is inadvisable, therefore, to continue for many days the use of such ointments, otherwise they may perpetuate these rashes. On withholding this treatment, the rashes produced by the scabies will frequently disappear at once. After treatment, the patient must put on an entire change of linen, and the soiled clothes should either be boiled in water, or heated in an oven, at a temperature above 212° Fah., to destroy the animals and their ova concealed in the texture of the linen.

Some maintain that the sulphur of the ointment plays no part in the destruction of the animals and their eggs, but that the fatty matters, by obstructing their breathing-pores, suffocate, and so destroy them. This opinion seems to be erroneous, a sulphur ointment being far more effectual than a simple fatty one. Sulphuretted hydrogen destroys lice, and some suppose that sulphur kills the itch insect by conversion into this gas.

Except in rare cases, the ointment need not be applied to the head and face, as in this country these parts are not often affected. The disagreeable smell of the ointment may be in part concealed by the addition of some otto of roses or other agreeable odorous substance.

On account of the disagreeable smell and irritating effect of sulphur, many dermatologists substitute storax, which is said to be as effectual as sulphur.

The complexions of some young women, in whom the menstrual flow is disordered, are spoiled by numerous small elevations or pimples, scarcely or not at all reddened, the skin at the same time losing its healthy transparency. Sometimes on the summit of the elevation a minute pustule forms. This may be a form of acne, but is unlike that commonly seen. Sometimes the eruption appears without disturbance

of the menstrual functions, and at the menstrual period may almost disappear, to recur when the discharge has ceased. This complaint may last months, or even years, greatly to the annoyance of the patient. It will, however, very generally yield to the application twice or three times daily, of the following lotion:—Sulphur, a drachm; glycerine, an ounce; rose water, half a pint. This lotion speedily benefits the eruption when it has continued for years uninfluenced by other treatment. Acne may be treated in the same way.

An ointment composed of two drachms of hypochlorite of sulphur and an ounce of simple ointment, or especially iodide of sulphur ointment, are very useful in the severer forms of acne, (see Sulphides). They should be applied twice daily. Where acne indurata is accompanied by much acne punctata, these applications may be assisted by frequent washing with plenty of soap and warm water. In genuine prurigo, Dr. Anderson applies night and morning an ointment composed of an ounce of sulphur, six drachms of liquid tar, and four ounces of benzoated lard.

Being quite insoluble in any of the fluids of the mouth, sulphur possesses no taste; but, as it often contains a small quantity of either sulphurous acid or of a sulphide, it may partake of the flavour of these substances. It undergoes no change in the stomach, and in no way affects the mucous membrane of this organ.

In the intestines, however, the case is quite otherwise. Here, in ordinary doses, sulphur causes rumblings, slight colicky pains, followed in a short time by a softened evacuation, which may be soon repeated. From the occurrence of colic, and the semi-solid condition of the motions, it is generally held that sulphur acts but slightly on the mucous membrane, but purges chiefly by exciting contractions of the muscular coat of the intestines. From the mildness of its operation it is ranked among the laxatives. The precipitated sulphur, being more finely divided than the sublimed, acts as a purgative more surely and effectually.

If taken for too long a time, it excites a catarrhal state of the mucous membrane, and impairs digestion.

It is useful when a mild purgative is required, and when it is needful to maintain the motions in a soft and yielding state, as in piles and fissure of the anus, so that they may not be irritated and pained by hard difficult stools. It is also employed in stricture of the rectum and in habitual constipation. In habitual or obstinate constipation it often succeeds after the failure of other remedies. The compound liquorice powder of the Prussian Pharmacopœia, or 10 gr. of sulphur mixed with confection of sennæ are convenient forms. The compound liquorice powder contains both sulphur and senna, and is not disagreeable; indeed children like it; hence, as Dr. George Bird tells me, it forms an excellent purgative for children. The dose for adults is one to two teaspoonfuls stirred in a little water or milk. Apart from its softening effect on the motions, sulphur exerts a beneficial action on the rectum in prolapsus and in piles. Five to ten grains of sulphur, mixed in a drachm of confection of senna, each morning, is a very useful laxative in piles.

What changes does sulphur undergo, and in what way does it act as a purgative?

It has been suggested that some of the sulphur becomes dissolved in the fat it meets with in the intestines, and is thus in a fit condition both to act as a purgative and to pass into the blood; the fact that, when sulphur is administered simultaneously with much fat, the quantity of the sulphur in the urine is not increased, renders this explanation improbable.

Some of the sulphur, undoubtedly, is converted into a sulphide by the action of the alkali of the bile; for after the ingestion of sulphur, not only does the gas generated in the intestines contain a considerable quantity of sulphuretted hydrogen, but much of this gas is given off by the skin, to the extent even of tarnishing metal articles worn about the person. By conversion into a sulphide, sulphur acts as a purgative, and by virtue of the same change it is enabled to

enter the blood. This view is supported by the fact that sulphides act in the same way as sulphur. Yet a portion in the form of fine particles, probably passes through the walls of the intestines undissolved, but the quantity so conveyed is undoubtedly very small.

The action of sulphur on the physical or chemical constitution of the blood is at present unknown. It has been said to produce salivation occasionally in persons who had previously taken mercury. The opinion is general that it excites in healthy persons an increased secretion from the mucous membrane of the air passages, although Buchheim denies this. Graves, and other authorities, strongly recommended sulphur in doses of from five to ten grains, repeated three or four times a day, in severe chronic bronchitis, with abundant discharge, especially when accompanied by constitutional debility. It is said to lesson the secretion, and to render its expulsion easier.

It increases, so it is said, both the frequency and force of the heart's contractions, and promotes the flow of perspiration; but these assertions both greatly need confirmation.

It is asserted that the pain of chronic rheumatism and sciatica may often be relieved by applying sulphur to the skin over the seat of pain; but, as in applying the sulphur it is generally recommended to envelope the affected limbs in soft flannel, it is difficult to discriminate to what extent relief is attributable to the sulphur or to the flannel.

Chronic eruptions of the skin of the dartrous family, as acne, psoriasis, impetigo, and eczema, are said to be benefited by the internal administration of this remedy.

Most of the sulphur taken into the stomach escapes with the fæces; while part of that which enters the blood, becoming oxidized, appears in the urine as a sulphate or one of the lower oxides of sulphur. The sulphuretted hydrogen, from its great volatility, escapes in some measure by the lungs and skin, and occasionally with the milk, and by the urine.

Some aver that a portion of the ingested sulphur passes

through the system, and is separated by the kidneys in the uncombined state. Sulphur produces no change in the quantity of the constituents of the urine, with the exception of the sulphur compounds, which it augments.

Sulphur may be conveniently administered in milk.

SULPHIDE OF POTASSIUM.
„ SODIUM.
„ AMMONIUM.
„ CALCIUM.

Many natural waters contain one or more of these substances. Sulphurous waters are found at Harrogate, Barèges, etc. They have a characteristic disagreeable odour like that of rotten eggs.

The three first substances are freely soluble in water; the last is very scantily soluble.

Strong solutions of these soluble salts excite active inflammation of the skin; weak solutions stimulate the skin, augment its supply of blood, and increase perspiration.

Baths containing these substances prove very useful in the chronic forms of some skin diseases, as psoriasis, eczema, and lichen; likewise in chronic rheumatism, chronic gout, and chronic lead poisoning. In these diseases the natural sulphurous waters are largely used as baths. Care must be taken not to employ them till the subsidence of the acute stage of eczema and psoriasis, otherwise they will much aggravate the rash. Obstinate forms of these skin diseases, rebellious to other treatment, often yield to these baths.

The good results of sulphurous baths, in cases of chronic lead poisoning, has been explained by the assumption that they eliminate the lead with the sweat. It is said that under the use of these baths, the skin becomes covered with innumerable black points of sulphide of lead; but to this it may be objected that the lead thus blackened is deposited

on the skin from without, not eliminated with the perspiration. This objection, however, is met by the assertion, that if a lead-poisoned patient carefully abstains from all contact with lead, yet, as often as he uses a sulphurous bath, his body still becomes blackened, time after time. It is difficult, on theoretical grounds, to understand how this metal can be eliminated with the perspiration; but for the further consideration of this point we must refer our readers to the section on lead.

The use of these baths at a very high temperature will often restore much of their suppleness to joints much distorted and stiffened by chronic rheumatoid arthritis. Yet as other baths of like temperature appear to do equal good, it is difficult to say whether the sulphides play any part in the beneficial results, although it is true there is a wide-spread belief in their efficacy.

A very efficient application to cure itch is made in the following way:—Boil one part of quicklime with two of sublimed sulphur in ten parts of water, until the sulphur and lime combine. The solution should be allowed to stand, and should then be decanted. Metal vessels should not be used in its preparation. The liquid solution is to be painted over the body after it has been well cleaned by a bath and wiped quite dry. This application is rather irritating, and sometimes produces roughness of the skin, which may continue some time after treatment. Dr. Bourguignon, who introduced this plan, claims to cure the patient by it in half an hour.

Taken into the stomach, the sulphides are in part decomposed by the acids they encounter there, and disagreeable eructations of sulphuretted hydrogen gas are often given off.

The sulphides in small doses excite a sensation of warmth at the epigastrium, but in excessive doses they produce active inflammation in the digestive canal, with its customary symptoms.

Small doses act as slight irritants to the intestines, and determine slight relaxation of the bowels. It is supposed that sulphur acts as a purgative, by its conversion into a sulphide through the agency of the alkali of the bile, (vide p. 65.)

These substances are employed in cases of poisoning by certain metallic salts. They precipitate the metal in the form of an insoluble sulphide, and so render it harmless. There is, however, danger of giving the sulphide in too large a quantity, when in its turn it would itself excite inflammation of the stomach; wherefore sulphide of iron is often recommended as in most instances preferable to the alkaline sulphides.

Their effect on the blood after absorption into that fluid is at present unascertained.

Persons who habitually breathe air impregnated with sulphuretted hydrogen certainly suffer from great anæmia, and the gas appears to cause much depression of the functions of the body.

When taken by the stomach in over-doses, they produce insensibility and speedy death. It has been doubted, however, whether this result is not due to the effect of these substances on the stomach itself, and not to their absorption into the blood and conveyance to the nervous centres; for it appears from Bernard's experiments, that sulphuretted hydrogen injected into a vein is so quickly eliminated by the lungs, that the arterial blood is uncontaminated by this gas, and consequently the nervous centres cannot be affected by it.

These substances may be very usefully employed in certain troublesome diseases, and often yield very striking results.

Thus, when taken by the stomach, they possess decided influence over the suppurative process.

The influence of the group on the suppurative process is easily made manifest. Thus when sulphide of potassium or calcium is administered, a thin, watery, unhealthy discharge from a sore becomes at first more abundant, afterwards diminishing, and throughout continues thicker and healthier, possessing indeed the characters of "laudable" pus. The condition of the sore improves correspondingly, and its healing is promoted.

The sulphides appear often to arrest suppuration. Thus in inflammation threatening to end in suppuration they reduce the inflammation, and avert the formation of pus. This effect

is manifested when sulphur compounds are employed locally in acne indurata; but further on I shall speak more in detail concerning their employment in this eruption. The influence of this group is still more conspicuous after the formation of pus. They then hasten maturation considerably, whilst at the same time they diminish and circumscribe the inflammation. They promote the passage of the pus to the surface and the evacuation of the abscess. Their efficacy may be frequently demonstrated in cases of the following kind. An unhealthy child, from six to twelve months old, suffers from a slight sore-throat, occurring perhaps in scarlet fever or measles. The sore throat produces considerable enlargement of the glands behind the angle of the jaw, and the swelling, of stony-hardness, may be sufficiently large to interfere with swallowing and to push the head on one side. Suppuration takes place, but is very deep-seated, and for a long time there is neither redness of the skin nor fluctuation, and the pus very slowly makes its way to the surface, so that a fortnight, three weeks, or even a month may elapse before the abscess bursts, or is fit to be opened, when a deep hole is left, with considerable induration around it. The pain and constitutional disturbance are so great that the child sometimes dies; and even if this termination is averted, the deep discharging hole heals very slowly owing to the indurated and unhealthy state of the adjacent tissues. In such a case if a tenth of a grain of sulphide of calcium, mixed with a grain of sugar of milk, is given every hour or two, the results are most striking. The swelling becomes smaller, the pus reaches the surface in four or five days, and when it is evacuated leaves a benign wound which quickly heals. The effects of these remedies are equally conspicuous in mammary abscesses, although in rare instances they appear temporarily to increase the pain—a remark which seems sometimes to hold good with respect to boils. But as a rule the pain is speedily mitigated. Singular to say, I have found these remedies of much less use in forwarding the maturation and expulsion of pus in indolent buboes, but in such cases my experience of their use has been but small.

It may be urged that it is difficult to imagine how these remedies can produce effects so different and apparently opposite as the dispersion of inflammation in one case and the expulsion of pus in another; but poultices and hot fomentations certainly possess the property both of subduing inflammation and of preventing suppuration, and in other cases of hastening considerably the evacuation of pus.

In boils and carbuncles these remedies yield excellent results. A tenth of a grain of sulphide of calcium, given every two or three hours, generally prevents the formation of fresh boils, while it lessens the inflammation and reduces the area of the existing boils, and quickly liquefies the core, so that its separation is much more speedy, thus considerably curtailing the course of the boil. Where the skin is not yet broken, and the slow-separating core therefore not yet exposed, the sulphides often convert the boil into an abscess, so that on bursting, pus is freely discharged and the wound at once heals, or if the centre of the hardened swollen tissues is not yet dead, the pustule dries up, the inflammation subsides and a hard knot is left which disappears in a few days without the formation of a core and without any discharge. These remedies meanwhile improve the general health, removing that debility and malaise ordinarily so markedly associated with these eruptions. In some cases, however, as in the deep-seated boils and abscesses of diabetes, they are powerless. In carbuncles the sulphides will generally be found equally serviceable, melting, as it were, the core into healthy pus, and so quickly expelling the dead and otherwise slow-separating tissue. In abscesses and carbuncles it is useful to apply belladonna over the inflamed part to reduce inflammation and allay pain. The skin should be thickly smeared with equal parts of belladonna and glycerine, and over this a poultice should be applied, renewing the smearing each time the poultice is changed. Poultices, however, being liable to bring out a fresh crop of boils, it is well to smear belladonna ointment some distance round but not over the boil, and then to apply a poultice, the greasy application thus pro-

tecting the neighbouring tissues. Or, still better, apply a belladonna or opium plaster on leather, with a hole the size of the boil, around the swelling, and through the opening smear glycerine and belladonna, covering all with a small poultice. The leather plaster efficiently protects the surrounding skin and averts the production of fresh boils. I have thought it worth while to mention these useful plans of protecting the boil; but it is scarcely necessary to observe that whilst investigating the effects of sulphides I have employed them alone, or at most sometimes using only a poultice.

The good effects of sulphides are conspicuous in certain scrofulous sores not uncommonly seen in children. Scrofulous children during the first few months are sometimes subject to indolent abscesses in the cellular tissue which run a very slow indolent course. At first only small hard substances are observable, no larger than a pea, under the skin, which is of natural colour, and movable over them. The small substances next suppurate and gradually enlarge, the skin becomes adherent to them, and changes in colour to red or even violet, while sometimes in their neighbourhood the smaller vessels become enlarged and even varicose. They may grow to the size of a florin, and when maturated feel soft and boggy. After a time a small circular opening appears, not larger perhaps than a pin's head, through which escapes a thin unhealthy pus. If deep-seated, as on the buttocks, or in fat children, there may be very little or no discoloration of the skin. The chief noticeable character then is the small sharply-cut opening, as if a piece had been punched out. These formations follow one another, and may continue to distress the child for months or years. In mild cases a few only may form, whilst in severe cases there may be at one time ten or a dozen in different stages of development. When they heal they leave a white, sharply defined, but not deeply depressed scar. On the administration every hour or two of a tenth or twentieth of a grain of sulphide of calcium the following effects occur:—New formations seldom

appear, although for months or years the child may have been infested with them. Many of the abscesses, especially in a very early stage of development, dry up and disperse, others generally speedily come forward and discharge their contents, the pus being laudable, instead of thin and unhealthy. The abscesses already in an open state improve, their pus becoming healthier, and the wounds healing speedily.

In some cases, in addition to these subcutaneous formations, the bones also become affected. The phalangeal bones of the hand are most frequently attacked, but not uncommonly the metacarpal, and more rarely the metatarsal. Where the phalangeal bones are affected, one or several of the fingers become nodose. For a long time the skin remains pale and freely movable, but after a time suppuration ensues, when the swelling increases, the skin becomes red and painful, and, after a time slowly softens at one point, remaining boggy for a considerable time before the abscess opens naturally. Then generally a little bone separates, or in bad cases the whole of the shaft comes away, leaving the epiphyses behind. When an opportunity occurs to examine these bones before suppuration sets in, the shaft is found considerably enlarged, very pale, and the cancellous structure infiltrated with a straw-coloured firm substance, whilst the epiphyses and their cartilages are healthy. Even an affection so severe as this may be considerably benefited by sulphides. Thus before suppuration has set in, or whilst it has made little way, they often remove the swelling, though large doses may be required. After much suppuration, their good effects depend in a great measure on the amount of the disease of the bone. If the whole shaft becomes necrosed, of course the sore will not heal till this has been got rid of; but suppuration often occurs and yet but little, or perhaps none, of the bone dies. In such a case the sulphides hasten the expulsion of the pus, and if before they are employed the skin is already broken, they improve the character of the wound and the discharge, and the sore heals, leaving a sunken scar

adherent to the bone, whilst the finger slowly assumes its natural proportions. Large indolent abscesses may form on the back of the hands or feet. These are similarly affected by the sulphides. Whilst these remedies are thus influencing locally these strumous formations and abscesses, the child's health greatly improves, although failing previously, in spite, perhaps, of the administration of cod-liver oil and steel wine. That the improvement is due to the sulphide is shown by the fact that the amendment occurs where only this drug is administered. On prematurely discontinuing the sulphide, fresh formations are apt to appear, especially on the occurrence even of a slight illness; indeed, a severe illness will often excite a few fresh abscesses, in spite of the sulphides.

The sulphides appear to me to exercise a very beneficial influence in suppurating scrofulous glands in the neck. Here again they hasten the elimination of the pus, and subsequently the cheesy scrofulous matter. After the abscesses have burst, and continued slowly discharging a scanty, unhealthy pus, and when the edges of the sores have become much thickened and indurated, these remedies render the discharge more abundant, thick, creamy, and healthy, considerably hasten the evacuation of the scrofulous matter, which prevents the healing of the wound, and at the same time soften the round indurated edges, so that the sore heals much more speedily. If small doses appear to affect these sores but little, larger doses, as half a grain or a grain, should be given several times a day, or even every two hours. I need hardly say that to compass the results described, the treatment must be continued several weeks, for it is vain to expect them to occur in a few days, when the sores have been discharging perhaps for months or even years.

The topical effect of sulphur ointment, or of an ointment of the hypochloride of sulphur, or, still better, of the iodide of sulphur of the Pharmacopœia, is very marked on acne indurata and acne rosacea. Here, again, the effects are twofold, and even opposite, according to the stage of the eruption. If applied at the very commencement of the erup-

tion, as soon as the little hard knot is felt under the skin, further development is arrested, and the hardness speedily disappears. For instance, if smeared over the hardness just before going to bed, in the morning scarcely any induration will be felt, though after a time, perhaps from exercise, or the irritation from washing, much of the hardness may return, to be again removed by a renewed application of the ointment, so that in two or at most three days a papula that threatened to become of considerable size may be completely dispersed. When, however, the nodule has advanced further, and suppuration has set in, then the effects of the ointment are much like those of sulphides, administered internally, on boils. The ointment hastens maturation, limits the swelling and hardness, and thus considerably curtails the duration of the eruption. Nay, further, if rubbed over the skin it appears to check the formation of the acne spots. If rubbed over the nose and neighbouring parts of the face in acne rosacea its effects are often striking. Not only does it act as in acne indurata, but the hardened, swollen tissues become softened and reduced to a more natural state. I have found the iodide of sulphur useful likewise in bromic acne, reducing the eruption, or at least, lessening considerably the size of each spot. In acne the ointment should be thickly smeared over the eruption night and morning.

Anyone who gives the sulphides a fair trial in the foregoing cases will, I feel confident, have reason to be gratified with the result.

A formula adopted by the author is a mixture of much the same strength as the Harrogate waters. Thus, he directs a grain of the sulphide of calcium (the member of this group which he always employs) to be mixed with half a pint of water, and of this a child should take a teaspoonful hourly. It must be carefully borne in mind that the salt rapidly becomes oxidized and changed into a sulphate, so that in a very short time none of the sulphide remains; consequently it is essential that the medicine should be compounded daily. It is still more convenient to give the sulphide in powder, in doses

for an adult of one-tenth to one-half of a grain mixed with sugar of milk, taken hourly, or every second or third hour as the case may require. Four to six powders daily is usually sufficient; a child should take one-tenth or one-twentieth of a grain.

It may not be amiss to mention that, in employing these agents in baths, porcelain or wooden vessels must be used, as the sulphides attack and discolour most metals. These baths emit an offensive and powerful stench.

CHLORINE GAS.
CHLORINE WATER.
CHLORINATED SODA
CHLORINATED LIME } **and their solutions.**

These substances are used as deodorizers, disinfectants, and antiseptics.

Whatever power they possess in these respects, is due either to chlorine or to hypochlorous acid.

Chlorine gas possessing very strong chemical affinities, acts probably by seizing with avidity the hydrogen from many organic and inorganic substances, and thus breaks up their composition.

Hypochlorous acid, which is given off abundantly by the two last-mentioned members of the group, is an active oxidizing agent. It yields up its oxygen readily, and so destroys many substances: at the same time chlorine gas is set free, which again acts in the way just described.

These substances are thus deodorizers, destroying the ammonias, sulphuretted hydrogen, and sulphides of ammonium, on which the disagreeable odours of sick rooms depend.

Chlorine, from its gaseous state, is admirably suited as a deodorizer, as it penetrates every cranny of the room, searching out and destroying noxious and offensive gases.

While these substances may be conveniently and profitably used as deodorizers, it must always be borne in mind that it is preferable to prevent bad smells by free ventilation, and that chlorine gas itself has an odour very disagreeable to most people. If these deodorizers are often required in a sick room, it is a sure sign that ventilation is defective, and probably that the nurse is careless.

These substances are employed as disinfectants, but the evidence in favour of their possessing such a property, although very generally held to be sufficient, is inconclusive.

When treated with these substances, some infecting matters, it is true, lose their power to propagate disease; but it is impossible to subject either persons or things to such destructive action as was found to be required in these experiments. It is not, however, the less desirable to fumigate rooms lately occupied by sick people, as the process can do no harm, and is probably highly salutary.

To disinfect unoccupied rooms, the air must be very strongly impregnated with chlorine. M. Regnault recommends the following plan:—Sew one pound of chloride of lime loosely in a strong canvas bag and put it into a mixture composed of a pint and a half of commercial hydrochloric acid with four and a half pints of water. The room is then closed and the chimney outlet blocked. After twenty-four hours the room should be freely ventilated for forty-eight hours.

Besides destroying many offensive gases, these substances prevent decomposition; hence they are useful as washes or injections to prevent the decomposition of the pus of sores or cavities of the body. Sloughing, foul-smelling sores should be washed with solutions of these or similarly acting substances. Chlorine compounds, being slightly stimulating, improve the condition of indolent sores. After an operation, it sometimes happens that hollows are left, in which pus collects and putrefies. The fetid gas and putrid pus becoming absorbed, poison the system. This may be avoided by washing out the cavities several times daily with a weak chlorine

solution. In puerperal peritonitis, or at any time when the uterus contains decomposing matters, the vagina must be thoroughly and frequently washed out, and it is desirable to add some deodorizing and antiseptic substance to the injected water.

In empyema, after the chest is opened spontaneously or artificially, the putrefaction of the contained pus must be prevented by washing out the cavity with antiseptic substances. In sloughing of the throat, as of scarlet fever or diphtheria, and in salivation and ulceration of the mouth, the smell and putrefaction are removed by washing with similar solutions.

A strong solution of chlorinated soda applied to the throat in diphtheria has been highly recommended.

The deodorizing and antiseptic substances chiefly in use besides the members of this group, are iodine, permanganate of potash, and carbolic acid. Solutions of permanganate of potash, unless unnecessarily strong, are bland and unirritating; while the chlorine and carbolic acid solutions are stimulating, and even irritating. Carbolic acid in some respects is inferior to the members of this group. Both arrest or prevent putrefactions, but carbolic acid manifests no power to destroy offensive gases.

IODINE.

Iodine possesses powerful chemical affinities, and combines energetically with many organic and inorganic substances. It is volatile, and readily penetrates the animal textures.

It is applied to the skin for a variety of purposes. A strong solution, as the liniment, is frequently used as a rubefacient and counter-irritant. It produces at first a sensation of heat and burning, which may increase to an unendurable extent. The inflammation it excites separates the cuticle to a greater or less extent from the dermis. So slight may this be that in a few days mere desquamation results; but if the liniment is

a strong one, even a blister, containing serum with much fibrin, is rapidly produced, leaving sometimes a permanent scar—a misadventure which it need hardly be said should be carefully avoided.

The skin can generally bear two lightly painted coats of the pharmacopœia liniment, unless a previous application has rendered the skin thin and delicate, when one coat, lightly applied, is all that can be endured. If, as sometimes happens, the application causes much pain, the iodine should be washed off with spirits of wine, gin, whiskey, or eau de Cologne, or, best of all, a solution of iodide of potassium, and the pain subdued by the application of a poultice. Iodine liniment will often excite a crop of itching papules at and around the painted spot.

The liniment applied to the chest as a counter-irritant in chronic pleurisy is used to promote the absorption of the fluid accumulated in the pleura. Painted under the clavicles in the chronic forms of phthisis, it is of great service to allay harassing cough, and to check secretion from the bronchial tubes and cavities of the lungs. Painted over the front and back of the chest it often affords relief in chronic bronchial catarrh by easing the cough and lessening expectoration. It may also be painted on any part of the chest affected with pleurodynic pains, although a mustard poultice is preferable, as it can be re-applied should the pain return. The iodine, however, may succeed where the mustard poultice fails. Iodine is painted around joints affected with chronic rheumatism or chronic gout, or with chronic synovitis. Like blisters, it eases the pain, and often removes the fluid distending the cavity of the joint; like blisters, too, it often causes, for a few days, increased distension of the joint, its good effects not becoming apparent till later. This increase in the swelling may be regarded as an indication of the success of the application. The liniment is useful when painted on the skin over a bronchocele. It should be applied as often as the state of the skin will permit, till the tumour disappears. It can seldom be borne oftener than once a week. The liniment or tincture

is recommended as a local application to lupus. It must be painted, not only on the edges of the sore, but also over the tissues around it. Thus applied, it is said to arrest the spreading of the disease. In the form of ointment its applications are manifold. It is of the greatest benefit in chilblains, if well rubbed over the affected part before the skin is broken. The tincture lightly painted over the part is often used for chilblains, but the ointment is far more efficacious, curing the chilblains in one or two days if the skin is unbroken.

The ointment is often useful in removing some of the non-inflammatory pains of the chest. These, however, not being always of the same nature, discrimination must be exercised in the employment of this ointment. When the pain is situated in the muscles (myalgia), and these are tender on pressure, while the skin may be pinched without pain, this ointment is indicated. But if the tenderness is situated in the skin (pleurodynia), belladonna is to be preferred. The author believes Dr. Hare first pointed out this distinction, and it is one which holds true, but not without exceptions.

The ointment, tincture, and liniment of iodine are used for the same purposes; but it must be recollected that the ointment and tincture are much milder preparations, and will produce, even after several applications, but a small amount of desquamation. When a strong irritant action is needed, the liniment must be employed.

The tincture or the ointment is applied often to the skin, over indurated swollen glands, or over parts thickened by inflammation, with the intention of removing the diseased products; when painted over scrofulous glands or glands sub-acutely inflamed, care must be taken, or sometimes the applications increase the inflammation and favour suppuration. Iodine mixed with light oil of wood tar in the proportion of two drachms of iodine to an ounce of oil of wood tar, has been recommended by Mr. Coster, as an efficient application in tinea tonsurans. This application usually produces no pain, and without doubt prevents the extension of this troublesome disease.

The liniment, ointment, or tincture, will, by its irritant action, remove herpes circinnatus. One application of the liniment is enough, but the ointment or tincture must be applied once or twice daily.

The spreading of erysipelas, it is stated, may be arrested by painting the affected and circumjacent skin with a solution of iodine.

Mr. Jordan and Dr. T. K. Spender speak highly of the local application of the liniment in the neighbourhood of local inflammation. If applied so as to produce vesication around a bubo, an abscess, or a carbuncle, it considerably reduces inflammation.

In hydrocele, iodine in solution is often injected into the serous cavity surrounding the testicle. The serous fluid is first drawn off, then a solution of iodine is injected into the cavity, which, exciting in the parts over which it flows, adhesive inflammation, the contiguous parts of the sac become united, and the further effusion of serum is rendered impossible.

Iodine solution is injected into joints affected with white swelling, into the cavity of the pleura in empyema, into ovarian tumours after tapping, and into large abscesses, after they have been evacuated. Ten ounces of the tincture, and even more, may be injected into an ovarian sac. The results of the cases thus treated are most satisfactory, and if the testimony of its advocates is not overdrawn, it is surprising that this treatment is not more widely employed. In the treatment of white swellings, it is said to produce no disagreeable symptoms; and unless there is caries or necrosis of the bones, or swelling of the surrounding parts, this treatment is generally favourable.

In chronic pleurisy, after the side has been evacuated, iodine injections remove the great fetor often present, arising from the decomposition of pus in the pleural sac, and at the same time diminish the secretion from its walls. The injection must be at first weak, say four or five grains of iodine and iodide of potassium to a pint of water. When the struc-

tures have become accustomed to this injection, a stronger solution may be employed. Although no doubt such treatment is often successful, still it must be adopted with the greatest caution, otherwise inflammation, with high fever, may set in, and prove fatal to the patient.

Milder injections containing permanganate of potash, or a small quantity of creosote, are sometimes all that is required; and if these succeed in removing the fetor from the pus, the more powerful application need not be employed. Since the wasting, the loss of appetite, and depression in cases like these is mainly traceable to the absorption of poisonous gases and putrid fluids, it is of the highest importance to keep the sac free from foul gases and decomposing pus.

Iodine solutions injected into the cavities of large abscesses after their contents have been discharged, often prove very serviceable. The tincture itself may be freely used; the cavity of the abscess should subsequently be kept clean and sweet by frequent washings with a weak solution of permanganate of potash. Iliac and lumbar abscess may be treated in this way. The tincture of iodine may often be used as an inhalation, with signal benefit in the four following instances.

In the chronic forms of phthisis (fibroid lung), when the expectoration is abundant, and the cough troublesome, an inhalation used night and morning will generally lessen the expectoration, and allay the cough.

Children, six to ten years of age, after measles, or independently of it, on exposure to cold, are seized with hoarseness, a hoarse hollow cough, and some wheezing at the chest. The parts affected appear to be the larynx, trachea, and larger bronchial tubes. This affection often proves very obstinate, is apt to return, and to continue a considerable time; but iodine inhalations will generally cure it.

Iodine inhalations have proved of great service in some epidemics of diphtheria. Dr. Waring-Curran recommends the following mixture:—4 grains of iodine, 4 grains of iodide of potassium, 4 drachms of alcohol, and 4 ounces of water.

A teaspoonful of this should be added to boiling water, and the steam inhaled. The water should be kept hot by a spiritlamp. As the patient becomes accustomed to the iodine, the quantity of the solution may be increased till half an ounce of it is employed at each inhalation. It should be repeated many times a day, and each inhalation continued from eight to twelve minutes.

Patients of various ages are greatly troubled, often for many years, with daily attacks, lasting, it may be several hours, of sneezing, running at the nose of a watery fluid, weeping of the eyes, and severe frontal headache. This affection is often removed at once by iodine inhalations.

The author adopts the following simple, handy, and cleanly plan of inhalation :—A jug, capable of holding about two pints of water, is well heated by rinsing with boiling water; then partially filled with boiling water, into which twenty or thirty drops of the tincture of iodine are poured; the patient is then directed to put his face over the mouth of the jug, and to breathe the iodized steam; both the jug and the head of the patient being covered with a towel to prevent the escape of the steam. This inhalation should be used night and morning, for five minutes, or a little longer. Too much iodine will occasionally produce a sensation of soreness in the chest and throat, sometimes with redness of the conjunctiva, running from the nose, and pain in the head.

The inhalation is sometimes employed in chronic bronchitis; but the author thinks without much advantage.

The tincture may be employed with benefit to remove tartar from the teeth; and to stimulate the gums when these are beginning to recede, leaving the teeth exposed to become decayed. It should be painted over the gums close to the teeth.

An iodine gargle, made with two or four drachms of the tincture to eight ounces of water, has been recommended to allay mercurial salivation; and the tincture of iodine is applied to sores of the throat, syphilitic and simple.

Iodine taken into the stomach in undue quantity, irritates

and excites inflammation in the delicate structures of this part, inducing pain at the epigastrium, vomiting, diarrhœa, sometimes much collapse, and even death. It should be given soon after a meal, when the mucous membrane is protected by the food contained in the stomach.

When this substance reaches the stomach or intestines, and certainly when it enters the blood, theory would suggest that the iodine would become converted into either an iodide of potassium, or, more probably, of sodium, and that thenceforth, in its career through the body, it would manifest the effects of an iodide. Practically there is much to confirm this view, as the action of iodine is very generally admitted to be identical with that of the iodides on the distant organs of the body. Yet some practical authorities state that in chronic rheumatic arthritis the tincture of iodine is serviceable when iodide of potassium fails. It is certainly difficult to understand how this should be.

Iodine may be used as a deodorizer and disinfectant in contagious diseases by simply suspending a chip-box or saucer containing a few grains over the patient's head.

IODIDE OF POTASSIUM.

This being an extremely soluble salt, and endowed with a very high diffusion-power, it finds a ready entrance into the blood, and as speedy an exit from it with the secretions of the body.

As an external application, it formerly enjoyed more favour than it at present holds. As an ointment, it is often applied to the skin over enlarged glands, or parts thickened with inflammatory products, with the view of restoring the tissues to their natural state. In conjunction with the internal use of iodide of potassium, the ointment, applied to obstinate nodes, hastens their resolution, and it is especially useful when this salt disagrees, causing nausea, diarrhœa, or

great prostration. The ointment is sometimes applied for the itch. The ointment of this salt, or of iodine, is often applied in bronchocele.

According to most authorities, the iodide, probably after its absorption into the blood, produces decided changes in the mucous membrane of the mouth. It causes redness and injection of the lining of the cheek, the throat, soft palate, and of the tongue, and an increased growth and separation of the epithelium covering these parts, and an augmented flow of saliva. These phenomena, however, are certainly often absent after large doses of the medicine, and even in severe iodism. It has a saltish taste.

A large dose proves an irritant to the stomach, and disorders digestion. Some are much more prone to be thus affected than others; and so marked is this difference that even minute medicinal doses sometimes irritate the stomach.

Like the chloride of sodium and chloride of ammonium, this salt increases the production of mucus from the stomach and intestines, as well as from the mucous membrane of other parts of the body. When such a result is desired, we resort to the chloride of ammonium in preference to this salt.

From its great diffusion-power it passes with great rapidity from the stomach into the blood, and very speedily appears in the urine. Only a small proportion, therefore, passes into the intestines, and generally it purges only when taken in very large doses; but it is never employed for this purpose.

Some maintain that when iodide of potassium comes in contact with chloride of sodium, either in the stomach or blood, it changes its base, becoming iodide of sodium. At present we know but little what physical or chemical changes it produces in the blood; nor know we much regarding the organs to which it is carried.

If its administration is continued for a long period, or if the patient manifest great susceptibility to its action, we produce a condition termed iodism.

Many persons can take this drug in very large quantities for an almost indefinite time without the induction of iodism, while others suffer from it even after very small doses.

In iodism, the tissues most frequently and most severely influenced by this drug are the mucous covering of the eyes and lining of the nose, frontal sinus, and mouth, with the skin of the face. Some slight running at the nose is first noticed, with occasional sneezing, and a little frontal headache; these symptoms becoming more marked when the conjunctiva is injected, and the tears flow abundantly. The loose tissues about the orbit become swollen, reddened, and œdematous, and occasionally a peculiar rash appears on the skin of the face. This is at first noticed around the eyes, after which it attacks the nose and its neighbouring parts, and then the chin. The parts in the order here stated are most severely affected by it. The nose is sometimes reddened, especially at the tip, and is rather swollen. The rash does not always present the same appearance. It is often very much like acne, and is always hard, shotty, and indurated, but the papules may be broad and large, and covered with what looks like a half-developed vesicle or pustule. The changes in the mouth have already been mentioned, when speaking of the influence of this medicine on that part. With some persons the stomach is at the same time deranged, although in the author's experience this organ often escapes when the face is affected; on the other hand, the stomach sometimes suffers when the nose and eyes are unaffected. When the stomach is singled out by the iodide, it induces nausea, and a sensation of sinking at the epigastrium, with loss of appetite, and sometimes watery diarrhœa. A grain or even less may thus affect the stomach.

If on the occurrence of iodism the use of the drug is discontinued, the symptoms just described very speedily disappear; and the rash on the face, the running at the eyes, etc., will greatly decline in the course of twenty-four to forty-eight hours,

Iodides sometimes cause diuresis. In some persons iodides

produce a petechial rash. This rash almost always affects exclusively the leg, rarely extending above the knee, and rarer still to the trunk or upper extremities. It may, at first, take several days to produce this rash, but on continuing the medicine when the spots have disappeared, one dose of five grains may suffice to reproduce the rash in three hours. Sometimes on persisting with the medicine no fresh rash appears, and the old spots die away; while in other cases the rash lasts as long as the medicine is continued. This rash may be the only apparent effect of the iodide, but it is generally accompanied in a variable degree by a few or many of the symptoms of iodism. The salts of iodine differ with respect to the production of this rash; thus in many cases the ammonium salt is most apt to induce it, and the sodium salt the least liable; in other cases where the ammonium and potassium salts produce a large crop of petechiæ, the sodium salt is inoperative. Some persons are equally affected by each of these three preparations. In one case while the ammonium and potassium salts produced numerous petechiæ, the sodium salt failed to do so, but excited on the arms some erythema marginatum. The petechial rash is often preceded by a sensation of heat accompanied by some tenderness. The above facts disprove the assertion that either in the intestines or blood all iodides ultimately become iodide of sodium.

Iodide of potassium sometimes produces distressing depression of mind and body. The patient becomes irritable, dejected, listless, and wretched. Exercise soon produces fatigue and perhaps fainting. The appetite is generally very bad. These symptoms may arise from a very small dose of the medicine, and may occur without coryza or irritation of the stomach. It is important to bear this in mind; otherwise, the cause of the depression being overlooked, the medicine may be persisted in. On discontinuing the drug, these distressing symptoms disappear in one or two days. It now and then exceptionally happens that the symptoms just enumerated cease sometimes in a few days if the medicine is persevered in.

It appears that when the potassium salt is not tolerated, sometimes the ammonium or sodium salt can be borne. Thus, iodide of potassium in ten grain doses administered thrice daily produced so much headache, sneezing, and running at the nose, that it could not be continued, whilst the same dose of iodide of sodium was easily borne causing no headache, and only a little running at the nose.

Some maintain that a full dose of carbonate of ammonia or spirits of ammonia given with the iodide of potassium will obviate these symptoms of iodism. The author has many times put this recommendation to the test, but without any decided results, although it has appeared to him that the ammonia did occasionally somewhat control the iodism.

Ten grains of iodide of potassium taken at bed time often cuts short an acute cold in the head, especially if taken at the onset of the attack. It is much less efficacious if the cold attacks the lungs also and appears to be useless in influenza. In ten-grain doses several times a day it is said to cure that troublesome and obstinate affection, violent paroxysmal sneezing (see arsenic). It is likewise useful in chronic colds in the head.

The iodide is employed in a great variety of diseases. It is largely employed in syphilis, but is not equally efficacious in all its forms. It is most useful in secondary and tertiary syphilis, especially in the tertiary form, where mercury may do harm. When the health is broken, when mercury has been taken without good results, or when the bones are diseased, the iodide of potassium should be employed. Its action is conspicuously beneficial, especially when the disease fixes on the periosteum of the bones or fibrous structure of the softer organs, and forms what are called nodes. Its action on this form of the disease is almost magical. It soon subdues the pain; and if not of long standing the nodes quickly disappear. In the treatment of tubercular syphilitic skin eruptions, Dr. Neligan prefers it to a salt of mercury. It is of very great service when deep-seated and important organs are attacked by syphilis. It has been commended in

syphilitic iritis; but most authorities in this case prefer mercury. The secondary syphilis of children is best treated with mercury; yet the following somewhat rare form of syphilis is better treated with iodine. There is sometimes observed in children a few months or years old a syphilitic thickening of the periosteum, usually attacking the heads of several of the long bones, but sometimes also the shafts. The thickening is first felt around the bones; but as the disease advances the neighbouring soft tissues become infiltrated with a firm exudation, which may increase to such a degree that the implicated part of the limb becomes much swollen, the skin very tense and shining, and a little reddened. The affected parts are very painful. When the disease is seated at the head of the bones, the movement of the joint is not impaired. This disease, if long uncured, leaves permanent thickening and enlargement behind it; and so it sometimes happens that children with syphilitic teeth, and blind from syphilitic iritis, have the heads of several of the long bones considerably enlarged.

Other non-syphilitic periosteal thickenings yield likewise to this remedy.

The iodide of potassium has been recommended in mercurial salivation. The author agrees with those observers who believe that iodide of potassium often aggravates mercurial salivation; and yet the iodide appears sometimes undoubtedly beneficial. As the action of the iodide on the mercury in the system throws much light on this question, we will now shortly discuss it.

The mercury salts, like those of most other metals, form insoluble compounds with albuminous substances. These compounds are very generally soluble in the chlorides, bromides, and iodides of the alkalies, but especially in the iodides. Many metals are deposited from the blood in an insoluble form in the animal structures, and amongst other metals, mercury and lead. Iodide of potassium, by re-dissolving these two metals, brings them again into the circulation, and so re-subjects the system to their influence. But

iodide of potassium will promote the separation of both mercury and lead by the urine, and thus free the system from their pernicious effects. It has been said that iodide of potassium will disolve mercury compounds of albumen in the body, and bring them back into the circulation; and herein we have the explanation of a well-known property of this salt, namely, that of producing salivation in persons who have previously taken considerable quantities of mercury. If, after taking mercury for some time, a patient had then become salivated, it would naturally be anticipated that iodide of potassium would still further increase the ptyalism, and not check it. In other cases it might happen otherwise; for we have seen that the salt will effect the separation of this metal through the urine. In a case, therefore, where but little mercury has been taken, and for a short time only, but sufficient to produce salivation, the iodide of potassium, by quickly separating the metal from the system, would remove the mercurial symptoms, including the salivation. Should it ultimately prove that the increased elimination is due to the mercury being brought back into the circulation, and so under the influence of the kidneys, and that the iodide does not promote the exit of the metal in any other way, then the iodide must be simply harmful in mercurial salivation.

It has been said that this salt of itself will produce salivation, an effect which has been ascribed to the action of the iodide on the mercury in the way just explained; others hold, even where no mercury has been taken, that the iodide of potassium increases the salivary secretion to a variable amount in different people.

From the unequalled efficacy of iodide of potassium in eliminating lead from the system through the urine, this drug is employed in lead poisoning. Further on, when treating of lead, it will be shown how iodide of potassium, by virtue of its power of eliminating this metal, may prove useful in certain forms of gout.

It is of signal service in bronchocele, when the enlarge-

ment of the thyroid gland is due to hypertrophy, and not to cystic formations, or to other causes. Under the influence of this drug, hypertrophic enlargement often speedily diminishes. Its internal employment is often supplemented by painting the tincture or liniment of iodine over the swelling. Iodide of potassium is used too in other indurations or enlargements of the glands, as of the mamma or testicle though with less advantage than in bronchocele.

The iodides quicken the absorption of inflammatory effusions, such as occurs in pleurisy and in inflammatory thickening of organs. Sciatica and lumbago are sometimes relieved by iodide of potassium; although both, and especially sciatica, even, when the pain is worse at night, not seldom remain unaffected by it.

Chronic rheumatism, chronic rheumatic arthritis, chronic gout, especially the two former affections, are sometimes benefited by iodide of potassium. It should, however, always be borne in mind, that the pains of secondary syphilis, frequently resembling in all respects those of so-called chronic rheumatism, are frequently confounded with and included among the manifold affections termed chronic rheumatism. Some of the so-called cases of rheumatism relieved by iodide of potassium are probably cases of syphilis.

The pains which yield to iodide of potassium are mainly those marked by nocturnal increase of suffering which may be accepted as a strong indication for the employment of this medicine,—an indication holding true, whether the pains are referrible to rheumatism or to some other source. Syphilitic pains, as is well known, are generally worse at night, and so are the pains of many cases of chronic rheumatism, and it is in such cases of rheumatism that iodide of potassium is beneficial.

It is not uncommon to meet with persons, especially men who suffer with a pain in the head, generally throbbing in character, sometimes accompanied with intolerance of light, —a pain which may be felt over the whole head, or, beginning at the back of the neck, and passing over the vertex to

the brow. This pain, worse, or indeed felt only at night, becomes then almost unendurable; and, in the patients' vernacular, is fit to drive them out of their mind. The pain is apt to be increased by alcohol. The pain having passed away, the scalp is left very tender. Whether this form of headache is due to syphilis it is impossible to say, as it does not present its characteristic features. Iodide of potassium in ten-grain doses, repeated three times a day, will generally remove these symptoms.

Iodide of potassium is sometimes singularly useful in peptic and bronchial asthma. Five grains, or more, if needful, three times a day, may be required. Now and then its good effects are not manifested for some time, though possibly in these cases, larger doses would have brought relief sooner. Dr. Hyde Salter whilst admitting the great usefulness of this salt in some instances, is inclined to think that in the majority of cases it is useless. My limited experience leads me to think it more frequently useful than Dr. Salter admits.

Barrenness has yielded to iodide of potassium. It is to be presumed that sterility thus cured was due to syphilis.

It has proved of signal service in certain cases of chronic Bright's disease, even accompanied with considerable dropsy and very scanty urine. In these successful cases the urine considerably increased, the dropsy disappeared, while the general health simultaneously improved. Probably these patients owed their Bright's disease to syphilis.

The iodide has been recommended in tubercular disease and in cancer, but experience has failed to endorse this treatment.

Dr. Balfour recommends iodide of potassium in aneurism in from five to thirty grain doses continued for a considerable time, even twelve months, conjoined with the recumbent posture and a restricted diet. He narrates several cases strikingly confirmatory of this mode of treatment, and Dr. Chuckerbutty supports his statements.

Iodine has been detected in the blood, saliva, and in the milk, in the urine, even in the urine of the sucking child,

whose mother was taking iodide of potassium. Owing to its great diffusion-power, it is probable that it might be detected in all the fluids bathing the tissues or moistening the cavities.

It appears in a few minutes in the urine, and even still earlier in the saliva. The rapidity of its absorption is, of course, influenced by the state of the stomach and vascular system, the absorption occurring more slowly when these are replete. The statements concerning its influence on the various constituents of the urine are so discrepant, and the observations made on the subject so very imperfect, that at present our knowledge in this respect must be considered as untrustworthy. When the administration of this medicine is discontinued, it is rapidly separated from the body, and, even after large doses, soon becomes indetectible in the urine; indeed, every trace of it may vanish in less than twenty-four hours after withholding the drug. It is stated, that it may be detected in the saliva for some days after it has ceased to appear in the urine. This sounds doubtful.

In most diseases, five grains three times a day is generally sufficient. Sometimes, as in rheumatoid arthritis, and in cases of syphilis, no good is obtained until much larger quantities, as ten, fifteen, or even twenty grains are given at a dose.

Large doses of this medicine arrest the rapid sloughing of some syphilitic sores and promote the healing process. Full doses not uncommonly succeed when smaller ones fail.

For the removal of syphilitic nodes from the membranes of the brain, five to ten grains, repeated three times a day, is generally sufficient. The drug, not uncommonly at first, intensifies the pain, then the disease rapidly declines. In no affection does this medicine work such striking results. Iodide of potassium may be conveniently administered in milk.

BROMIDE OF POTASSIUM.
„ SODIUM.
„ AMMONIUM.
„ LITHIUM.

In physical and chemical properties these salts are closely allied to the corresponding iodides; yet in their action on the body, the bromides and iodides exhibit considerable differences.

When administered for some time, bromides occasionally produce an acneform rash and even boils; effects to be more fully described in a subsequent part of this section. Dr. Cholmeley reports some obstinate cases of acne cured by moderate doses of bromide of potassium.

As a local application to ease pain, or remove spasm, bromide of potassium, in five parts of glycerine, has proved useful it is said, in hæmorrhoids, fissures of the rectum, and in painful growths.

When bromide of potassium is taken in moderate doses for some time, or when large quantities are administered for a shorter time, it induces loss of sensibility in the soft palate, uvula, and upper part of the pharynx, evidenced by the absence of movement in these parts when they are touched. Zœpffel finds that bromide of potassium affects the reflex irritability but not the sensibility of the pharynx; thus, after its use, irritation of the throat will not excite deglutition, but the pain of operations is not lessened. He agrees with Voisin, that thirty grains may be insufficient to affect the pharynx, and that sometimes it may be necessary to repeat this dose two or three times a few hours apart. On account of this property the bromides are recommended to remove or lessen the excitability of the throat, preparatory to a laryngoscopical examination. It is even averred by some writers that merely brushing the pharynx and soft palate with a solution of the bromide, is sufficient to quell the irritability, so as to enable a laryngoscopic

examination to be made with ease. Many observers, however, doubt the efficacy of bromide for this purpose. Dr. Mackenzie considers that ice is the only means of lowering the excitability of the pharynx.

Assuming that the bromides possess the property of diminishing the sensibility of the pharynx, it has been surmised that they may exert a similar influence on the larynx, lessening its excitability, and may thus prove useful in those diseases accompanied by spasmodic contraction of the glottis, as whooping cough and laryngismus stridulus.

The discrepant statement concerning the influence of this remedy on these diseases can be reconciled in the following way:—

As to whooping cough, all observers must admit that some cases are altogether uninfluenced by this remedy; that it neither lessens the frequency nor the severity of the paroxysms of coughing. In other cases it appears, however, to control both the frequency and severity.

The bromide, the author believes, will be found serviceable only in simple uncomplicated whooping cough. If there is fever, or much catarrh of the lungs; if there is pneumonia, or tuberculosis; if the child is teething, and the gums are swollen, red, and painful; or if any gastric irritation exists, then this remedy fails till these affections have been met by appropriate treatment. These complications being removed, and the case reduced to a simple form, the bromide of potassium does certainly influence the disease, lessening both the frequency and severity of the paroxysms.

It is thus found to be of most service in the summer, or when the weather is genial and mild. Like other remedies for whooping cough, the bromides are more efficacious in some epidemics than in others.

The efficacy of bromide of potassium on laryngismus stridulus, is subject to conditions very similar to those which limit its usefulness in whooping cough. Any irritation, as from teething, must be removed before the remedy appears to manifest any power.

As, however, we possess in cold sponging, a cure for laryngismus stridulus, ready, prompt, and efficient, we need not often have recourse to the bromide. (See Cold Bath, p. 19).

The bromides are sometimes useful in whooping cough and laryngismus stridulus when complicated with convulsions. During a paroxysm of laryngismus stridulus or whooping cough, the obstruction in the larynx becomes not unfrequently so great as to produce very imperfect oxidation of the blood, and to cause partial asphyxia, resulting in an attack of convulsions. Convulsions, moreover, are not uncommon in laryngismus independent of asphyxia, unaccompanied with an attack of crowing. The early and less developed stage of these convulsive attacks being manifested in carpo-pedal contractions, squinting, &c. The recurrence of these convulsions can be controlled by the bromides, even when the disease is apparently otherwise uninfluenced.

With regard to laryngismus stridulus, cold sponging is generally sufficient to avert the convulsions; but in those cases where, from the effects of any irritation, cold sponging is ineffectual, the bromide of potassium, will, in most instances, avert the convulsions, obviating thus, one of the gravest dangers of this disease.

It occasionally happens, from the time of their birth, that children can swallow solids with ease, yet are choked every time they try to drink. This affection is in no way connected with diphtheria or any visible affection, or malformation of the throat. This curious affection may be much benefited by the bromide of potassium.

The bromides, so far as is at present known, appear to have very little influence on the stomach.

In certain diseases, these salts exert a beneficial influence on the intestines; for instance, in a form of colic, which sometimes affects children a few months to one or two years old. The walls of the belly are retracted and hard, while the intestines are visibly, at one spot, contracted into a hard lump, the size of a small orange, and this contraction can be

traced through the walls of the belly, travelling from one part of the intestines to another. These colicky attacks occur very often, and produce excruciating pain. This form of colic is unconnected with constipation, diarrhœa, or flatulence. Sometimes it is associated with a chronic aphthous condition of the mouth. It generally resists all other kinds of treatment, but will mostly yield at once to the bromides.

Like the iodides, these salts pass quickly into the blood, and we shall now treat of their influence on the organs to which they are conveyed by this fluid.

The experiments of Brown-Sequard, Meuriot, and Amory, show that bromides contract all the blood vessels, producing anæmia of the brain and spinal cord, thus diminishing the excitability of these organs. Certain experiments show that this contraction is probably owing to the action of bromide of potassium on the vaso motor nervous system. The six toes of both hind feet of a frog were quickly cut off, and during the following two minutes eight drops of blood flowed from the right leg and nine from the left. Another frog, after being poisoned by bromide of potassium was treated in the same way, but during the two minutes after amputation two drops only flowed from the right leg. The left sciatic plexus was then divided, thereby cutting off nervous communication between the limb and the vaso motor centres, and in two minutes ten drops flowed from the left leg.

Under the influence of bromide of potassium decided diminution of reflex irritability is observed in animals. M. Laborde applied bromide of potassium to the web of a frog's foot, and twenty minutes after its absorption reflex irritability ceased,—first in the posterior extremities. This diminution of reflex irritability is not due to the action of bromides on the muscular tissue, as the muscles contracted energetically on the direct application of electricity. Nor is it due to the action of the drug on the motor nerves, for after poisoning a frog and tying a ligature tightly round a nerve, electricity applied beyond the ligature excites muscular action, but when applied to the proximal side of the ligature, it induced no

reflex action. Dr. Amory thinks that the diminution of reflex irritability is due in part to alteration of the sensory nerves, but mainly to diminished supply of blood to the cord.

Bromide of potassium is used in a variety of diseases, but its virtues are chiefly conspicuous in convulsions.

It is serviceable in all forms of convulsions—in epilepsy, in the convulsions of Bright's disease, and in the convulsions of children, whether due to centric or eccentric causes. Although convulsions may be excited by many causes, it is probable that the conditions of the nervous centres producing the attack are in every instance identical; and it appears to be these conditions which the bromide controls.

In no disease is the bromide of potassium more efficacious than in epilepsy. But the bromide is not equally useful in all its forms, for this drug leaves attacks of *petit mal* often unbenefited. It is the convulsive form of epilepsy which is so remarkably amenable to the bromide, for in by far the greater number of cases, the fits, under its influence, become much less severe and less frequent. Even when of great severity, and repeated perhaps several times a day, the fits may be postponed for weeks, and even months; nay, in some cases, the fit has been delayed for years.

Cases of the convulsive form, however, occasionally occur, over which the bromide appears to exert no infiuence; the fits recurring as often and as severely as if no medicine had been taken. At present it is not possible to foretell when the medicine will succeed, and when it will fail. As might be expected, the effects of the drug are most marked when the disease is of short standing.

Dr Weir Mitchell recommends bromide of lithium in epilepsy. It contains a larger percentage of bromine than either the sodium or potassium salts, and it acts more powerfully, so that smaller doses may be given. Dr. Mitchell thinks the lithium salt succeeds sometimes when the potassium and sodium salts fail. As a hypnotic, he says, "it is superior to the potassium and other salts of bromine." Echeverria thinks it is inferior to the potassium salt in epilepsy, and superior as a hypnotic to the sodium and calcium salts.

Echeverria considers the potassium salt in epilepsy much superior to the ammonium salt. The ammonium salt is more disagreeable to the taste. In epileptic maniacal excitement Echeverria finds bromide of sodium far less serviceable than bromide of ammonium. He moreover asserts that bromides fail to suppress mental excitement in epileptics unless combined with some other narcotic, as conium, cannabis indica, hyoscyamus, chloral (15 to 20 grains each) or still better, ergot of rye.

Brown-Sequard thinks it advantageous to mix the potassium and the ammonium salts, this combination exerting a greater influence on epilepsy than either salt separately, and lessening the risk of bromism. Echeverria disputes these assertions.

In mild epileptic cases, ten grains three times daily is sufficient. If the attack occurs only at night the best way to avert it is to give, at bed-time, a full dose of thirty grains. Echeverria finds that the average dose required is sixty grains daily, but in severe cases a much larger quantity may be needed. In respect to the dose, Voisin says, "I have employed for many years a method which has given me the best results, and which consists in determining the condition of reflex nausea by introducing a spoon as far as the epiglottis. I have remarked that a therapeutic dose of the bromide of potassium is not attained till reflex nausea is suppressed; it is not till then that the bulb is certainly acted on, and its excite motory force diminished . . . . The study of other reflex phenomena, such as lachrymation, cough and sneezing, enables us to follow the action of the medicine upon the bulb and spinal cord. The dose should not be increased beyond the suppression of reflex nausea, but it should be given continuously for years together. If the malady be ameliorated or in process of cure, at the end of two years of amelioration, the remedy instead of being administered every day may be given every second, third or fourth day, provided reflex nausea be always and certainly absent." Voisin considers that the early manifestation of toxic effects is a good, and their late appearance a bad, augury.

If the patient is not cured, but only benefited, by the bromide, it may be continued for months or years. But its administration should be suspended at times for a week or ten days, otherwise the system becomes accustomed to it, when it losses its influence over the disease, so that not uncommonly the good effects so well marked originally, cease altogether, the fits recurring with their old severity and frequency. If the drug is withheld for a time in such a case, and then resumed, it again manifests all its previous efficacy.

It has been asserted that chloride of potassium in epilepsy is as efficacious as bromide of potassium; this statement, however, has been denied.

We have already spoken of the effect of bromide of potassium on the convulsions sometimes accompanying whooping-cough and laryngismus stridulus. The bromide will often succeed in all other diseases associated with general convulsions. Of course the exciting cause of the convulsive attacks should, if possible, be removed; but even when the cause is indetectible, this salt will often lessen or prevent the epileptiform attacks. The convulsions caused by intestinal worms sometimes resist this remedy completely.

Bromide of potassium will often check the convulsions resulting from simple meningitis, which sometimes persist after the decline of the inflammation, leaving serious damage behind.

Many writers extol bromide of potassium in teething, averring that it obviates irritability and restlessness, and prevents convulsions.

Dr. Begbie has much commended this salt as a soporific. The hypnotic effects, Dr. Clarke and many others consider due to the anæmia of the brain which these salts produce. Too much anæmia he asserts, induces wakefulness, whilst a less degree produces sleep. In this way he explains the different effects of bromide of potassium on himself. After unusual mental or physical fatigue which he asserts causes anæmia of the brain, forty or fifty grains of bromide of potassium by increasing the anæmia caused sleeplessness, but it

soothed and quieted him. When only wakeful from an ordinary amount of mental work, a state when the brain is in a hyperæmic condition, the same dose produced sound and refreshing sleep. Given when the brain receives only a usual amount of blood it produces unusually profound sleep. Voisin referring to his patients in the Bicetre says, "the hypnotic action upon them was very remarkable night and day. Some were obliged to sleep for a few minutes at a time in the midst of their work. None, in spite of whatever efforts they made to the contrary, could resist sleep directly after their evening meal." It has been found of especial use in obviating that sleeplessness and wandering at night, not unfrequently occurring during convalescence from acute diseases. Often, too, it is of service for the like symptoms during even the febrile stage of inflammatory and specific fevers, as pneumonia, rheumatism, and typhoid fever.

In sleeplessness from other causes, as worry, overwork, grief, dyspepsia, etc., it may be employed with the expectation of success. Besides sleeplessness, if the patient, although of abstemious habits, suffers from delirium, having the characters of delirium tremens, these remedies are especially indicated.

Bromide of potassium is often of conspicuous benefit in delirium tremens, removing the delusions, calming the delirium, and inducing sleep; and its efficacy is most apparent in the earlier stages, before the delirium becomes furious. It is, moreover, of great service in dispelling delusions which may remain after the partial subdual of the attack.

Dr. Clarke recommends salt in the insomnia accompanying mental anxiety, hysteria, pregnancy, and "a sort of hyperæsthesia, which I know not how to describe by any other name than general nervous irritability."

To produce sleep, twenty to thirty grains should be given at night; and should this prove insufficient, a like dose may be taken in the morning. Likewise twenty to thirty grains, or even more, may be given in delirium tremens every two hours, till the patient falls asleep. The salt often succeeds as

a soporific when opium fails. It increases the hypnotic effect of chloral, hyoscyamus, belladonna, cannabis indica, ether and chloroform.

Dr. Begbie recommends it for persons who have overtaxed their brain by study, or an over-strenuous application to business. It calms the excitement, procures sleep, and dispels the giddiness, noises in the ears, and perversions of the external senses, which often harass these patients. In such cases it is invaluable. He also recommends this salt in acute mania. It is useful too in the headache connected with grief or worry. Drs. Yandell and Davis of America, and Latham of Cambridge, have administered the bromides successfully in sick-headache, occurring in both men and women. It is serviceable where the headache precedes and predominates over the gastric symptoms; also when the patient is troubled with sleeplessness or dreamy unrefreshing sleep. Drs. Yandell and Davis find five or six grains generally sufficient, but they have given half a drachm three times a day. It is stated that an attack may be considerably shortened by taking a narcotic dose at the onset of the attack; the patient falls asleep and wakes free from headache. Dr. Wilks narrates the case of a gentleman, who, after a hard day's work would return home with a splitting headache, when on taking fifteen or twenty grains of the salt, he would fall asleep and in an hour wake free from pain.

Sometimes in the later months of pregnancy, a woman becomes at night the prey of the most frightful imaginings, labouring under the impression that she has committed, or is about to commit, some great crime or cruelty, as the murder of her children or husband. The bromide dispels these delusions, and induces calm, refreshing sleep.

Dr. Clarke commends bromide of potassium in many of the distressing troubles incidental to "change of life," as timidity, irritability, broken sleep, apprehension of serious evil, flushings, numbness, and deranged sensations.

Bromide of potassium is of great service in the treatment of children subject to night screaming, a symptom which appears

to be allied to nightmare. Children from a few months to several years old may be attacked with this affection. Sometimes the attack occurs only once or twice a week, as is usually the case with older children; or it may be repeated several times each night. The screaming may last only a few seconds, or it may endure for several hours. While screaming, these children are generally quite unconscious of what is occurring around them, and cannot recognise, nor be comforted by, their friends. They are generally horribly frightened. A somewhat similar condition is met with in children a few years old, a state very similar to somnambulism, but sometimes apparently allied to epilepsy. The child gets out of bed while fast asleep, walks about the house, and performs as if awake, various acts, quite unconsciously. This state is not accompanied with any terror. With the screaming and fright, squinting sometimes occurs, which, after some time may become permanent. Bromide of potassium will prevent the screaming, and remove the squinting. This affection in children being connected very generally with deranged digestion, the condition of the stomach or intestines should be attended to; but even in spite of this derangement the bromide will give quiet and refreshing sleep.

The nightmare of adults will generally yield to the same medicine.

Men, but especially women, and usually townspeople, become subject to great despondency, at times so unendurable as to make them, as they express it, "feel as if they should go out of their mind." These distressing symptoms generally yield to bromide of potassium. It is soothing in hysteria, giving patients greater control over themselves and preventing hysterical paroxysms.

Dr. Begbie has used the same salt with great advantage in some cases of asthma and of diabetes. It occasionally relieves the pain of neuralgia.

It is also used with decided benefit in certain derangements of the organs of generation. Large doses are said to lessen the natural menstrual discharge. In some forms of menor-

rhagia it is equal, if not superior, to any remedy we possess; but it is more useful in the flooding of young than of old women. Over that form of flooding due to uterine tumours of various kinds it exerts less control than ergot and some other remedies. To check profuse menstruation, its administration must be regulated by the circumstances of the case. If the loss of blood occur only at the natural period, the medicine is then commenced about a week before: and when the menstrual flux has ceased, the remedy should be discontinued till the next attack is about to begin. On the other hand, if the loss of blood occurs every two or three weeks, or oftener, the medicine must be given without intermission till the loss is controlled; and when the discharge has been brought to its right period and amount, it will still be desirable to give a few doses for a short time before each monthly period. Ten grains three times a day is a dose sufficient in the flooding of young women but much larger doses are required in the more obstinate forms depending on organic changes in the womb. This remedy has been recommended by Dr. Begbie in puerperal mania and nymphomania. Dr. Clarke also says it reduces sexual excitement in those instances of hysteroidal excitement verging on nymphomania. Small doses are unavailing. Not less than twenty grains thrice daily will exert a decided control over excessive sexual propensity.

It also restrains spermatorrhœa. Its employment should be supplemented by cold sponging of the scrotum and perinæum, and the suspension of the testicles in cold water for some minutes, night and morning. Seminal emissions are generally excited by dreams, which may generally be avoided by abstaining from suppers and sleeping on a hard mattress. Dr. George Bird has pointed out that seminal emissions occur from undue indulgence in bed, the emissions taking place very generally early in the morning, during the second sleep. He recommends, therefore, that the patient should be roused after six or seven hour's sleep, and should never give in to a second sleep. Dr. Hardman of Blackpool tells me that he has cured some obstinate cases of spermatorrhœa, by direct-

ing the patient to empty his bladder on waking from the first deep sleep.

It proves useful in allaying various forms of hyperæsthesia, and sometimes eases the severe pain of chronic arthritis.

Dr. Da Costa finds that bromide of potassium lessens or even prevents many of the disagreeable symptoms of opium, as giddiness, confusion of mind, fainting, headache, and sickness. It manifests this effect over morphia and codia less than over laudanum. A large dose—20 grains—of bromide must be given half an hour before and two hours after the laudanum. Even larger doses are sometimes necessary; he even gives 40 to 60 grains some hours before the administration of the opium. Da Costa says the bromide exerts most control over the faintness. He avers also that the bromide heightens the "anodyne or hypnotic effects of opium."

If the medicine is continued for a long time, as is sometimes required in the treatment of epilepsy, the physiological effects of the drug become apparent. "Diminished sensibility, followed by complete anæsthesia of the soft palate, uvula, and upper part of the pharynx, is the first symptom that the patient is getting under the influence of the drug. The sexual organs are amongst the first to be influenced, for there is soon produced failure of sexual vigour, and after a time marked diminution of the sexual appetite itself" (Bazire).

These effects vary greatly; in some the remedy producing only moderate diminution, in others temporary impairment. On discontinuing the remedy the sexual organs regain their lost power. Another frequent result of the prolonged administration of the bromide, is an eruption, generally acneform, occurring most on the face and back, but it may affect even a larger surface. These spots do not generally suppurate, nor do they scar. Echeverria asserts that five or ten minims of liquor arsenicalis, given with the bromide, will prevent this eruption. I have found that iodide of sulphur ointment, frequently applied, considerably lessens the quantity and the severity of these eruptions. The efficacy of the remedy bears no proportion to the amount of acne. The bromide sometimes

excites, it is said, eczema and spots like erythema nodosum. The acneform spots may become true boils, and these boils sometimes form large ulcers with conical scabs, looking like rupia. Dr. Weir Mitchell narrates a case of this kind. He found that bromides of potassium, sodium, ammonium, and lithium, produced these ulcers. He tried also bromides of calcium, magnesium, and bromine itself, but as these preparations failed to control the epileptic fits they were not given long enough to determine if they too would produce these rupoid ulcers. Undue administration of the bromide renders a patient low-spirited, easily fatigued and unfitted for work, symptoms which soon subside on the suspension of the medicine.

Acne, and the other evidences of bromism, rarely occur, unless more than one dose, however large, is taken daily.

M. Rabuteau says that bromide of potassium may be detected in the urine and saliva twenty days after the administration of a dose of fifteen grains. Dr. Amory could not detect it more than forty-eight or fifty-two hours after a single dose, but for a much longer time after the drug had been taken several days. Elimination by the urine is less rapid than absorption by the stomach. Traces appear in the urine in ten minutes. Elimination is most active during the first eight or ten hours, and in less than twenty-four hours the greater part disappears.

Bromide of potassium is conveniently administered in beer or milk.

SULPHURIC, HYDROCHLORIC, NITRIC, PHOSPHORIC, AND ACETIC ACID.

The members of this group are powerful acids, and accordingly have a strong affinity for alkalies and bases. Some of them, as sulphuric and phosphoric acids, absorb water with avidity. They all possess a high diffusion-power, and so pass

readily through animal membranes and textures. These are the properties which explain most of their actions on the living body.

These acids, when concentrated, produce decided changes in the skin by their affinity for the bases and water of the tissues, as well as in a minor degree for the organic substances themselves. Their great diffusion-power enables them to penetrate readily and deeply beneath the surface, and to continue their destructive action till they are diluted with water or neutralised by the bases of the animal structures. From their greater affinity for water, sulphuric and phosphoric acids are especially energetic: they withdraw this element from the textures, and thus effect their complete destruction. Applied in adequate quantity, they will destroy the tissues to a considerable depth, and produce a brown or black eschar.

The remaining members of this group, owing to their feebler affinity for water, destroy the tissues less extensively, and their action is much more superficial.

Sulphuric and phosphoric acids are never used undiluted, on account of their physical action on the tissues. Nitric acid, on the other hand, is frequently employed to destroy and remove the surface of foul and unhealthy sloughs and ulcers; and, in virtue of a property of which we shall shortly speak, to change an unhealthy and indolent sore for one more healthy and prone to heal. Thus it is frequently employed in cases of soft chancres, indolent and broken bubo, cancrum labialis, etc.

Nitric, hydrochloric, and especially acetic acid, may produce some vesication. Nitric acid colours the skin characteristically yellow.

They are often used for the purpose of exciting inflammation, and often with the best results. It is now established that two diseased actions cannot co-exist actively in the same part. On this principle, we use one or other of the three acids, nitric, hydrochloric, and acetic. For instance to a patch of herpes circinnatus, we apply an acid, usually acetic,

thus cutting short at once a disease which tends to spread and to continue for a considerable time, and to establish in its place an inflammation which quickly subsides and disappears.

Thus it is that nitric acid induces a healthier action in indolent ulcers, or arrests the spreading of sloughing sores. Acetic acid, and somewhat diluted nitric acid, are frequently applied to warts, which they destroy by withdrawing the bases, and by dissolving the tissues of the warts themselves But although any of these acids are effectual, in many cases completely removing the warty growths, yet sometimes a fresh and abundant crop springs up in the neighbourhood of those undergoing treatment, Dr. George Bird finds the glacial acetic acid very effectual in removing warty growths.

Small syphilitic warts and condylomata kept constantly moist with a wash of diluted nitric acid are thus removed, certainly and painlessly. A drachm or two of the dilute acid to a pint of water is sufficient.

The members of this group are more generally employed as external applications mixed with water. Thus diluted, they still excite some irritation, and may be used for this purpose with great benefit as lotions in urticaria, controlling the very troublesome itching, even preventing the formation of wheals, and in some cases appearing to be mainly instrumental in the curing of this disease.

Acids, especially nitric and hydrochloric acids, are less employed now than formerly as baths, yet, beyond doubt, they exert a most powerful influence on the skin. A general bath, with two to eight ounces of the strong nitric or hydrochloric acid, is a very powerful exciter of a torpid skin.

What influence, if any, these baths bring to bear on the other organs of the body is at present quite unknown, no experiments having been made to settle this question. It is highly probable, however, that in common with other materials dissolved in baths, these acids remain unabsorbed by the skin, and that any change in the deep parts of the body resulting from their use must be ascribed to the direct action of

these agents on the skin. Profuse sweating can be effectually controlled in some cases by sponging the surface of the body with water weakly acidulated with acids. The sweat is an acid secretion.

To the skin, stripped of its cuticle, they act as stimulants; thus nitric acid is frequently used as a lotion in the treatment of indolent and painful ulcers, for which it is a very valuable application.

Applied to the softer tissues, the dermis, mucous membranes, etc., they act as astringents, causing a direct condensation of the tissues, probably by removing part of the base, by combination with which the albuminous substances were held in the soluble form.

By virtue of their astringency they check profuse secretions from unhealthy sores. Nitric acid is mostly preferred in such cases. Nitric acid is often used as a test for albumen in solution. As we have stated, it precipitates the albumen by abstracting it from the base combined with it, and in setting the albumen free, converts it into an insoluble substance.

These acids, when diluted, very effectually check bleeding from the smaller vessels and capillaries by constringing the tissues, exciting the muscular coat of the arteries to contract, and by coagulating the blood in the ends of the wounded vessels, and so plugging them. Thus vinegar, being always at hand, is valuable when diluted in checking bleeding from leech-bites, piles, cuts, etc.

Before speaking in detail of the action of acids on the various parts of the alimentary canal, it will save much repetition and render our course far clearer, if we make a few general preliminary remarks on the action of acids on the secretion of the various glands opening into the alimentary canal.

Repeated and careful experiments have established the fact that dilute acids taken into the stomach check its secretion; while, on the other hand, alkalies stand prominent among the most powerful exciters of the secretion of the gastric juice. From these facts the more general law is inferred, that acids applied topically check the production of acid se-

cretions from glands, while they increase the flow of alkaline secretions; the very reverse being the case with alkalies, which are inferred to check alkaline, but to increase acid secretions. This general law gains support by interpreting fully the effects, substantiated by experience, of acids on the secretions of the alimentary canal in disease. (See Alkalies, page 124).

Acids are powerful stimulants of salivary secretion and act through the cerebro-spinal nerves, supplying the salivary glands; and if these are divided, acids cease to augment the salivary secretion.

These acids produce the same effect on the mucous membrane of the mouth as on the skin, and for the most part are used for the same purposes. Thus, strong nitric acid is often applied to foul and sloughing ulcers of the mucous membrane to change their character and to check their progress.

Acids are in part neutralized by the alkaline secretion from the salivary glands, while any acid remaining free precipitates the mucus, coating the mucous membrane, and, if in sufficient quantity, attacks the mucous membrane itself. They act beneficially as astringents, when the lining membrane of the mouth is relaxed or ulcerated, as in ulcerative stomatitis, salivation, etc.; but other astringents are to be preferred. As these acids are apt to dissolve the earthy constituents of the teeth, they should, therefore, be taken through a quill, a glass tube, or a reed.

But nitric acid exerts a further action on the mucous membrane of the mouth, and may be given in small medicinal doses with conspicuous benefit when in various ways this membrane is inflamed or diseased, as in ulcerative stomatitis, apthæ, salivation from mercury, or when reddened, inflamed, and glazed, a condition not unfrequently met with in great irritation of the digestive organs.

These, with other acids, as citric, tartaric, etc., quell the thirst of fever patients much more effectually than plain water, especially if the drink is made rather bitter with some agreeable-tasting substance, as orange-peel or cascarilla. Much

of the troublesome thirst of fevers is not the expression of the wants of the general system, but is owing to dryness of the mouth and throat. This disagreeable local sensation is very liable to lead fever patients to drink more water than is really good for them, producing loss of appetite, indigestion, and even diarrhœa and flatulence.

The action of acids in lessening this thirst has already been explained. Acids, as we have seen, probably increase alkaline secretions, and thus the acid drinks used by fever patients promote an increased secretion in the salivary glands. Bitters, as we shall subsequently see, possess the same power, and hence it is that acid and bitter drinks, by their action on the salivary glands, keep the mouth and throat comfortably moist, and quench the thirst. By lessening the harassing thirst they quiet the patient, quell irritability of temper, favour sleep, quiet the pulse, and diminish the heat of the body; hence these medicines, especially the organic acids, are largely employed as fever medicines. They are applied to the throat for the same purpose as to the mouth. Thus, undiluted nitric acid acts beneficially as a topical application, on the foul sloughs or ulcers occurring in the course of scarlet fever or other diseases.

Bretonneau has strongly recommended the application of strong hydrochloric acid to the throat in diphtheria. The acid may be used undiluted, or it may be mixed with an equal part of honey, which gives the mixture consistence, and makes it cling for some time about the parts on which it is painted. It should be applied to those spots only of the mucous membrane attacked by the diphtheritic inflammation, not to the neighbouring healthy tissues, where it would produce active inflammation. The diphtheritic membrane being very prone to implant itself on inflamed surfaces, the application of the acid to the sound tissues might, by exciting inflammation, favour the spread of the disease. This treatment, however, is of little, if any, service, and in the author's experience fails utterly to check the progress of the inflammation.

Nitric acid, in small medicinal doses, may be given with

benefit when the throat presents the same appearances as those of the mouth previously described [*vide* p. 110].

The albuminous constituents of food are digested and rendered soluble mainly by the agency of acids: all acids are not epually efficient. Lactic and hydrochloric acids far outstrip all others in this respect, while sulphuric acid hinders rather than promotes digestion, by precipitating the albumens in an insoluble form. The action of acids on nitrogenous substances is greatly heightened by the addition of pepsin.

Thus, in scanty secretion of gastric juice, dilute hydrochloric acid may be employed to assist digestion. The considerations developed at the beginning of this section concerning the action of acids on acid secretions render it obvious that the time of its administration, in respect to the meals, is all important. If given before the meal, acids check the secretion of the acid gastric juice, and so hinder, instead of aid, digestion. When the secretion is scanty, the acid must be given after the meal, when the secretion from the membrane of the stomach is completed; then the additional acid will assist the action of that secreted naturally, but too scantily. In many cases of atonic dyspepsia, alkalies are preferable to acids; but they must, of course, be given a short time before a meal, because then they stimulate abundantly the secretion of the gastric juice. In most cases of atonic dyspepsia, alkalies, with the precautions noted, are superior to acids given after the meal, although, as is well known, certain cases occur wherein acids answer better than alkalies. In cases like these, the mucous membrane is presumably considerably damaged by excesses in eating or drinking, and owing to degeneration of the glands of the stomach, no stimulant could excite a sufficient flow of gastric juice.

Acids, as we have seen, will check or lessen the secretion of gastric juice. In many stomach diseases, or from sympathy with distant organs, the follicles pour an excess of acid into the stomach, which undue secretion may be checked by the administration of acids shortly before food is taken. But acidity of the stomach is often owing to excessive or irregular

fermentation leading to the production of a large quantity of various acids, as acetic, butyric, and lactic. This excessive or irregular fermentation of acids is itself checked by acids; and as either undue secretion of the gastric juice, or excessive formation of acids by fermentation, are the two causes of acidity, we have in acids themselves remedies able to control and check the acidity of the stomach, and relieve the distressing symptoms accompanying this condition, whether due to pregnancy.* uterine disease, calculus of the kidneys, the various dyspepsia, or more serious diseases of the stomach.

Practical men indeed know well that the administration of acid checks acidity, removing the acid eructations, the heartburn, and the sense of discomfort at the chest and epigas trium, arising from excess of acid in the stomach. Hydrochloric or nitric acid is generally preferred, and small medicinal doses, separately or combined, are ordinarily sufficient, provided the prescribed conditions are complied with.

Patients are sometimes greatly annoyed by eructations of an offensive gas, with the odour and flavour of rotten eggs—a gas evidently consisting largely of sulphuretted hydrogen gas. The late Dr. Day, of St. Andrew's, noticed that in such cases the urine is loaded with oxalic acid, for which condition he strongly recommends the employment of the mineral acids. Nitric acid is likewise of great use in the treatment of dyspeptics with oxalic acid in the urine but who are free from sulphuretted hydrogen eructations, and who suffer from great mental depression.

In the treatment of dyspepsias, a clue to the administration of acids on the one hand, or of alkalies on the other, is sometimes to be obtained by testing the reaction of the fluids ejected from the stomach. Not unfrequently, soon after a meal, a fluid regurgitates almost unconsciously into the mouth, sometimes so strongly acid that it sets the patient's

* The acidity of pregnancy is often prevented by two or three drops of tincture of nux vomica, taken a few minutes before meals; sometimes it is controlled by ipecacuanha.

teeth on edge. The exhibition of nitric or hydrochloric acid shortly before each meal, almost immediately removes this acid pyrosis. Sometimes the fluid of pyrosis has an alkaline reaction, often accompanied with much distress, with nausea and vomiting of the just-eaten food; the rejected contents of the stomach generally show a strong alkaline reaction. Here the nausea, the vomiting, and all distressing symptoms, may be removed by the use of an acid immediately after a meal. On theoretical grounds, we should expect an alkali administered shortly before the food would yield even more satisfactory results, but the author has had no experience of the use of alkalies in such cases.

It need hardly be said that acids given soon after a meal to patients troubled with acidity and heartburn, greatly aggravate their sufferings. It is adding fuel to fire. These remedies should not be continued too long, lest they should not merely check undue acidity of the stomach, but exceed this office, and by lessening the secretion of gastric juice to an undue extent, actually induce the very opposite condition to that for which they were, in the first instance, employed. To those who have watched the action of acids on the stomach, it is well known that, if too long continued, the improvement first following their use, lessens, ceases, then fresh symptoms arise, which, with apparent strangeness, are relieved by the very opposite treatment which had previously benefited.

If their administration is long continued they excite a catarrhal inflammation of the mucous coat of the stomach and intestines, accompanied often by diarrhœa, and even general wasting. This damaging action of acids explains the occasional effects of vinegar, when taken for a long time, in reducing the stoutness of fat people. Vinegar is sometimes taken surreptitiously in wineglassfuls several times a day to reduce obesity. It may reduce the stoutness, but it does so at the expense of serious injury to the body, and is a foolish practice which cannot be too strongly condemned.

It has been ascertained that these acids are inoperative to

check the growth of sarcinæ in the stomach. They often fail even to check the acidity accompanying these growths. It is a common practice with drunken soldiers to drink a wine-glassful of vinegar in a tumbler of water, with the view to remove the intoxication. Whether it does sober a drunkard is not quite certain, but it seems to steady and enable a tipsy soldier to pass muster on presenting himself at barracks.

They are useful in bleeding from the stomach by virtue of their astringent action, and their power of coagulating the blood. Sulphuric acid is generally preferred to the other members of this group. Many other astringents are surer.

Their high diffusion-power enables these acids to pass readily from the stomach into the blood. The acids which pass into the intestines must, to a great extent, become neutralized by the alkalies of the bile and pancreatic juice, and as acids, can affect to a very small extent, by direct contact, the middle and lower part of the intestinal tract. But in becoming neutralized, some of the biliary and weaker acids are set free, heightening in some degree the acidity of the contents of the intestines.

Dilute acids are used as antidotes in poisoning by the alkalies.

The influence exerted by acids on the pancreas or liver is unknown. The secretions from these two organs being alkaline, has led to the suggestion that the acids may increase the glandular secretion; but on this point nothing is known with certainty. It has long been held that nitric acid acts in some way beneficially on long-standing diseases of the liver, as in chronic congestion and cirrhosis, and that this drug will augment the flow of bile after the liver has struck work from the excessive use of mercury.

There can be no doubt that sulphuric acid is highly useful in checking summer and choleraic diarrhœa, although, as it is generally administered with opium and warm carminatives, it is difficult to distribute to each remedy its exact share of merit. Its mode of action is less obvious than its efficacy. It may control the formation of acid in the intestines, or it may

act as an astringent, and so check diarrhœa. If as an astringent, then, as the acid is soon neutralized and converted into a sulphate in the upper part of the small intestines, losing its astringency at once, its influence on the lower and middle part of the small intestine must be exerted through nervous sympathy between one part of this canal and another. Sulphuric acid is considered to act often capriciously, giving rise to much uncertainty in its administration; but this lack of uniformity in its results can be accounted for, in many instances, by the dose. A small medicinal dose often benefits, whilst a full one, by increasing the acidity of the canal, may even aggravate the diarrhœa. Dr. Neligan and other authorities, recommend it in chronic diarrhœa, and to control the "profuse sweating and colliquative diarrhœa of hectic."

In small medicinal doses, nitric acid is of great use in many diarrhœas. Thus it often acts admirably in the straining diarrhœa of children, when the motions are green, curded, and mixed with mucus. This form of diarrhœa yields speedily to acids which counteract the acidity of the intestinal canal, on which this flux depends. Yet, on the whole, other remedies are to be preferred to acids. Nitric acid may sometimes be used with great benefit, especially when given with pepsin, in that chronic diarrhœa of children when the pale and pasty motions smell sour and very disagreeable.

The application of strong nitric acid is an efficient remedy for internal piles; two, or at the most three, applications to the enlarged and dilated vessel are sufficient; nor need the acid be applied to the whole surface, but only to one or two points; it is useful in granular or ulcerated piles. A superficial slough follows. It produces little or no pain. After the separation of the slough the contraction of the sore diminishes the swelling. A drachm or half a drachm of the dilute nitric acid to half a pint of water, is an excellent lotion for bleeding piles. It stays the hæmorrhage, constringes the swollen and inflamed tumour, and eases the heavy, tensive, wearying pain.

Acids are reputed to heighten the action of purgative medicines, and sulphuric acid is sometimes employed for this purpose. They are usually added to purgative salts, as Epsom salts, when a tonic and bracing action on the mucous membrane is desired, as in many cases of anæmia of young women.

If not already neutralized on their passage into the blood, these acids must at once become so, and it would appear that thenceforth their history must be that of the salts they form. Yet the received action of these acids on the organs of the body is so different from that of any of their salts, that the behaviour of the acids must be spoken of separately from that of their salts.

On combining with the alkalies of the blood, the acids must set free some weaker acids, and so to a slight extent lessen the alkalinity of that fluid, as is evidenced by the increased acid reaction of the urine following the use of these mineral acids. What further effects they may have on the blood is at present quite unknown. They are reputed to be tonic and bracing, but the improvement in the general health may be more safely attributed to their action in the intestinal canal. Still, they do produce certain changes in the fluids and solids of the body, since acids, especially vinegar, are beneficial as preventives of scurvy in the absence of lime-juice or fresh vegetables.

Dr. Rees recommends large doses of lime-juice to the extent of eight ounces daily, in acute rheumatism. Dr. Inman speaks highly of this treatment, and finds that tartaric and citric acids cannot be substituted for lime-juice, and that lemon-juice is inferior to it.

Nitric acid is recommended in secondary syphilis. Salivation, it is said, has been caused by its administration; if so, salivation may have been due to the direct action of the acid on the mucous membrane by increasing the alkaline secretion of the salivary glands.

Acids are sometimes observed to abate the rapidity of the pulse in fevers; a result not due probably to the direct ac-

tion of the acid on the heart or nervous centres, but ascribable with more likelihood to the diminished restlessness, arising from diminished thirst.

Sulphuric acid, especially in conjunction with sulphate of zinc, is considered to check the profuse sweating of phthisis and other exhausting diseases; and Dr. Graves ascribed a similar action to vinegar. The following was his favourite recipe: Distilled vinegar, ʒij. Laurel-water, 3ij. Syrup, 3vj. Aqua, ʒv. An ounce or two ounces to be taken every third or fourth hour. Further, sulphuric acid appears to possess a decided power of checking bleeding from the lungs or womb. It is difficult, indeed, to understand how an ordinary dose of sulphuric acid can exercise such an influence after becoming so greatly diluted by admixture with the blood, and the difficulty is enhanced by the consideration that these acids, either before or immediately after their entrance into the blood, are converted into salts, as sulphates, nitrates, and phosphates. Whatever influence, therefore, is exerted on distant organs must be effected through these combinations; yet we cannot ascribe to any salts of these acids properties similar to those ascribed to the acids themselves.

In questions like these, experience is a safer guide than speculation. For the subtle influence of even small doses on distant organs of the body is well exemplified by the influence of these medicines on the mother's milk; for after taking acids for some time, they induce sickness, diarrhœa, and colicky pains in the child.

Phosphoric acid has been recommended in diabetes. Griesinger, who has carefully studied the action of this medicine, considers that it does more harm than good. He pushed the acid to the extent of an ounce daily, and found that this dose increased the sugar. The members of this group augment the acidity of the urine, whence it has been proposed to dissolve phosphatic calculi by artificially acidifying the urine; but the objections to this method of treating calculi are insuperable, owing to the action of acids on the mucous membrane of the stomach and intestines precluding their persistent

administration; whilst, as the acidity of the urine can be but slightly heightened by their administration, they must be taken for a considerable time to effect any notable change in the size of a stone.

The injection of nitric acid, sufficiently diluted, has been employed with success by some eminent surgeons, and is a far more effectual treatment for phosphatic calculi. From his experiments on the solvent power of dilute solutions of this acid on calculi after their removal from the body, Dr. Roberts of Manchester considers this treatment worthy of much wider application than at present obtains: moreover, by neutralizing the urine, if alkaline, and preventing its decomposition, nitric acid injections protect the mucous membrane of the bladder from the irritation of the alkaline urine.

The further influence of sulphuric, nitric, and hyrochloric acids on the urine is unknown. Of the influence of acetic and phosphoric acids we shall speak in another place.

Before closing our remarks on the action of these acids on the body, it is right to add that phosphoric acid may possess many other properties than those specified above; but these will be referred to in speaking of the phosphates, in which form this acid exists in the blood, and manifests many of its good effects on the diseased body.

SULPHUROUS ACID.
SULPHITES.
HYPOSULPHITES.

Sulphurous acid is commonly used as a deodorizer and disinfectant. It is a deodorizer by virtue of its power to arrest putrefaction; hence it may be used to prevent bad smells, but it possesses little or no power to decompose offensive gases; consequently it is of little service in destroying foul odours. It arrests fermentation by destroying the minute organisms which determine this process It is ranked among disinfect-

ants, but in this respect there is at present no proof of its power. It is supposed that contagious diseases are produced by minute organized particles and that sulphurous acid will destroy them. If these conjectures are correct, sulphurous acid is a disinfectant.

It must be borne in mind that sulphurous acid corrodes metals, so that, when used as a disinfectant, these should be protected by a covering of some greasy substance. Sufficient sulphur should be burned to render the air of the room unfit for respiration, and the escape of the gas by the chimney, windows and crevices of the doors should be prevented. It is better to repeat this process three or four times at intervals of twenty-four hours. To disinfect a bed, Mr. Startin recommends that a warming-pan containing live coals sprinkled with sulphur should be put between the clothes, till the sulphur is consumed. A damp napkin held before the mouth will prevent the sulphurous acid irritating the lungs. It is far better, however, to submit the bedding, etc., which cannot be boiled, for some hours, to a temperature between 250 and 300 in a disinfecting chamber or oven.

The quickest way of curing itch is to immerse the patient in a gaseous bath of sulphurous acid, his head being left free. The bath is made by burning 12 drachms of sulphur in a suitable apparatus. Whilst in the bath, the patient's clothes should be baked, so that in half an hour he is cured of his itch and freed from risk of re-infection from his clothes.

The acid is of great use in chloasma, by destroying the parasite on which the disease depends. The acid of the pharmacopœia, mixed with an equal quantity of glycerine, may be used, (Garrod). Warm baths should also be employed to remove the cuticle infested by the parasite. It is useful also in favus, and in tinea tonsurans; but when they are unusually obstinate, its action should be assisted by epilation.

Dr. Dewar of Kircaldy, has drawn attention to the beneficial action of sulphurous acid in various diseases.

Dr. Dewar applies the sulphurous acid in three ways,—as

a solution, by fumigation, and by the spray-producer. Chilblains and chapped hands, he asserts, are speedily cured by solutions or by fumigation. Equal parts of the acid of the pharmacopœia, and of water or glycerine, he says, will at once ease the burning, and prevent the spread of erysipelas. Wounds and sore nipples he treats with the solution, constantly applied, either neat or diluted. Bruises, it is said, may be prevented or quickly removed by the same treatment.

According to the same authority, many internal diseases are equally amenable to sulphurous acid; amongst others, cold in the head, influenza, tonsillitis, malignant sore throat (scarlatinal or otherwise), laryngitis, chronic bronchitis, chronic phthisis, asthma, croup, clergyman's hoarseness, and typhoid fever.

The acid may be applied to the throat by fumigation or by inhalation: a few drops being added to boiling water, the steam is inhaled; or it may be applied by a camel-hair brush, or by the spray-producer.

It may be carried into the lungs by fumigation, inhalation, or by spray. The pharmacopœia acid, if properly and carefully employed, excites scarcely any irritation or annoyance. The application of sulphurous acid may be conducted in the following ways:

"Put a few red cinders into a kitchen shovel, set this upon a wooden stool, and then sprinkle flowers of sulphur from time to time till the room is not inconveniently filled with smoke."

The spray may be applied by a vaporizer furnished with vulcanite tubes constructed upon Dr. Dewar's plan. For a child the instrument should be held about three feet from the mouth, and the fine spray should be inhaled and repeated according to circumstances. In an acute attack with no time to lose, it may be repeated hourly, or even oftener.

In applying the spray to adults, Dr. Dewar advises "to hold the nozzle of the instrument about six inches from the patient's mouth, and administer three or four whiffs to begin

with; then, after a corresponding interval, during which a cough or two is given, the process is repeated, about twenty squeezes in all, which represents the injection of from forty to sixty minims of acid. The acid should be pure."

For the relief of rheumatism and gout, besides the fumigation, Dr. Dewar advises that the bed-clothes should be exposed to the strong fumes, and then spread over the patient. Sweating breaks out, and, after a refreshing sleep, the patient wakes much relieved.

The solution, either strong or diluted in various proportions speedily removes thrush. Dr. Lawson speaks highly of sulphurous acid as a remedy for pyrosis; indeed, he says it never fails to be of service. He finds the sulphite useless.

Sulphurous acid in doses of five to ten minims often prevents flatulence produced by fermentation, and is especially useful when the gas is abundant. It is more efficient than sulphites and hyposulphites.

Sulphites, administered by the mouth, will, it is said, prevent decomposition and putrefaction of urine in the bladder.

Sulphites and hyposulphites have been employed to destroy sarcinæ and torulæ in the stomach.

It is said that hyposulphite of soda, in fifteen to twenty grain doses every two hours, will cure intermittent fever.

CHROMIC ACID.

Chromic acid was first used as an escharotic by Mr. John Marshall, of University College. He employed it to remove warty growths from the nose, genital organs, and elsewhere. Immediately after touching the parts with chromic acid, Mr. Marshall applies lead lotion, "which restrains the subsequent inflammation, relieves the subsequent soreness, and does not in any way neutralize or retard the rapid effects of this apparently useful escharotic." He uses a solution containing a

hundred grains of crystallized chromic acid to an ounce of water. "The solution is best applied by the aid of a pointed glass rod, or, when a large quantity is needed, by means of a small glass tube, drawn to a point. Only so much should be applied as will saturate the diseased growth, avoiding the surrounding healthy mucous membrane, for, though the solution is not sufficiently powerful as an escharotic to destroy or even vesicate the mucous membrane, it may give rise to an unnecessary amount of inflammation." Any superfluous acid may be removed by a piece of wet lint. The first effect of its application to the warts is to produce a slight smarting pain. If, however, any ulcerated surface be touched, the pain is of a burning character, more lasting, but not so acute and intolerable as that caused by nitrate of silver or by nitric acid, with or without arsenious acid. Under its influence the morbid growths rapidly waste, in some cases being thrown off altogether, and in others undergoing a partial, though evident, diminution in size. The best immediate dressing is dry lint, afterwards the part may be washed with lead lotion, and dressed with lint moistened in the same." "In most cases one application suffices, the cure being completed in from four to eight days. In severe cases, where the warts are large, repeated applications are necessary." Mr. Marshall further states that "chromic acid solution neither burns nor stains linen; it all washes out."

A solution of this acid is said to allay itching, but the kind of itching is not mentioned.

Group containing CAUSTIC POTASH, SOLUTION OF POTASH, CARBONATE AND BICARBONATE OF POTASH, ACETATE OF POTASH, CITRATE OF POTASH, and the corresponding preparations of SODA-POTASH SOAP, SODA SOAP, BORAX.

The members of this group are all endowed with very high diffusion-power, the potash in a greater degree than the soda salts. All are very freely soluble in water. With the exception of the acetates and citrates of potash or soda, they have an alkaline reaction, weak in some, as the biborate of soda, but very marked in others, as caustic potash or soda.

Some of these substances have a strong affinity for water, and will abstract it from animal tissues, so as to completely destroy them. This is especially the case with the caustic salts, less so with the carbonates, and in a very slight degree with the bicarbonates and acetates.

They dissolve the nitrogenous constituents of the animal textures; and their solvent power is in proportion to, yet distinct from, their affinity for water.

We wish to draw attention in this place, to one important property of alkalies,—namely their power to increase the secretion of the gastric juice, itself an *acid* secretion. We venture to think that many facts warrant the following generalization:—that alkalies applied to the orifices of glands with acid secretions, increase their secreting power; while alkalies applied in a corresponding way to glands with alkaline secretions, lessen or check this secretion. As we proceed with the consideration of this group, we shall find reason to believe that this general proposition is true, and that, whilst it affords an explanation of many effects of alkalies on the body, it gives us a clue to their employment in disease.*

* In the *Medico-Chirurgical Review* for April, 1870, the author's attention has been directed to some remarks by Kühne, in his *Physiological Chemistry*, apparently opposed to this general statement. He asserts that

Owing to their affinity for water, and their solvent action on the nitrogenous tissues, several of these substances will destroy the skin or other structures to a considerable depth. The caustic alkalies possess a greater affinity for water, and therefore a more solvent and destructive action on the tissues than the remaining members of this group. The carbonates and solutions of the caustic alkalies come next; while the bicarbonates, acetates, and the rest of this group, are comparatively feeble agents.

The caustic alkalies, undiluted, or mixed sometimes with caustic lime to lessen their activity, are often employed to destroy warty growths or the hard edges of some unhealing sores, such as chancres, or to open abscesses, or to make issues.

alkalies, as well as acids, stimulate the secretion of the submaxillary gland. The secretion produced by alkalies is thick, whitish, and cloudy; but that excited by acids is clear and less viscid. A difference in the characters of the secretions from the submaxillary gland is observed according as the cerebro-spinal or sympathetic nerve supplying this gland is irritated. Irritation of the sympathetic excites a secretion identical with that produced by alkalies; while irritation of the cerebro-spinal nerves excites a secretion identical with that produced by acids. Hence it is inferred that alkalies act on this gland through the sympathetic, and acids through the cerebro-spinal nerves.

No doubt the saliva produced by acids and by irritation of the cerebro-spinal nerves is a true secretion; for it is abundant in quantity, and quickly changes starch into sugar; and irritation of this nerve so greatly increases the flow of blood to the gland that its veins pulsate, and their blood is of a bright arterial tint. It is doubtful, however, if the fluid produced by the influence of alkalies or irritation of the sympathetic nerve is a secretion; indeed, Kühne thinks it is due to rapid degeneration of the gland. Thus, the quantity of fluid produced by alkalies is very small, and that obtained by irritation of the sympathetic requires many hours to produce even a trace of sugar in a solution of starch. The fluid thus obtained contains large quantities of very pale gelatinous bodies, of different forms and sizes, composed partly of albumen and partly of mucin. Moreover, by the irritation of the sympathetic nerve, the flow of blood to the gland is retarded, and the blood in the veins becomes dark and venous in tint. Alkalies produce very little secretion from the parotid gland, and so far as our present knowledge goes, none is excited by irritation of any branches of the sympathetic nerves.

It must be borne in mind that in common with the rest of this group, the caustic alkalies, possessing a very high diffusion-power, will penetrate the tissues, and destroy them widely and deeply, so that by the diffusion of the alkali, unless great care is taken, a much larger amount of destruction is effected than is desired, and a large slough is produced, followed of course, by an equally large sore. To avoid this excessive action, the application of the alkali should always be checked before it has taken full effect, since the destructive effect will continue for some hours after. Other precautions should likewise be observed, or the caustic alkali dissolved in the fluids of the tissues will run over a large surface, subsequently destroying it. As soon as the application is finished, it is desirable to wash the surface with vinegar and water, to neutralize any of the remaining alkali. Moreover, in making an issue, pieces of plaster with a hole in them of the required size, should be placed one over the other, and the caustic applied to the skin exposed through the hole, while the neighbouring parts are thus protected effectually by the plaster. The caustic, very slightly moistened, should be rubbed on the surface till it assumes a dull bluish look, and till the cuticle is softened and easily rubs off, when a poultice should be applied to help the separation of the dead parts, and to ease the pain.

A solution of a member of this group sponged over the peccant part will often allay the troublesome itching accompanying many skin diseases. A weak solution of the caustic salt, or of its carbonate, is best. A solution of carbonate of potash or soda, containing a drachm of the salt to a pint of water, applied with a small piece of sponge, is often of extreme comfort in urticaria or lichen. A solution of the same strength, of cyanide of potassium, which has also a strong alkaline reaction, is perhaps, a still better application.

The itching of many other eruptions, as of scabies, eczema, pruritus ani, and pruritus vulvæ, and prurigo from lice, yield better to other applications, which are indicated elsewhere.

The carbonates of the alkalies are employed either as soap,

or in the form of ointment, in the treatment of itch, to remove the superficial and dead cuticle, and so to break up the burrows of the itch insect.

Soap, by virtue of the alkali it contains, facilitates the removal of the scales of psoriasis.

In the treatment of eczema, a weak solution of carbonate of potash or of soda finds much favour with medical men; and the author has no doubt of its usefulness in the early and middle stages of the disease, when there is copious weeping from the red and raw surface; but when the weeping has ceased, and especially when mere desquamation remains, the alkali ceases to be of use, and other applications are preferable. Dr. Hughes Bennett recommends a solution containing half a drachm of the carbonate of soda to a pint of water. The surface affected with the disease is to be kept constantly moist by a thin piece of lint, soaked in the solution, and covered with oil-skin, or with a piece of lint spread with simple ointment. A weaker solution acts sometimes still better. The ointment, like the oil-skin, prevents evaporation, but is less "heating" and more comfortable to the patient. This treatment is an instance of the general proposition (*vide* p. 124) of alkalies as local applications, checking an alkaline secretion; for the fluid which oozes so abundantly from eczematous surfaces is strongly alkaline, and an alkaline applica- very speedily checks the abundant weeping.

It must be admitted, however, that in some instances, the alkali appears to irritate the skin, a result often due to using too strong a solution. During this treatment due attention must be paid to the state of the digestive organs, and any irritation, as that depending on teething or worms, should be attended to.

It is sometimes useful to wash the moist and weeping eczematous surface night and morning with soap and water, which in many cases checks the secretion, and allays the heat and irritation. If a strong soap is too irritating, a milder one must be used. In the chronic forms of eczema, Hebra recommends the application of liquor potassæ or of stronger solution of caustic potash. He brushes liquor potassæ once

a day over the surface, and, if it produces much smarting, washes the residue off with cold water. When the skin is only slightly infiltrated and thickened, he employs a solution composed of two grains of caustic potash to an ounce of water; but if the infiltration is greater, he uses a solution containing from five to thirty grains or more to the ounce. These stronger applications must be employed only once a day, and must be quickly washed off with cold water. This treatment speedily allays itching, but is liable to make the skin brittle. To obviate this condition, Dr. McCall Anderson applies, every night, either cod-liver oil or glycerine. Dr. Anderson frequently employs alkalies in conjunction with tar or oil of cade. He recommends the following prescription: "Equal parts of soft soap, rectified spirit, and oil of cade. A little of this to be firmly rubbed over the eruption night and morning. It should be washed off before each re-application." It is right to mention that Mr. Startin condemns the use of soap in this and in any skin disease: using instead a wash consisting either of yolk of egg and water, or milk and water.

A saturated solution of borax in water is an effectual application in pityriasis of the scalp. The head should be sponged with this wash several times a day. It eases the itching at once, loosens the scales, and cleans the head. Pityriasis often gives way in a short time to this treatment; although, unfortunately, the affection after a variable period generally returns, which indeed happens when the disease is removed by other treatment. Should the pityriasis prove rebellious, the glycerine of borax often proves more useful, as it keeps the scalp continually moist with the weak alkaline preparation. This plan is also useful in eczema of the ears and scalp.

Acne punctata generally yields to hot water and plenty of soap several times a day, a treatment which keeps open the orifices of the sebaceous follicles and prevents the accumulation of the abundant secretion. If this treatment roughens, reddens, and irritates the skin it should be well rubbed with glycerine of starch after each washing.

Free ablution with soap and water is very effective in decomposing and removing the acid irritating secretions which keep up the intertrigo so often infesting the buttocks of children, or in the folds of the skin of stout children or under the breasts of fat women. After carefully drying the parts, they should be smeared over with some greasy application, which, in the author's judgment, is generally preferable to the dusting powders as starch powder or oxide of zinc. Caustic potash or soda are sometimes used to open abscesses, and it is stated that this method prevents scarring.

Alkaline baths are often employed, but their action on the skin and its secretion is not yet satisfactorily determined; like acid or simple baths, they lessen the acidity of the urine.

Pityriasis of the face is often caused by using soap too strong in alkali and it will often disappear at once on substituting a milder soap as "Compressed glycerine soap" or "solidified glycerine."

A weak solution of bicarbonate of potash or soda, of a drachm of the salt to a pint of water, is a useful injection to check leucorrhœa, when this discharge depends on an increased secretion of the glands of the os uteri. This secretion is strongly alkaline, and when unduly abundant, the efficacy of alkaline injections to check it, is another proof of the general proposition made at the commencement of this section, that alkalies check alkaline secretions.

When the leucorrhœal discharge is clear, like white of egg, or when it is lumpy, but not yellow, three or four injections will generally check it. When, on the other hand, the discharge is yellow, and puriform, the injection may fail; although, in many cases, when this yellow discharge is due to mere abrasion of the os uteri, the injection, continued for one or two weeks, will change the yellow to a white discharge, and even this will soon disappear. If the leucorrhœa is produced by displacement of the uterus, or ulceration of its neck, this injection, like many others. may temporarily check the discharge, but it soon returns, and in such cases the leucorrhœa cannot be cured till these conditions are removed.

The success of this injection obviously depends on its reaching and coming well in contact with the os uteri, the offending part; hence it is necessary to give full and careful directions as to its use. The patient should be directed to lie on her back, to raise the buttocks by placing a pillow under them, and then to introduce the syringe as far as she conveniently can, and to leave the injection in the vagina about five minutes. The injection should be used cold, and be employed twice or three times in the day. A Kennedy's syringe, by means of which any quantity of lotion may be forcibly injected, and which, by washing away the discharges and douching the part with a cold medicated application, is even more effectual.

Mr. Norton, of St. Mary's Hospital, ingeniously employs a solution of liquor potassæ (two drachms to the ounce of water) in the treatment of ingrowing toe-nail. "A piece of cotton-wool is saturated with the solution, and pressed gently down between the upper surface of the nail and the soft tissues. The solution permeates the substance of the nail, and softens and pulpetizes the superficial cells. The wool is kept constantly moist with the lotion, and the softened tissues are wiped away each morning. The nail in a few days becomes thin and flexible, and, if desired, it can be pared away without pain. The lotion should be continued until all ulceration has disappeared."

Sir J. Simpson recommends borax in "the pruriginous eruption which appears on the mucous membrane of the vulva, and extends up along the vagina as far as the cervex uteri. It may also extend, and is sometimes indeed originally situated on, the cutaneous border of the vulva, and appears on the outer cutaneous surface of the labium, spreading backwards along the perinæum to the circle of the anus. Accordingly, it is a flitting and transient affliction, recurring with menstruation, pregnancy, or delivery. It may be more fixed, and last weeks, or months, or years, producing constant irritation and distress, frequently interfering with rest and sleep, and rendering the victims miserable and almost de-

ranged when the disease has become somewhat chronic, and necessitates the patient to attempt to alleviate it by constant and sometimes rough friction. The mucous membrane becomes at the most irritable parts white, and thickened with red fissures." This distressing complaint, says Sir J. Simpson "may be generally cured by the assiduous and persevering application of a solution of biborate of soda (five or ten grains to the ounce of water)." A hot solution much enhances the efficacy of borax. Water alone, as hot as can be fairly borne, will often allay this itching; but hot water with borax is much more efficacious. If this treatment fail, infusion of tobacco may be tried; or an ointment of iodide lead (3i to 3i), or an ointment of bismuth and morphia. Chloroform vapour, liniment, or ointment, is often found useful; a drachm of chloroform may be added to an ounce of some sedative liniment or ointment. A strong lead lotion or a solution of nitrate of silver often does good. Dr. Simpson says, "There is great advantage in alternating these local applications; for most of them begin to lose their effects when persevered in above a few days. In the most obstinate and severe cases strong astringents are sometimes of the greatest use, as a strong solution of alum or tannin."

Dr. Garrod employs strong solutions of lithia salts to remove gouty enlargements. Gout-stones are composed of urates. Urate of lithia being the most soluble of uric acid salts, a strong solution of a lithia salt is applied with the intention of converting the urates in the tissues into urate of lithia, and so to soak the urates out through the skin.* The swelling must be constantly enveloped in lint or rag kept moist with the lithia solution. In Dr. Garrod's hands this treatment has proved very successful. He has removed considerable enlargements, and restored suppleness and even free movement to stiff and useless joints. The author has employed this treatment with considerable success. It is

* Dr. Garrod thinks that lithia salt formed with the uric acid passes into the blood, and that in this way gout-stones are reduced. He employs carbonate of lithia, five grains to the ounce.

especially useful when the skin is broken over the gouty enlargement. It is well known that a sore of this kind is extremely difficult to heal. The urates being intimately mixed with the connective tissue, and oozing very slowly through the wound, are dissolved and washed away by the lithia solution, thus enabling the sore to heal. The citrate of lithia is to be preferred; but a strong solution of citrate of potash is nearly, if not quite, as useful. It probably converts the biurates into neutral urates, and in this more soluble form the urates are carried off through the skin. Equal parts of citrate of potash and water may be used. Neither the solution of citrate of lithia, nor that of citrate of potash, irritate the skin. As might be expected, this treatment takes many weeks, or even months, to effect considerable reduction of large deposits.

If the theory propounded at the beginning of this section is sound, we should expect that these remedies would check the secretion from the salivary glands, since this fluid has an alkaline reaction. But of their influence in this respect we have already spoken.

Aphthæ is often treated with borax and honey, or the glycerine of borax. In this disease the mucous membrane is covered with usually small, round, sharply cut superficial ulcers, covered with a pultaceous exudation. Aphthæ runs naturally a short course, and when left untreated gets well in most cases in a week or ten days. The same preparations are useful in removing the curdy exudation of thrush.

Dr. Corson finds, that a piece of borax the size of a pea, allowed to dissolve in the mouth, restores the voice sometimes like magic, in cases of sudden hoarseness brought on by a cold, and frequently for an hour or so, it renders the voice "silvery and clear." Borax is useful in the hoarseness common with clergymen and singers.

The action of the members of this group on the stomach has been somewhat anticipated when it was shown that alkalies increase the secretions of the gastric juice, and may thus prove useful to promote digestion. It is obvious, how-

ever, that method must be observed, or the contrary effect to that intended will result; for if given soon after a meal, the alkalies will neutralize the acid of the gastric juice, and effectually retard and impede digestion. Alkalies given to increase the quantity of gastric juice, and to promote digestion, must be taken a short time before the meal. In this way the alkaline saliva swallowed at the beginning of a meal is highly useful; although, as it must speedily become neutralized by the acids of the stomach, its action can continue for a short time only, Alkalies may be usefully administered in many forms of atonic dyspepsia, and in other forms associated with deficient secretion of the gastric juice, The bicarbonate of soda is the salt generally employed.

When, on the other hand, a patient complains of heartburn and acid eructations, these disagreeable symptoms may be removed at once by the exhibition of an alkali, as the bicarbonate, which neutralizes the excess of acid on the stomach. But it must always be remembered that the treatment is merely palliative. No doubt a course of alkaline treatment appears sometimes to remove acidity; but the good attributed to alkalies may, with great probability, be ascribed to the tonic generally combined with them. The bicarbonates are preferred to the more caustic salts, on account of their milder action, while the acetates and citrates are neutral, and become alkaline only by decomposition in the intestines or blood. The bicarbonates being milder can be continued longer than the more caustic preparations; but they have the disadvantage of giving off much carbonic acid gas, which may cause trouble from distension of the stomach. To prevent this, magnesia, which is an alkali, and acts like this group, may be substituted if the bowels are confined, or lime-water if they are relaxed.

Alkalies are apparently sedative to the stomach, at least they often relieve the pain of this organ. Liquor potassæ is generally employed in such cases.

In cases of poisoning by any of the acids, those alkalies only which irritate the stomach but slightly are employed to

neutralize and to prevent the further action of the acid on the tissues.

In poisoning by metallic salts and alkaloids, the same salts, namely, the bicarbonates of the alkalies, may be used, to precipitate the insoluble oxide of the metal or of the alkaloid. Magnesia is generally preferred, as it acts as a slight purgative, and so helps to expels the poison from the intestinal canal.

The substances contained in this group by virtue of their diffusion-power, pass so readily into the blood, that but a small portion of them reaches far into the small intestines. Little is known of their action on the small intestines, and on the organs which pour their secretion into them ; yet it seems probable that those secretions having an alkaline reaction may be affected in a double and opposite way, according to the time these drugs are administered acting contrariwise on the stomach. The secretion from the intestinal glands is alkaline; hence, if the general statement made at the beginning of this section is valid, acids applied to the orifices of their ducts should augment their secretion, while alkalies should have the contrary effect. But we have seen that alkalies, given before meals, increase the secretion of the acid gastric juice, and thus augment the acidity of the intestinal canal; and they should likewise increase the biliary and pancreatic secretion. On the other hand, the alkalies, if given after a meal, neutralize the acid in the stomach, and should lessen the secretion from the liver and pancreas. Nothing, however, on these points is known with certainty, the foregoing statements being at present merely conjectural.

The milder alkalies, as bicarbonates of potash, soda, or magnesia, may be used with great benefit in diarrhœa due to excess of acid in the intestines. By neutralizing the excess of acid, these substances arrest the diarrhœa.

Soap is often added to anal injections, to suspend castor oil or turpentine. Soap itself, moreover, may be used as a mild and safe purgative. A piece the size of the thumb, covered

with castor oil or merely wetted with water, and thrust up the rectum as high as the finger will carry it, will, in a short time, produce an easy, copious, and natural evacuation. This plan is especially available for infants and children

On entering the blood, these substances undergo various changes, according to their composition. The acetate or citrate, which has not already undergone a like change in the intestines, becomes converted into the carbonate, the form probably ultimately assumed by the oxide of the alkalies.

The alkalinity of the blood must therefore be increased by these alkalies, not probably to any great extent, as from their high diffusion-power they are rapidly eliminated by the kidneys. On this increase in the alkalinity of the blood much speculation has been built. The alkalies are known to promote oxidation, whence it has been conjectured that, by increasing the alkalinity of the blood, its oxidation, and that of the tissues, may be increased. It has been suggested that alkalies might be profitably employed in diabetes, to promote the oxidation of the sugar. Alkalies have been advocated also for excess of uric acid in the urine, with the expectation of oxidizing this product of the nitrogenous tissues and so converting it into urea or some other substance. And they are sometimes given to fat people to increase oxidation, in order to consume their fat, and so to control unseemly obesity. The solutions of the bicarbonates and especially of the oxides are used for this purpose.

Their action in diabetes appears to be nil, or rather, it should be said, they in no degree lessen the amount of sugar separated by the kidneys, although, if long persisted in, some derangement of the stomach must occur, with diminution in appetite, so that less food being taken, less sugar is excreted.

Nor does it appear that they can oxidise uric acid in the blood; at least there are no experiments in proof of this. It is, however, very useful to give alkalies so as to render the urine weakly acid, or even alkaline, so as to convert the excessive quantity of uric acid into a more soluble urate. This treatment too will prevent the growth of uric acid calculi.

Micturition in young male children not unfrequently causes severe pain, which is found to depend on the existence of uric acid or biurates, in the form of spicular crystals, which in their passage irritate the urethra; by alkalinising the urine, these are dissolved and rendered innocuous.

The citrates having very little action on the mucous membrane of the stomach are the salts best adapted to render the urine less acid, or to make it alkaline.

Next, as to the power of alkalies to increase the oxidation of fats: that the long-continued administration of the more alkaline preparations will induce much wasting of the body, admits of no doubt, but this wasting is effected by their disordering action on the mucous membrane of the stomach. To diminish fatness in this way, so likely to damage the health, and even to endanger life, is surely very injudicious. Some writers of authority, however, maintain that obesity may be thus reduced without any ill effects on the mucous coat of the stomach. Thus, Dr. Neligan states that he has often removed an uncomfortable excess of fat, by the use of liquor potassæ without in any way injuring the patient's general health. This treatment, however, though perhaps occasionally successful, generally fails signally.

After the passage of alkalies into the blood, and their conversion into carbonate, the action of these substances on that fluid is at present but little known. Dr. Garrod is of opinion that scurvy is due to deficiency of potash salts with the food, a surmise supported by many facts, but not yet confirmed by exact observation.

The bicarbonate or the citrate of potash is often employed in rheumatism. This disease is supposed to be produced by an excessive formation of lactic acid, which, having an affinity for certain tissues of the body, excites in them the rheumatic inflammation. Alkalies are given to neutralize this acid, and to protect the tissues from its action. But so little is known about the nature of rheumatism, that it is impossible to approach the question of its treatment on the theoretical side. As careful records of exact observations with this treat-

ment are non-existent, we can only be influenced at present by individual impressions. This much, however, must be conceded; that in many cases the rheumatic pain is much relieved as soon as the patient is well under the action of the drug, and the urine has become fairly alkaline.

Many eminent authorities are firmly convinced that the alkaline treatment* renders rheumatic fever both milder and shorter, and diminishes the danger of heart complications. The author has made many careful observations on this question, and he is led to believe that, due attention being paid to the age of the patient, and to the nature of the rheumatism, it will be found that these salts are unavailing to lessen the intensity or the duration of the fever.

Potash salts exist abundantly in the milk, whence it has been suggested that the administration of these salts may promote this secretion. Some recommend them in amenorrhœa, in syphilis, and scrofula.

The sustained administration of the alkalies and their carbonates, renders the blood, it is said, poorer in solids and in red corpuscles, and impairs the nutrition of the body; but these results are probably due to disordered digestion, produced by the long-continued use of alkalies, and are not dependent on an excess of alkalinity of the blood; for such excess must always be slight, on account of the rapid elimina-

* In the fifty-second volume of the *Medico-Chirurgical Transactions*, Drs. Gull and Sutton published a paper on the value of remedies in rheumatic fever. Although not numerous enough to settle this much-vexed question, these cases lead them to the conclusion that alkalies, lemon-juice, or blistering, are inoperative in shortening the course of rheumatic fever, but they do not deny that these remedies may allay pain. They further conclude that neither alkalies, lemon juice, nitrate of potash, nor blisters, prevent the occurrence of heart disease in rheumatic fever. In dealing with statistics relating to the treatment of rheumatism, it is necessary to be specially cautious, for tendency, warranted by observation, is to the conviction that hereafter rheumatism will be discriminated into many varieties. Thus already we have distinctive rheumatic fevers, due not only to weather influence, but to syphilis, lead, etc. Moreover it is often difficult and at first even impossible, to distinguish gonorrhœal rheumatism and acute febrile rheumatoid arthritis from rheumatic fever.

tion of these salts by the kidneys; moreover, it has been shown by Dr. Roberts, of Manchester, that the citrate of potash may be taken for an almost indefinite time, without deranging the general health, yet this drug increases the alkalinity of the blood, while, owing to its neutral reaction, it is harmless to the stomach.

Liquor potassæ bears the reputation of promoting the absorption of inflammatory formations, and is occasionally employed in pleurisy; but its good effects are not conspicuous, and the disorder it produces in the stomach renders its use unadvisable for any length of time.

Carbonate of potash in one or two grain doses, given three or four times daily, with a little syrup to cover the taste, is much used in Philadelphia for whooping cough.

What influence have the alkalies on tissue change? Dr. Parkes has investigated the action of liquor potassæ, and he thinks that it probably increases the disintegration of the nitrogenous substance of the body; and he believes that his experiments justify him in concluding that it disintegrates also the sulphur-holding tissues; for liquor potassæ increases both the urea and sulphuric acid of the urine. The strong reaction of liquor potassæ unfits it to be given in doses sufficiently large to affect in any great degree the reaction of the urine, so that the bicarbonates or citrates must be employed when it is required to alkalinize this fluid.

What action have alkalies on the constituents of the urine? They are all reputed to be diuretic, but as no exact observations have been made with these salts this statement must be regarded as only a probable assumption.

Before referring to the presumed diuretic properties of these substances it will be as well to digress for a short space to speak in general terms of diuretics.

By diuretics, we understand medicines which act as eliminators of the urine; and we must distinguish diuretics from those medicines which, by promoting tissue change, cause an increase in any of the constituents of the urine. Diuretics merely separate from the system already-existing products.

As the urine is a complex fluid, containing, besides water, many salts and other ingredients, we may have medicines which will eliminate one or more of these, but leave the rest unaffected. We may therefore have diuretics of water, or of urea, or of uric acid, etc. Again, the retention in the blood of materials which should be eliminated by the kidneys, may be due to a variety of conditions. The physical state of the kidneys may be altered, and these organs disabled, by disease of distant organs, as of the heart. Or, on the other hand, through insufficient oxidation and combustion of the effete products of disintegration, refuse materials may remain in a form unexcretable by the kidneys; and, lastly, the retention of the urinary ingredients in the blood may be dependent on organic disease of the kidneys themselves.

Thus, in one instance a medicine acting on some organ at a distance from the kidneys, as the heart or lungs, will be a diuretic; while in another, those means which promote oxidation in the blood will prove diuretic; and, lastly, diuretics may act immediately on the kidneys by removing or altering those physical conditions which hinder the action of these organs.

How far do the members of this group act as diuretics? and in which of the foregoing ways? We cannot give very satisfactory answers to these questions.

First as to their diuretic action.

It is generally held that all these substances are diuretic, and, under certain circumstances, they may possibly become so. Acetate of potash and acetate of soda enjoy the highest repute in this respect. Some careful observations have been made with these substances on persons in health, which have led to unexpected results. Thus it was found by Böcker (quoted by Parkes), "that so far from acting as a diuretic in health, the acetate of potash diminished the water, the urea, the extractives, and, in a remarkable manner, the earthy salts." Some valuable observations concerning the action of citrate of potash and acetate of potash, as diuretics in health, have been made by Dr. Nunneley on himself. He

took daily, for twelve days, three to five drachms of citrate of potash. On an average, the daily excretion of water was increased by two ounces and a half, but the urea was lessened by eighty-four grains, and the solids by sixty grains. The acetate of potash, in daily doses of two and a half to three and a half drachms, exerted a similar influence in a somewhat less degree.

But should we expect medicines to act as diuretics or eliminators in healthy persons? In their blood there should be but little urea or uric acid to be eliminated, and we must be careful, therefore, how far we allow physiological experiments to guide us as to the action of diuretics in disease. That such caution is highly necessary is shown by an observation by Ranke, who, after giving acetate of potash, noticed a very considerable increase in the quantity of urine voided soon after, showing that this salt will sometimes act as a diuretic of water.

Having spoken of their properties as diuretics, we will endeavour to answer the second part of the foregoing question: —In what way do they act as diuretics?

It is not supposed that any members of this group act on organs remote from the kidneys. They may possibly act by promoting oxidation in the blood, and so reducing effete products to urea, in which form they are separated by the kidneys·

Some of these medicines are considered to be febrifuge, as the citrates and acetates. If so, they would act as eliminators of water, as on the decline of fever an increase takes place of the urinary water, previously held back in the system during the febrile state, and an increase in the solids of the urine often occurs simultaneously. If, therefore, these substances will check fever, this increase of water and solids must, in some measure, be due to their action.

These alkalies are generally reputed to act as diuretics when the kidneys are diseased. Thus the citrates and acetates are given in acute and chronic Bright's disease. Some consider that, by making the urine alkaline, it is enabled to

dissolve the organic, but diseased, matters which block up the uriniferous tubes in Bright's disease, and hinder the secretion of the kidneys.

It has already been mentioned that the members of this group render the urine less acid, or even alkaline; but we may here add that, strange to say, the amount of acid excreted with the urine is actually increased, although, being neutralized by the alkalies, it gives no acid reaction.

Of these remedies, the citrates and bicarbonates are constantly employed to make the urine alkaline, when the urinary organs are irritated or inflamed. They are used in cystitis and gonorrhœa. If in cystitis the urine, before it is passed, is already alkaline from decomposition of the urea, alkalies must be intermitted; for they would, of course, increase the alkalinity of the urine, and so promote still further the decomposition of urea, and the formation of carbonate of ammonia, as alkaline, decomposes much more readily than acid urine.

When excess of uric acid occurs in the urine, it should be kept for a time alkaline; and Dr. Roberts, of Manchester, by many careful and ingenious experiments, has shown that uric acid calculi may probably be dissolved in the bladder, if the urine is maintained alkaline for some weeks. This treatment is probably useful in renal calculus which is generally composed of uric acid only. It is reasonable to expect that the alkaline urine would, in time, reduce the calculus sufficiently to pass down the ureter. We certainly meet with patients complaining of much pain in the back, passing bloody urine containing a large quantity of uric acid crystals, and a little pus, who are curable with large doses of citrate of potash.

We may here introduce a short account of some interesting experiments made by Dr. Paul Guttmann on the action of potash and soda salts. He confirms many of the conclusions arrived at by Claude Bernard and others. The results are singular, and scarcely in accordance with the experience of medical men of the action of these substances on the human body. We give a short summary of his paper:—

Potash Salts are all far more poisonous than soda salts.

Potash salts are all equally poisonous and fatal in the same space of time, if applied in the same way.

Chloride of potassium, carbonate of potash, and nitrate of potash, in identical doses, are equally powerful to destroy life, and in the same period of time, even when the salt, previous to injection, is mixed with a solution of albumen.

The acid of the salt plays no part in the fatal result.

In poisonous doses great muscular weakness sets in, first appearing in the hinder extremities; while in warm-blooded animals dyspnœa and convulsions take place. They lessen the frequency and force of the heart's beats, and sometimes make them irregular. This holds good with all potash salts.

Large doses at once arrest the action of the heart, which always ceases to act in the diastole.

Traube asserts that the action on the heart is effected through the vagi nerves. This view Guttmann considers erroneous, as, after the vagi were both divided, and the medulla removed, the potash salts still affected the heart as before, and even when the vagi was paralyzed by woorali, the potash salts still acted as usual on this organ. Whether their effect on the heart is owing to their action on the heart's substance, or on its ganglia, Guttmann cannot say. He states that these salts lowered the temperature of the body; but certainly to a very insignificant extent.

These salts act but slightly on the muscles, and not at all on the peripheral nerves, unless applied directly to them in a strong form. The loss of sensibility and motion is due to their paralyzing action on the spinal cord, an action first evidenced and most expressed on the posterior part of the cord.

Soda Salts, in twice or three times the quantity which proves fatal in the case of the potash salt, produce no effect on the system, except a passing weakness.

Even in larger doses, soda salts exert no action on the heart, cause no diminution in the temperature, and produce no apparent effect on the cord, brain, nerves, or muscles.

The heart of a frog suspended in a solution of potash

quickly ceases to contract, while a solution of soda of similar strength required a much longer time to produce that effect.

Many soda salts produce an opacity of the lens in frogs but this is not noticed to occur with the sulphate of soda. Guttmann shows that the opacity is not due to mere abstraction of water from the lens. This opacity does not take place in mammiferous animals; it is removed by immersing the opaque lens in water.

SOLUTION OF AMMONIA.
CARBONATE OF AMMONIA.
SPIRITS OF AMMONIA.

These preparations have many properties in common with the alkaline potash and soda group. They possess a strong alkaline reaction, are freely soluble in water, have a high diffusion-power, and dissolve the animal textures; but they differ from the potash and soda preparations in their volatility, and in being more powerful local irritants of the living animal tissues, exciting in them very active inflammation.

Their action on the skin is in many respects similar to that of the alkaline potash and soda preparations. Liquid ammonia, owing to the water in its composition, manifests but little attraction for that of the tissues; and since its solvent action on the textures is less than that of the soda or potash salts, it physically destroys these much less quickly and extensively. Owing, however, to its high diffusion-power, it readily penetrates the cuticular covering of the body, and excites a degree of active inflammation, sufficient to destroy the tissues, and so produce, first a slough, then an ulcer. The preparations of the members of this group are never purposely employed to produce formidable destructive changes in the tissues, but, in the form of liniment or the

solution of ammonia itself, are used as vesicants and rubefacients.

The strong solution may be employed when it is desired to produce very speedy vesication. A few pieces of lint are to be cut a little larger than the desired blister, and on these ten or twenty drops of the strong solution of ammonia are to be poured, and the pledget is to be applied at once to the skin, and covered with a good-sized watch-glass. Heat, with some smarting and tingling, is soon felt, and in a short time a rim of redness appears around the glass, when the application should be removed, and a poultice applied, which promotes the vesication, and at the same time eases the burning pain. In this way a blister may be produced sometimes in ten minutes; sometimes it takes half an hour; but so great is the difference in the vesicating action of ammonia, that with some a blister is not formed at all. It must be considered a very uncertain vesicant.

As a rubefacient or "counter-irritant" it is a more useful application, but it is in no respect superior to a mustard poultice, the materials for which are always at hand. The liniment of ammonia acts very imperfectly as a counter-irritant, if merely rubbed or dabbed on the skin. It must be applied on lint or linen, kept in contact with the skin, when decided rubefaction takes place in a few minutes.

As a counter-irritant it is used for the same purposes as mustard poultices or blisters, and we must here refer our readers to the sections on these remedies.

Dr. Tilt speaks highly of Raspail's sedative lotion in the headaches occurring at the change of life or from defective uterine functions. It is made by adding two ounces of liquor ammoniæ and of common salt, three drachms of camphorated spirits of wine to thirity-two ounces of water. This lotion is applied to the painful part of the head with a small sponge and is renewed as often as may be required. It excites a sensation of burning and reddens the scalp. If too strong, it should be diluted with water and cold cream should be rubbed on the irritated skin.

The weaker solutions of ammonia are sometimes applied to the bites or stings of insects, as wasps, spiders, etc., to neutralise the formic acid, the active principle of the poison.

Salts of ammonia applied to the nose, and breathed into the air passages, are commonly used in fainting and in poisoning by narcotics. They are used in the same way in the early stages of colds in the head, or they are serviceable as derivatives to remove pain and inflammation of the nose and frontal bones. Ammonia inhalations have been recommended in chronic bronchitis to ease and probably to lessen the over-abundant expectoration.

In the stomach ammonia acts much in the manner it affects the skin. It neutralises the acid it encounters, and is hence an antacid; at the same time, if incompletely neutralised, it acts as an excitant, or even irritant, of the mucous membrane.

Soon after the administration of ammonia, a sensation of warmth at the pit of the stomach sets in, which soon spreads to the rest of the body. It may be used as an excitant when the functions of the stomach and upper part of the intestines are depressed. It often obviates spasm of the intestinal canal, and braces up the relaxed mucous membrane. Ammonia compounds of this group are therefore among the best antispasmodics. They are useful remedies for children, especially for infants, who are frequently tormented by colic or flatulent distension of the intestines, generally owing to bad feeding.

In the after-stages of diarrhœa, after the removal of the irritating excitant cause, when the mucous membrane continues to pour out a watery secretion which perpetuates the diarrhœa, these preparations may be profitably employed.

The alkaline preparations of ammonia are employed in flatulent distension of the stomach and intestines, with the view of absorbing the excess of gas, generally consisting of carbonic acid. There is no doubt that these remedies are often temporarily useful as palliatives in these affections, owing to their exciting the muscular coat of the intestine to

contract, and so promote the expulsion of the distending gases.

These remedies in full doses excite an increased formation of mucus, and even vomiting; and as emetics they act without inducing nausea or depression. They are seldom employed alone, but are added to other emetics to obviate the depression these usually induce.

If administered too long, they excite catarrh of the stomach and intestines.

These substances readily enter the blood, and must to some extent increase its alkaline reaction; but owing to their volatility and high diffusion-power they are rapidly eliminated, and therefore exert only a transient action on the blood and the organs of the body.

The effect of ammonia on the blood is at present unknown. It has been maintained without much show of proof that carbonate of ammonia is the poisonous agent in uræmia; that the urea decomposes in the blood, forms this carbonate, which in its turn produces the serious symptoms constituting uræmic poisoning.

Ammonia induces a slight increase in the force of the pulse, some excitement of the brain, and a general sensation of warmth. Being a slight stimulant of the heart, ammonia is used in fainting and exhaustion. Ammonia is frequently administered as an antispasmodic—an action depending probably in part, on its power to strengthen the heart's action, but, like all other antispasmodics, its influence is but brief.

Carbonate of ammonia is often employed as a stimulating expectorant in chronic bronchitis, when the expectoration is profuse, and the patient's strength is diminishing. It is often given with hydrochlorate of ammonia, which probably acts in a similar manner. Carbonate of ammonia is often of signal service in severe bronchitis, or broncho-pneumonia of children, especially when they are prostrate, and livid from obstructed breathing.

Carbonate of ammonia, in three to five grain doses, administered uncombined with any other drug, hourly, or every two

or three hours, according to the severity of the case, has been highly praised in scarlet fever. It was largely used by the late Dr. Peart, who, from the time he employed it, "did not lose one patient out of nearly three hundred." The late Mr. Wilkinson also employed it largely with equal success; and recently Mr. Charles Witt has written a pamphlet extolling its virtues. It is said to be useful in all forms of scarlet fever, especially when given early. The immediate effects of the remedy are stated to be diminution of heat, fever, and delirium, and a disposition to sleep. Mr. Wilkinson says it is equally useful in measles, and that the ammonia treatment leaves no secondary evils. Mr. Charles Witt says, care must be taken that no acid drinks nor acid fruits of any kind are permitted, or the ammonia, becoming neutralized, loses its efficacy. Solution of acetate of ammonia, is a useful diaphoretic and is largely employed in fevers. It is especially useful in the milder forms, as in common catarrh. A full dose of spirits of ammonia or Mindererus' spirit will often speedily sober and steady a drunkard. The supposed effect of ammonia in preventing iodism is noticed in another place.

Owing to their high diffusion-power, these substances escape very readily from the body in different ways, a portion passing with the breath, some probably with the sweat, and much with the urine.

MAGNESIA, LIGHT MAGNESIA, CARBONATE OF MAGNESIA, LIGHT CARBONATE OF MAGNESIA, SOLUTION OF CARBONATE OF MAGNESIA.

These substances having an alkaline reaction, might on this account be placed in the group of potash and soda alkalies. Their effects on the body, however, are in many respects very different. We have elsewhere treated of the properties pertaining alike to all alkaline substances, including, of course, the members of this group. (See Potash group.)

Some of the oxide of magnesia combines with the acids of the gastric juice, and becomes soluble; the remainder is unaffected, and is left insoluble. Part of the carbonate, decomposed by the acids of the stomach, sets free its carbonic acid.

These substances act as antacids, and as antidotes in poisoning by the strong acids and by some metallic salts. In some cases they are preferable, as antacids, to bicarbonate of soda or lime. The advantages of the members of this group are—(1) their large saturating capacity for acid; (2) their purgative property; (3) when given in excess, they are harmless on account of their insolubility.

Their disadvantage consists in their great bulk. The oxide or carbonate of magnesia is generally used as an antacid; but the oxide is preferable, as the carbonate, by giving off much gas, may produce disagreeable distension of the stomach. It must not be forgotten that they are merely temporarizing remedies, and that acids are far better remedies for acidity of the stomach. (See Acids.)

The oxide of magnesia is a convenient antidote to the strong mineral or vegetable acids. These it neutralizes, and protects the delicate structures of the stomach from their corroding action. It precipitates many metals from their acids, and renders them less soluble, and therefore less poisonous. They form an insoluble compound with arsenic, and thus take rank among the antidotes of this poison.

The magnesian salts combine in part with the acids of the gastric juice. The oxide and carbonate cannot pass into the blood on account of their insolubility; nor does the chloride pass in any amount because of its low diffusion-power. Hence almost all the magnesia passes into the intestines.

Here the salts of magnesia undergo changes according to their composition. The chloride probably is decomposed by the bile, and the oxide precipitated, part of which combines with the biliary acids. The oxide is converted first into the carbonate, then into the bicarbonate by the carbonic acid of the intestines, and so made soluble, and capable of acting as

a purgative. The carbonate is changed in a similar manner into the bicarbonate, and likewise becomes a purgative. Thus they act as purgatives only after conversion into bicarbonates, in which form they possess most of the properties of the group which includes sulphate of magnesia, etc. Like the members of this group, the bicarbonate has a very low diffusion-power, and, like them, it is purgative. Its action in this respect being, however, very mild, it is termed a laxative. Their mild action, freedom from taste, and antacid property, fit these substances admirably for children. They are generally combined with a little rhubarb. If unduly employed, these substances occasionally accumulate, and form concretions of ammonio-magnesian phosphates in the intestines.

Bicarbonate of magnesia, fluid magnesia, as it is termed, is a useful and mild aperient.

Magnesia has been lauded in sympathetic vomiting, as that of pregnancy, when it is to be presumed the vomiting depends on excessive secretion of acid from the stomach; but its effects are very transient. Should it fail, recourse may be had to oxalate of cerium (one grain every three hours), ipecacuanha, quinine, acids, etc. (See Ipecacuanha).

The chief of the magnesia passes out with the fæces, and, for the reasons stated, a small portion only enters the blood. In excess of uric acid, members of this group prove useful by saturating much of the acid in the stomach, and carrying this out of the body.

LIME, CAUSTIC LIME, LIME-WATER, LINIMENT OF LIME, SACCHARATED SOLUTION OF LIME, CARBONATE OF LIME.

This group contains highly valuable medicinal substances which might with advantage be more extensively used in disease.

Thus, lime is a necessary constituent of the body's hard and soft tissues, of bone and the parts more vitally endowed, as

the nerves and muscles; wherever there is active growth, whether natural or unnatural, there lime salts are found in excess, probably as phosphate, being in all likelihood the form of lime required by the body for the performance of many of its functions. In practice, however, we find the other salts of lime of equal service in almost precisely the same morbid states in which the phosphate is so valuable, and it seems feasible that a portion of the lime salts becomes united in the body with phosphoric acid.

Their diffusion-power being very low, and having little affinity for animal structures, they produce very little change when applied to the skin. But caustic lime, having a strong attraction for water, will withdraw this from the dermis when deprived of its cuticle, and to some extent effect the destruction of the tissues. Yet, as its diffusion-power is slight, it fails to penetrate the tissues, and consequently its action is but superficial. Caustic lime is not often used as an escharotic. Mixed with caustic potash, it forms a compound less deliquescent, far more manageable, and safer than simple caustic potash, especially in affections of the neck of the uterus.

Applied to the broken skin and to sores, the carbonate and lime-water are slightly astringent; hence lime is sometimes used to check the discharge from sores and skin eruptions.

Lime-water with oil, in equal quantities, or in the proportion of four of lime-water to one of oil, enjoys a high reputation in the treatment of burns.

Lime-water as a lotion to cracked nipples is sometimes useful.*

Lime-water is sometimes employed to check the abundant discharge of certain skin diseases, as eczema, and likewise as a sedative to ease the smarting and tingling. Where the in-

* But it is far better, if possible, to prevent cracked nipples, which is much easier than curing them. The nipple should be carefully washed and dried immediately the child is removed from the breast, and the tissues may be hardened by washing them some short time before delivery, and after each suckling, with a little brandy and water. It is also a useful practice constantly to wear a zinc shield over the nipple.

flammation of eczema has been subdued, but the discharge is great, lime-water and glycerine form a useful and comforting application.

Carbonate of lime is sometimes used as a dusting powder in eczema or intertrigo, with the intention of absorbing the abundant secretion, of preventing discharges from irritating the already inflamed skin, and of protecting the skin from the air. This powder, in common with other dry powders, is, in the author's opinion, inferior to some simple, bland, or slightly stimulating, greasy application. Cases occur, however, which are certainly more benefited by dry powders, as oxide of zinc, bismuth and carbonate of lime, than by ointments.

Carbonate of lime, as we have said, is used for intertrigo of the buttocks and perinæum of young children, to protect the skin from the irritation of the urine and of the air. Napkins soaked in urine being very generally the cause of this eruption, it is obvious that greasy applications afford a more efficient protection, for the powder readily absorbs discharges, becomes itself irritating to the skin, and cakes and cracks, leaving parts of the surface exposed. The best treatment indeed consists in frequent ablutions with soap and water, and greasy applications.

Lime-water, on account of its astringent quality, is used as a wash in discharges from the ears and vulva, and is of most service when some active inflammation is still present. In the chronic stages of ear disease it is far inferior to the glycerine of tannic acid, and other astringents.

Dr. Joseph Bell recommends lime-liniment with cotton-wool to prevent pitting from small-pox. Cotton-wool cut in proper shapes is dipped into the liniment, and applied so as to cover the face and neck carefully, leaving apertures for the eyes, nose, and mouth. No crevice must be allowed, and a large hankerchief must be tied over all, and the dressing allowed to remain on until convalescence.

Lime-water is often useful as an injection in leucorrhœa, and its good effects are probably due to its alkalinity.

Chalk makes a good tooth-powder, and is preferable to

powders with hard and angular particles, which wear away the enamel, and lay bare the dentine of the teeth.

Lime-water is occasionally used to lessen the discharge, and promote the healing, of inflammatory and ulcerative diseases of the mouth.

These substances neutralize the acid in the stomach, and are hence antacids; but other remedies are mostly preferred. Salts of lime are useful in poisoning by oxalic acid.

At present it is not easy to indicate precisely the therapeutic value of lime-water in vomiting, but, in some forms of it, few remedies are more useful. It is generally useful in chronic vomiting. It often arrests the vomiting from chronic ulcer of the stomach. It should be mixed with milk, either in equal parts, or in the proportion of one of lime-water to four of milk; and if the vomiting is incessant, the patient should be fed on this only, small quantities, a tea or table-spoonful, being frequently administered. Young children not uncommonly eject much of their milk in large lumps.* These

* This vomiting occurs in early months of life, sometimes even during suckling. If the child is brought up "by hand" the milk should be sufficiently diluted, and during the first month with at least an equal quantity of water; (indeed some authorities advise two parts of water to one of milk,) as the child grows older the relative quantity of milk may be increased. A child a month old may take a pint to a pint and a half. Dr. Meigs, of Philadelphia, recommends the following excellent food for healthy children, and especially for those suffering from the kind of vomiting under consideration. Soak a scruple of gelatine in a little cold water for a short time, and boil it in half a pint of water till it is dissolved, that is about ten or fifteen minutes. Just before finishing the boiling, add milk with some arrowroot made into paste with cold water, and afterwards some cream. The proportion of milk, cream, and arrowroot, depends on the age of the child. For an infant less than a month old he advises three to four ounces of milk, a teaspoonful of arrowroot, and half an ounce to an ounce of cream, to half a pint of gelatine-water; for older children the milk may be increased to a half or two thirds. The gelatine and arrowroot prevent the lumpy coagulation of the milk, while the small quantity af arrowroot will not disorder the stomach. If even this food is rejected, then dilute the milk with three or even four parts of a very thin decoction of arrowroot, or try merely cream and water, one part of cream to three or four of water. This food consisting of milk, cream, arrowroot, and gelatine-water is very useful in diarrhœa.

lumps of curd may pass into the intestines, and escape with the motion, causing, in their passage, severe colic and much wind. Cows' milk is apt to induce this condition, as gastric juice coagulates it in lumps, while it generally coagulates human milk in fine flakes. Lime-water, by preventing this lumpy coagulation, checks this kind of vomiting generally at once; or, should it continue, the rejected milk is no longer curdled. In case of constipation, bicarbonate of soda should be substituted for lime-water. One-eighth of lime-water is generally sufficient, but if this fails, a larger quantity, even equal parts of each, should be tried. Half a drachm to a drachm of bicarbonate of soda should be added to a pint of milk. These remedies both sometimes fail, and it may be necessary for a time to withhold milk, and to feed the child on sopped bread, water gruel, and chicken broth, or veal broth.

Again, in young children suffering from chronic vomiting and diarrhœa, and consequent wasting, lime-water is often of great benefit, improving digestion, and apparently assimilation, and obviating that highly irritating state of the urine, which so commonly occasions intertrigo.

Solutions of these salts pass but slowly into the blood, on account of their low diffusion-power, hence the greater part pass through the intestines, and are ultimately voided with the fæces.

These substances neutralize any acid present in the intestines, and check the secretion from the mucous membrane; and sometimes by one means, and sometimes by both, act efficaciously in diarrhœa. Carbonate of lime and in a less degree lime-water, deservedly hold a high place among remedies for diarrhœa. They are useful in the later stages, when the irritant is got rid of. Common chalk mixture is useful in the diarrhœa depending on more serious causes, as ulceration in phthisis or typhoid fever; but in these cases other remedies are to be preferred.

It has been said that saccharated solution of lime does not confine the bowels, but, on the contrary, relieves constipation.

It should not be taken on an empty stomach, lest it excite nausea.

Dr. Warburton Begbie extols chloride of calcium in ten to twenty grain doses, in scrofula with glandular enlargements of the neck; in cases resembling tabes mesenterica, and chronic diarrhœa with weak digestion. It should be given in milk after food and must be continued for a considerable time, its good effects in many cases not at once becoming apparent.

Lime-water is reputed to be useful in whooping-cough, and this may well be, owing to its astringency; for in certain forms of this disease, astringents, as alum and tannin, often effect a decided improvement.

Lime-water is a useful injection to destroy the thread worms which infest the rectum. It has been also used as an injection in gleet.

From their low diffusion-power, a small quantity only of these substances passes into the blood; so small, probably, that it might well be doubted if they could in any way influence the organs remote from the intestines. But experience shows that lime-water or carbonate of lime are valuable remedies in deficient nutrition, and in convalescence from serious disease, their good effects being most marked in children, in some stages of rickets, mal-nutrition, etc.

In some instances these good results are traceable to the action of the lime salts on the mucous membrane of the intestines. The action of these salts, however, being very similar, although inferior, to that of phosphate of lime, we refer our readers to the section which treats of this salt. One point may be noticed here, confirmed by both theory and experience, that, since but little of these substances pass into the blood, as much good may be obtained from small as from large doses.

PHOSPHATE OF LIME.

Both in health and in disease this salt is of very great importance. It must be ranked among the most valuable and necessary foods, being probably as essential to proper growth and nutrition as the nitrogenous and fatty foods. Observations have abundantly proved its physiological importance. It gives solidity to the skeleton, and if the quantity supplied to the body is small, or if the demand for it is greater than the supply, these solid structures suffer and lose their hardness. Chossat produced softening of the bones of animals fed on food free from lime salts; while, during pregnancy, much phosphate of lime being required for the ossification of the skeleton of the fœtus, it is found that the fractured bones of pregnant women unite slowly and imperfectly.*

Some experiments by Milne Edwards bear practically on this point. He found that animals' bones intentionally fractured united more quickly if the animals were supplied with phosphate of lime.

But far greater than merely to give solidity to the skeleton, is the importance of this necessary food to the soft and growing tissues, in promoting cell growth and natural nutrition.

That this is a very feasible conclusion the following considerations tend to show:—

1. The presence of this salt throughout the body.

2. Its presence in much larger proportion in the intercellular fluid of the body than in the blood itself.

3. The fact that in herbivora the intercellular fluid is as rich in this salt as it is in carnivora, though the vegetable-feeders take so little of it with their food; hence it must be carefully retained in the intercellular fluid for some important purpose.

In respect to the two foregoing considerations, it must be

* The urine of pregnant women is said to be deficient in lime salts, but the evidence on this point is very discrepant.

borne in mind that phosphate of lime is soluble in acids, and as the intercellular fluid is acid, the phosphate would be expected to accumulate in it.

4. Schmidt's observations show "that a certain quantity of phosphate is required to supply the first basis for the new tissues, even in the case of those organs which subsequently exhibit an excess of carbonate of lime," as the shells of animals; an observation showing that phosphate of lime is necessary to initiate growth, and, in this respect, is not interchangeable with the carbonate.

5. Wherever cell-growth is active, there is phosphate of lime in excess,—a statement holding good both with regard to healthy and diseased growths; for even in disease, associated with rapid formation, this salt is found to prevail.

Viewing the subject theoretically, it might be supposed that abundant knowledge exists to enable us to determine the occasions when to employ this salt remedially. In defective nutrition, or deficient cell growth, it would be assumed that the phosphate of lime would prove serviceable, and experience fully corroborates this inference. Certain theoretical objections have been urged against the employment of this salt. It has been said that the fault is really not due to deficiency of lime, but inheres in the tissues, which fail to assimilate it. It is urged that, in cases of defective cell-growth and of malnutrition, the quantity of the phosphate in the urine is unusually great; and, consequently, in such cases our efforts should be directed to remove the circumstances which check assimilation. It is as little reasonable, it may be said, to treat diabetes with sugar, as a diabetes of phosphate of lime, with phosphate of lime. Some truth there is, no doubt, in these strictures, and too much attention cannot be paid to ensure the hygienic conditions favourable to assimilation, as good air, abundant light, and sufficient exercise. The case before us is more analogous to anæmia than to diabetes; and we give iron with decided benefit in anæmia even where this condition is due, not to want of iron in the food, but to the non-assimilation of it by the tissues. The efficacy of phos-

phates, however, must be decided by experience, and this speaks abundantly in its favour. Beneké, to whom on this subject we owe much of our knowledge, both physiological and therapeutical, has shown that phosphate of lime is especially useful in those very diseases wherein it occurs in excess in the urine, as hectic, and chronic wasting disease.

This salt is of great use in the anæmia of young and rapidly growing persons, and women weakened by rapid child-bearing, prolonged suckling, or excessive menstruation. In checking chronic tubercular and non-tubercular diarrhœa, and other profuse discharges, as in leucorrhœa, chronic bronchitis, and large abscesses, it is a valuable remedy, effecting in these states both general and local improvement. Beneké greatly praises its influence on scrofulous sores. It is useful also in caries of the bones.

Women dwelling in towns are apt to have a deficiency of this salt, and are improved by its administration; an increased quantity too, finds its way into the lime-lacking milk of a suckling mother, and thus both she and her child are simultaneously benefited.

Persons in broken health from prolonged town life or overwork, or who from other causes are languid, hipped, and incapable of much exertion, are often much benefited by this medicine. In cases like this, a good formula is a grain of phosphate of lime, phosphate of iron, and carbonate of lime; but phosphate of lime will act admirably by itself. In the chronic forms of phthisis, with little or no fever, this medicine is useful. It should be taken on the tongue, either dry or mixed with a little milk.

The author thinks no reasonable doubt can be entertained of the efficacy of phosphate of lime in many cases of rickets.

It has been sought to establish a connection in all cases between a deficient supply of lime and rickets, and in favour of this view it is urged that rickets commonly occur during the first dentition, when much lime is required by the growing teeth, and that rickets affect the children of mothers in that state of ill health in which it has been established that

lime is deficient in their milk. There may be much truth in these statements; but, as in many cases of rickets an excess of lime is found in the urine, the disease in such cases cannot be held to depend on a deficient supply of the salt, but must be due to other circumstances, with which, at present, we are only partially cognizant. In cases where the disease is dependent on deficiency of phosphate of lime, its administration is obviously all that is required.

In rickets, moreover, there is not merely deficient ossification of the bones, but unnatural growth and defective nutrition, both in the skeleton and in the other textures of the body. The phosphate of lime appears to control this defective and perverse nutrition, and to induce healthy growth, so as not merely to favour the consolidation of the skeleton, but to improve the condition of the soft organs, and experience shows abundantly that many rickety cases are benefited more decidedly by lime salts than by any other single drug.

German authorities who have studied this subject most attentively, consider that the fittest time to give this remedy is only after the cessation of the active stages of the disease, that is, when the pains and tenderness of the bones have disappeared.

It is well here to caution against the uselessness of administering this or other lime salts in large quantities, as, from their very low diffusion-power, very little passes into the blood. A grain or two grains, several times a day, is a sufficient dose. Given in excess, it hinders digestion.

Phosphate of lime in the stomach must be variously affected by the free acids, as lactic, hydrochloric, and, in a lesser degree, acetic acid, dissolve it.

Most of the phosphate of lime taken into the stomach passes into the intestines, where, if its use is too long continued, it is liable to form concretions. Being unaffected by the pancreatic and biliary secretions, and but slightly soluble in the intestinal juice, most of the phosphate passes off with the stools.

Phosphate of lime is highly recommended in various forms

of chronic diarrhœa, and especially in that of young children, to whom it may be given with carbonate of lime and lactate of iron. Whether the beneficial effects are due to its direct action on the mucous membrane, or take place after absorption, in the manner previously described, our present knowledge does not enable us to decide.

Being soluble in the acids of the gastric juice, and to some extent in solutions of common salt, its passage into the blood takes place probably in several ways. It has, however, been doubted whether any portion, if uncombined with food, passes into the blood, since no augmentation of this salt is met with in the urine; nay, in some cases it seems even lessened. The observations on this point are, perhaps, too scant to set the question at rest.

Much phosphate is taken either in combination with the food, or so intimately blended with it that it is well-nigh impossible to separate it from the tissue-forming substances, and so it finds ready entrance into the blood, with the digested materials constituting the chief, and in ordinary cases the only, source of phosphate of lime for the supply of the system, That so alkaline a fluid as the blood is capable of dissolving the phosphate, is explained by its solubility in solutions containing free carbonate acid or common salt.

HYPOPHOSPHITE OF LIME.
" SODA.

These medicines have been extolled for their efficacy in some forms of phthisis, and have found more favour with American than with English practitioners. In America they are used in other diseases besides phthisis, as "nervous and general debility." (See Phosphate of Lime.) In ordinary doses the soda salt often purges slightly, even ten grains thrice daily may produce this effect.

CHLORIDE OF POTASSIUM.
„ SODIUM.
„ AMMONIUM.

These substances, having many chemical and therapeutic qualities in common, have been grouped together; but the remarks in this section refer mainly to chloride of ammonium.

These salts are freely soluble, and posses high diffusion-power. They have a saltish taste, which, in the case of chloride of ammonium, is very disagreeable, and constitutes one of the objections to its use.

All these chlorides increase considerably the secretion from the mucous membrane; and may indeed even excite catarrh. This is notably the case with chloride of ammonium, which is consequently employed chiefly when it is desired to influence the mucous membrane. How do they promote the formation of mucus? Let us take the instance of common salt. Chloride of sodium is a large constituent of mucus, and when taken into the system, salt probably promotes the production of those secretions of which it forms a large part. It is, indeed, a food to the mucous membranes. This suggestive hypothesis may possibly apply in the case of other members of this group. These substances, and especially sal ammoniac, are not uncommonly employed in catarrhal conditions of the intestines, and to prevent the formation of that thick tenacious mucus which forms an excellent nidus for various worms infesting this canal.

Owing to their high diffusion-power, these salts pass rapidly into the blood, and travel too small a distance along the intestines to act as purgatives; so that, unless administered in considerable quantity, they exert very little influence on the character of the motions.

Common salt is used to produce sickness, or to promote it after taking other emetics. Given in poisoning by nitrate of silver, it effects a double decomposition, precipitating the silver as the harmless insoluble chloride.

Chloride of ammonium is often given with considerable success in chronic catarrhs of the bronchial and urinary mucous membrane. It is indicated in chronic bronchitis when the secretion is thick and abundant, and it may be applied topically to the morbid mucous membrane by the atomizer.

The same remedy has been lauded for whooping-cough. It is said to be frequently successful in removing the pain of facial neuralgia "of rheumatic character." It should be given in half-drachm doses, and if, says Sir T. Watson, four doses fail to give relief, the drug may be considered unsuitable for the case. The author has many times found it useful in facial neuralgia; and Dr. Anstie speaks well of it in megraine, clavus, myalgia, intercostal and hepatic neuralgia and in mild forms of sciatica. It must be given in full doses several times a day.

Many practitioners highly esteem the salt in all forms of neuralgia, and I have heard some eminently practical men go so far as to assert that in this painful affection they require no new remedy, since chloride of ammonium so rarely fails. Dr. Thompson also lauds this remedy, holding it only second to phosphorus.

Chloride of ammonium is given with advantage in headaches due to menorrhagia, amenorrhœa, etc.

Common salt sometimes arrests hæmoptysis. Half a teaspoonful should be taken undissolved, and be repeated occasionally till nausea is produced.

Dr. Parkes states that "muriate of ammonia is not oxidised, but passes out unchanged by the urine." "According to Böcker, it increases (in health) all the constituents of the urine, except the uric acid, which it slightly diminishes. The mean daily increase of the urea in these experiments was 4·793 grammes, or 74 grains, an amount which indicates a vast augmentation of metamorphosis or of elimination. The volatile salts and extractives were increased by no less than 18·959 grammes, or 292 grains, which was, no doubt, partly owing to the presence of the volatile chloride of ammonium." (Parkes on Urine).

Group containing—

SULPHATE OF POTASH.
„ SODA.
„ MAGNESIA.
PHOSPHATE OF SODA.
TARTRATE OF POTASH.
BITARTRATE OF POTASH.
TARTRATE OF POTASH AND SODA.

We have adopted this grouping with slight modification from Buchheim's excellent work on therapeutics.

With the exception of the sulphate and bitartrate of potash, these substances are freely soluble in water.

The sulphates have a very disagreeable bitter taste, which in the phosphate of soda is but slight, and in the tartrates is absent.

They are all purgative, producing watery evacuations, which is probably due to their very low diffusion-power.

They have little or no affinity for animal textures, nor much attraction for water, whence they effect few changes in the organic constituents of the body.

While they all act as purgatives, producing watery evacuations, they excite very little irritation in the mucous membrane.

How do they produce their purgative effect?

Purgatives may act in one of two ways, or in both combined.

Some purge by increasing the moisture of the intestines, and so facilitating the passage of the contents along the canal; others act by increasing the peristaltic action of the intestines, so that the contents are more rapidly urged towards the rectum; while most purgatives combine both modes, although one action usually predominates.

The watery character of the motions shows without doubt that, in part at least, these drugs purge by augmenting the

moisture of the contents of the intestines. This augmentation is effected in three ways; the medicine may cause water to flow from the blood into the intestines, or it may excite the mucous glands of this tract to increased secretion, or it may effect the retention of the water already present in the intestines. From Buchheim's careful observations it appears that these medicines purge solely in virtue of their power to retain in the intestines the water existing there. He concludes that they produce no flow of fluid from the blood, no increased secretion from the mucous glands, from the fact that, after purgation with these medicines, no albuminous substances are found in the fæces.

How do they retain in the intestines the water existing there?

These salts, as we have said, possess a very low diffusion-power; they pass slowly and hardly, through animal membranes; that is, they pass from the intestines to the blood with difficulty, so that they are long retained in the canal. As, however, they hold with considerable tenacity both the water of solution and that encountered in their course through the body, they prevent this water passing from the stomach and intestines to the blood. It is not generally held that the members of this group act purgatively by increasing markedly the peristaltic contraction of the intestines, since none produce much pain and griping. It appears then that these medicines are mere expellents from the intestines, not eliminators of the effete material from the blood, although by emptying the intestinal canal they prevent contamination of this fluid by the products of fæcal decomposition.

An excellent way to administer some of these salts is in the form of Pullna or Friedrichshall waters, in doses varying from a wine-glassful to half a tumblerful or more. Usually one dose before breakfast is sufficient; if not, a second, and even a third dose may be taken in the course of the day. It is advisable to mix the natural water with a third or an equal quantity of hot water; for if taken cold it is sometimes liable to "lie heavy on the stomach." Usually a wine-glassful of

Pullna water, with an equal quantity of hot water, is sufficient to open the bowels without much griping or pain.

A wine-glassful of Friedrichshall water in a breakfast cupful of hot water is very useful in bilious sick headache. The best time is before breakfast, but it is useful at any time. It stays the nausea and soon removes the headache, sometimes without purging. The taste of this mixture is not very disagreeable. Pullna or Friedrichshall water mixed with milk is a good purgative for children, the milk disguising the bitterness of the natural waters.

An orange or two eaten before breakfast is a pleasant and often effectual way of overcoming moderate habitual constipation; and sometimes indeed this plan overcomes the more obstinate forms. A glass of cold water before and an orange soon after breakfast is another good means of obviating constipation.

Carlsbad waters are eminently useful in many abdominal diseases. The imported waters are especially efficacious when a dietary is adopted similar to that enjoined at Carlsbad. The water should be warmed to about 100° to 110°, and the patient must drink three to six tumblerfuls before breakfast, prolonging the drinking over an hour or more, and if possible whilst taking exercise in the open air. Dr. Stephen Ward says, "even when first taken and in moderate quantity they usually cause pulpy slimy stools of dark colour and offensive odour. The stools are generally frequently repeated and the patient is astonished at the quantity that sometimes comes away, but in many persons no very evident symptoms beyond the purgative action attend the drinking of the waters." I have rarely seen them purge, because perhaps, I have chiefly used them in obstinate constipation. The quantity to be taken depends on their effects. It is better to begin with three tumblerfuls and gradually increase the quantity to four, five or six according to the action. This treatment must be continued three weeks or a month. It often induces some weakness. It reduces stoutness and sometimes even makes patients very thin. But if it produces much depression or excites nervous symptoms,

a smaller quantity must be taken and the course must be limited to a fortnight or three weeks. The good effects of this treatment are sometimes not apparent, till a week or so after the course. The diet at Carlsbad is extremely simple. "Fat, butter, cream, pastry, cheese, rich meats, as pork, goose, suasages, salmon, mackerel, herrings, anchovies, entrées and other dishes, seasoned with spices, pepper, onions, garlic, &c., are to be avoided. Dressed salads, cucumber, and uncooked fruit generally are objected to as being indigestible and likely to cause flatulence and irritation of the bowels. The use of spirits is absolutely forbidden, and the wine of the country or the lighter French wines are permitted only sparingly and in cases especially requiring a certain amount of stimulus. The breakfast which is usually taken about an hour after drinking the last cup of water, consists merely of weak tea or coffee, with milk and a little sugar, and small well baked rolls or second day's bread; meat, fish, or eggs being excluded, except for the very delicate. The dinner which takes place at one, consists but of three courses; soup free from grease and spices, and thickened with barley rice or vermicelli; meat, as beef, mutton, lamb, poultry or game, with well boiled fresh vegetables; and a light simple pudding or a compôte of stewed fruit: a cup of coffee may be taken in the afternoon; a light supper is taken at eight o'clock, smoking in moderation is not objected to." (Dr. Stephen Ward.)

This treatment is extremely useful in obstinate habitual constipation and by means of it I have cured some of the most rebellious cases. In such instances it may not relieve the bowels for some days, indeed, even a week may pass without relief. In other cases it at once produces one or two soft copious natural evacuations, and on discontinuing the water the bowels act daily. After some months, however, a recourse to the waters may again become necessary owing generally to some fault in the patient's habits. In cases of obstinate constipation simply it is not necessary to enforce very strictly the rigorous diet first described.

Again in cases of the following kind Carlsbad waters are very useful. A middle aged woman accustomed to eat and drink somewhat too freely suffers from acidity, much flatulence, constipation with attacks of pain at the epigastrium, or over the liver, or between the shoulders, the conjunctiva becoming rather jaundiced and the complexion sallow. In cases like this a well regulated diet greatly assists the action of the waters. This treatment is also useful in gall stones and gout. It is not uncommon to hear patients say they have tried Carlsbad waters without good results, but then it is found that they have simply taken Carlsbad salts dissolved in a small quantity of water. In such a form the Glauber salts purge, but fail to yield the excellent results, when given largely diluted with water; I have no doubt that the large bulk of water plays a prominent part in the therapeutic effects.

The medicines now under consideration are not to be indiscriminately used. The bitartrate of potash is employed in both general and local dropsies, but more frequently in general dropsies, and is especially used as a hydragogue cathartic in Bright's disease, to prevent watery accumulation to a dangerous degree in the cellular tissues, or in the cavities containing the important organs, as the heart and lungs. With the water too it draws off the effete and poisonous matters which, in this disease, are retained in the blood. Being mere evacuants of the intestines, it might be thought that these remedies are ineffectual to withdraw either water or urea from the system; but a little reflection will show us this is not the case.

During digestion, a considerable quantity of fluid is poured into the intestines by the stomach, the liver, and the pancreas. Now, if the blood contains poisonous matters, some portion of these must contaminate the fluids secreted by these organs. These medicines, retaining in the canal much of this fluid, until it undergoes expulsion through the anus, thus diminish the quantity of fluid of the body, removing simultaneously some of the poisonous matters accumulated in it.

So far theory; and experience, we find, supports it. The concurrent testimony of practical men bears witness to the fact that free purging with bitartrate of potash, or by other members of this group, lessens the fluid in the cellular tissue and cavities of the body, while it often simultaneously removes the coma, convulsions, and other symptoms due to the poisoned blood. This treatment must be adopted with caution; for it must be borne in mind that free purging is weakening.

A brisk purgative frequently promotes free and abundant secretion from the kidneys, either when healthy or diseased; and herein we have, perhaps, further elucidation of the good effects of these remedies in Bright's disease.

One or other members of this group, generally either sulphate of magnesia, or phosphate of soda, is often given as an intestinal evacuant in fever; hence they are reputed to be febrifuge. But their action is due simply to unloading the bowels; for it is well known that constipation augments the preternatural fever heat.

Dr. Armstrong strongly recommended free purgation to the extent of several evacuations in the day to fever patients during the few first days, before exhaustion had set in. In the present day this treatment finds favour—the author thinks justly—with many practical authorities, although Dr. Graves disapproves it. Some consider that free purgation in scarlet fever prevents the severe sore throat, the glandular swellings, discharges from the nose and ears, with many other disagreeable sequelæ.

Purgatives must be given with caution in measles, the bowels being generally irritable, and diarrhœa often present.

The salts of this group most frequently employed are the bitartrate of potash, sulphate of magnesia, and phosphate of soda. This, phosphate well-nigh tasteless, may be given to children in a little broth, without their knowledge.

The sulphates are common ingredients in purgative natural waters, and in this form are frequently taken in small doses

in constipation or torpid liver. In obstinate constipation a draught should be taken once or twice daily. Small doses, often repeated, act with greater certainty than a single large dose; hence when the bowels are tightly locked up, and have resisted the action of a full dose of Epsom salts, it is a good practice to give the same remedy in small and often-repeated quantities.

It must be mentioned that the administration of sulphate of potash must be conducted with some caution, for although usually a safe and mild purgative it has proved in some cases poisonous.

On account of the low diffusion-power of these salts, very little passes into the blood, the greater part, especially when they purge, passing from the system with the fæces. Small doses, if they tarry long in the intestines, ultimately pass into the blood, and are separated by the kidneys. They are reputed to act as diuretics. The tartrates of this group are highly esteemed as excellent diuretics in Bright's disease, and are often employed in doses short of purging. The tartrates and bitartrates are converted into carbonates, partly in the intestines, and partly in the blood. They lessen thus the acidity of the urine, or even render it alkaline. Except in the case of phosphate of soda, the action of these salts on the constituents of the urine, either in health or disease, has not yet been worked out.

As the action of phosphate of soda and of phosphoric acid appears to be nearly identical, we will speak of them conjointly; and for the account of their action we must be indebted to Dr. Parkes' classical work on the urine.

If Böcker's experiments on his own person are to be accepted as conclusive, the effects of these substances are highly singular. Thus, he found that phosphoric acid always carried potash out with it, and that phosphate of soda changed its base, taking potash in its place.

Phosphate of soda, therefore, greatly lessens the quantity of potash in the body, and the acid would greatly diminish the amount of alkali in the blood, but for the singular fact

observed by Böcker, that, while eliminating potash, both phosphoric acid and phosphate of soda caused a retention of chloride of sodium in the blood, to such a degree as actually to heighten the alkalinity of the body.

The effect of phosphate of soda is to lessen the urea in the urine, partly by the retarding effect it exercises on digestion, so limiting the supply of food to the system, and consequently diminishing the quantity of urea separated by the kidneys. But it appears that this diminution is due in part to lessened metamorphosis of tissue, since even when the salt is given on an empty stomach, the urea is still diminished. Phosphoric acid neither lessens the urea, nor affects the digestion.

For further information regarding the influence of these two medicines on the urine, we must refer our readers to Dr. Parkes' work.

NITRATE OF POTASH.
„ SODA.

These salts possess a very high diffusion-power, and are freely soluble in water. They lower the temperature of water, an effect very considerably increased if sal ammoniac is mixed with the nitre. This combination used to be applied to the skin as a refrigerator. but however, now it is rarely employed for such a purpose, and is to be especially avoided if the skin is broken, for solutions of the nitrate are very irritating to wounds. Ice is in every way a preferable refrigerator.

The inhalation of the fumes of burnt nitre-paper will sometimes avert a paroxysm of asthma. According to Dr. Hyde Salter this treatment is most effectual in pure uncomplicated asthma. He points out that the paper must not imbibe too much nor too little nitre. If the bibulous paper is too thin, it absorbs insufficient nitre; if too thick, it takes up excess of nitre, and the fumes are too carbonaceous; the paper burning too fast, with a sudden explosive flame. There should be

no brown smoke, but clear white fumes. Red blotting-paper of moderate thickness and loose in texture is best. Dr. Salter gives the following directions for the manufacture of nitre-paper:—Dissolve four ounces of nitre in half a pint of boiling water; pour the liquid into a small waiter, and soak the paper in it; then drain and dry it; cut it into pieces four inches square, and when required, burn one or two of these pieces, or a piece may be burned nightly in the bedroom. The prepared paper must be kept in a dry place. In the Pharmacopœia of the throat hospital, Dr. Morell Mackenzie gives the preparation of three papers of different strength; one made from a solution containing 60 grains, another 40 grains, and the third 30 grains of nitre to an ounce of water. He directs the paper to be cut into pieces 3 inches long and ½ inch broad, and one to six of these pieces to be used successively at each inhalation. Various substances may be added to the solution, as compound tincture of benzoin, spirits of camphor, oil of cassia, and tincture of sumbul, and appear in some instances to heighten the effect of the nitre. It is a singular circumstance affording a marked example of the "caprice" of asthma, that a paper prepared with nitre only will relieve one patient, yet will utterly fail to relieve another, although a nitre paper prepared in a different manner may be quite successful. It must be borne in mind, therefore, that although one kind of nitre paper has failed, it does not necessarily follow that another sort of nitre paper will not be successful. Sometimes a thin paper fails where a thick one succeeds, or *vice versa*. It appears indeed that very slight differences in the mode of manufacture influence the therapeutic effects. Many quack papers said to contain other substances besides nitre, or besides nitre and chlorate of potash, often succeed admirably.

The crystals of nitre have a cooling, saline taste. They are sometimes sucked in acute inflammation of the throat, but other remedies are preferable.

These salts, it is thought, while undergoing solution in the stomach, will absorb heat, and cool this organ; no

doubt this is the case; but to be of any service in this way a sufficient quantity cannot be taken with safety. Ice or iced water is far more effectual.

The nitrates in large doses inflame the stomach. Even when taken for some time in moderate quantities, they considerably disorder digestion, producing nausea, vomiting, and a coated tongue; consequently, their action must be carefully watched.

How the nitrates excite inflammation of the skin or stomach is not yet explained; for if these tissues are soaked in solutions of these salts, no other change takes place than occurs from the action of simple water.

From their high diffusion-power these salts speedily enter the circulation. Unless indeed large quantities are taken, they pass but a short way along the intestines, and, therefore, do not purge, and indeed, so far as we know at present, exert little or no direct influence on either the small or large intestines.

Much conjecture has been hazarded regarding the action of the nitrates on the blood. It is well known that they prevent the coagulation of the fibrin in blood withdrawn from the body, or, when coagulated, dissolve it. Scherer, however, asserts that they will not dissolve the fibrin of inflammatory blood. These facts have led to the supposition that the nitrates may possess a like influence over fibrin in the circulation, and that they are indicated when this substance is in excess, as in inflammations and acute rheumatism. There is no proof, however, that they possess any such power; and indeed, unless employed in considerable quantities, the nitrates exert very little influence upon fibrin out of the body. Hence it cannot be expected that after its dilution with the fluids of the circulation, a harmless quantity can influence in any way the fibrin of the blood. But, indeed, this notion is no longer tenable; for it has been ascertained that blood withdrawn from the body, both before and after the administration of nitrate of potash, contains in each case the same quantity of fibrin.

These salts are considered to be highly useful in acute rheumatism. It has been supposed that they protect the valves of the heart, or restore them to their natural state when damaged by rheumatism—a supposition founded on a misapprehension of the morbid processes which lead to valvular contraction and incompetency. These structural changes, it was imagined, resulted from the deposition of fibrin on the surface of the valves, and the subsequent contraction of this substance rendered them shrunken and inefficient. This explanation certainly does not hold good, for these changes in the valves are owing to lymph formed in their own substance. Occasionally, it is true, fibrin is deposited on thickened and roughened valves, but even this, as has been just pointed out, can neither be prevented nor removed by these salts.

But, while it must be admitted that these salts do not act in the way supposed, many high authorities consider that they mitigate and shorten an attack of rheumatism. The advocates of nitre administer it in large doses, freely diluted in water, giving as much as half an ounce to an ounce of the salt in the course of the day. It may be given in lemonade or barley-water agreeably sweetened. Under its influence, the urine, it is said, becomes very abundant, when the fever simultaneously declines, and the pains abate. At present there are no observations sufficiently exact to determine this point.

The same discrepancies of opinion prevail regarding the influence of the nitrates on acute inflammation.

Large doses produce pains in the stomach, with vomiting and diarrhœa, great weakness, faintings, loss of consciousness, and death. The same symptoms, in a minor degree, are witnessed when less immoderate quantities are used. The patient is made languid, disinclined to exert either body or mind, and the pulse is feeble and slow.

These salts readily pass from the body through the kidneys with the urine, and in their passage over the urinary organs may irritate and inflame them, and in large doses may even produce bloody urine.

Nitrate of potash has been recommended for incontinence of urine of children.

The nitrates appear to increase temporarily the water and urea of the urine; ultimately, however, these both fall below their natural amount; hence the nitrates are mere eliminators of these substances.

They enjoy with some a very high reputation as diuretics, and in some cases appear to be of considerable service. Their diuretic action is well displayed in lumbago and chronic rheumatism, accompanied by scanty high coloured urine, becoming turbid on cooling. Ten grains of the salt dissolved in water, taken hourly or every two hours, will, in most cases, soon increase the urine, and render it clear and limpid, when the rheumatic pains generally decline.

CHLORATE OF POTASH.

In many of its chemical properties this salt corresponds to the preceding group of nitrates; like them it is endowed with a high diffusion-power, but differs from them in its sparing solubility.

A solution of the chlorate is used as a wash to foul ulcers, which it is said to clean and stimulate; but other remedies are more effective.

This salt appears to increase the flow of the saliva, and, according to Hutchinson and others, to produce ulceration of the mucous membrane of the mouth. It is largely used in various affections of the mouth, and is of signal service in mercurial and simple salivation, in ulcerative stomatitis and aphthæ. It is particularly useful in the ulceration of the edges of the gums. This ulceration, generally limited to one side of the mouth, affects both the upper and lower jaws, also that part of the tongue and cheeks coming in contact with the ulcerated gums. Although not at all dangerous, it is often a

very obstinate complaint, especially with adults. Children are most prone to it. The influence of the chlorate on this form of ulceration is almost magical; in one or two days it cleans the dirty-looking ulceration, and heals it in a day or two more. It is said to cure follicular and phagedenic ulceration like a charm.

Dr. Leonard Sedgwick speaks highly of chlorate of potash in catarrh: he says, it quickly relieves the stuffing of the nose, rawness of the throat and thickness of voice. Taken early and frequently, it will stop many a cold. Eight or ten lozenges should be sucked in the twenty-four hours.

Some assert that the action of chlorate of potash is simply local, and that all its good effects are due to its topical application.

Chlorate of soda is more soluble than chlorate of potash, and is said to be equally serviceable.

It seems to produce but little effect on the stomach, unless taken in considerable quantities, when, like the nitrates, it inflames the mucous membrane, and produces both vomiting and diarrhœa. It is not employed in diseases of the stomach.

It passes readily into the blood, owing to its high diffusion-power; but owing to its slight solubility, a large quantity of this salt cannot be conveyed quickly into this fluid.

Dr. Kent Spender recommends large doses of it in phthisis, and lets the patient drink a concentrated solution, *ad libitum*. This treatment, he says, checks diarrhœa and prolongs life. He recommends also, large doses in the stomatitis of children.

As this salt easily loses it oxygen, it was at one time supposed, that yielding up this element to the blood and tissues, it might promote oxidation; but careful observations have proved conclusively the erroneousness of this view, as the salt can be obtained unaltered from the urine.

It has been recommended in facial neuralgia.

Its influence, if any, on the organs of the body is unknown.

ALUM.
DRIED ALUM.
ACETATE OF ALUMINA.

These salts act mainly as astringents, in virtue, it is supposed, of their capacity to unite with albumen, and coagulate it.

They produce no effect on the entire skin; but when applied to sores, they coagulate the albumen of the pus, mucus, or of the tissues themselves, thus coating the sore with an impermeable layer, and protecting it from the action of the air. Alum, like many other metals, may be used to form this protective coating. These remedies have, however, a further action than that just described; for, as just stated, they act as astringents by combining with and condensing the tissues. The topical application of alum contracts the bloodvessels and lessens the supply of blood to a sore. By constringing the bloodvessels, and by condensing the tissues themselves, the members of this group will depress the vital action of a sore, and so check the secretion of mucus or pus. For this purpose alum is applied dry, or in solution, to relaxed and abundantly secreting sores.

Other astringents in such cases generally succeed better.

Alum solutions may be applied to free-weeping eczematous surfaces, to check profuse discharge, and to bring the eruption into a condition suited for other remedies. Alum, like other astringents, is generally insufficient to heal the eczema.

Owing to their capacity of condensing tissues and coagulating albumen, these substances may be used to control bleeding, and alum has the advantage of being almost always at hand in an emergency. It is applicable only in the milder forms of bleeding. In severe hæmorrhage other treatment is of course required. But to check the bleeding of piles, leech-bites, or slight cuts, alum dusted on the affected part, first wiping it dry. or applied in pretty strong solution, is generally sufficient. Bleeding from the gums may be

treated in the same way. Alum may be injected into the nose in epistaxis, or may be snuffed up as the dried powder.

Alum in strong solutions (six grains to the ounce) has been recommended in prolapsed anus or uterus, but is little used in either case.

As a wash in vulvitis of children, few remedies can be compared to alum, used in the strength of sixty grains to a pint of water. This solution must be frequently applied, by the help of a syringe, to the secreting surface, first washing away the pus with warm water. The lotion should be applied every hour or oftener, and a piece of lint soaked in it should be left between the parts. Although generally successful, this treatment not unfrequently fails to check this troublesome complaint, even when it cannot be traced to any irritation, as worms, constipation, or teething. The discharge in some cases, besides coming from the surface of the vulvæ, is poured out from the lining membrane of the vagina, when it is necessary to take care to pass the injection up the vagina. Want of attention to this fact explains the occasional failure of treatment and apparent obstinacy of the case. The solution just recommended may sometimes prove too strong, increasing both the inflammation and discharge, when of course its strength must be reduced.

Similar solutions are useful in chronic otorrhœa, although alum is far inferior to glycerine of tannic acid.

A solution of alum of the strength of eight grains to the ounce of water is an excellent solution in simple, and especially purulent ophthalmia of children. The conjunctiva must be well washed with it every quarter or half-hour. The frequency of the application is the chief condition of its success; for simple water, as frequently applied, is a useful, although inferior, application.

Few substances are so useful as alum in certain diseases of the mouth. Thus in simple ulcerative stomatitis,—that form which, beginning at the edge of the gums and never spreading far beyond, is often limited or most marked over one half of the jaw,—dried alum applied dry by the finger many times

a day will heal the ulceration in a few days. It is not merely astringent; but, from its attraction for water (which it has lost by being heated), it is also slightly escharotic, and gently stimulating to the indolent tissues. Ulcers like these, produce ulceration by contact with the contiguous mucous membrane of the tongue or cheek.

Aphthous ulcers, showing but little disposition to heal, or indeed tending to spread, may be touched with dried alum a few times a day with the best effect. Usually no such application is required, and chlorate of potash, and perhaps a purgative, are all that is required. Other forms of ulceration may be treated in the same way. Alum is recommended to be applied to the throat either dry or in solution in simple or scarlatinal sore throat, in tonsillitis, and even diphtheria. Alum being now little used in any of these cases, perhaps its advocates exaggerated its good effects.

It is asserted that ten grains of powdered alum placed dry on the tongue will sometimes arrest a paroxysm of asthma.

Gargles of alum are more useful in chronic inflammations of the throat, when the mucous membrane is relaxed and covered with a grey mucus or with pus. Although alum is highly useful, the glycerine of tannin is a surer and less disagreeable application.

In chronic ozœna a solution of alum, a drachm to the pint, is highly serviceable. Many cases speedily yield to efficient irrigation. About a foot above the patient's head is a basin containing the solution, and in this, one end of an elastic tube is placed. The solution is then sucked into the tube, when the free end is placed in one nostril, and the ala of the nose pressed on it to secure it in position. Here we have a syphon, and the fluid runs from the vessel through the tube, up one nostril and down the other, washing the sinuosities of the nasal membrane most thoroughly. The head is bent a little forward, and the mouth must be kept open, and, if properly managed, none of the solution escapes by the mouth, but the whole of it runs through the nose.

This application generally removes the disease very speed-

ily; and even when it fails to eradicate the disease, it checks the discharge, and removes the offensive smell so often present. Some prefer acetate of alumina as more efficient than simple alum, in correcting the fœter. If the fœter persists, the application should be used twice a day, or oftener. If the fœter is very great, a weak solution of permanganate of potash or carbolic acid may be used. This fœter, depending on decomposing matters, can generally be prevented by irrigating the nose in the manner described. A wash of a solution of glycerine of tannin in water is often useful. A strong solution of alum is sometimes useful in pruritus vulvæ.

Ten grains of alum to the ounce of water is used in the form of spray for chronic coughs and hoarseness.

Alum behaves in the stomach, as on the denuded skin, coagulating the albumen, and constringing the mucous membrane; and it hinders digestion by each of these processes. It will often check bleeding from the stomach, but it is inferior to other astringents It sometimes controls vomiting. In six to ten grain doses it sometimes checks obstinate forms of vomiting, occuring in phthisical patients, especially that form excited by coughing.

Dr. Meigs speaks very highly of alum emetics for children. He prefers it to other emetics in croup. He gives a drachm in honey or syrup every ten or fifteen minutes till the child vomits, but a second dose is not generally required. Alum, he says, does not weaken, and does not lose its effects so soon as antimony or ipecacuanha. Dr. Meigs strongly advocates the employment of emetics in true croup, and thinks that many lives might be saved were they more frequently used and repeated oftener. In severe cases he produces vomiting three or four times a day, or even oftener. This treatment must be begun early.

Alum checks secretion from the mucous membrane of the intestines and constipates by rendering the contents of the canal more compact and more difficult of propulsion. Alum is sometimes used in both acute and chronic diarrhœa, and it

has proved useful in the diarrhœa of typhoid fever and of dysentery.

It is uncertain how far the members of this group pass down the intestinal canal, but probably not far without being decomposed and rendered inert. Alum has been extolled by the highest authorities in lead colic. It is said to remove the spasm and the pain, and at the same time to unload the bowels more speedily and certainly than other remedies. It is given in considerable quantities, as much as ten grains every hour. The few trials the author has given this treatment have not been rewarded with success.

The long-continued administration of these substances produces loss of appetite, constipation, and at last chronic catarrh of the stomach and intestines. Large doses cause gastro-enteritis at once with its usual symptoms.

In certain stages of whooping-cough alum is an excellent remedy. It is useful when the acute stage is over, and when there is no fever nor inflammation of the lungs, nor any irritation of the teeth. In fact, it is useful only in uncomplicated cases; but in these, few remedies give more satisfactory results. It speedily reduces the violence and frequency of the paroxysms, often indeed at once lessening the frequency one half, and, in fact, soon cures the case.

Alum checks, often straightway, the troublesome vomiting so often met with in this disease, while, at the same time, the appetite much improves—effects observed sometimes even before the cough undergoes any diminution. Constipation rarely happens when alum is administered.

The alum may control whooping-cough by its astringent action on the throat, and in support of this conjecture is the fact that other astringent substances, as tannin, etc., are likewise useful (see Tannin), even when the remedy is applied only to the throat; and that alum itself acts best when mixed with some tenacious fluid, as gum, glycerine, or honey, by which the solution is made to hang for some time about the fauces.

The alum should be given in doses varying from two to

six grains every three hours, or it may be given hourly in corresponding doses. Alum is generally beneficial in the paroxysmal cough, which may continue a long time after the characteristic whoop has disappeared, and in other coughs having the same spasmodic character.

How much of these substances is absorbed by the intestines, and conveyed into the blood, is unknown; but probably not a large quantity. The chief part escapes with the fæces, which the alum is said to make firmer and odourless.

It is doubtful if alum has much effect as a remote astringent to check bleeding from the lungs, uterus, kidneys, etc, and to check profuse sweating and discharges. Alum injections, one drachm to a pint, employed in the manner directed for the injection of carbonate of soda (see Potash Group), are very useful to check leucorrheal discharges. The alum solution constringes the parts, and sometimes causes severe cramp-like pains in the belly.

PREPARATIONS OF IRON.

Iron is a constant and necessary constituent of the body, and must be regarded as an important food.

None of the preparations of this metal applied to the skin produce any change in it. Several of the soluble salts combine with albumen on raw surfaces, sores, and mucous membrane, condensing the tissues, and constringing the blood-vessels; and, independently of this astringent action, they act at the same time as stimulants or irritants according to the strength of the application or the condition of the sore.

The organic salts are less astringent and stimulating than the inorganic; while, of the inorganic, the ferric salts possess these properties in a greater degree than the ferrous salts.

Several compounds of iron may be employed as astringents and stimulants; but, when a stimulant is required, other metallic preparations are preferable. The sulphate, but es-

pecially the ferric chloride, solid or in solution, is employed to check hæmorrhage. The chloride is a powerful styptic, and readily controls the bleeding from small vessels, but it has the disadvantage of irritating the surface of wounds and preventing union by first intention. Carbolic acid will probably supersede perchloride of iron; for this acid, properly employed, does not prevent the immediate closure of a wound.

The soluble preparations have a metallic astringent taste, and act on the mucous membrane of the mouth as on the abraded skin.

Iron salts are never employed as topical agents in diseases of the mouth; and as they often discolour the teeth, especially when the breath contains sulphuretted hydrogen gas, arising from carious teeth, etc., they are often taken through a quill, glass tube, or reed. They are conveniently given in the form of pill. Salts of iron stain the tongue black.

The effects of these salts in the stomach differ according to their properties. Some are astringent, stimulating, and in large doses irritating to the mucous membrane, as the pernitrate, the perchloride, the iodide, and the sulphate, while the remaining preparations are with respect to this membrane almost inert. If the stomach is irritable, then bland preparations of iron must be chosen. It is often stated that chlorotic or anæmic patients with weak stomachs must be treated with bland unirritating preparations of iron. In some instances, no doubt, the astringent preparations are ill borne, but in most cases they produce far better results than the bland forms of iron. A pale, flabby, broad, and teeth-indented tongue indicates almost always the need of large doses of the astringent preparations of iron. Thirty drops of the tincture, or three or four grains of the sulphate, may be given three times a day. Weak anæmic girls, suffering from pain and vomiting after food, with perhaps tenderness of the skin at the epigastrium, are often effectively treated by large quantities of the tincture of the perchloride.

The soluble preparations of iron combine with the albumen in the stomach, while the insoluble preparations are dissolved

to a variable extent in the acids of the gastric juice. The reduced iron is pretty freely soluble in this acid, but gives off hydrogen gas, or, if the preparation is impure and contains a sulphide, sulphuretted hydrogen; either gas causing eructations, and the latter a very disagreeable taste. The peroxide, if strongly heated, is soluble with great difficulty in the stomach; the more slightly heated forms should therefore be preferred. The carbonate and the magnetic oxide are more easily dissolved than the sesquioxide.

The metallic preparations and the proto-salts, after undergoing solution, become converted, either in the stomach or duodenum, into per-salts, very likely by means of the oxygen of the air swallowed with the saliva.

The astringent preparations, as the perchloride, acetate, pernitrate, or sulphate, are employed to check hæmorrhage from the stomach. These preparations, in proportion to their astringency, confine the bowels; but to this rule there are exceptions. As, soon after quitting the stomach, they are changed into an insoluble and inert sulphide, their astringency must be exerted on the upper part of the small intestines.

The sulphate, acetate, perchloride, pernitrate, in common with other astringent metallic preparations, may be given in diarrhœa. The pernitrate, much praised in the chronic forms of this complaint, is probably an efficient preparation.

Owing to the astringency of iron salts, it is a useful practice to combine with each dose some laxative, as a quarter of a grain of aloes, a few grains to half a drachm of sulphate of magnesia, soda, or potash. Some consider that the combination with a laxative promotes markedly the absorption of the iron.

In their course along the intestines, the iron salts, as we have said, are changed into a sulphide of the metal, giving to the fæces a black and characteristic appearance. A very small quantity of an iron salt is sufficient to stain the motions deeply, and to keep them darkened for several days after the discontinuance of the medicine. Iron salts have no direct influence on the pancreatic or biliary secretions.

In the treatment of the small thread-worms infesting the rectum, the tincture of the sesquichloride, in the strength of half a drachm of the tincture to a pint of water, is an efficient injection. The iron coagulates the albumen of these animals, and so destroys them.

Now comes an interesting and important question,—How much iron is absorbed into the blood? Probably but little of the insoluble compounds, as the quantity of acid in the stomach is not great. Of the soluble preparations it is hard to say. The increase of the iron in the urine being very small after administering a soluble iron salt, it has been concluded that very little passes into the blood; and the fact that almost all the iron taken by the mouth may be re-obtained from the fæces, seemed to strengthen this view; but a wider knowledge concerning the elimination of metals from the body proves this reasoning to be inconclusive. Most metals probably, but iron certainly, are eliminated from the system through the intestines, and make their exit with the fæces; for when iron salts are injected into the blood, almost the whole of the metal is ultimately recoverable from the fæces. That much more is absorbed than is appropriated by the blood corpuscles, is shown by the coloration iron produces in all the albuminous secretions of the body; for the fluids bathing the various cavities become coloured reddish-brown.

In the treatment of anæmia, many physicians advocate the use of large doses of iron salts; others as strenuously maintain that all the good effects may be obtained from very small doses, and they instance the beneficial effects of ferruginous waters. In many instances, no doubt, anæmia is curable by the employment of small quantities of iron, but it is likewise certain that large quantities, when they can be borne, act far more promptly. Half-drachm doses of the tincture, or six to eight grains of the sulphate, may be given two or three times daily. The following pill, originally employed by Blaud, is strongly recommended by Niemeyer: Sulphate of iron, carbonate of potash, of each half an ounce; tragacanth, as much as is required to make ninety-six pills.

Three of these are to be taken three times a day, an additional pill being added daily. No doubt this pill is very efficacious; but the iron without the carbonate appears to answer as well. These large doses of iron, while rarely upsetting the stomach, or producing headache, cure anæmia with astonishing rapidity.

Iron salts, in anæmia, possess important properties other than influence over the growth of the corpuscles. They act bracingly on the relaxed mucuous membrane of the digestive canal, and probably in this way tend to restore its functions. Moreover, it is highly probable that, after its entrance into the blood, the iron exerts an influence beyond that of merely increasing the quantity of red corpuscles; hence iron preparations are useful, not simply as a food in promoting the formation of the blood discs, but on account likewise of their beneficial influence on the tissues of the body. Iron, therefore, cannot be regarded merely as a food to the system; it is also an important curative agent. Large quantities of the soluble astringent preparations should be administered where we desire to benefit tonically, the mucous membrane of the digestive canal and the tissues.

The experience of physicians of the last generation accorded with these views, and so does that of many highly practical men of the present day, but on the introduction of the bland and almost tasteless preparations of iron, they were assumed to be in every way superior to the astringent forms. Their comparative tastelessness is certainly in their favour; moreover, it was considered, mainly on speculative grounds, that the astringent preparations must disorder digestion in anæmic persons. These theoretical opinions still prevail, but the author believes them to be ill-founded, and that, in the class of patients just described, the astringent preparations, even in large doses, are preferable; and that a large share of the benefit derived from them is due to their direct action on the mucous membrane of the stomach and intestines, and on the organs which stud them. It has been experimentally shown that sulphate of iron does not check the solvent action

of the gastric juice, and experience justifies the conclusion that in weak anæmic patients it does not lessen, but rather increases the formation of this secretion.

If the digestive mucous membrane is in an irritable state, then, as we have previously pointed out, the astringent iron preparations, in full doses, may do harm.

There are also individual peculiarities in respect of iron. Some persons cannot take iron in any form, not even a single dose of a weak ferruginous water. The digestive organs of some patients are easily upset by it; in some it induces fulness and pain in the head, while others in apparently similar conditions take it not only without inconvenience, but with great benefit.

It is sometimes advisable to humour the stomach by occasionally changing the preparation of iron.

According to most authorities, the iron in the blood combines with albumen. Bernard thinks it exists in the blood as a protoxide. Under certain conditions iron increases the quantity of blood corpuscles, and in this way improves the general nutrition of the body.

Iron salts are thus useful "in maladies attended with defect of the red corpuscles of the blood; as in anæmia, with or without irregularity of the uterine functions (chlorosis, amenorrhœa, dysmenorrhœa, and menorrhagia), and whether occurring spontaneously and without any obvious cause, or resulting from profuse discharges (hæmorrhages, fluxes, as leucorrhœa, etc.), from food defective in either quantity or quality, and from deficiency of light and pure air. In these cases the use of iron, conjoined with sufficient nourishing food, pure air, abundance of light, and, when necessary, the employment of purgatives, proves curative. But, when the anæmia or hydræmia is dependant on organic diseases, as cancer, granular degeneration of the kidney, or morbis cordis, the use of iron can at best be palliative only. Also in some chronic affections of the nervous system great benefit is obtained by the use of iron. Chorea, in a large number of cases, may be relieved, and oftentimes cured, by chalybeates;

though in general they are inferior to arsenic, which usually cures chorea much more speedily and certainly than they do. Cases, however, sometimes occur in which the chalybeates are preferable, as where anæmia co-exists. Epilepsy and hysteria are other nervous affections which are sometimes benefited by a course of iron, especially when they are attended with anæmia or uterine obstructions." (Pereira.)

The long-continued use of iron is highly beneficial in scrofula and rickets.

Iron-salts are commonly administered in amenorrhæa. Conjoined with this affection there is usually much anæmia, so that the iron, by remedying this condition assists in restoring the proper functions of the uterine organs.

It must be remembered that anæmia is dependent, not on deficiency in the supply of iron, but on a scanty assimilation of it; hence its use must be conjoined with well-regulated hygienic circumstances, otherwise iron does comparatively little good.

In a case of neuralgia, when no organic cause can be discovered, salts of iron are especially recommended where the patient is anæmic, although it is true their action is very uncertain. The huge doses in which these salts, especially the sesquioxide, have been given are probably injurious, and exert less influence over the disease than smaller ones. Large doses of perchloride of iron are of great benefit in diphtheria. It is a good plan to use the solution rather than the tincture, and to give the medicine very frequently—every hour, or even oftener. It is uncertain whether the effects on the throat depend on the topical action of the medicine, or whether they take place after its entrance into the blood. The solution is frequently painted on the throat, taking great pains to apply it very gently, lest by increasing the inflammation it does more harm than good, and this process appears to arrest the spread of the disease, and it is said to maintain the strength of the patient. The solution may be applied with the atomizer, so as to penetrate into the trachea and bronchial tubes. Large hourly doses of the perchloride have been found of

great use in erysipelas. In the hands of some observers this treatment has altogether failed, which may possibly be accounted for by the long intervals between the doses. The *frequent* repetition of the medicine is one of the most necessary conditions of success.

In the so-called hysteria of middle-aged women, occurring especially at the cessation of menstruation, they often experience distressing fluttering of the heart, a sensation of fulness of the head, with heat and weight on the vertex, frequent flushings of the face, and "hot and cold perspirations." This combination of symptoms is generally removed by considerable doses of the sesquichloride of iron, given three times a day. If the symptoms are limited to the head and face, then other remedies are more successful (nux vomica, opium, belladonna).

The salts of iron sometimes excite considerable irritation of the bladder, with frequent desire to pass water, which may contain a considerable quantity of mucus. They may cause in children even nocturnal incontinence of urine. Yet iron salts not unfrequently cure this troublesome complaint, even when not dependent on worms in the rectum, or other irritation. The astringent preparations of iron are employed to arrest hæmorrhages, as from the lungs and kidneys, and the acetate is the best preparation; and the following is stated to be a very effectual way to administer it:—Add sufficient of the salt to water to make it taste distinctly, but not disagreeably, and let the patient sip this constantly. Sufficient can be taken thus without exciting nausea or disgust; indeed, patients often like it.

The salts of iron appear to lessen profuse secretions, such as occur in chronic bronchitis and leucorrhœa. Dr. Graves gave the compound iron mixture, in doses of one or two fluid drachms, to check excessive bronchial secretion.

The iodide of iron may be given where both iron and iodine are indicated, for instance, in syphilis complicated with anæmia. It is a question of much interest whether it is preferable to administer these two agents separately or combined

in the iodide of iron, and whether they continue in combination in their course through the stomach and circulation, or whether the salt is decomposed. Viewing this question simply from a chemical point of view it would seem that an iodide of sodium and albuminate of iron must be formed in the stomach or blood; but some observations made, I believe, by Bernard, throw much doubt on this conclusion; for it was found that if iodide of potassium and a salt of iron were injected into the blood, no iron appeared in the saliva, but if an iodide of iron was injected, then both iodine and iron were found in this secretion.

The iron of the effete red corpuscles probably escapes with the bile; and when iron salts are swallowed, this fluid contains an excess of the metal. This, therefore, is one way by which iron may be separated from the body.

Its further separation takes place by means of the albuminous secretion of membranes; and as iron, very probably, like most other metals, exists in the body only as an albuminate, it has been conjectured that it can be separated only by the secretions containing albumen; and certain facts and considerations favour this view. For when iron is injected into the blood, much of it reappears in a short time on the surfaces yielding an albuminous secretion, as the mucous membrane of the intestines, of the bronchial tubes, of the gall-bladder, of the urinary bladder, and the serous membranes, as the pericardium, peritoneum, and pleura. A small quantity escapes with the urine; but whether excreted by the kidneys, or separated by the mucous membrane lining the urinary passages, is uncertain. Some maintain that it is separated by the mucous membrane, and, in support of this view, urge that when the iron of the urine is much increased, irritation of the mucous membrane always sets in, shown by the frequent desire to make water, and by the excess of mucus in the urine.

The tincture of the percloride of iron, in the proportion of half a drachm to half a pint of water, with a drachm of laudanum, makes a capital injection for gonorrhœa or gleet, often

speedily checking the discharge, and easing the pain on micturition. Mr. C. C. Fuller, of Albany Street, finds very useful, an injection, used three times a day, composed of sulphate of iron, twelve grains, tincture of opium, half an ounce, water, eight ounces.

The syrup of the phosphate of iron, is a useful form, if there are any indications for the employment of phosphoric acid. (See Phosphate of Lime.)

NITRATE OF BISMUTH.
CARBONATE OF BISMUTH.

These powders are commonly used as harmless cosmetics; in intertrigo, and sometimes in eczema, they are useful as dusting powder; but other remedies are to be preferred in eczema.

When applied to the broken or unbroken skin, these substances, being insoluble in any fluid they may meet with then, are not absorbed.

Trousseau employed equal parts of bismuth and Venetian calc in chronic non-syphilitic ozœna, ordering the patient to snuff up some of this powder, after clearing the nasal passages by strongly blowing the nose. He, however, prefers mercurial powders. (See Mercury.)

Being insoluble, they are tasteless, but they sometimes occasion a disagreeable sensation of roughness, and sometimes they blacken the tongue. This rough taste may generally be obviated by administering the drug in milk.

Little is known at present of the changes these medicines undergo, nor of their effect on the stomach. Whether they are dissolved or not, or whether their efficacy depends on physical or chemical properties, are questions remaining yet unsolved.

In many diseases of the stomach, these preparations, and the nitrate especially, are very valuable. They ease the pain

of most affections of this organs, whether depending on organic or so-called functional disease. Therefore, in cancer, chronic ulcers, and chronic inflammation of the stomach, bismuth is often serviceable. It is especially useful in the chronic gastritis of drunkards, subduing the pain, checking the vomiting, and enabling the stomach to tolerate food. It is also useful in gastrodygnia and cramp of the stomach. Many forms of vomiting in children, and notably that depending on acute or chronic catarrh of the stomach, yield speedily to this remedy. The various forms of pyrosis, whether acid, alkaline, or neutral, are very amenable to this drug, although our limited knowledge concerning the causes of this symptom fails to enable us to lay down precise rules respecting the particular kind of pyrosis most benefited by bismuth.

Dr. Graves successfully treated acidity of the stomach with nitrate of bismuth, and experience confirms his recommendation. He generally mixed it with opium or morphia, and sometimes magnesia. Flatulent dyspepsia, in some of its forms, yields more or less to bismuth; it may be mixed with an equal quantity of vegetable charcoal.

These remedies prove useful in some forms of chronic diarrhœa, succeeding often when other remedies fail. Their action is most conspicious in checking the exhausting purging of phthisis. It is necessary to give as much as half a drachm to a drachm of the nitrate several times a day, and this large quantity, taken with milk, does not disturb the stomach. It often subdues diarrhœa, the most intractable to other treatment, effecting sometimes so great an improvement in the general health, that patients, whose speedy death seemed inevitable, rally, and return to the ordinary duties of life.

Bismuth in large doses is freely used on the Continent in the various forms of diarrhœa of young children. Thirty to sixty grains hourly are recommended, and at the same time milk is withheld. Much smaller doses, however, are often useful and may be given with milk. A grain hourly is very

efficacious, and its good effects are often enhanced, by adding to it a sixth of a grain of grey powder.

The bismuth preparations are not employed to act on the remote organs of the body.

A bismuth injection, consisting of bismuth, half an ounce; glycerine, half an ounce; water, three ounces, is very useful in gonorrhœa, especially in the chronic state. The same injection sometimes proves serviceable in gleet.

The chief part, if not all the bismuth, is evacuated with the fæces. Some indeed may be absorbed, but the quantity entering the blood is probably extremely small.

LEAD SALTS.

Lead added to albuminous fluids, forms a precipitate composed of albuminate of lead. Like other metals, the soluble salts of this group, when applied to the abraded skin or to sores, or to mucous membranes, coat them with an impermeable air-proof covering; if, however, a protecting covering is required, other metals are generally employed. Besides combining with the albumen of the secretion, any excess of the solution will combine with the tissues themselves, in which manner, probably, lead salts condense these structures, and constringe the blood-vessels. The soluble lead salts are used as lotions to unhealthy and over-secreting sores, and to eczematous eruptions. In some forms of eczema lead lotions are very useful. When there is much inflammation, and when the surface is raw and weeps copiously, a lead lotion allays inflammation, checks the discharge, and quells the itching, burning, and tingling, so often accompanying eczema. Two or three drachms of liquor plumbi in ten ounces of water is generally sufficient; but a stronger lotion, consisting of two ounces of liquor plumbi, two ounces of glycerine, and four

ounces of water, is sometimes more successful. If the inflammation is great and the weeping abundant, the rash must be constantly covered with rags soaked in the lotion. In some cases it is useful to apply a poultice at night and the lotion during the day. The stronger lotion is especially useful in diffused eczema, without weeping, but with excessive itching and tingling. The diseased skin should be sponged with the lotion several times a day. A weak alkaline or a sulphur bath greatly assists the action of the lotion. The fluid oozing so abundantly in eczema being strongly alkaline, the property of these lotions to check this discharge may be owing to their weak alkaline reaction (*vide* 124). The stronger lotion allays very effectually the itching of pityriasis. Lead lotions occasionally ease the itching of urticaria.

A lead lotion is often of great service in pruritus pudendi, especially when the mucous membrane is red and excoriated. A weak lotion fails sometimes where a strong one succeeds. It may be necessary even to use equal parts of liquor plumbi and glycerine, an application which may excite a little very temporary smarting. When pruritus pudendi depends on ascarides, hæmorrhoids, or a tumour in the urethral passage, it is obvious that these applications are useless.

A lotion of one part of liquor plumbi,* with one or two parts of glycerine, applied warm after the crusts have been entirely removed, is useful in the milder forms of lupus.

While lead salts have many properties in common with those of other metals, they are distinguished by their unirritating, soothing character, whence they are used only as astringent and soothing applications. The soluble lead preparation may be used to check bleeding from small vessels; but other astringents are more effective.

Solutions of the acetate and diacetate are employed as injections and washes in chronic otorrhœa and vulvitis of children. They lessen the production of pus, and ease pain, by virtue of their astringency and their soothing qualities. They are of most use when the acute stage has just subsided,

* When liquor plumbi is mentioned, we refer to the strong solution.

the tissues remaining irritable and painful. Stronger astringents are needed in the later stages.

Bland, unirritating plasters made of lead are in common use.

These plasters, and lead applications generally, are sometimes objectionable, owing to the black discoloration they produce from the formation of the black sulphide with the sulphuretted hydrogen gas produced by the decomposition of the discharges.

Pain in the loins, due to weakness, is often relieved by a stout plaster. Burgundy pitch on leather is generally used, but is very liable to produce a crop of itching papules which may spread over the greater part of the body, while lead plaster, though somewhat less adhesive, is free from this objection. Plasters sometimes relieve back pains due to uterine disease or piles.

For sweating feet Hebra employs an ointment composed of equal parts of lead plaster and linseed oil spread on linen and wrapped round the feet, renewing the application every third day for nine days.

The foregoing ointment applied on soft linen twice daily is sometimes invaluable in the sub-acute stage of eczema.

In ulceration and sloughing of the cornea, lead washes must be avoided, lest a white compound become deposited in the structures of the ulcer, leaving a permanent opacity.

Lead injections are sometimes employed in gonorrhœa, gleet, and leucorrhœa.

Lead may be absorbed by the skin in quantity sufficient to produce lead-poisoning, entering the blood probably as an albuminate, which is soluble in weak acids and alkalies. Lead-poisoning occurs only when the solutions are applied continuously to large raw surfaces; moreover, this incident occurs so rarely as not in any way to prohibit the use of lead lotions.

The insoluble lead salts are tasteless; the soluble have a sweetish acid and astringent taste.

The soluble preparations are astringent to the mucous

membrane of the mouth, and combine with the albuminous substances they meet with there.

That portion of the soluble compounds of lead which escape combination with albumen in the mouth, is converted into an albuminate in the stomach.

The soluble lead preparations are sometimes used in hæmatemesis, and have been much recommended to check pyrosis.

The albuminate of lead in the intestines is probably speedily decomposed into a sulphide of lead, an insoluble and inert compound. The soluble salts act powerfully as astringents of the intestines, and cause constipation. They control many forms of diarrhœa, even that dependent on disease of the lower part of the small or of the large intestine.

The effects of lead on the parts of the intestines distant from the stomach and duodenum must be manifested through the nervous system; and we know the intimate sympathy existing between the different parts of this canal.

In summer diarrhœa, a few grains of the acetate with a small dose of morphia is a sure and speedy remedy.

It has been recommended in cholera, especially in its early stages. In the purging from dysentery and typhoid fever, and from tubercular disease of the intestines, few remedies are so useful. The acetate should then be combined with opium.

Added to a starch injection, used to check various forms of diarrhœa, it will increase its efficacy. It may be applied for a similar purpose as a suppository.

The acetate, in large doses, acts as a weak irritant poison, but the symptoms it produces differ from those of other irritants chiefly by the presence of constipation instead of diarrhœa.

It is by no means common to meet with cases of acute poisoning with lead salts, and even the most soluble salts rarely cause death.

Acute poisoning by the acetate induces the following symptoms:—Dry burning sensation in the throat, thirst, vomiting.

colic (the pain of which is relieved by firm pressure), tenderness of the abdomen, obstinate constipation, dark slate-colour motions from the presence of plumbic sulphide, great prostration of strength, cramps of the extremities, cold sweats, giddiness, numbness and even paralysis of the lower limbs; sometimes coma; urine scanty and high-coloured. In one case it is reported that in less than five hours the extensor muscles of the extremities became paralysed, and the flexors rigidly contracted. The subacetate is even more powerful than the acetate. The carbonate has no irritant action.

The treatment of acute poisoning is to promote vomiting by lukewarm drinks, to give sulphate of soda, or sulphate of magnesia, or fresh precipitated sulphide of iron; but this last is rarely at hand; the stomach-pump should be used, and milk, with white of egg, may be given with advantage.

Small, nay even minute, quantities taken for a long time, will produce chronic lead-poisoning, which may occur in various ways, owing to the manifold uses of lead compounds. Oxide of lead is used to sweeten wines, the soluble salts are used as hair-dyes, and wafers are often coloured with red lead. The carbonate being the basis of all paints, when the lead is ground down it often occurs, unless great care is taken, that the finer particles are inhaled. Snuff is sometimes adulterated with lead, and in this way sufficient may be taken into the system to produce chronic poisoning. Dr. Garrod has lately narrated an instructive case of chronic lead-poisoning through the decomposition of the leaden envelope of a packet of snuff. Then painters become poisoned by eating their meals with unwashed hands, and so introducing lead into the system. Again, drinking-water sometimes becomes contaminated with lead dissolved from the lining of the tanks. Certain conditions of the water respectively favour and retard the solution of the lead. Thus, pure water, and waters containing carbonic acid, carbonate of lime, and sulphate of lime act but little on lead. But, on the other hand, waters containing much oxygen, organic matters, nitrites, nitrates, and

chlorides, act freely on this metal. Carbonic acid is very protective of lead; it crusts the metal with an insoluble covering of carbonate, and protects it from the further action of the water.

A very small quantity of lead is adequate to produce all or some of the symptoms of lead-poisoning; even one-fortieth to one-fiftieth of a grain per gallon. But there appear to be individual differences in respect to the action of lead, some persons becoming sooner affected by it than others. In some cases this difference can be explained, as will be mentioned shortly. Acetate of lead, in five grain doses, may be given for weeks, or even months, without producing symptoms of lead-poisoning, as has been abundantly proved at the Brompton Hospital, where the acetate is largely employed to check the diarrhœa of consumption; yet it is extremely rare, even after the medicine has been continued for months, to meet with any symptoms attributable to the lead.

The symptoms indicative of chronic lead-poisoning are briefly—constipation and, it may be, impaired digestion, with a sweetish taste. A blue line is soon observed at the edges of the gums, produced by the sulphuretted hydrogen developed from the tartar of the teeth penetrating the tissues of the gums, and, uniting with the lead, forming a black sulphide; consequently the blue line is most marked in persons who do not clean their teeth. It is seen only at the edge of the gums, where they come in contact with the teeth; where the teeth are absent, the blue line is absent. It is observed first, and is always most marked, in the gums in the neighbourhood of the incisor teeth. This blue line is one of the earliest indications of the effect of lead, and is one of the slowest to disappear. Dr. Garrod says this blue line is never absent if there are any teeth, and that it may extend to the whole gums, and sometimes it is seen on the parts of the lips and cheeks corresponding to the gums. Besides the foregoing symptoms,, the nutrition is impaired, the skin becomes very sallow, and sooner or later, severe colic, with obstinate constipation, and

sometimes vomiting, sets in. Colic may occur without any premonitory signs. In lead-colic the abdominal walls are retracted, and very rigid. The pain is mostly eased, but is sometimes aggravated, by firm pressure.

Frequent cramps—often severe—occur in the calves, and sometimes in the uterus, penis, and scrotum; pains about the joints, generally of the extremities, increased by movement or wet weather, and, closely simulating rheumatic pains, sometimes harass the patient.

Sometimes paralysis takes place, generally affecting the upper extremities and the extensors of the arm, with its supinators and pronators. The muscles of the ball of the thumb waste greatly, and in severer cases the deltoid and even the muscles of the neck and trunk are similarly affected. Indeed, in the worst cases general paralysis may occur, with wasting of the muscles of the whole body, even the voice becoming weak. The paralysis mostly affects motion only, but sometimes sensation also is lost. Epilepsy, delirium, convulsions, or coma may occur, and destroy the patient; but death from chronic lead-poisoning is uncommon.

The cramps are not confined to the muscles of the extremities. The intestines are also affected, sometimes almost throughout their length, but generally only a limited extent is involved. If the finger is passed up the rectum, the contraction can sometimes be felt in the lower part of the bowels. The bloodvessels are said to be subject to cramps, like other parts of the body.

How the lead produces these paralyses and spasms, whether by attacking the muscles, nerves, or bloodvessels, or some or all of them, is at present quite unknown.

The colic is generally dependent on constipation; for when this is set right the colic very generally disappears..

The influence of lead on the urates in the blood is most singular. Dr. Garrod, in his remarkable discoveries concerning gout, has elucidated this subject, and shown the intimate connection existing between lead-poisoning and gout. In gout, as this philosophical observer has shown, the

urates, probably undergoing increased formation, are retained in the blood. In gout, especially during the acute attacks, scarcely any uric acid is to be found in the urine, while an abundant quantity is detectible in the blood. The urates dissolved in the blood manifest especial affinity for particular structures, as the cartilages, bursæ, and fibrous tissues, particularly those of certain parts, and during the deposition of the urates in the joints, acute inflammation is excited, and this constitutes gout.

Now, lead checks the separation of urates from the blood by the kidneys, diminishes the uric acid of the urine thus greatly augmenting that of the blood, and thus we have the pathological condition which excites the gouty inflammation. Dr. Garrod has further shown,—and his experience is corroborated by all who have investigated this subject,—that gout very frequently occurs among lead-workers, and that gouty patients often exhibit the characteristic blue lead line on their gums.

There, too, is the fact, in further confirmation of Dr. Garrod's discoveries, that if to a gouty person, free at the time from an acute attack, a salt of lead is administered, it developes acute gout, with its accompanying symptoms of severe pain and high fever, The author has repeatedly verified this fact first pointed out by Dr. Garrod, which affords an explanation, in part at least, of the good effects of iodide of potassium on gout, since, as we have shewn already, this salt promotes the excretion of lead from the system.

Lead is used for a variety of purposes, but chiefly for its astringent action on the tissues, as in profuse discharges of the mucous membrane from the lungs in bronchitis, in which disease it has been strongly recommended, and to check bleeding from the nose, lungs, kidneys, and uterus.

It has been conjectured that lead in Bright's disease might check the escape of albumen from the blood and therefore lessen the amount of it in the urine and George Lewald has published some experiments instituted with the view of testing this point. He does not mention the form of kidney disease

his patients suffered from, but it was probably the pale, flabby, fatty kind. He observed at the same time the influence of the lead on the amount of urine voided. These experiments, too few perhaps to decide the question, showed that lead constantly diminished the albumen of the urine, but to a very small extent only, namely, to about nine or ten grains in the twenty-four hours. The diminution appeared to hold no relation to the quantity of lead administered. The quantity of water was simultaneously increased on an average by 200 c.c. in the twenty-four hours. Here, again, the increase held no proportion to the quantity of lead employed.

Lead has been found in the lungs, kidneys, spleen, liver, and brain, but there is no evidence of its possessing an especial affinity for these parts.

M. Paul who has investigated the influence of lead-poison ing on the fœtus, says that women working in lead factories frequently abort; and that the father may cause abortion, even when the mother is not a lead-worker.

In 123 pregnancies, seventy-three children were born dead; and of these, sixty-four were abortions, four premature births, and five born at the full time. Of the fifty born alive, twenty died in the first year, eight the second, seven the third; one later; and only fourteen reached the age of ten.

Our knowledge is scant concerning the elimination of lead. A little lead only passes off with the urine; its elimination however, is increased by the administration of iodide of potassium.

It is a further question whether the metal is separated by the kidneys with the urine, or by the mucous membrane of the urinary tract. On theoretical grounds it is difficult to imagine how metals, existing in the body as albuminates, can be eliminated with a non-albuminous secretion; moreover, after the administration of lead, as after that of iron and other metals, an increased quantity of the metal is detected in the urine; an increased amount of mucus too, simultaneously, with signs of irritation of the lining membrane of the bladder,

even to the extent of inducing a catarrhal condition; whence it has been inferred that the metal is separated with the mucus secreted by the mucous membrane.

NITRATE OF SILVER.
OXIDE OF SILVER.

The soluble preparation of silver, when painted on the entire skin, colours it first an opaque white, which changes gradually to brown and black; and the application if a strong one will even produce vesication. Nitrate of silver is sometimes applied as a caustic to warts and other excrescences.

Applied to the abraded skin or to sores, the soluble silver salts form an albuminate which coats the surface with a thin layer and protects the skin from the irritation of the air. The nitrate of silver acts as a powerful excitant of the tissues, and destroys them, but only very superficially. It is very frequently applied to unhealthy and unclean ulcers, to induce healthier growth. It gives much smarting pain, which, however, soon passes away.

Like most other soluble metallic preparations, the nitrate causes condensation of the tissues as well as contraction of the blood-vessels, on which account it is used to stay hæmorrhage. Being liable, however, to excite much inflammation and pain, other blander astringents should first be tried. Sometimes it is necessary to check the bleeding from leech-bites by touching them with a stick of nitrate of silver.

It is stated that if a burnt or scalded surface is painted over with nitrate of silver, before vesication takes place, both the blistering and pain are prevented.

The pitting of small-pox may be prevented if each vesicle is opened, as soon as formed, and nitrate of silver is applied to the raw surface beneath. Dr. F. Bowen has recorded an instructive case showing the good effects of this treatment He treated the vesicles on one side of the face and neck in the

way described, but left untouched the vesicles on the opposite side, with the result that on recovery the untreated side was deeply pitted, while the opposite side remained smooth and scarless. Dr. Bowen, who has devoted much attention to this subject, states that it is easily carried out by a nurse. At an early stage of the eruption, at the latest on the fourth or fifth day, he punctures the vesicles with a fine needle dipped in a solution containing twenty grains of nitrate of silver to an ounce of water. Mr. Higginbottom finds it unnecessary to puncture the vesicles. It is enough, he says, to paint the skin in the manner recommended by him in erysipelas, which subdues inflammation and prevents suppuration.

Bed-sores are best prevented by painting the threatened but unbroken skin, as soon as it becomes red, with a solution of nitrate of silver (20 grains to an ounce) with the effect of dispersing the redness, hardening the skin, and preventing the bed-sore, unless, as in the case of paralysis, there is a great proneness to the formation of bed-sores.

That species of boil which, beginning first as a papule maturates into a pustule, and inflames and extends till a large dead core is produced, may, it is said, be arrested in its early pustular stage by painting it over at its very commencement with a strong solution of nitrate of silver. The author has had no experience of this method; but of the beneficial influence of collodion on similar boils, to be mentioned in another place, he can speak with great confidence.

Herpes labialis and the vesication of shingles may be arrested if the patch of erythema is painted over with nitrate of silver before or as soon as the vesicles begin to form.

It is not uncommon to meet with patients annoyed with a patch of lichen, the size of the palm of the hand, affecting almost any part of the body. The irritation caused by this patch may be excessive, sufficient even to break the sleep, and injure the health. By painting the patch with the nitrous ether solution (*vide* p. 202) of silver every day, or second day, as the itching may require, it may generally be removed.

Limited patches of eczema are sometimes treated with benefit in the same way. Nitrate of silver proves most serviceable after the weeping stage.

Psoriasis of the tongue and mucous membrane of the mouth is benefited by the occasional application of nitrate of silver or sulphate of copper; but if it depends on syphilis, mercurial applications are best. A weak solution of nitrate of silver, gradually strengthened, is stated to be useful in the superficial kinds of lupus.

Higginbottom very strongly recommends the local application of nitrate of silver in erysipelas. No agent, he says, is so safe or efficacious in subduing external inflammations; but he points out that the success of this treatment depends entirely on the manner of conducting it. He directs the skin to be well washed with soap and water, then with simple water; then to be wiped quite dry. Next, a solution of four scruples of the brittle stick of nitrate of silver, in four drachms of water, is to be applied two or three times to the inflamed surface, extending two or three inches beyond.

The intolerable itching of pruritus pudendi often yields to the application of nitrate of silver. A large camel-hair brush saturated in a solution containing from two to five grains to the ounce, should be painted three or four times a day over the vulva, and be thrust up to the os uteri. A stronger solution used less frequently will not answer so well.

A weak solution of nitrate of silver often relieves pruritus ani.

Pruritus cutaneus of the meatus auditorius, occurring without any eruption on the skin, should be treated by the application of a strong solution of nitrate of silver, carefully avoiding the membrana tympani. If the itching arises from undue dryness of the ear from deficient secretion of wax, almond oil or glycerine should first be tried.

Nitrous ether is by far the best solvent of nitrate of silver when used as an outward application, for this solution by dissolving the fatty matters of the skin forms a uniform layer over the surface, and, unlike a watery one, does not run into

drops leaving the intermediate skin dry. This solution is not available for erysipelas, as nitrous ether will not dissolve the quantity of silver required. It is important to bear in mind that a nitrous ether solution acts much more strongly than an aqueous solution of corresponding strength. The nitrous ether solution applies itself to the skin more uniformly and thoroughly, while the watery solution runs off or collects in drops. The ether solution must therefore be made weaker, five to ten grains to the ounce being generally strong enough. Five grains to the ounce is sufficiently strong for threatened bed-sore, a stronger solution often blistering, particularly on applying several coats.

Solutions of nitrate of silver are used to blacken the hair of the head. The hair is first washed with the solution of nitrate of silver, and then a comb, dipped into a solution of sulphide of potassium, is passed through it; a process resulting in the production of a dull, shiningless, ghastly, black-bluish colour.

The solid nitrate of silver stick is sometimes passed over the edges of the eyelids in obstinate tinea tarsi, first removing the eyelashes and the scabs.

A few drops of a solution of nitrate of silver, varying in strength, is inserted with the aid of a quill several times a day into the eye, in conjunctivitis. It excites in the membrane a healthier inflammation, which soon subsides.

The nitrate may be applied to ulcers of the mouth.

The soluble salts have an astringent metallic taste.

In the early stage of inflammation of the throat, when the inflammation is superficial and there is only a little swelling, the application of a strong solution, or of the solid stick of nitrate of silver, subdues and sometimes even extinguishes the inflammation.

In chronic sore throats, when the tissues are relaxed and covered with pus, solutions of the nitrate are serviceable, but the author does not think they are superior in any way to strong astringent and unirritating applications. Even ulcers are best treated by the glycerine of tannin; but if in a slough-

ing and unhealthy condition, then the irritant nitrate must be preferred. The nitrate of silver is also applied with doubtful benefit in diphtheria. Most authorities are agreed that the application should be limited to the inflamed patches; for if applied beyond their area, it excites an extension of the inflammation, on which the false membrane may readily plant itself.

Nitrate of silver, in powder or solution, is sometimes applied by means of a probang, brush, or sponge, to the chronically inflamed larynx, as in phthisis; or solutions of nitrate of silver, in the proportion of gr. $\frac{1}{2}$ to gr. v. to the ounce of water, may be brought to bear on the pharynx and larynx by the spray producer.

Dr. Horace Green injects a solution of nitrate of silver into the trachea in asthma, bronchitis, and phthisis, after deadening the sensibility of the glottis by applying to it for one or two weeks a solution of nitrate of silver. He passes a no. 10 or 12 catheter which produces only a sensation of warmth, through the rima glottidis down even to the bifurcation of the trachea and injects the solution. Dr. Hughes Bennett, who endorses this treatment, injects either two drachms of a solution containing half a drachm of nitrate of silver to an ounce of water, or even half an ounce of a solution consisting of forty grains of nitrate of silver to an ounce of water. While introducing the catheter the head is thrown back and the tongue drawn forward, when the catheter glides along the laryngeal surface of the epiglottis which is nearly insensible through the rima glottidis itself.

Sponging out the throat with a solution of nitrate of silver greatly diminishes the violence and frequency of the paroxysm in whooping-cough, and renders the cough but half as frequent and the fits much less severe, and enables a child harassed with broken sleep to obtain a good night's rest. But there is a formidable drawback to this treatment; for the application generally produces, especially with very young children, so violent an attack of coughing, as to excite fears lest suffocation should ensue. Instead of sponging the throat,

the nitrate of silver may be applied in the form of spray by the atomizer. Very young children, however, cannot be induced to open their mouths, and allow the inhalation of the spray; hence the use of this application is restricted to children more than two or three years old. As either of these applications is apt to excite retching, they should be employed when the stomach is empty.

That part of the salt having escaped conversion in the mouth is changed into an albuminate when it enters the stomach. If sufficient albumen is not present to effect this, the salt attacks the mucous membrane, and excites an active inflammation. The best antidote for a poisonous dose is common salt, a fact useful to bear in mind, if as sometimes happens, the solid stick of nitrate breaks off and is swallowed.

Nitrate of silver acts as an irritant in the stomach, and may be used in precisely the same class of cases for which arsenic is applicable. It often checks the pain and vomiting of chronic inflammation, of chronic ulcer, and even of cancer, of this organ. It should not be given in the form of a pill, but in solution.

The nitrate acts as an astringent in the intestines, and, in common with several other metallic preparations, may be used in diarrhœa, both of the acute and chronic kind.

These salts enter the blood, and probably collect in the red corpuscles as other metals tend to do, if not speedily deposited in the organs or separated by the secretions. These salts after absorption are supposed to be astringent to the tissues to which they are conveyed, but this is doubtful, and they are never used to check either bleeding or secretion from the distant organs of the body.

Both the oxide and nitrate are employed in chorea and epilepsy, apparently with occasional benefit. The oxide has been given to check profuse sweating. If administered too long, these substances, in some form, probably as the reduced metal, are deposited in the deeper parts of the skin and most abundantly where the skin is finest and most vascular; but, once deposited, the metal remains as a permanent discolora-

tion, of a deep leaden hue, which neither time nor treatment can remove. Silver appears to be chiefly eliminated by the intestines and bile, very little escaping by the urine.

The nitrate, in solutions of various strength, is used successfully as an injection in gonorrhœa. Some advocate a very strong solution (twenty grains to the ounce), averring that in many instances the disease may be at once cut short by it; others prefer a much weaker solution of one or two grains to the ounce of water, repeating the injection several times a day.

The solid stick is sometimes applied to strictures of the urethra.

The author believes that a solution of glycerine of tannin, one half the strength of the pharmacopœial preparation, will be found a better injection for both gonorrhœa and gleet than nitrate of silver.

MERCURY AND ITS PREPARATIONS.

The salts of mercury possess very various physical as well as chemical properties; but as in every instance their effect on the system is well-nigh the same, probably all mercury compounds ultimately assume the same form in the blood.

The nitrates of the oxide and suboxide are escharotic; but much of this action is due to the free nitric acid of the salt. They are used to remove warts, condylomata, and other slight excrescences. The annoying itching of some skin affections may be completely allayed by mercurial applications. Solutions of bichloride, black wash, yellow wash, or mercurial ointment, may each prove useful, but the application must be a strong one. Trousseau highly recommends the part to be bathed with a solution of about twelve grains of bichloride in a pint of very warm water. After much experience of these applications, the author believes that an oint-

ment composed of a drachm of calomel to an ounce of lard will be found by far the best application.

But this ointment, in common with other mercurial applications, is not useful in all kinds of itching of the skin; for instance, the irritation of urticaria remains unaffected by it.

Calomel ointment often immediately removes the itching of pruritus ani. This irritation may be due to rashes, as psoriasis, lichen, or eczema, or no eruption may be visible, yet the ointment will prove equally efficacious. Sometimes the itching is felt along the raphé between the anus and scrotum, and may be due to little round spots looking like psoriasis, with the scales washed off. This form also yields to the ointment. Pruritus pudendi is less frequently eased by this application. In obstinate cases of pruritus ani and pruritus pudendi, blisters to the thighs, or the application of a few leeches, sometimes afford relief.

The ointment in many instances improves the rashes themselves, but this is due, in some measure, to the cessation of the scratching on the disappearance of the itching.

Sometimes a little scabbiness of the head, looking like mild eczema, occurs in children, accompanied by a degree of itching sufficient to prevent sleep, and to cause constant restlessness. The calomel ointment speedily appeases this irritation.

The inunction with calomel ointment allays the distressing itching of the scalp sometimes accompanying pityriasis. It may be profitably added to other ointments used for the removal of pityriasis, as oxide of mercury or of tar.

It may be objected that so strong an application of mercury, especially when applied to soft and absorbing parts, as the inner surface of the vulva, and the skin around the anus, must surely produce salivation. No doubt care should be exercised, and no more ointment used than is needed. Yet the risk of salivation seems to be extremely slight; for, with a very large experience of the ointment, the author has never seen salivation produced by it. Properly applied, a very small piece of ointment is generally sufficient to allay the irritation at once, and even to remove it altogether in a few

days, although it is very apt after a variable time to return, when it again yields to a renewed employment of the ointment. Having many times seen it succeed when other remedies have entirely failed, the author is convinced of the value of this application in these harassing and perverse diseases. Its grateful effects are often almost instantaneous; but sometimes it takes a few days to give ease.

The various kinds of lice infesting different parts of the body are destroyed by white precipitate or nitrate of mercury ointment, or by corrosive-sublimate wash. For lice on the pubes it is necessary to apply the ointment or lotion to the scrotum, hair on the perinæum, and around the anus. These applications destroy both the animals and their nits. The nits can be dislodged by washing the hairs with spirits of wine, which dissolves the gluey matter so strongly attaching the nit to the hair. If the lice have produced much rash, it is recommended to cut off the hair. The body louse may be killed by the essential oils, as the oil of rosemary, or by powdered pyrethrum, or by an ointment of staphisagria. Through the groundless fear of inducing salivation, some prefer these to mercurial applications. The under linen should be boiled to destroy any hidden lice.

The irritant ointments of mercury are useful in that obstinate and disfiguring affection, tinea ciliaris. The eyelashes should be cut short, and the ointment, either of nitrate or oxide of mercury, applied night and morning, picking off the scabs before each dressing. It is a common practice to dilute the unguentum hydrargyri nitratis with from four to six parts of simple ointment, whether the application is employed to rashes or to tinea ciliaris. In many instances the undiluted ointment is best, and it seldom happens that it requires to be reduced more than half the officinal strength: the failure of the ointment in eczema psoriasis lichen tinea ciliaris, is often due to its employment in too weak a form. Mr. Hutchinson and others assert that epilation insures the speediest cure. Should these stimulating applications fail, others more powerful should be tried, as nitrate of silver, or

sulphate of copper, the last-named salt being preferable, on account of its giving less pain.

Patches of obstinate lichen and psoriasis, especially of the hands, even when not syphilitic, will sometimes yield to mercury ointment when milder treatment fails. The calomel and nitrate of mercury ointment may be mixed, and tar ointment is sometimes added to them with benefit.

Citrine ointment is also very useful in some cases of eczema, even in the weeping stage if there is but little inflammation. It is especially useful in the stage of desquamation when the skin has healed. It is markedly useful when eczema affects the hairy parts of the face, often curing this obstinate form when other remedies have been tried in vain, and even if it fail to cure it generally in great part subdues the disease. The same ointment is very beneficial too in pityriasis of the hairy parts of the face. In both eczema and pityriasis it is better to mix it with tar ointment, though this combination is sometimes more irritating than the citrine ointment alone; not unfrequently this mixture cannot be borne whilst the citrine ointment pure or diluted proves very useful.

In the early stages of acne a lotion composed of corrosive sublimate, one part; alcohol, enough to dissolve it; water, 100 parts, is said to be of use. A tea-spoonful is to be added to a quarter of a pint of water, and the face sponged with the lotion night and morning. The bichloride lotion, after a time, produces a "scaliness and hardness of the cuticle."

Bichloride of mercury, one of the best parasiticides, is useful in favus, tinea sycosis, tinea tonsurans, eczema marginatum, and pityriasis versicolor (chloasma.) A lotion containing two grains of bichloride to an ounce of water is generally sufficiently strong. In favus and tinea sycosis and tinea tonsurans, the lotion should be applied after each epilation, and should be continued for some time after epilation is discontinued. This treatment is highly spoken of by McCall Anderson.

It is taught, on high authority, that paronychia may be much benefited by the application of mercury ointment, re-

peated for ten minutes every hour, applying poultices at other times. Dr. Scott and Mr. McCormac find nitrate of lead dusted on the diseased tissues night and morning very useful; they both report several striking cases of rapid cures treated on this plan.

Mercurial preparations are used as local applications for chronic inflammation; for instance, Scott's ointment is often employed in chronic inflammation of the knee-joint. Mr. John Marshall has recently introduced a new mercurial preparation, oleate of mercury, varying in strength according to the needs of the case, variously combined with other remedies. Mr. Marshall's paper is so practical and valuable and so insusceptible of condensation or abridgment that we have deemed it best to reproduce the larger portion of it. These preparations, he says, "are cleanly and economical and have a much greater diffusibility or penetrating power than the old mercurial ointments, for they are absorbed by the skin with remarkable facility, and manifest the remedial effects with great promptitude."

"They should not be rubbed in like ordinary liniments or embrocations, but should be *merely applied with a brush, or be spread lightly over the part with one finger;* otherwise they may cause cutaneous irritation, or even produce a few pustules on the skin, especially in certain persons. This result may, however, be obviated by the addition of a small quantity of olive oil, or purified lard, according as an oleaginous or an unctuous preparation is required. Any of these forms may be scented by the addition of essential oils."

"In employing these mercurial solutions for combating persistent inflammation of joints, I soon found that the addition of morphia was of very great advantage. For this purpose the simple alkaloid must be used, as neither the hydrochlorate, the acetate, nor the meconate is soluble in oleic acid. For every drachm of the solution of oleate of mercury in oleic acid one grain of morphia may be added. Being, as well as the mercury, completely dissolved, it quite as rapidly penetrates the skin, comes quickly into contact with the extremi-

ties of the nerves, and thus, even within a few minutes, acts upon them at their most sensitive points, and speedily produces a soothing effect."

"The oleates of mercury and morphia, thus united in one preparation, represent, as it were, a liniment, ointment, or plaster of mercury and opium; but they are far more elegant, economical, and efficacious. As a rule, according to the size of the part affected, from ten to thirty drops are sufficient for one application. This should be repeated twice daily for four or five days, then at night only for four or five other days, and afterwards every other day, until a cure is obtained. The morphia immediately begins to relieve pain, allays the nervous irritation and consequent vascular turgescence, and thus arrests the progress or 'persistence' of the inflammatory process; whilst the mercury probably promotes the death and degeneration of the morbid products, and so facilitates their subsequent removal by absorption. Unless used in excessive quantity, the oleate of mercury does not salivate, or produce any marked constitutional disorder."

Mr. Marshall says "their applicability and utility appear to me to be almost co-extensive with the occurrence of 'persistent' or chronic inflammations, provided only that the seat of the disease be in, or sufficiently near to, the skin."

"I may first mention that not only in persistent articular inflammation, but also in simple synovitis, these remedies rapidly relieve the tenderness and pain, and promote the absorption of the fluid effused into a joint. They are also of decided benefit in the rheumatic, the arthritic, and the mixed forms of joint disease; but in these they do not, of course, supersede the necessity for general treatment. In inflammation of the mammary gland occurring during or after lactation or altogether independently of that secreting process, their efficacy is unequivocal; for I have seen, not only the induration left after previous abscesses, speedily disappear under their use, but a tendency to recurrent suppuration in the site of old abscesses, and the threatened formation of new ones, entirely controlled and arrested. I have also seen a threat-

ened abscess in the perinæum from inflammation of one of Cowper's glands, and likewise the troublesome indurations left after ordinary perineal abscess, rapidly disappear on the use of these preparations. In obstinate and painful tonsillitis, in epididymitis, in periostitis, and in inflammation with imminent or actual suppuration in or around lymphatic glands, I have similarly employed them with decided advantage. In hydrocele they have not appeared to be useful. I have used equal parts of the 20 per cent. ointment and purified lard applied outside the eyelid, with success, in hordeolum and in palpebral conjunctivitis."

"In many cutaneous affections the oleate of mercury solutions, without morphia, form elegant and powerful remedies. It was in a case of obstinate sycosis menti that I first used, and with excellent results, an etherial solution of the perchloride of mercury mixed with oleic acid; but I now much prefer, as equally efficacious and far less irritating, the five per cent. solution of oleate of mercury in oleic acid, with the addition of an eighth part of ether. This, when applied to the skin with a camel-hair pencil, is a most diffluent and penetrating remedy. It enters the hair-follicles and the sebaceous glands, penetrates the hairs themselves, and carries every where with it its powerful metallic constituent. Besides sycosis, it will cure chloasma and the various forms of tinea; it is useful in porrigo and in pruritus ani et pudendi; but I have not found it serviceable in non-specific psoriasis or in eczema. The solution of oleate of mercury destroys pediculi immediately; and, owing to its singular power of permeation, simultaneously kills the ova—a result not always certain when ointments containing undissolved mercury are used."

"Again, in many of those syphilitic affections for the cure of which mercury is applicable, the oleate-of-mercury preparations offer some advantages. Thus, in congenital syphilis, a piece of the 20 per cent. ointment, about the size of a pea or bean, placed in the child's axillæ night and morning for five or six days, rapidly and easily, and without any sign of

uncleanliness, produces constitutional effects. Even in the adult this mode of introducing mercury into the system, either for the cure of syphilis or other disease, may often be preferable to, and less troublesome than, the bath, and it certainly gets rid of the objections to the ordinary mode of inunction. As a topical remedy for certain local manifestations of syphilis, such as the non-ulcerated forms of syphiloderma, especially when these disfigure the head, face, neck, or hands, the 10 per cent. solution is a most valuable adjunct to other treatment, the spots rapidly disappearing under its use. This, or the 20 per cent. preparation, diluted with equal parts of purified lard, may also be applied to non-ulcerated syphilitic indurations and condylomata, but it gives pain if applied to surfaces much excoriated or ulcerated, to moist warts, or to mucous membranes. In syphilitic iritis, and also in non-specific forms of that disease, this diluted oleate ointment smeared over, not within, the eyelids, evidently promotes the absorption of the effused lymph. Lastly, in some of the remoter kinds of syphilitic affections, which iodide of potassium will usually cure, such as very hard nodes and certain forms of syphilitic testicle, the external application of the oleate of mercury is very valuable. I have seen a case of enlarged testicle and epididymis, the syphilitic origin of which had not been suspected, and for which no mercurial course had been prescribed, but which during a period of six years had been, from time to time, relieved by enormous doses of iodide of potassium, speedily and decidedly benefited by the inunction of the 20 per cent. mercurial oleate."

"In reference to other uses of the combined oleates of mercury and morphia, I may remark that I cannot doubt their value in the treatment of 'persistent' inflammation of certain internal parts and organs—as, for example, of obstinate pleurisy, pneumonia, pericarditis, and endocarditis; for they would here also allay pain and nervous irritation, would thus contribute towards the arrest of progressive disease, and would likewise promote the process of absorption. Moreover, I may state that a solution of morphia in oleic acid (one or

two grains to the drachm), without mercury, is an excellent topical remedy in neuralgia, and in that exquisitely painful affection, herpes zoster, care being taken not to produce cutaneous irritation by friction. I have also used, endermically, with advantage, a solution of atropia in oleic acid, and have had prepared for me the oleates of zinc and copper. Each of these preparations will probably come to have its uses, to which, however, I have now only time thus generally to refer, Oleic acid is likewise a ready solvent of cantharidine and croton oil. It is itself aperient, and permeates fæces more readily than olive oil. Indeed, I fully anticipate that this acid, as well as its compounds with mercury and with morphia, besides other preparations made by its aid, will eventually be admitted into the Pharmacopœia. An ointment of the oleate of mercury would almost supersede the old-fashioned blue ointment, whilst the solutions of the oleates might replace the liniment of mercury. The remaining mercurial ointments of the Pharmacopœia, of which the nitrate may contain a little oleate or some allied salt, will, however, still have their special uses."

"The oleate must be prepared with the oxide precipitated by caustic potash or soda from a solution of the metal in nitric acid, recently made and well dried. The solution of mercury by oleic acid is assisted by a temperature of 300° Fah."

"The 5 per cent. solution is a perfectly clear pale-yellow liquid, resembling olive oil, but thinner; the 10 per cent. solution is also fluid and perfectly clear, but as dark as linseed oil; whilst the 20 per cent. preparation is an opaque yellowish unctuous substance, closely resembling in appearance resin ointment, melting very readily at the temperature of the body, and forming a kind of transparent, viscid, colourless varnish when applied to the skin. The chief care to be observed in the manufacture of these solutions is not to hurry the process, and not to employ a high temperature, or the mercury will be immediately reduced."

Baths of corrosive sublimate and chloride of ammonium, in

the proportion of half an ounce of sublimate to one ounce of the chloride, are sometimes useful in the treatment of obstinate syphilitic and non-syphilitic rashes.

Goitre is successfully treated with an ointment of biniodide of mercury. It has been largely employed in India with remarkable success. Its action is aided by the effects of the sun's rays, to which the tumour is exposed after inunction. The ointment is prepared in the following way: Melt three pounds of lard or mutton suet, strain, and clean; when nearly cool, add nine drachms of biniodide of mercury, finely triturated; work the mixture well in a mortar till no grains of red are visible, and keep it in pots, protected from the light. In India this ointment is applied to the swelling at sun-rise by means of an ivory spatula, and is then well rubbed in for at least ten minutes. The patient then sits with the goitre held up to the sun as long as he can endure it. In six or eight hours there will probably be some pain from the blistering action of the application, although no pustules will have arisen. At about two o'clock in the afternoon a second application is made, and the ointment is rubbed in with a light hand. The ointment is then allowed to remain, and its absorption is completed about the third day. In ordinary cases one such course cures the patient, but in bad cases it may be necessary to repeat the treatment in six or twelve months. In countries where the sun is less powerful, the patient sits before a fierce fire; or the ointment may be rubbed over the swelling night and morning, afterwards covering it with oilskin. The full effect is produced in a few days when a mild ointment like spermaceti is substituted (Stainthorpe).

Mercurial ointments are useful in erythematous lupus (Moriz Kohn). The author has witnessed great advantage result from the use of calomel ointment in scrofulous and tubercular lupus of children.

In tubercular lupus Nayler advises touching the summit of the tubercle with the solution of acid nitrate of mercury, repeating the application till the tubercles are reduced to the

level of the skin, but not deeper or a scar will result. Each application excites a good deal of inflammation and pain; but the pain may be allayed by covering the spot with collodion. Nayler uses the mercurial vapour bath in general eczema.

Mercurial preparations, especially black-wash, are very useful applications to syphilitic sores. Thus, mucous tubercles soon yield to black-wash. Black-wash is useful too for those elevated indurations occurring at the anus of children, differing from mucous tubercles, being of much larger size, of irregular shape, often limited to one side, and generally extending some way up the rectum. This eruption, which may bleed and smart severely each time a motion passes, often disappears but slowly under the influence of mercury administered by the mouth, and in spite of it may continue increasing slightly for months; while, if kept constantly moist with black wash, the friends may be assured of its removal in ten days or a fortnight. Black-wash is very useful in other syphilitic sores.

When it is not convenient to apply black-wash, calomel or citrine ointment well rubbed in may be substituted.

Calomel dusted over syphilitic condylomata generally removes them.

Cyanide of mercury in solution, in the proportion of ten or fifteen grains of the salt to an ounce of water, is useful as a local application to syphilitic rashes and sores, as those of the throat, tongue, anus, penis, &c. To sores on the prepuce or glands, a weaker solution of five grains to the ounce is generally strong enough, and even this strength sometimes excites a good deal of smarting. It should be well rubbed in with a camel-hair brush, once or at most twice a-day, carefully avoiding the neighbouring healthy tissues. In case of chancres it is a good plan to apply this solution daily, and to keep the sore moist with lint soaked in black wash. Mercurial ointments rubbed into the skin of the penis are often apt to bring out a crop of eczema with considerable swelling.

Mercurial applications mixed with other substances, as tar, are very useful in syphilitic psoriasis.

Mr. Lee strongly recommends mercurial fumigations in the treatment of syphilis. Calomel being undestroyed by heat or moisture, and giving constant results, is to be preferred to other mercurial preparations. Some employ dry fumigation; others maintain that the therapeutic effects of mercury are increased by steam. This mode of administering mercury is considered the best and surest way of eradicating syphilis. Moreover, it affects the general health less deleteriously, disturbing neither the functions of the stomach nor the intestines. Ten to twenty grains of calomel are used at each fumigation. The fumigations often produce a good deal of weakness and prostration, so that in many cases they cannot be continued. There can be no doubt that many cases of syphilis, rebellious to other treatment, yield to these fumigations. Sometimes only a portion of the body affected with syphilitic rashes is subjected to calomel fumigations.

Mercurial applications, but especially the mercurial and calomel ointments, are rubbed into delicate parts of the skin, to obtain their absorption and to mercurialize the system. This method of inunction has the advantage of not disordering the digestive canal, but it has the disadvantage of uncleanliness.

Bichloride of mercury has been injected under the skin, and a much smaller quantity affects the system than when administered by the mouth. This painful mode of treating syphilis is not likely to become general.

At one time the application to the face of mercurial ointment or of mercurial plaster was in vogue to prevent the pitting of smallpox.

It is a question of interest, whether the mercury itself plays any part in arresting the maturation of the pustules, or whether other applications are not as effective. A good deal has been said on each side of this question, but the author thinks that other safer remedies may be used, if not with equal benefit, yet with sufficiently good results to render it desirable to employ them in preference to the mercurial compounds, for several instances of very severe salivation have followed their employment in smallpox.

The exclusion of light and air probably thwarts the development of the pustules and prevents pitting. The exclusion of air and light can be perfectly effected by collodion and india-rubber dissolved in chloroform. This, or other means, should therefore be employed in preference to mercury compounds. (*Vide* Nitrate of Silver.)

In non-syphilitic ozœna, Trousseau employs the following snuff-powders—White precipitate, 4 grains, sugar in fine powder, 232 grains; or red precipitate, 4 grains, sugar in fine powder, 232 grains. The nose is first cleared by blowing it strongly, and then a pinch of either of these powders is snuffed up a few times daily for a few days. These powders sometimes produce a rather powerful irritating effect on the mucous membrane. They quickly remove the stench, and modify the state of the mucous membrane, but unfortunately do not cure this very intractable complaint, as after a variable time the discharge usually recurs.

In the syphilitic ozœna of children, mercurial ointments, as nitrate of mercury ointment, partially melted, applied twice a day after the nose has been well cleared, will arrest the secretion, remove the obstruction, and improve the condition of the mucous membrane.

The child's health consequently improves, for the nasal obstruction prevents sucking during which the child is unable to breathe. It is well known that a child, especially in sleep, breathes only through the nose; consequently when the nasal passages are blocked the health must suffer through inability to sleep.

Mercurial medicines, if administered at an undue time, seriously affect the mucous membrane of the mouth and salivary glands. The first symptom is a disagreeable metallic taste; the gums become swollen and tender, of a dark-red colour around the teeth; the mucous membrane investing the incisor teeth being the first affected, whence the inflammation spreads; the tongue swells, the breath is excessively fetid, the secretion from the buccal mucous membrane is augmented, and the saliva is increased in

quantity even to the extent of one or two pints daily. At first the saliva is richer than natural in epithelium and solid constituents, but after a time becomes clearer, more watery, and contains fat and mucous corpuscles. The salivary glands become swollen and painful; at last the inflammation of the mouth reaches such a point that ulceration sets in, and progresses till large portions of the gums and cheeks may be destroyed, the teeth becoming loose, and the bones of the jaw carious. Some are much more prone to become salivated than others; weak people are more easily affected than strong. Children are rarely salivated. Disease, too, influences the operation of mercury; for in inflammation it is often well borne, while in granular disease of the kidneys or scrofula, patients are very liable to become salivated. It is stated that salivation has occurred three hours after a dose of mercury, that it may last a few hours only, or endure for several years, and even disappear for a time and then return.

The influence of mercurial preparations on tonsillitis in certain conditions is most marked, owing probably to its absorption into the circulation. In quinsy or scarlatina, when the tonsils are so enlarged as almost to meet, and when the difficulty in swallowing is nearly insuperable, with even danger of suffocation, if at such a crisis a third of a grain of grey powder is taken every hour, it greatly reduces the swelling in a few hours, and obviates the distress and danger; and, even if an abscess has formed, its maturation and evacuation appear to be effected more quickly.

The same powder, administered in the same dose three or four times daily, is useful in mumps, speedily relieving the swelling and pain of this affection. Probably, as in the last case, the drug acts only after its absorption.

The soluble preparations of mercury combine with the albuminous matters in the mouth, and any portion left uncombined attacks the mucous membrane, and may excite in it acute inflammation.

They act in a similar manner in the stomach.

A form of vomiting is sometimes met with in very young

children—generally only a few weeks old—which yields in many instances to grey powder or calomel, but especially to grey powder. The chief, and to a great extent characteristic, feature of this vomiting is its suddenness and instantaneousness. Immediately the milk is swallowed, it is forcibly expelled, curdled or uncurdled, apparently without any retching or effort on the part of the child. The milk shoots out of both mouth and nose. Diarrhœa may exist, but more generally there is constipation. This affection often proves both obstinate and dangerous, as all the food is rejected, till the child, reduced almost to a skeleton, dies actually of starvation. At the *post-mortem* it often happens, either that nothing is found to account for this untoward result, or the mucous membrane may be much softened, and in consistency and appearance like water arrowroot. This vomiting, which resists all other remedies, is in many instances quickly stayed by one-third of a grain of grey powder, repeated every two or three hours. A twelfth of a grain of calomel every two hours sometimes also succeeds.

The soluble preparations act as purgatives, increasing the secretion from the mucous lining and the contractions of the muscular coat of the intestines. Not all, however, are employed as purgatives; and, when purgation is needed, our choice falls either on calomel or grey powder; either, being tasteless, is a useful preparation for children.

The influence of mercury salts on the pancreatic and biliary secretion is still undecided. Seeing the influence of mercury on the salivary glands, some conceive it probable that it exerts a similar influence on the pancreas, a gland whose structure and secretion are very similar to those of the salivary glands.

Most opposite statements have been made concerning the action of mercury on the secretion of bile. It has been stated, from experiments on animals, that the secretion of bile in health is much diminished by mercury. In his report, as secretary of the Edinburgh Committee appointed to investigate this matter, Dr. Hughes Bennett arrives at somewhat the

same conclusion. This report states: (1.) That neither blue pill, calomel, nor corrosive sublimate, affect the bile unless they purge or impair the health when the quantity of bile is diminished. (2.) That during an attack of dysentery, both the solid and fluid constituents of the bile are diminished. (3.) Purgation from any cause lessens the amount of bile and the proportion of its solid constituents.

Yet the experience of generations strongly supports the general conviction that in some diseases mercury does increase the bile. And it is not difficult to conceive that mercury in disease may set aside some condition hindering the formation of bile, and thus act as a cholagogue; yet in health it may even check this secretion.

When administered to promote the secretion of bile, it is a common practice to give for one or two nights a purgative dose; but if there is no constipation better effects may be obtained by a small dose, say one-sixth to one-half a grain of grey powder twice or three times a day. The method of administering small doses frequently is especially advantageous in those cases where the illness is apt to recur frequently from slight and scarcely preventable causes, and where the frequent employment of purgative doses would favour after constipation—produce depression and possibly salivation. For these reasons it is very common to hear highly practical doctors decry mercurial preparations, whereas, were they to employ the minute doses now recommended they would obtain the desired effect without the bad results they fear. Given in the doses just mentioned mercurial preparations in certain cases which I will indicate are signally useful.

A patient voids pale clayey stools and suffers from acidity, flatulence, or vomiting, occurring sometimes only before breakfast. Half a grain of grey powder given three times a day often restores colour to the stools, when the dyspeptic symptoms cease at once.

Small doses of mercury yield excellent results in a form of diarrhœa common in children. The child's health is bad; the digestion is imperfect, generally with annoying flatulent

distension; and three or four pale, clayey, pasty, stinking motions are passed in the day. Even when this condition has existed some weeks, a single grain of bichloride dissolved in half a pint of water, and a tea-spoonful of this given each hour, or what is better still, one-third of a grain of grey powder every hour or two hours, will in one or two days, restore to the stools their natural biliousness and frequency.

Again, we frequently meet with a case like this:—A patient, generally of nervous temperament, on exposure to cold, or after fatigue, or excitement, or even without any discoverable cause, feels sick, perhaps vomits, has a coated tongue, and in a few hours becomes jaundiced, the discoloration sometimes only affecting the conjunctiva, in other cases dyeing the skin of the whole body yellow. The stools are pale or colourless. The attack lasts three or four days and is accompanied by great depression. The patient may undergo many attacks, and so frequent indeed, that before the discoloration of one has passed away, another has begun. Here one-sixth or one-third of a grain of grey powder taken at the very onset and repeated three or four times a day allays the sickness, cuts short the illness, increases the intervals between the attacks, and after a time cures the patient even though he may have thus suffered for several years. If, however, there is obstinate constipation, then a course of Carlsbad waters is sometimes more efficacious.

The same weak bichloride of mercury solution of a single grain in ten ounces of water in doses of a teaspoonful is very efficient in another serious form of diarrhœa, either acute or chronic, common in children. The characteristics of this form are very slimy stools, especially if mixed with blood, accompanied by pain and straining. The great indication for the bichloride is the slimy character of the motions. Sometimes the slime is very tenacious, and, being coloured with blood is described by the mother as "lumps of flesh." This affection, as we have said, may be acute, or it may be chronic, and last for months; but in either case the bichloride cures with remarkable speed and certainty.

A similar treatment relieves the dysentery, acute or chronic, of adults, provided the stools are slimy and bloody. A hundredth of a grain, given hourly, or every two hours, according to the severity of the case, is generally sufficient, rarely failing to free the stools from blood and slime, although in some cases a diarrhœa of a different character may continue for a short time longer, requiring perhaps other treatment for its removal.

A sixth of a grain of grey powder given hourly is of great service in infantile cholera, characterized by incessant sickness, with profuse and almost continuous diarrhœa, very offensive and copious motions, watery almost colourless, or of a dirty muddy aspect. Under this treatment the vomiting generally soon ceases, and the diarrhœa shortly afterwards. Infantile cholera is an extremely fatal disease, running so rapid a course, that in a very brief space a child is reduced to a deathlike aspect and dangerous condition. It is essential then to check the diarrhœa as speedily as possible. A starch injection, with a minute quantity of laudanum, assists the action of grey powder, and should be employed in urgent cases.

Infants are not unfrequently the subjects of chronic diarrhœa, characterized by watery, very offensive, muddy-looking or green-coloured stools, often to the number of ten or twelve daily. This diarrhœa is generally to be restrained by grey powder, in doses of a sixth of a grain, given at first hourly, and then every two or three hours, according to the frequency of the stools. The occurrence of vomiting is an additional indication for this treatment. Although this medicine may check the diarrhœa and vomiting, yet, if the disease has endured a long time, so serious may be the injury inflicted on the mucous membrane of the stomach, that food can neither be digested nor absorbed, and the child gradually wastes away. The appearance of thrush in the mouth is an unfavourable sign, as it generally indicates profound damage to the mucous membrane of the digestive canal. So also it is a bad sign always in the chronic diarrhæa of children, when

the stools change in character from time to time—now watery then slimy, at another time curdy, and at another green. It is far easier to cure a diarrhœa when the motions are always of a uniform character.

It is important to treat promptly the severe forms of infantile diarrhœa, for being generally inflammatory, the mucous membrane of the large, and even that of the small intestine becomes seriously affected. The mucous membrane of the large intestine is extensively ulcerated or considerably thickened and granular-looking, whilst the mucous membrane of the small intestine, a part of the tube less commonly affected, may be much softened. It will be readily understood that disease so extensive must take some time to cure.

Mercury, as we have seen, proves very serviceable in most of the forms of children's diarrhœa, both acute and chronic. I have endeavoured to point out the circumstances when one mercurial preparation is preferable to another. It may be urged that as both in severe, acute, and chronic diarrhœa the same pathological conditions are found, that the same form of mercury suitable for one case would equally benefit another. But though the pathological state is held to be identical, still some differences there must be which have hitherto escaped observation, for surely it requires a different pathological condition to produce in one case slimy stools, in another watery, and in another green curdy stools. These differences displayed in the symptoms, though at present not discriminated pathologically, require somewhat different treatment. Hence, though in each kind of diarrhœa, all forms of mercury are useful, it is found that in some cases bichloride of mercury is greatly to be preferred, and in other cases grey powder. In the treatment of chronic diarrhœa, mercurial preparations are often required for many days, and it frequently happens that though they alter the character, and lessen the frequency of the motions, yet the diarrhœa may persist and may require for its cure, other remedies, like lime, arsenic, and nux vomica. In the treatment of chronic, as well as in that of acute diarrhœa, too much attention can-

not be paid both to the quality and quantity of the food. Acute diarrhœa is often aggravated, and made chronic, by over-feeding; a short time after each meal, the child is violently purged, and the mother seeing it wasting rapidly, is apt to think, she can check the diarrhœa by giving as much food as possible. But it must be borne in mind, that digestion is greatly impaired, so that but little food is digested; the excess lodging in the intestinal canal, undergoes decomposition and acting as an irritant, increases the disease. Not only should the quantity of food be small, but it should be given frequently in very small portions. It is also important to clothe the child warmly, and to put a flannel roller round the belly, as Dr. Eustace Smith strongly insists.

There is a form of diarrhœa little influenced by mercurial preparations, nor indeed by the other usual remedies for diarrhœa: the child passes large acid offensive curdy stools evidently consisting of decomposing curds. This diarrhœa is best treated by withholding milk entirely and substituting animal food.

The chronic diarrhœa of adults, independently of serious organic change of the intestines, with watery, pale stools, often yields to the hundredth of a grain of corrosive sublimate every two or three hours. The same treatment answers sometimes in the diarrhœa of typhoid fever and phthisis.

A thickly-coated creamy tongue occurring in dyspepsia, in the course of chronic disease, or in early commencement of convalescence from an acute illness, may generally be cleaned with simultaneous improvement of the appetite and digestion and removal of disagreeable taste in the mouth by one-third or a grain of grey powder three or four times a day. If there is constipation then it is better to give half a grain of calomel with three grains of extract of hyoscyamus repeated for three nights. The first pill generally purges twice or thrice, the second less, and the third not at all. Grey powder should be given if there is either diarrhœa or tendency to it, for besides its effect on the tongue and stomach, it will generally control the diarrhœa at the same time

restoring to the motions, if too light or too dark, their natural colour.

With the exception of the sulphide, all mercury compounds enter the blood, and are employed in a variety of diseases on account of their action on distant organs.

The prolonged and undue employment of mercury produces serious mischief. The body wastes, and the blood becomes much impoverished, and "mercurial fever" may be induced, sometimes accompanied by pustular or vesicular eruptions. In mercurial tremors, weakness in the upper extremities is first noticed, and the voluntary movements lack their usual precision. Soon, slight tremors occur, and gradually increase in severity and extent till the whole body becomes affected, the legs being attacked before the trunk. These tremors are easily excited, they cannot be controlled, and persist for some time. In severe cases, almost every part of the body is affected by severe spasmodic movements, so that respiration is spasmodic, and the sufferer may be unable to walk, talk, or masticate. Loss of memory, headache, delirium, and even convulsions, may occur. Salivation is sometimes absent; for the mode of poisoning greatly influences the effect of mercury, inhalation generally producing tremors, inunction producing salivation. Inunction, however, has produced tremors. Complete recovery generally takes place, provided the patient is removed from the influence of mercury before the disease has greatly advanced. The treatment of mercurial poisoning consists in the use of simple or sulphurous baths, and of iodide of potassium. The influence of iodide of potassium on mercury in the system has been spoken of elsewhere. (*Vide* Iodide of Potassium.)

Mercury was formerly indiscriminately administered for the cure of syphilis, in all its forms and stages. Given in enormous quantity, the constitutional effects sought to be produced were very serious. Further experience showed that this severe treatment was by no means necessary; nay, that it did more injury than good. The bad effects undoubtedly resulting from the too free administration of this drug have

led many to discontinue its use in syphilis, and even to attribute to the pernicious influence of mercury many of the more serious diseases, as destruction of the bone, etc., formerly met with in syphilitic patients. It has even been denied that these graver lesions are ever produced by syphilis.

There is much to countenance these views; for it is singular how similar the phenomena produced by mercury are to those which result from syphilis. The author thinks it is fairly shown that the serious secondary and tertiary symptoms laid to the charge of mercury, can be produced undoubtedly both by syphilis and by mercury salts; so that these salts if given too freely, for too long a time, or under improper circumstances, inflict great harm by aggravating the disease they were intended to cure.

An influential school of the present day maintain that over syphilis mercury is powerless, and that its administration is simply harmful; there is, however, a larger and more prevailing school as firmly convinced of the usefulness of mercury when judiciously employed.

The believers in the efficacy of mercury hold generally:

That it is good in both primary and secondary syphilis.

That it is of use in the treatment of the hard chancre only, and does harm in the soft.

That by the aid of mercury the hard chancre is more speedily cured, and the patient is less liable to secondary symptoms which are milder in character.

That most forms of secondary syphilis yield quickly to mercury.

The following propositions are extracted from the admirable lectures by Mr. Jonathan Hutchinson to whom medical science is in so many ways indebted.

"That mercury is probably a true vital antidote against the syphilitic virus and that it is capable of bringing about a real cure.

"That in practice, a good many cases are really cured by mercury; the cure being proved by the restoration to good

health, and in some cases by renewed susceptibility to contagion.

"That the probability of cure depends upon the stage of development, attained by the disease when the remedy is resorted to, and upon the perseverance, with which it is used.

"That in order to secure the antidotal efficacy of mercury against syphilis, it is desirable to introduce a considerable quantity into the system and to protract its use over a very long time.

"That ptyalism and other evidences of the physiological action of mercury, so far from being beneficial, are if possible to be carefully avoided, since they prevent the sufficiently prolonged use of the remedy.

"That in cases in which the patient shows an idiosyncrasy, peculiarly susceptible to mercury, the indication is to reduce the dose, rather than to omit the drug.

"That it is impossible to begin the administration of mercury too soon, and that it should be resorted to without loss of time, in all cases in which a chancre shows a tendency to indurate.

"That many cases of indurated chancre, treated early by mercury, never show any of the characteristic symptoms of the secondary stage.

"That in other cases of mercurial cure of the chancre, in which yet secondary symptoms do occur, they are usually milder, than if allowed to develope without specific treatment.

"That when mercury does not wholly abrogate the secondary stage, it exhibits a remarkable power in delaying it.

"That delayed outbreaks of secondary syphilis, are to be regarded, rather as proof that the administration had not been sufficiently persevering, than that the remedy was not efficient.

"That it is probable that the risk of tertiary symptoms, is in ratio with the severity and prolonged duration of the secondary stage.

"That there are some grounds for believing that the tertiary symptoms of syphilis, are both less frequent and less

severe, in those who have been efficiently treated by mercury, than in others.

"That mercury cautiously given, does not in a great majority of cases do any injury to the general health, and that its local inconveniences may usually be prevented.

"That the doctrine of the real antidotal character of mercury in respect to syphilis, ought to lead to much more prolonged administration of it, with the hope of destroying utterly all lingering germs of the malady.

"That most collected statistics as to the duration of treatment and freedom from relapse, are misleading and worse than useless, because usually the treatment was far too short to be effectual.

"That it has not yet been proved that there are any special forms of syphilitic disease, in which mercury ought to be avoided, although as a rule it is acknowledged that it must be used with more caution in all forms which are attended with ulceration, than in others.

"That iodide of potassium possesses little or no efficacy against either the primary or secondary forms of syphilis.

"That the efficacy of mercury is often most signally proved in cases which have utterly resisted the action of iodide of potassium.

"That it does not much matter whether mercury is given by the mouth, by inunction, or by the vapour bath, provided that whatever method is selected, care is taken to avoid salivation, purging, &c.

"That the doses usually resorted to for internal administration, are for the most part too large, and thus often necessitate a premature discontinuance of the remedy.

"That if one method of administration does not proceed satisfactorily, another should be tried; and that in no case of difficulty should the vapour bath be forgotten."

Congenital syphilis of children in most of its forms, succumbs to mercury with singular rapidity. It is a common practice to give to children small doses, as of a quarter of a grain of grey powder, and to add to it small doses of Dover's

powder to prevent relaxation of the bowels. But the author is convinced, that much larger doses of grey powder, are more beneficial, and remove the disease far more quickly and succeed indeed, where the smaller dose fails. Thus one or even two grains of grey powder, may be given three times a day, unguarded with opium, for it is the rarest thing for even these doses to purge; nay, if any diarrhœa exists, a not uncommon complication, these doses check it. Moreover these large doses may be continued for a considerable time, till every symptom has vanished, without producing any of the toxic effects of the drug. As a rule, however, one grain of grey powder thrice daily is sufficient. Those comparatively rare forms of congenital disease, where the periosteum is affected, usually near the articulation of some of the long bones, yield best to iodide of potassium (see this drug), though as far as my experience goes, it is still necessary in most cases to resort to mercury, to remove the other evidences of syphilis.

While admitting the validity of these views, it is necessary to say that sometimes syphilitic patients are apparently completely cured without mercury, by mere general treatment, tending to improve the health; and further, if the health is kept in good order, the secondary symptoms will be of a mild character. Cases of syphilis occur which are entirely uninfluenced by mercury, and are curable only by diligent attention to those hygienic circumstances which mend the general health.

Mercurial fumigations with steam when other means fail often cure certain obstinate syphilitic rashes.

The firmest believers in the efficacy of mercury in syphilis are unanimously agreed that it is not only undesirable, but pernicious, to give it in quantities sufficient to produce salivalion; yet it appears that those preparations which salivate quickest manifest the greatest power over the disease, and hence the metallic and mercurous preparations, as grey powder and calomel, are preferred by some to the mercuric as corrosive sublimate.

It is a common, and often successful practice to take mercurial purges, generally in the form of a blue pill, to prevent or mitigate an attack of sick headache. For further information of the employment of mercury in this troublesome affection, the reader is referred to the section on podophyllum.

It was thought formerly that mercury salts were endowed with the power of controlling inflammation, and to this end they were constantly given even to salivation; now, however, their use under such circumstances is much less general. Bichloride of mercury certainly appears to be of great use in iritis and inflammations of the deep-seated parts of the eye. In other inflammations, especially of the serous membranes, it is probably of service, appearing to check the inflammation, and to promote the absorption of effused products.

According to very high authorities, among whom may be mentioned Dr. Parkes, small doses of calomel may be most beneficially given in typhoid fever. This medicine should be given at the commencement of the disease; some think it useless after the ninth or tenth day. It is considered to lessen the height of the fever, to shorten its course, to make the intestinal derangement much milder, and to check the diarrhœa. Some push the medicine till the gums are slightly touched; but this practice, not only unnecessary, but harmful, should be carefully avoided.

There are some observations, in part made by Dr. Harley, which tend to show that corrosive sublimate is a "heart poison;" for the heart of an animal destroyed by corrosive sublimate soon ceases to contract after death; and the heart of a frog suspended in a solution of this salt ceases to beat much sooner than a heart suspended in pure water.

Mercury remains a long time in the body, and, it is stated, may accumulate in globules in the cancellous structures of bone.

Mercury salts are to some extent eliminated by the urine, but chiefly by the mucous membrane of the intestines, and with the bile.

PREPARATIONS OF COPPER.

Applied to the unbroken skin, the soluble salts of copper produce no visible effect. On sores they unite with the soluble albuminous substances, forming an insoluble albuminate, which coats the surface, and in an imperfect manner may take the place of the lost cuticle. The thin pellicle thus formed protects the delicate structures from the air, and the substances floating in it, and so promotes the healing process. Like many other metals, these salts condense the structures and constringe the blood-vessels, and so lessen the supply of blood to the part. They may even arrest hæmorrhage from the smaller vessels. They act as irritants to the delicate tissues, producing slight inflammation, with some smarting pain.

To arrest bleeding, and as an irritant to indolent sores, the sulphate is most employed, either in stick or solution, or as an ointment.

Indolent forms of impetigo, after resisting the more usual applications, will sometimes yield to sulphate of copper.

The solid sulphate may often be rubbed with conspicuous advantage along the edges of the eyelids when affected with tinea tarsai. The eyelashes should be previously cut off closely and the scabs carefuly removed. Indeed, in every case where slight stimulation is required, this salt may be used. Milder in its action than nitrate of silver, it excites much less pain.

The soluble salts combine in the mouth with the liquid albuminous substances of this cavity, and precipitate them more or less completely. If used in quantity more than sufficient to do this, the mucous membrane itself is attacked in a manner altogether similar to the abraded skin. These salts possess a metallic styptic taste. The sulphate, in the solid form, may be applied with great advantage to the tongue when affected with either specific or simple psoriasis, or indolent sores. Painted in solution over the edges of the

gums in ulcerative stomatitis it generally quickly heals the ulcerated surfaces; but, on the whole, dried alum is to be preferred.

A weak solution of this salt painted over the mucous membrane will remove the white, curdy-looking coating of thrush, and prevent its renewal.

The soluble salts behave in the stomach in the same manner as in the mouth, and if taken in large quantities act as powerful irritant poisons.

These salts are emetic; the sulphate being speedy, and mostly effectual in its operation, is not unfrequently prescribed. A good way to give this salt as a vomit is to administer it in small and frequently-repeated doses. It generally produces one copious evacuation, neither purging nor producing much nausea or prostration. It is supposed to exert an especial action on the larynx, hence it is sometimes given in croup, and when it is necessary to expel any obstructing substances from the glottis by the mechanical efforts of vomiting.

In moderate doses these salts are astringent to the mucous membrane of the intestines. The sulphate, administered either by the mouth or by injection into the rectum, is often effectual in staying severe chronic or acute diarrhœa, whether depending on serious organic disease or not.

Copper salts, taken for a considerable time in small quantities, are said to give rise to a condition not unlike that produced by lead; for example, colic, with alternating constipation and diarrhœa; and it is even said paralysis of the upper extremities, undistinguishable from that of lead.

Salts of copper find their way into the blood, existing there probably as albuminates.

Copper salts have been given in cholera and epilepsy.

Solutions of the sulphate are employed in gonorrhœa, gleet, and leucorrhœa.

Copper is eliminated both by the urine and fæces.

PREPARATIONS OF ZINC.

The members of this group are employed in a variety of ways as external applications.

Their common action is astringent and irritant; but on account of their different degrees of solubility, their varying affinity for water, and perhaps for the tissues, these properties are manifested in unequal degrees.

The chloride and iodide, from their high diffusion-power and great affinity for water, are the most energetic of the zinc salts. Yet even these remain almost inert on the skin, unless the cuticle is first removed, when they permeate the tissues, and destroy them for a considerable depth. The chloride at first produces a sensation of warmth, which increases to a burning pain, lasting seven or eight hours, by which time the tissues are destroyed, and a white eschar is formed, which separates in from seven to twelve days. The chloride and iodide, as we have just said, have hitherto been regarded as the most energetic salts of this series, but recently Mr. Marshall, of University College, has shown by experiments that the nitrate penetrates deeper than the chloride, destroying the tissues to a greater depth, and, according to the same authority, it possesses the further advantage of producing less pain than the chloride. These three preparations, but especially the chloride, are employed to destroy nævi, warts, condylomata, the skin affected with lupus, and the tissue of syphilitic ulcers.

The sulphate having a lower diffusion-power, its action is much more superficial. In common with the other soluble salts of zinc, it forms an insoluble compound with albumen, and by virtue of its astringency condenses the tissues and contracts the blood-vessels. As a stimulant and astringent it lessens the secretion, and promotes healthier growth of ill-conditioned, free-secreting sores or eruptions. In common with the chloride it is used as an injection in gonorrhæa or gleet.

A grain or two grains of chloride of zinc dissolved in a pint of water, and a little of this solution injected every hour of the day, is a useful injection for gonorrhœa. Rest, if possible, should be observed; but this is not indispensable to the success of the injection. If the frequent injection causes any pain in the testicles, they should be suspended in, and frequently fomented with, hot water; if, notwithstanding, the pain continues, and the swelling increases, the injection must be employed less often. If treated at its very beginning, this injection will often remove the disease in twenty-four to forty-eight hours.

A solution so weak as the one recommended is no better it may be objected than simple water; to which it may be answered, simple water does not cure with anything like the same rapidity. Moreover, if some of this solution is taken into the mouth, and retained there a few seconds, it will produce a decided roughness of the mucous membrane. Now, if the solution is strong enough to affect the mucous membrane of the mouth, it can certainly influence, in at least an equal degree, a similar, but more sensitive, structure in the urethra.

The carbonate and oxide are insoluble, or but very slightly soluble, in the animal fluids; and as these salts possess no affinity for water, their action on the tissues is very weak. They are, however, slightly astringent, and are useful, on account of this property, in ointment, or in powder. The ointment of the oxide is used as a mild stimulating application in eczema and impetigo, when, inflammation having subsided, the raw surface is left in an indolent state, with very little disposition to heal. Both the oxide and carbonate are used as dusting powder, and are, perhaps, the best powders for this purpose; but, as a rule, greasy applications are preferable. In inflamed conjunctiva, a weak solution of the sulphate dropped into the eye several times a day is often very useful. The same salt is occasionally employed as a gargle in relaxed sore throat, and is sometimes added to alum injections for leucorrhœa.

The more soluble preparations possess a metallic, styptic taste. None are employed in diseases of the mouth. The chloride has been used to destroy the exposed painful pulp of decayed teeth.

The carbonate in large doses produces some nausea and vomiting; but a full dose of the sulphate acts much more speedily, is a safe emetic, producing little prostration or nausea, and generally empties the stomach in one complete evacuation. It is therefore the best emetic in cases of poisoning, being far preferable to the slow and unsure action of ipecacuanha. It may be employed as an emetic in bronchitis or croup; in bronchitis, to expel the mucus from the bronchial tubes; in croup, the false membrane from the larynx; but other emetics are mostly preferred. The sulphate may be employed as an emetic, or in doses short of the induction of vomiting, in painful affections of the stomach, dependent on chronic inflammation of the mucous membrane. No satisfactory explanation has yet been given of the action of zinc salts as emetics. They vomit even if mixed with albumen. Injected into the blood, the sulphate excites vomiting.

On account of its slight solubility, the oxide exerts but little action on the stomach, little being dissolved unless much acid is present in the stomach.

The choloride is a corrosive poison. The sulphate, on account of its astringency, may be employed, like most other metallic salts, in diarrhœa. Its action must take effect on the upper part of the canal, since the portion escaping absorption must be speedily converted into an inert sulphide. The stomach may become habituated to the ingestion of very large doses of the sulphate, to the extent even of forty grains thrice daily, without obvious bad results, or without inducing either nausea or vomiting, or apparently any alteration in the mucous membrane of the digestive canal. The prolonged employment of such doses is imprudent, as it has been shown that superficial ulceration of the stomach may be produced.

Zinc colic has been described. The symptoms included constipation, vomiting, prostration with disagreeable taste in the mouth.

Zinc finds its way into the blood, and exists there probably as an albuminate.

The oxide and sulphate have been employed with advantage in epilepsy, and whooping-cough. We now possess a better remedy for epilepsy in bromide of potassium.

Sulphate of zinc is often very useful in chorea. Like tartar emetic, it succeeds best when given in doses sufficient to produce nausea, or even vomiting daily. To effect this, however, the dose must be rapidly increased sometimes to the extent of two grains every two hours daily, and it is astonishing how much of this drug can be borne, for I have given fifteen and sometimes twenty-two grains every two hours without producing nausea. This salt thus administered often effects striking improvement, but these heroic doses after a time excite pain at the pit of the stomach with loss of appetite. When this happens, another emetic, like tartar emetic, may be substituted: when given to excite nausea it is a good plan to administer a dose before breakfast. It is a noteworthy fact that most emetics are useful in chorea. Do they act by exciting the physiological state of nausea, or by their operation on the nervous centres through which emetics produce nausea? As improvement occurs in many cases independently of nausea, the latter suggestion is probably the more feasible. Zinc salts are reputed to be powerful nervine tonics, an expression meant I suppose, to imply that they promote the nutrition of the nervous system, and some authorities attribute to this property their influence over chorea.

In certain forms of hysteria zinc salts prove useful, especially in the shape of valerianate of zinc.

These substances are reputed to be antispasmodic. When they produce nausea, no doubt they indirectly act thus; but it is doubtful whether non-emetic doses are efficient antispasmodics.

The oxide in two-grain doses, given nightly, often controls profuse colliquative sweating. It is also said to check the profuse secretion from the bronchial mucous membrane in some forms of bronchitis.

Dr. Hammond recommends oxide of zinc, in two to five-grain doses, for nervous headache. Bismuth he also finds useful.

This metal does not become fixed in the body, nor does it produce chronic affections like lead or mercury. Zinc salts are eliminated from the body less rapidly than some other metals. They pass out of the system in small quantities only by the urine. It has been thus asserted that very little of the salts pass into the blood. This may be true; but the fact that the chief part may be re-obtained from the fæces is no proof of this statement, as zinc, like many other metals, is probably excreted by the mucous membrane of the intestines, and with the bile.

PREPARATIONS OF ANTIMONY.

Tartar emetic, in the form of ointment, excites in the skin a characteristic inflammation, at first papular, then vesicular, and lastly pustular. The rash thus runs the course of the eruption of small-pox, and in each stage simulates it very closely. Yet there are points of difference distinguishable to a practised eye. Like small-pox eruption, this rash often scars; moreover, the action of this ointment, being capricious and painful, renders it an unsuitable external application.

Tartar-emetic ointment has been used as a counter-irritant to obtain a powerful action of some continuance; for instance, to the scalp in tubercular meningitis.

Chloride of antimony is a powerful escharotic, but it produces an ill-conditioned, slow healing sore.

Tartar emetic being the most used member of this group, our remarks will apply to this preparation, except when the contrary is stated.

Antimony perparations are not used as topical applications to the mouth. After small medicinal doses the stomach experiences a slight sensation of soreness—a sensation easily mistaken for hunger. Pushed yet further, the medicine produces increased secretion of mucus from the stomach and intestines to the extent of inducing numerous moist motions; and diarrhœa with colic may set in. The bronchial mucous membrane also yields an increased secretion, and probably the secretion of the whole mucous tract is augmented.

Antimony is never used as a purgative; in fact, opium is frequently given in combination with tartar emetic, expressly to prevent purgation. Large doses excite nausea and vomiting. As an emetic, tartarized antimony produces considerable depression, with much nausea; and the repeated vomiting it excites is accompanied by great straining. It is somewhat tardy in its action, and may require twenty minutes to half an hour before it operates. This tardy action disqualifies it as an emetic in cases of poisoning. Like all nauseating medicines, it produces weakness and prostration, but in a greater degree than most other emetics.

Majendie has shown that tartar emetic, when injected into the veins, excites nausea even after the removal of the stomach and its substitution by a pig's bladder; hence it has generally been held that this salt produces vomiting, not by its effects on the stomach, but on the nervous centres. Grimm who is confirmed by Kleimann and Simonowitsch, finds that it excites vomiting more slowly when injected into a vein, than when administered by the stomach, whence he concludes that it produces vomiting by its effects on the terminations of the nerves of the stomach. He disposes of the difficulty raised against this view by Magendie's experiment, by assuming that tartar emetic excites nausea, by its effects on the termination of the nerves of the œsophagus and intestines.

Tartar emetic was formerly employed to induce muscular

weakness and the relaxation of spasm, to faciliate the reductions of dislocations and hernia, but in such cases chloroform has now completely superseded it.

Trousseau taught that the action of this medicine was much influenced by food. With low diet it produces its constitutional effects, but with a full diet it excites vomiting and purging. Its action is further modified by the quantity of water administered with it: this being small in bulk, vomiting takes place; if large, diarrhœa is produced. It was further observed by Trousseau that certain substances modify the effects of antimony; for wine and acid fruits, both fresh and preserved, develop the emetic and purgative properties of the drug.

The soluble antimony compounds easily enter the blood, but the form they there assume is unknown. Possibly the oxide of the metal, either in the stomach, intestines, or blood, combines with albumen, forming an albuminate. Antimony compounds, it is said, do not combine with albumen, except in acid solutions, when an insoluble compound is formed.

It has been proved experimentally that the administration of tartar emetic increases the insensible perspiration, chiefly of the skin. Since at the stage of nausea all emetics increase the sweat, it is difficult at present to decide whether tartar emetic affects the perspiration in any other way. Tartar-emetic wine is commonly given in fevers as a diaphoretic.

It is convenient here to notice the influence tartar emetic exerts on the excretion of carbonic acid and urea. Under its influence these excrementitious substances are both eliminated in greatly increased quantity. Whether the medicine is to be considered a mere eliminator of these products, or whether it likewise increases their formation, the experiments are not sufficient to determine, as in no instance were they continued long enough to decide this question.

In common with other emetics, this remedy is sometimes given in large doses to produce profuse nausea and vomiting, and it is held by many eminent authorities, among whom

Dr. Graves may be mentioned, that the strong impression thus made on the system will cut short acute specific fevers and inflammations. Graves held that in this way typhus might be summarily checked. The period for the exhibition of emetics, he states, is very short; for after the lapse of twenty-four or thirty-six hours from the occurrence of the rigor, they will not succeed in arresting the disease.

Many cases of ague may be cured by the impression emetics make on the system. The action of quinine may be aided by an emetic administered each morning, and cases which resist quinine often yield immediately to the united action of quinine and emetics. Ipecacuanha and other emetics should be preferred to antimony.

Given to a healthy person, antimony will not lower the temperature of the body, if one experiment may be accepted as sufficient to settle this point. The author gave to a strong young man tartar emetic in half-grain doses every ten minutes for nearly seven hours, inducing great nausea and vomiting, with profuse perspiration, but during the whole time the temperature remained remarkably constant, not varying more than 0·4 Fahr., an amount of variation frequently observed in health.

Of late years, antimony has been much employed in acute pneumonia, and the general experience of the profession is strong in its favour. Discretion, however, must be used in adapting the dose to the strength of the patient, who, if weak, must take alcoholic stimulants in conjunction with the tartar emetic. In many cases of pneumonia, under the influence of antimony the pain in the side gives way, the expectoration from rusty changes to bronchitic, the pulse and breathing become reduced in frequency, and the further spread of the inflammation is checked.

Other kinds of acute inflammation may be similarly treated, although the good results are not so apparent as in pneumonia. It is necessary to give the tartar emetic at the very beginning, otherwise its power over pneumonia is much less marked. In inflammation, one-fourth to one-half grain may

be given every two or three hours, or a lesser proportionate dose every hour.

Treated in this way, tonsillitis, pleurisy, orchitis, bronchitis, puerperal peritonitis, inflammation of the breast, whitlow, and other inflammatory affections, may be shortened and made milder. Antimony may also be employed with considerable success in chronic bronchitis, when the expectoration is copious, frothy, and difficult to expel.

In the following disease tartar emetic is invaluable.

Young children, six to twelve years old, on the slightest exposure to cold, are attacked with much wheezing and some difficulty of breathing, sometimes so urgent as to compel them to sit all night propped up with pillows. The expectoration may be pretty abundant, but children of this age do not generally expectorate. On listening to the chest, there is heard much sonorous and sibilant, with perhaps a little bubbling, rhonchus; but this last is often absent. The wheezing is audible for a considerable distance, and sometimes the noise is so great as to be heard many rooms off. Occasionally the cough is troublesome, and on each exposure to cold the voice may become hoarse, and the cough hollow and barking. Some children are thus afflicted whenever the weather is cold, even in summer, and may not be free the whole winter; with others the attack lasts only a few weeks or days. This affection sometimes follows measles. It is compared by the mother to asthma, with which, if not identical, it is certainly allied.

The best way to prepare and administer the solution of this salt is to add a grain of it to half a pint of water; of this give a tea-spoonful every quarter of an hour for the first hour, afterwards hourly. If the wheezing comes on at night, it is sufficient to give the medicine only at this time. The good effects of the medicine are speedily evident; for the child is often greatly benefited on the first night of its employment. So small a dose, it may be thought, must be inefficacious, but when first given it very generally produces vomiting once or twice in the day. As it is not necessary to

produce sickness, the dose in this case must be still smaller.

There is, however, an affection somewhat similar to that just described, which it is necessary to discriminate, since it is unaffected by tartar emetic. It occurs in children a few months old, and consists of a loud rattling, which is obviously caused by mucus in the throat or larynx. There is no bronchitis, or, if it exists, this is a mere coincidence; nay, sometimes on the occurence of bronchitis the complaint in question ceases for a time. It is brought on and aggravated by cold, and may last, with some fluctuations, many months. In some cases the rattling is worse in the day, but is usually worse at night.

Antimony in small hourly doses is very useful in the acute catarrh of children, which is not uncommonly accompanied by vomiting and diarrhœa probably due to catarrh of the intestines. The intestinal canal is sometimes, but most frequently the lungs are first attacked. The tartar emetic generally quickly stays the vomiting and diarrhœa, but often takes a longer time to control the bronchitis.

Antimony acts as a depressant on the heart, weakening its contractions, and increasing their frequency. These results depend in part on the nausea it produces.

According to the recommendation of Graves, it may be usefully employed in typhus and other fevers, when there is much excitement and furious delirium, symptoms which may be generally calmed by the exhibition of this drug. As wakefulness is generally present, being indeed, the cause of the excitement and delirium, opium should be added to the antimony. The combined influence of these remedies calms the excitement, and induces refreshing sleep, out of which the patient wakes refreshed and free from delusions. Judiciously employed, these remedies may save an almost hopeless life. Each drug appears to assist the action of the other; and the relative doses must be determined by the circumstances of the case. In furious delirium the tartar emetic must be given in full, and the opium in small quantities; while, if wakeful-

ness is the chief symptom, the delirium being not very boisterous, the dose of tartar emetic must be reduced, and the opium increased.

Graves advises one-fourth to one-half of a grain of the salt every hour or two hours, and to be discontinued when it produces bilious stools. This treatment is very useful in the delirium which usually sets in about the ninth or tenth day of typhus.

The mania and sleeplessness of delirium tremens generally gives way to the same treatment.

Puerperal mania may be treated in the same way, although probably bromide of potassium and chloral give better results.

Tartar emetic given to the extent of producing nausea and vomiting once or twice a day is sometimes useful in chorea. (See sulphate of zinc.) Increasing doses must be given, as the system appears soon to tolerate it. Other remedies, however, are more efficient.

Tartar emetic, in doses of 1-36th to 1-48th of a grain, three or four times a day, may be given with advantage in strumous ophthalmia. Sharp purgation at the commencement of the treatment is highly useful.

In acute poisoning by tartar emetic, violent and continuous vomiting occurs, accompanied with a diarrhœa of bilious and bloody stools. The common symptoms of gastro-enteritis, and sometimes of peritonitis, are present. The prostration is intense, and profound and repeated faintings take place. The respirations and the pulse are said to be reduced both in frequency and in strength; others assert that the pulse is more freequent.

The *post-mortem* appearances are, inflammation of the stomach and intestines, but not often of the gullet. The peritoneum may be, and, according to Harley, the rectum often is, inflamed, and usually some inflammation of the lungs is observable, tending to make it probable that tartar emetic exerts an especial action on these organs.

Applied to a sore or to the broken skin, or injected into

the veins, antimony still excites nausea and vomiting, thus manifesting an especial affinity for the stomach or nervous centres.

In the treatment of poisoning by tartar emetic, the vomiting should be promoted by warm demulcent drinks, while strong tea or coffee, tannin, or decoction of oak bark, should be diligently administered.

The statements concerning the influence of antimony on the urine are conflicting. The probable effect of tartar emetic on this excretion is to lessen the amount of water and chloride of sodium, owing to increased perspiration. Urea is greatly increased, and apparently in proportion to the dose of the antimony. The pigment and uric acid are also increased, but in a less degree.

The golden sulphuret increases all the constituents of the urine, especially the urea, and sulphuric acid (Parkes on Urine.)

Antimony is separated chiefly by the kidneys; some, however, passes with the bile, and perhaps by the intestines. A portion is retained in the body.

PREPARATIONS OF ARSENIC.

Since all arsenic salts produce the same symptoms, it is probable that in the blood they ultimately assume the same form.

Dry arsenious acid produces no changes in the unbroken skin, but in wounds or sores it excites very active inflammation, sufficient, if the application is a strong one, to destroy the tissues for some depth. Arsenious acid has long been used to destroy warts, condylomata, cancerous growths, etc.

It may be applied pure, or mixed in variable quantities with some bland powder, as starch. At times this application has enjoyed a high reputation, whilst at other times it has fallen

into almost complete disuse. It is said that some have fallen victims to this treatment, through the absorption of arsenic in sufficient quantity to destroy life. An untoward result like this can occur only when certain well-known precautions are disregarded. Absorption can be effectually prevented if sufficient arsenic is employed to excite active inflammation; for inflamed tissues lose the power of absorption more or less completely. Produce active inflammation, and the patient is safe; but if, through fear of poisoning, the application is too weak, that is the most efficacious way of doing what it is desired to avoid. Surgeons, experienced in the employment of arsenic, recommend that if the tissues to be destroyed are extensive, the arsenic should be applied to a part only of the surface at a time. When employed to remove large growths like cancer, the skin being unbroken, incisions are first made, and into these the arsenical paste is laid. Deep-seated and active inflammation soon sets in, and the growth dies for a considerable depth. The whole tumour often sloughs away from the healthy tissues,—is enucleated, as it is said,—leaving a clean and healthy sore, which heals without trouble in fifteen to thirty days.

Lupus and other obstinate skin affections may be treated in the same way.

Arsenious acid and powdered acacia, of each an ounce, blended with five fluid drachms of water, form an arsenical mucilage much used by Dr. Marsden to remove epithelioma-tous growths. Some of this arsenical mucilage is to be painted over the tumour night and morning, taking great care to limit its employment to the diseased tissues. Each application, covering not more than a square inch, is to be several times repeated, and the separation of the sloughs aided by poulticing.

The following powder may also be used:—Fresh lime, half an ounce; yellow sulphide of arsenic, 20 grains; starch, 180 grains. This powder may be cautiously used as a depilatory. The arsenic should constitute one-fifth or one-sixth part of arsenical powder, so as to insure the excitation

of sufficient inflammation to prevent poisonous absorption.

Liquor Arsenicalis painted over warts is said to cause them to disappear.

Arsenical baths are useful in some forms of rheumatoid arthritis. A bath is made by adding to the water four ounces of common washing soda and twenty grains of arseniate of soda.

Arsenic has a sweetish taste. In moderate doses it apparently neither undergoes nor produces any changes in the mouth. Dentists employ it as an escharotic to destroy the exposed sensitive pulp of decayed teeth, or to destroy the pulp before stopping the tooth. If used to remove pain, the arsenic may be mixed with opium. The pain at first is sometimes aggravated.

The vapour of arsenical cigarrettes is drawn into the lungs to prevent and lessen attacks of asthma. Care, of course, must be exercised in their manufacture. Trousseau advised the smoking of cigarretes made of paper "saturated with a solution containing half a drachm or a drachm of arsenite of soda in three drachms of water. Such inhalations, we should suppose, might be mischievous, unless closely watched." (Stillé.)

These cigarrettes may be used in chronic phthisis.

Sloughing of the mouth or throat, malignant sores, as cancrum oris, malignant sore throat, and the like, are greatly benefited by arsenic given in medicinal doses. It is also useful in chronic coryza.

A drop of the solution of arsenic three times a day proves often serviceable in certain curious and allied complaints of the respiratory tract. A patient is, perhaps, every day, or even several times a day, seized with an attack of persistent sneezing, accompanied by profuse running from the eyes and nose, and sometimes severe frontal headache. Each attack may last several hours, and the disease may endure for years.

Several days sometimes elapse before an attack occurs,

which is then usually severe, lasting twenty-four hours or even longer. The sneezing is generally accompanied, and sometimes preceded, by itching at a small spot situated inside one or both nostrils, not far from the orifice, but in some cases the itching affects the whole of the inside and outside of the nose, even extending to the face. These attacks are excited by exposure to cold, by dust, and sometimes from unascertainable causes.

We occasionally meet with cases apparently identical to those just described but with this difference—the attack is excited by food, and is most severe after the larger meal, and lasts from twenty to forty minutes. My friend Mr. C. C. Fuller has furnished me with some cases of this kind.

Arsenic is invaluable too in another more developed and severer form of this affection. We not seldom find a patient prone to catch cold, when he is attacked with severe and repeated fits of sneezing, accompanied with profuse clear nasal discharge and severe frontal headache. Each attack, generally worse in the mornings, lasts a few days; but, owing to the great susceptibility to cold, it frequently recurs. Severe itching of the ala of one or both nostrils often forewarns the patient of an approaching attack. A simple irritant like dust may be adequate to excite a paroxysm. Continuing in this form for some time, occasionally for years, the inflammation may extend from the nose along the throat to the lungs, producing sore throat, soon followed by much difficulty of breathing, great wheezing, and free expectoration. The lung affection may last for some weeks. When this severe form has become established, the lungs may be attacked without any preliminary affection of the nose or throat.

Again, among children, we not uncommonly meet with a similar and perhaps identical disease. A child perhaps six months old undergoes a severe attack of bronchitis and thenceforth becomes very prone to catch cold. Then on catching cold, he is seized with frequent and incessant sneezing, lasting a variable time, sometimes a few hours, some-

times three or four days, and resulting in bronchitis, accompanied by much fever, wheezing, and great embarrassment of breathing, severe enough even to compel the patient to sit up in bed. The coryza may sometimes precede the dyspnœa three or four days, the shortness of breath continuing for many days or even weeks after the coryza has ceased. It is, indeed, a form of asthma. The child encounters many attacks in the year, especially during the winter, and may continue liable to them for years, and then perhaps lose them, or they may result in life-long asthma.

These cases appear related on the one hand to bronchitic and dyspeptic asthma, and on the other hand to hay fever. They are allied to the bronchitic form of asthma, being excited by dust, cold, and direct irritants; and through those cases where the paroxysmal coryza is always accompanied by bronchial asthma; and through those cases commencing as paroxysmal coryza, the disease extending and becoming complicated with bronchial asthma. To the dyspeptic forms of asthma this paroxysmal sneezing is related through those cases where the attack is excited by food; and those where the patient, a confirmed asthmatic for many years, then becomes afflicted with paroxysmal coryza induced by food, the asthma at last ceasing, the coryza alone remaining. The following case further illustrates the connection between paroxysmal sneezing and dyspeptic asthma. A child since six months old is subject to attacks, most common in winter, occurring every few months, beginning with not very severe sneezing, lasting from a day to a week, often, but not invariably followed by an attack of bronchitis, with much difficulty of breathing, and fever. Even when free from an attack, the child, after a full meal, suffers from stuffy breathing. In one instance, the disease is limited to part of the fifth nerve, and may extend downwards along the throat and involve the vagus nerve; or *vice versa*, beginning at the vagus it may involve the fifth; and in either case the disease may quit the nerve first affected, an occurrence most common where the attack first affects the fifth nerve. Indeed, in my experience this is

not an unusual way for asthma to begin in children; and as they grow up the coryzal symptoms cease, and ordinary bronchitic asthma alone remains.

On the other hand, these cases of paroxysmal coryza are related to hay asthma, which indeed appears to be the same disease, but owing to the patient's idiosyncrasies the attack is induced only by the pollen of plants; the similarity between these affections being shown by the fact, that in each case the mischief may be limited to the nose, frontal sinuses, and eyes, or extending further, may involve the lungs.

Mr. Blackley, in an admirable paper, shows, that in his own case and some other instances, hay asthma is solely due to the irritant effects of the pollen of plants. He conducted an extensive series of experiments with the pollen of many grasses, cereals, &c., and found that all are capaple of exciting an attack, although some kinds of pollen are more active than others. The pollen of poisonous plants is not more virulent than that of harmless plants, indeed, he finds that the pollen of solanaceous plants will excite a slight fit, while the pollen of wheat excites a very severe attack. He clearly shows, in his own person and in some other cases, that ozone, heat, strong sunlight, the volatile principle on which the odour of plants depends, oleo-resins, dust, unless it contains pollen,—and all these agents have been severally considered a cause of hay asthma by other writers,—are powerless to produce a paroxysm. In other cases it appears that one or more kinds of pollen only will produce the attack. Thus, rose-pollen only excites the attack in some patients; and it is said that in America, Roman wormwood is a frequent cause. Hay asthma and the diseases just described are indeed identical, but owing to individual idiosyncrasy, the attack is induced in one person by one irritant and in another by a different irritant. In some cases the attack as we have seen is induced by pollen, in other cases by ipecacuanha or by animal emanations, as from rabbits, cats, horses, &c. Dr. W. Smith, of Preston, narrates a case in which a linseed poultice provoked the symptoms of hay asthma. Simple dust will

occasionally excite these symptoms, and sometimes one kind of dust only is efficient. Thus a middle-aged man, an ironmonger, had suffered from paroxysmal coryza and asthma for two years, the attacks being brought on only by the dust of his shop; but other kinds of dust, as that of a road, failed to affect him, nor did flowers, grasses, &c., nor sun-light excite an attack. This case was singular in this respect that whilst coryza and asthma were excited only by the dust of his shop, yet in certain localities he suffered at night from simple asthma without coryza. Notwithstanding Mr. Blackley's careful and elaborate experiments, I cannot help believing that in some persons sun-light and great heat will bring on an attack without the aid of pollen. Of course it is well known that strong sun-light and great heat will much aggravate the disease produced by pollen. The itching and tingling which generally accompany paroxysmal sneezing, *no matter what their exciting cause*, may affect the whole or any part of the nose. Sometimes they are felt near the orifice, or inside under the bridge. These sensations may extend to the cheek or to the eyes, sometimes only to the inner canthus, or the tingling and itching may also affect the palate or throat. I remember the coryza in one case was accompanied and probably excited by itching of the nose and soft palate, and that iodine inhalations at once removed the coryza and nasal itching, but left unaffected the itching of the palate which at once ceased on the application of a little nitrate of silver.

Arsenic is most serviceable in many of these cases, quickly affording relief in some, but in others requiring ten days or a fortnight to manifest its remedial effect, while in other cases it fails altogether. Where there is fever, aconite, if given early, curtails considerably the course of the attack. Cases that fail to yield to arsenic are sometimes benefited by iodine inhalation, by the administration of iodide of potassium or veratrum viride. The following case of a young woman, 22 years of age, who had suffered for several years with attacks of sneezing like those described, well illustrates the

value of local applications. The fits occurred in the morning, lasted several hours, were accompanied by considerable pain over the forehead, and the sneezing was so violent that she became quite exhausted, and so remained the greater part of the day. She also complained of great itching over the whole of the inside and outside of the nose and part of the face, continuing as long as the sneezing. Her health was failing her, and her hair was growing very thin. Arsenic benefitted her very slightly, while iodine inhalations, the internal administration of veratrum viride, pulsatilla, iodide of potassium, bromide of potassium, and cod-liver oil were found useless. She was then ordered to use aconite liniment to the outside of the nose and itching part of her face, which immediately subdued the attack, removing both the itching and the sneezing. The attacks of sneezing recurred very slightly, and a fortnight's persistence with the treatment cured them.

The changes which arsenical compounds undergo in the stomach are at present unknown. There is no proof that, like most other metals, it combines with albumen to form an albuminate. From the uniformity in the action of all soluble arsenical compounds, it is probable that either in the stomach or the blood they ultimately become identical in composition.

Metallic arsenic, like the oxide, is poisonous; it is probably first oxidised, and then becomes active. Pure sulphide of the metal is inert, but as it generally contains a not inconsider able quantity of the oxide, this admixture renders it poisonous.

It has been maintained that the condition of the stomach controls the action of arsenic on the system; for example, if food is present, the medicine becomes absorbed by the lacteals, and through them mixed with the blood, while, if the stomach is empty, the arsenic is absorbed by the veins, and, passing into the liver, is separated with the bile.

In small medicinal doses arsenic excites a sensation of warmth at the epigastrium, and gives rise to a sensation of hunger; indeed, many maintain that arsenic promotes digestion, while increasing appetite, which others as strenuously

deny. Arsenic, as we shall see hereafter, by removing or lessening a morbid condition of the stomach, promotes digestion and appetite.

Few remedies are more useful in certain diseases of the stomach than arsenic. In the so-called irritative dyspepsia, where the tongue is furred, and its papillæ red and prominent a drop of the solution of arsenic, taken shortly before food, will be found of great benefit. Administered in the same manner, it will arrest the distressing vomiting of drunkards with almost unfailing certainty. This vomiting is accompanied by great straining and distress, and usually occurs in the morning before breakfast. Generally very little, and sometimes nothing, is ejected, and then it is called dry vomiting. The vomit is generally intensely bitter and sour, and of a green colour. Arsenic will not only arrest the vomiting, but will often improve the state of the stomach and restore both appetite and digestion.

Arsenic is valuable in chronic ulcer and cancer of the stomach. It allays pain and checks vomiting; the author has seen this metal give relief in chronic ulcer after failure of the commonly used remedies.

Arsenic sometimes removes heartburn and other distressing sensations of the stomach, and is very useful in gastralgia.

In that form of chronic vomiting, when the patient after most meals rejects his food without pain and with scarcely any nausea, the food simply regurgitating into the mouth, small doses of arsenic are serviceable.

It has been recommended in the vomiting of cholera.

The solution of arsenic is always of service in that form of chronic dyspepsia and diarrhœa characterized by the following symptoms:—A sinking at the pit of the stomach, which is relieved by food; but immediately on taking it, nay, even while it is being eaten, an urgent desire seizes the patient to relieve the bowels, which may constrain him to leave the table. The motions are solid, or semi-solid, usually containing lumps of half-digested food. The disease appears to depend on excessive peristaltic action of the stomach and

intestines, whereby the food, before it is digested, is driven from the stomach to the intestines, and thence expelled. This form of diarrhœa is common with children eight to twelve years of age. It may last many months. By a few days' use of arsenic the interval between the meal and the evacuation becomes prolonged, and at the end of a week or ten days the disease gives way. The author always gives the medicine, in a dose of one or two drops, shortly before each meal. (See Opium). Arsenic often proves useful in other chronic forms of diarrhœa, even when due to serious organic disease, as the bowel ulceration of phthisis, etc.

Arsenic has been strongly recommended in cholera; especially in the later stages, when there is much collapse.

Arsenic enters the blood freely, but the effects of this metal on it are unknown. It has been detected not only in this fluid but in most of the organs of the body.

The statements as to the effects of arsenic if taken for a prolonged period are strangely conflicting; yet, although it is impossible at present to reconcile the opposing statements, no doubt both are true.

Some animals, as the horse and sheep, can take considerable quantities of arsenic, not only without harm, but with apparent benefit.

It is now established beyond reasonable doubt that in some parts of lower Austria, as Styria, many of the inhabitants are accustomed to take considerable quantities of arsenic, sometimes as a condiment with their food. It is said they often eat it with cheese. They usually begin with a small dose, once or twice a week, the quantity being gradually increased, until half a grain, or a grain, or even more, is taken at one time. This habit seems to induce no untoward symptoms. Arsenic is eaten for a twofold purpose. The women, and even the men, take it to give clearness to their complexion, and to improve their personal appearance; and it is said to effect these objects. The men more frequently use it to enable them to undergo great exertion without fatigue. They maintain that they can climb mountains and accomplish fatiguing tasks

impossible to compass without it. The experience of most countries is opposed to the Styrian practice; for it is generally found that the long-sustained administration of arsenic fails to induce tolerance of the drug, but, on the contrary, induces most serious consequences. Even in the arsenic-eating countries the habit is not without risk; for it is a general opinion there that many persons fall victims to the drug. It has been supposed that the arsenic is taken in an insoluble form, is not absorbed at all, but passes out with the motions, leaving the system unaffected by it. Dr. Maclagan's investigations effectually dispose of this supposition, for after witnessing the eating of the arsenic by a well-known arsenic eater, and afterwards collecting his urine, he obtained from it a considerable quantity of the poison.

Ordinary experience, however, shows that the long-continued use of arsenic produces serious symptoms, evidenced first in the eyes and stomach. The eyelids become slightly œdematous, the lower before the upper; while usually at the same time, or soon after, slight conjunctivitis occurs with suffusion and smarting of the eyes, and sometimes dimness of sight. The mucous membrane of the nose, mouth, and throat may be reddened and inflamed, giving rise to thirst and dryness of the mouth and throat. In some, the digestion becomes deranged much sooner than in others. The appetite fails, and at the pit of the stomach a sensation of weight or soreness is felt, aggravated each time on taking food or the arsenic. Sometimes the stomach is affected before the eyes. On the appearance of any of these symptoms the drug must be given in smaller quantities, or discontinued. The skin becomes dry and dirty-looking, and a slight "branniness" may be noticed, most marked where the skin is covered with clothes. Eczema or urticaria may arise, or perhaps vesication or mere desquamation with tenderness of the palms of the hands and soles of the feet. Pityriasis and lichen also are said to have been produced by arsenic. So also with aching pains in the head, swelling and inflammation of the joints. Sleep may be much broken, or disturbed by dreams. Still

more serious symptoms arise. The voice becomes rough, and in some cases salivation has taken place. Ulcers may form in the mouth. Nausea, with vomiting and diarrhœa, set in, with slimy and bloody motions, voided with much straining and pain. The hair, and even the nails, sometimes fall off. Cough, with bloody expectoration, may occur. With these serious symptoms the patient wastes away, the skin becomes dry and hot, the pulse frequent, especially at night. Pains in the limbs, tremblings, and even paralysis, set in; till at last the memory fails, sensation is lost, and death soon follows. The susceptibility to arsenic varies; some being speedily affected by two-drop doses of the arsenical solution, while others can take without injury for a considerable time ten to twenty drops. Dr. McCall Anderson states that patients while taking arsenic are liable to bronchitis, and should therefore be cautioned against exposure to cold.

A large dose induces the symptoms of acute poisoning. The arsenic acts as an irritant to the whole digestive canal, exciting in its delicate mucous membrane very active inflammation. The symptoms to be expected from severe inflammation of this tract accordingly occur. But, strange to say, the symptoms following a large poisonous dose are not invariably the same. The symptoms arising from acute inflammation of the digestive canal are most common, and prove fatal in four or five days; but sometimes these symptoms are almost or entirely absent, and instead of the patient running the usual course of arsenical poisoning, profound coma sets in, from which he never wakes, but dies in a few hours, the mucous membrane of the stomach and intestines being free from all inflammation. Sometimes the symptoms are very like those of English cholera. (Guy).

Dr. Blachez describes another form of arsenical poisoning characterised by choleraic symptoms of the intestinal canal, with suppression of urine, cramps, and progressive coldness of the body, convulsions, and localized paralyses especially attacking the extensors.

Even when injected into the blood, or applied to a wound,

arsenic produces its local effects on the digestive canal, being found in the intestines, thus showing that this is one outlet by which the poison is eliminated. When the metal is injected into the blood or absorbed by a wound, the effects on the stomach and intestines are said to be as severe as when it is swallowed. This is perhaps hardly true. It is evident from the foregoing facts that arsenic manifests an especial affinity for the mucous membrane of the intestinal canal.

The *post-mortem* examination in acute poisoning by arsenic shows much inflammation of the stomach, often in patches, in which arsenic powder is visible, imbedded in the thick viscid mucus, and according to Harley the arsenical mischief is most marked at the cardiac end of the stomach. Spots of ecchymosis are sometimes seen, and less commonly ulcerations. Perforation is rare. The æsophagus and intestines may undergo inflammation, often most severe in the rectum. Occasionally the mouth, throat, and even windpipe and bladder, become inflamed. The curious fact has been pointed out, that notwithstanding the existence of symptoms of inflammation, yet sometimes no traces of it are apparent on a *post-mortem* examination. This absence of inflammation cannot be explained by want of time for the arsenic to act; for in cases ending in death yet more rapidly, severe structural changes are to be found. Death may occur in two hours. Ecchymosis is commonly met with under the lining of the cavities of the heart. Like phosphorus it is said to produce extreme fatty degeneration of the liver, heart, kidneys, and other structures even in a few hours. Ether, and even chloroform are said to produce similar effects.

Arsenic, in moderate doses, it is said, gives fulness and increased strength to the pulse. From Harley's observations, it appears, that after death, the heart of an animal poisoned with arsenic sooner ceases to beat than of one destroyed by mechanical means.

Some give arsenic in prostrating acute febrile diseases, with the effect, so they aver, of strengthening the pulse, moistening the skin, and invigorating the patient.

Dr. Bayes recommends arsenic for old or weakly persons with swelled feet; or for old people with a weak acting heart and feeble circulation, who often suffer from breathlessness on exertion.

If we may trust the experience of the inhabitants of Steyermark, the effect of arsenic is to make them long-winded; for under its influence they maintain that they climb heights and undergo greater exertion without distress of breathing.

Arsenic has long been recommended, and is an excellent remedy, in spasmodic diseases of the lungs; it is often useful in asthma, whether dependent on emphysema or not.

Arsenic often gives great relief to a class of emphysematous persons who, on catching cold, are troubled with slight wheezing at the chest, difficulty of breathing, especially on exertion, or at night-time, and are obliged, in consequence, to be partially propped up in bed. When there is very much bronchitis, or when the paroxysms of dyspnœa are very urgent, it appears to be of little service. In this contingency, lobelia or belladonna are better. Arsenic is especially useful in the foregoing cases, where the difficulty of breathing can be connected with the retrocession of a rash, as eczema. The wheezing, with oppressed breathing, which affects some children for months, and even years, is generally much relieved by arsenic.

Arsenic lessens the carbonic acid of respiration.

The beneficial influence of arsenic in certain skin diseases, particularly in the scaly eruptions and in chronic eczema, is universally recognised. Lepra almost always yields to it, and its efficacy over other forms of psoriasis is hardly less marked. Many cases it cures, others it improves, but a few it leaves unbenefited.

Hunt, who has had more experience of this remedy than perhaps any other person, lays down excellent rules for guidance in its employment. He recommends small doses as capable of effecting all that is possible by arsenic, and discountenances the practice of gradually increasing the medicine. If toxical effects arise, he advises, not the discontinuance of the arsenic, but lessening the dose.

Arsenic is hurtful during the inflammatory stages of eruptions.

Children above five years will bear a dose nearly as large as adults; and it is curious that girls often require a larger dose than boys.

The largest dose ever required is five minims, repeated three times a day; but some practitioners give double or even treble this quantity. As a rule it should never be given on an empty stomach.

Arsenic, if mixed with food, does not usually irritate the bowels. In the course of a few days or weeks it will produce an itching or smarting in the conjunctiva, and this membrane will appear slightly inflamed, the lower eyelid becoming a little puffed or swollen at this point. The cutaneous disease will now begin to decline, and the dose must be reduced one-fifth.

Should the conjunctiva continue much inflamed, the dose must be still further reduced, but the conjunctiva should be kept affected throughout the whole course.

If the skin become more inflamed, the course must not be interrupted, but an occasional aperient must be exhibited.

The arsenical treatment must be continued for as many months after the final disappearance of the eruption as it has existed years before.

These rules recommended by Mr. Hunt closely correspond to the advice given by Dr. Graves in his clinical lectures. With two statements made in this "code of regulations" the author's experience does not quite correspond, for he has not found that smarting of the eyes and swelling of the lower lid occur so often as Mr. Hunt implies; nor does he find it necessary to induce these toxic symptoms to insure the beneficial influence of the remedy.

The first influence of the medicine on psoriasis is to make it redder and more inflamed; in fact, to make it look worse than before, a fact, which if not known, would lead to the suspension of the drug just when it commenced to do good; but the remedy being continued, the redness soon declines,

the eruption heals in the centre, leaving in a short time only a slight redness.

Chronic eczema, although perhaps not so amenable to arsenic as psoriasis, is generally benefited by it. It is best suited to the obstinate chronic forms. It sometimes removes the rebellious eczema which infests the vulva, the verge of the anus, and the scrotum.

That troublesome disease pemphigus, as Mr. Hutchinson has shown, may generally be cured by arsenic; and although after a variable interval the eruption is liable to recur, it will again yield to a renewed recourse of the medicine.

Lichen and other obstinate skin affections are not unfrequently benefited by the same remedy.

Few, if any, remedies are so successful in chorea as arsenic. It is true that if there is much anæmia, iron is required; if fever or rheumatism, these must be subdued by appropriate treatment. But, in simple uncomplicated cases of chorea, arsenic is by far the best remedy. Its occasional non-success is sometimes owing to the undue smallness of the dose, and decided improvement often begins simultaneously with a freer administration of the medicine. If the chorea has resisted smaller quantities, children may take four, five or more minims of the solution.

Chorea may depend on various kinds of lesions of different parts of the nervous system, probably affording an explanation of the not unfrequent failure of arsenic.

Dr. Hughes and Dr. Cooper highly praise small doses of arsenic in neuralgia. Dr. Anstie also speaks highly of it in different neuralgias; and in angina pectoris, a disease regarded by him as a neuralgia, he states that it will lessen the severity of the attacks, reducing them in time to mere "tightness of the chest".

Arsenic has been found serviceable in epilepsy. It not unfrequently cures the dull throbbing pain affecting one brow. With the exception of quina, no drug subdues intermittent fever like arsenic. Some with large experience of this dis-

ease count arsenic equal, if not superior, to bark. The greater number of observers, however, do not credit arsenic with such preeminent virtues, maintaining that cinchona cures the disease more quickly and more certainly, and that it is especially to be preferred in those malignant forms which, unless at once arrested, speedily destroy life. A concurrence of testimony tends to show that arsenic is most useful in long-standing agues, especially of the quartan type.

Arsenic has lately been extolled in phthisis and tuberculosis. It is said to improve the appetite, increase assimilation, lessen expectoration and cough, and to promote the cicatrization of cavities. It will it is stated reduce the temperature in tuberculosis, and after carefully investigating this subject, I am inclined to believe so; at least I have frequently observed a steady and sustained fall of the thermometer follow the use of arsenic in cases where the undue temperature had continued unchanged for a considerable time, and this I have known happen twice or three times in the same case on reverting to arsenic after it had been discontinued. The decline generally takes place gradually and may begin soon after taking the arsenic, or the fall may be postponed for ten or twelve days. Moreover, children with severe tuberculosis involving lungs, intestines and peritoneum, whom I have considered in a hopeless state, I have seen steadily and slowly improve and ultimately recover under arsenic, and I have witnessed a like result in adults with phthisis especially in the subacute and chronic forms. It must, however, be admitted that this is a very intricate subject, seeing how irregular a course the fever of tuberculosis runs, and how sometimes cases the most desperate recover by means of other treatment or indeed through little or no treatment. Still, I am sure that the action of arsenic in phthisis and tuberculosis is well worthy investigation. I have generally given from two to four minims every two to four hours. In some cases it is ill borne and produces sickness and pain in the stomach and bowels.

Arsenic is often serviceable in rheumatoid arthritis and nodosity of the joints, but the indications for its employment are unknown. The pains of this troublesome affection are sometimes increased, sometimes benefited, by heat. Some cases are worse in summer, others in winter; some are worse during the day, others at night. All these forms arsenic will sometimes cure; yet its action is capricious, for in cases apparently identical, it sometimes fails, and sometimes cures. Its effects are sometimes astonishing. Stiffened joints, for a long time considerably enlarged, become reduced to their natural size, and regain their suppleness. Large doses, given for a considerable time, are necessary, and it must be borne in mind that if improvement does not speedily ensue it must not be concluded that the medicine will fail. Some consider it necessary to produce the toxic effect of arsenic; but in many cases improvement certainly results without pushing the remedy to this extent.

Dr. Simpson employed arsenic in that peculiar affection of the bowels prevalent among women, characterized by the copious discharge of membranous shreds, accompanied by much emaciation, and a long train of neuralgic and other nervous symptoms. This affection occasionally co-exists with dysmenorrhœa, the membranous shreds being discharged both from the bowels and uterus.

Like other metals, arsenic is retained a long time in the body. It is more quickly eliminated than some metals, as lead. Some maintain that arsenic is to be found in the bones as arseniate of lime. This statement is denied by others. It may be detected in the milk.

It is found in the blood chiefly with the red corpuscles. It is separated from the body by the urine, the stomach, and intestines, and, perhaps by the liver. After poisoning with arsenic, the metal is found in the liver in quantities larger than elsewhere. It may be that, like many other metals, it is separated from the body with the bile.

We know nothing of its influence on the composition of the urine. Some experimenters assert that the urea is lessened,

and, as the carbonic acid separated by the lungs is diminished they conclude that arsenic diminishes considerably tissue metamorphosis. Vogel observed hæmato-globulin in the urine of an individual poisoned with arseniuretted hydrogen.

Dr. Garrod maintains that arsenic acid is less irritating to the stomach than arsenious acid.

PHOSPHORUS.

For many years this substance has fallen into disuse, but quite recently, owing to its signal success in neuralgia in the hands of homœopathic practitioners, it has been restored to favour.

In large doses, sufficient to produce acute poisoning, its its effects are most singular. It is an irritant poison, but the symptoms are sometimes delayed for hours or even days. The patient complains of burning in the throat with intense thirst and severe burning pain in the stomach, followed by distention of the abdomen and vomiting; the rejected matters are dark green or black, with the odour of garlic, and are sometimes phosphorescent. There are the usual symptoms of collapse. There is, not unfrequently, jaundice, and suppression of urine; hæmorrhage and purpura often occur. In one case it is reported that the temperature of the rectum was 89° Fah. The *post-mortem* examination shows that the stomach and intestines are commonly inflamed. Most of the tissues are found in a state of advanced fatty degeneration, especially the liver heart and kidneys; the liver presents a very peculiar appearance. The fatty degeneration affects likewise the whole of the arterial system, down to the microscopic arterioles, (Wegner). The effects of chronic phosphorus poisoning are also most singular, and have lately been elaborately worked out on animals by Dr. George Wegner. It has long been known that workmen exposed to the fumes of

phosphorus are liable to necrosis of the jaw. Dr. Wegner believes that this results from the direct action of the phosphorus on denuded bone, and necrosis will not set in unless from wounds or from carious teeth, some of the soft tissues are destroyed, thus enabling the phosphorus to reach the exposed bone; and he adduces the following reasons in support of this view. 1. If the periosteum of an animal is severely wounded, and phosphorus is given in the form of a pill, even for months the periostial changes do not take place. 2. When the tibia of a rabbit is partially bared, a healthy granulating wound is soon established, but under exposure to a phosphorus atmosphere periostitis is set up similar to that in the jaw. 3. Many workers in phosphorus escape, whilst those who suffer have carious teeth.

Dr. Wegner found that gradually increasing doses of phosphorus or phosphorus fumes administered to rabbits produced congestion of the mucous membrane of the stomach, this membrane becoming of a brown colour and three times its natural thickness. The liver is chronically inflamed, with great increase of the interstitial tissue affecting earliest that portion surrounding the acini. This new tissue contracts, producing atrophy of the liver cells, and obstruction of the vessels and ducts. The organ, at first enlarged and livid in colour, sometimes gradually changes into the hob-nailed liver or into a shrunken irregular mass, deformed by contracting bands.

Given in doses too small to affect the stomach and liver in this way, phosphorus affects the bones, especially of growing animals. Thus, where spongy tissue should be formed in the growing bone, dense solid tissue takes its place, which by the naked eye and microscope is found to consist of well-formed bone. If the phosphorus is continued the proportion of dense bone increases, and the cancellous structure in accordance with a natural process becomes absorbed to make room for marrow tissue, till at last no cancellous structure is left, and afterwards the solid newly-formed tissue itself also undergoes absorption. Changes occur likewise in the bony

substance formed by the periosteum. The new bone looks natural, but the microscope reveals that it is dense, and compact masses encroach on the Haversian canals and at last a general narrowing of these canals takes place which affects even bone formed before the administration of phosphorus. If phosphorus is given for a long time to adult animals, the spongy tissue thickens, and the compact tissue becomes still more dense. After a time new bony tissue is deposited on the inside of the shaft, increasing till the bone actually becomes solid. The chemical composition of the bone is natural.

Dr. Wegner found also that under the influence of phosphorus callus after fractures or resection is more dense, and the formation of new osseous tissue is favoured.

The changes above described are produced by phosphorus as such, and not after its conversion into phosphoric acid. For phosphoric acid does not produce the peculiar changes in the stomach and liver. It does, however, affect the bones similarly, in very large quantities, larger than could be produced by the phosphoric acid generated from phosphorus introduced into the system, Wegner considers that it acts as a food, promoting natural growth.

The jaundice occurring in acute poisoning has been variously explained. Dr. Ebstein holds that it is not due to destruction of the liver cells, but to catarrh of the small biliary ducts, causing obstruction and leading to absorption of bile. The ductus communis choledicus has sometimes been found occluded by a tenaceous plug of mucus, thus greatly assisting the obstruction of the smaller ducts in the production of jaundice. Sometimes the contents of the intestines are found free from bile.

Phosphorus has been given lately in neuralgia with considerable success. It appears to be efficacious in neuralgia of any part of the body. Dr. J. Ashburton Thompson, in a valuable paper, records eighteen cases, and arranges them in three classes, acute primary attacks, acute recurrent attacks, and chronic cases. Each class is completed by six cases. In the first class the ages ranged between twenty-five and

forty-six; in the second between thirty and sixty; in the third between twenty-four and forty. Some of the patients suffered from trigemenal; some from cervico-occipital, others from cervico-bronchial neuralgia. All the cases in the two first classes were cured, of the third class three were cured, including one patient who had been afflicted sixteen years without a week's freedom from pain; two consumptives were relieved; and one uncomplicated case, a woman, aged forty, with disorder of the fifth nerve of ten months duration, was unbenefited, although under treatment for fifteen days. As might be expected, chronic cases take longest to cure, but relief followed the first few doses, in all the instances benefited. Dr. Thompson employs large doses, giving never less than one-twentieth, and generally one-twelfth of a grain every three hours. The testimony of other writers is equally strong, some regarding phosphorus as well nigh a specific. Some writers think one-hundredth of a grain a sufficient dose.

The most intractable and severe cases generally occur, as Dr. Anstie points out, in the degeneration period of life; but even in these instances phosphorus may prove useful. My own experience has hardly been so successful as that of Dr. Thompson. Phosphorus is probably most efficacious in typical neuralgia, and much less useful, as far as my experience goes, in those imperfectly-developed cases, where the neuralgia appears to be allied to, or passing into sick headache or pleurodyni, and in those instances of nerve pain which lack many of the more distinctive characters of neuralgia. Phosphorus is often serviceable in angina pectoris, a disease which is closely allied to, if it be not a true neuralgia.

Dr. Richard Hughes recommends phosphorus in chronic inflammation of the rectum, and Dr. Fleischmann of Vienna, approves its use in pneumonia especially if accompanied by typhoid symptoms.

Phosphorus has been tried in a variety of diseases. General nervous prostration, many affections of the nervous system, as mercurial tremors, paralysis agitans, and locomotor ataxy, in impotence, &c., but at present the evidence of its influence over these diseases is very unsatisfactory.

It has been asserted that phosphorus increases largely the quantity of urea of the urine, and it has been suggested that phosphorus splits up the nitrogenous tissues, converting them into fat and a compound which ultimately forms urea; others hold that the fatty degeneration is due to deficient oxidation (see turpentine).

COLLODION.

Collodion is useful in many ways. It is sometimes applied to chapped hands and chapped nipples; but chapped hands and lips are better treated with glycerine of starch, arnica cerate, or two parts of eau de Cologne to one of glycerine. Chapped nipples are often difficult to heal, and if other treatment fail, as equal parts of sulphurous acid and glycerine, collodion may be employed.

Collodion is used to adjust accurately and bind together the edges of cuts and wounds, and to exclude air.

Collodion, when painted over superficial erysipelas, slight burns, or patches of herpes before vesicles are developed, subdues inflammation, eases pain, and checks vesication. Unfortunately the collodion coating often cracks, admits air, and ceases to be efficacious; hence collodion is inferior to a solution of nitrate of silver in water, or nitrous ether (*vide* p. 201).

Dr. Hare, we believe, first employed collodion for boils. There are many kinds of boils. The common form begins as a pimple or pustule, whence the inflammation spreads, producing a hard painful swelling, the centre of which dying forms a core. Now if collodion is applied at the papular or pustular stage, the swelling around the pustule subsides, and the further development of the boil is arrested in the pustular stage. Collodion appears to be useless if the pustule has burst. The matter must not be let out after the collodion ap-

plication, or inflammation recommences, and the boil follows the usual course. It is desirable to apply fresh coatings of collodion over the old ones, allowing them to remain till the pustule has dried up, and the sore has healed. If much pus accumulate beneath this covering, causing considerable pain, the collodion should be incised under carbolic acid, and the pus allowed to escape. The subsequent treatment should be conducted on Lister's carbolic acid plan. This treatment allays the great irritation often accompanying the early stages of boils. Dr. Hare prefers the contractile collodion, and attributes much of its success to the pressure it exerts. The author has succeeded with flexible collodion; perhaps the contractile would have answered still better.*

Collodion, solutions of gutta-percha, or india-rubber in chloroform, prevent the pitting of small-pox. The flexible variety of collodion is better for this purpose (*vide* p. 200).

A mixture of collodion and carbolic acid is useful in tooth-ache due to an exposed and inflamed pulp. A jelly is made by melting in a test-tube some crystallized carbolic acid, then adding an equal quantity of collodion, and a portion of this preparation on a small piece of cotton-wool, inserted into the hollow painful tooth, at first may aggravate the pain, but in a few seconds, diminishes, and soon abolishes it.

Contractile collodion, with which some mix iodine, painted over the inflamed part in acute gout, will speedily relieve the pain, although for a brief space the application increases it. Too many coats must not be applied, or the contraction is too great and dragging on the skin excites a good deal of pain, or even produces vesication..

Sir D. Corrigan treats the incontinence of children with collodion. The prepuce is drawn forward by the left hand, and the little cap thus formed at its extremity is smeared over with collodion, which contracting, draws closely together the edges of the prepuce, and effectually prevents the exit of

* The extension of a carbuncle may be limited by tightly strapping with strips of adhesive plaster applied concentrically from the border inwards, around and over the swelling.

urine. A fortnight of this plan, which gives no pain and does not prevent sleep, sometimes suffices for the cure. When it is needful to pass water, the little cap of collodion can be easily chipped off with the nail. The prepuce in the morning is found distended with urine. Sir D. Corrigan thinks that it would answer as well to paint the collodion over the orifice of the urethra. The author finds this plan unsuitable for girls as it excites smarting, and induces them to pick off the collodion.

Two parts of glycerine to a hundred parts of collodion, sets without contracting or dragging the skin.

COD-LIVER OIL, ALMOND OIL, POPPY OIL, HEMP-SEED OIL, LINSEED OIL, COCOA-NUT OIL, DUGONG OIL, PALM OIL, LARD, SUET, WAX, &c.

Fats in one form or other are found abundantly in both the animal and vegetable kingdoms, showing their great importance in organic life.

Fats are necessary foods to the animal body, being heat-giving, force-supplying, and plastic. Their combustion contributes mainly to the generation of the heat of the body. They are essential to tissue-formation, for without them nutrition and growth would be very imperfectly performed, if not impossible.

Their combustion, moreover, supplies most of the force appropriated by the nitrogenous structures, and through them to be converted into muscular force, secretive force, nerve force, etc.

For the most part, all fats, so far as we know, have the same physical properties, differing only in the melting point. In their chemical nature, however, they differ much, but after their entrance into blood they are probably converted into fats having much the same composition.

Oils and fats are used to lubricate and to supple the skin when it has lost its elasticity, and become dry, hard, and liable to crack; for instance, in many scaly diseases, as psoriasis and xeroderma. They should be employed in conjunction with warm baths.

Fats, moreover, are applied to the surface of the body to prevent irritation from such excreta as urine or fæces, or by acrid discharges, as in eczema, and when used for this protective purpose, some stimulating substance is generally added, as oxide of zinc.

Simple oils are used to soften and facilitate the removal of scabs, as of impetigo, eczema, and favus. In favus, preparatory to epilation, poultices are likewise useful.

Oils are sometimes rubbed into the skin of the whole surface, with occasional success, to prevent the debilitating sweating accompanying exhausting diseases, as phthisis; but this process is inferior to that of sponging the skin with a weak acid wash, and to other means. With the ancient Romans, during the decline, when warm baths were so much indulged in, it was the custom to anoint the body with fats to check the profuse sweating caused by this enervating habit.

Fats have been rubbed into the skin with a view to their absorption, so as to minister to the nutrition of the body.

Fats and oils are in general use as excipients for the application of various agents to the skin.

It has been asserted that, if the body is rubbed over with fatty substances, a considerable fall in its temperature occurs; but in one instance tested by the author he found this statement to be incorrect.

The irksome sensation of heat and tightness produced by the rashes of scarlet fever or measles are removed by rubbing the hands and feet with some firm fat.

Some practitioners treat scarlatina solely by inunctions. The skin of the whole body is well anointed twice or three times a day with a bland fat or oil which is allowed to remain. Dr. Budd, of Bristol, recommends inunction of oil towards the end of scarlatina. During convalescence the

patient takes a bath at night, and, after being wiped quite dry, a bland oil, like almond oil, is rubbed over the whole body. This treatment is said to assist desquamation, and to prevent sequelæ; moreover by preventing the branny particles of the skin being carried about the room by currents of air, this method claims to lessen the risk of contagion.

It is a useful practice to grease the head very freely in cases of ringworm, as it prevents the sporules reaching the unaffected hair and thus prevents the spread of the disease. The uncontaminated members of the family should also use grease to the hair freely for the same purpose, and probably it would be beneficial to use a mild mercurial pomade or quinine dissolved in glycerine so that the sporules may alight on some poisonous substance.

Oils and fats are not used topically in diseases of the mouth, nor do fats undergo alteration in this cavity. They are almost as little affected in the stomach. If enclosed in albuminous walls, as in the form of cell, these being dissolved, the fat is set free. Although themselves not acted upon by the stomach, fats, however, act upon the other forms of food. They certainly promote the fermentation of sugar and starch; and it is generally accepted, that fats, by assisting those chemical changes which constitute digestion, aid the conversion of the nitrogenous food. For example, the presence of fats assists the fermentation of milk, and promotes the process of artificial digestion. This action of fats upon food has been demonstrated outside the body. In what way fats effect these changes, and whether they themselves are in any measure modified in constitution at the same time, are questions at present quite unsettled. The importance of this property of fats must be sufficiently apparent, and needs no further comment. In large quantities they hinder digestion, possibly by their decomposition and the formation of acids foreign to the stomach.

These substances undergo a variety of changes in the intestines; among others, they are absorbed both by the lacteals and veins, but how this is effected is still an undecided question.

They are emulsionised by the alkaline pancreatic juice, and it has been thought that this facilitates their absorption; but it is difficult to understand how mere division should assist their passage from the intestines to the blood; further, it is maintained that when the pancreatic duct is tied, animals remain as fat as before.

It has been surmised that fat may become saponified, and so pass through the walls of the intestines into the blood. A small part probably does pass in this form into the circulation; but as much unsaponified fat is visible in the epithelial cells covering the villi, and much can be extracted from the chyle, the chief part must undergo absorption in another manner.

The passage of fats through the moist animal membranes forming the intestinal canal is probably justly ascribed to the action of the bile. In support of this proposition apart from other evidence possible to adduce it may be advanced that:—

I. In capillary tubes moistened with water fats rise scarcely at all, if the tubes are moistened with bile the fats rise from twelve to fourteen times higher.

II. While fats pass with extreme difficulty through moist animal membranes, it has been experimentally proved that if these are moistened with bile the fats pass readily.

Fats, by the agency of the intestinal juice, pass, to a small extent, into the blood.

The chief part of the fat passes into the lacteals; a little into the veins; this portion being conveyed to the liver, there to be converted into cholic acid; or, at least, it is probable that the oleic acid undergoes this change. The cholic acid, uniting with the soda set free when the hydrochloric acid of the gastric juice is poured into the intestines, forms a kind of soap, namely, the taurocholate and glycocholate of soda. These again find their way into the intestines, and after serving their destined purpose there, the base reunites with the acid of the gastric juice from which it had been separated.

The influence of fats on the secretion of bile varies accord-

ing to circumstances. If taken on an empty stomach, fats lessen it; if taken with or after food, they increase it.

As food greatly augments the flow of bile, we have here an indication, abundantly corroborated by experience, to give fats either with or soon after a meal.

The melting point of a fat must influence its absorption; for if this point is above the temperature of the body, the fat must remain unabsorbed, unless dissolved in the more liquifiable fats.

The stomach tolerates animal far better than vegetable fats; moreover animal fats may be given in larger doses, and continued for a longer time; circumstances which, in some measure, explain the medicinal superiority of animal over vegetable fats.

There is a limit to the quantity of fats absorbable by the body. At first only a small quantity is taken up, and often for some weeks after the administration of cod-liver oil some of it reappears in the motions. By custom, however, more and more of it becomes absorbed, till large quantities may be taken, and find an entrance into the circulation; but in too large a quantity it is liable to decompose, and to form hurtful acids, exciting nausea, vomiting, colic, and diarrhœa. This limitation to the quantity absorbed, as well as the irritation caused by any excess remaining in the intestines, are sufficient reasons, to say nothing of economy, to make it undesirable to give more fat than can be appropriated. Too large a dose is both wasteful and harmful. By examining the motions day by day we can learn at any time if too much is administered.

Catarrh of the intestines is a condition unfavourable to the absorption of fat. Oils are sometimes given after a poisonous dose of a corrosive substance, with a view of forming a protective sheathing to the mucous membrane; but it is impossible to coat with oil a membrane moistened with water.

Fat is speedily saponified in the lacteals and bloodvessels, and most of it in the bloodvessels appears to collect in the blood corpuscles, and may contribute to their formation, growth, etc.

Fats, as we have said, are heat-giving, force-supplying, and plastic. In common with other combustible substances, they uphold, by their oxidation, the temperature of the body. Though an important, this is not their only, nor their most valuable function.

Fats, like phosphate of lime, are necessary both to growth and nutrition; for in the most vitally-endowed organs, fats are found in excess, and abound wherever cell-growth progresses rapidly; and this applies to both health and disease, for much fat is found in rapidly-growing cancer; it is found, moreover, associated with the more highly organised constituents. Thus the fat existing in pus is chiefly associated with the corpuscles, comparatively little being found in the serum. More fat is found in plastic, than in non-plastic formations. In fact, observations day by day demonstrate more and more the importance of fats as tissue-forming substances. Facts like these obviously bear on the application of the members of this group in disease; but to this subject we shall return shortly.

Recent observations tend to show that fats are force-yielding substances, and that the peculiar forces of the body are mainly derived from the fats we consume. Only a short time ago it was considered that the forces of the body were derived from the combustion of the nitrogenous structures; but many circumstances tell conclusively against this hypothesis.

1. After severe and prolonged exercise, the urea of the urine is scarcely increased; and as this substance is a measure of the consumption of nitrogenous materials, it follows that at such times but little of it is consumed.

2. Under exertion, enormous quantities of carbonic acid are exhaled from the lungs, pointing indubitably to the combustion of carbo-hydrates, or of fatty substances, the urea at the same time not being increased.

3. The combustion occurs chiefly, not in the blood, but in the muscles themselves; for when these are separated from the body, and made to contract under a bell-glass, they are found to yield during the time of their activity an enormous quantity of carbonic acid.

4. It has been found by experiment that, when only starchy and fatty foods are eaten, great exertion and prolonged labour can be endured, while at the same time the urea of the urine is but little increased.

Fats, being necessary to growth, nutrition, and the due performance of the functions of the body, are peculiarly suited to convalescents from acute general diseases. Fats are also useful in many chronic affections. For example: On the subsidence of many acute inflammations, as of the kidneys, heart, or lungs, a more chronic, but not less fatal, condition may be left, the danger of this being in proportion to the health of the patient previous to the acute attack. If the patient's health has been impoverished, or if he is the subject of tuberculosis, or of scrofula, many sequelæ are apt to occur. Middle-aged and old people, in whom the nutritive process begins to flag, are more liable to chronic diseases after acute attacks. A like danger threatens children whose previous health has been damaged by unhygienic conditions. The chronic malady depends on deficient nutrition, and as fats are peculiarly promoters of nutrition, they are especially useful in such chronic maladies.

The dependence of chronic affections on the state of general nutrition may be shown in another way. Persons are found to suffer from some slight local affection, which, while the health is unbroken, troubles them but little; but as the weakest link of the chain is the first to yield, so if the health gives way, the local mischief becomes immediately developed or aggravated. Thus many persons are able to measure the state of their general health by the condition of a local disease. Here again, any treatment restorative of the general health will reduce the local affection to its former unimportant state. In such a case cod-liver oil is often indicated.

Thus experience confirms the efficacy of cod-liver oil in many chronic inflammations, as of the heart, lungs, and kidneys, and in the sequelæ of the acute specific diseases, as the chronic discharge from the ears or nose so often left by scarlet fever or measles.

The chronic degenerative diseases of old age are benefited by the same remedy.

Cod-liver oil is of special service in scrofula, removing the various manifestations of this disease, as chronic discharge from the ears and nose, strumous ophthalmia, strumous disease of the bones, strumous abscesses, etc.

In the treatment of phthisis cod-liver oil stands pre-eminent. The term phthisis, however, includes several distinct diseases. For our purpose it is sufficient here to divide them into the febrile and the non-febrile varieties :—those forms manifesting preternatural heat of the body, and those in which the temperature is natural, or rises only occasionally, and for a short time.

The existence of fever in the febrile forms of phthisis is by no means an indication of the uselessness or harmfulness of cod-liver oil, for in this condition many patients derive considerable benefit from it. In this form of phthisis, as, indeed, in all cases, we must be guided, in the employment of this remedy, not only by the nature of the disease, but also by the state of the patient in other respects. If the digestion is good, cod-liver oil may generally be given with advantage; but, if the stomach is irritable, then cod-liver oil does harm by still further disordering the digestion.

In the chronic or non-febrile forms of phthisis, cod-liver oil is generally well borne, and does great good; but, as with the more acute varieties, it sometimes upsets the stomach. It is generally held that diarrhœa in phthisis is a decisive indication against the employment of the oil; but this is only partly true. Cod-liver oil, no doubt, sometimes increases the diarrhœa, but this often arises from a dose unduly large, or too frequently administered; for if only a teaspoonful is given at a dose, once or twice a day, it often happens that the diarrhœa is even controlled by cod-liver oil. In cases of phthisis with diarrhœa, it is a good plan to begin the cod-liver oil with caution, and then, if it suits, it may be given with greater freedom. An excellent method is to give a teaspoonful the last thing at night, immediately before the

patient lies down to go to sleep. In this way oil may often be borne without producing either nausea or diarrhœa, when previously it occasioned one or both of these symptoms.

As might be expected, phthisis, in the early stage, is most benefited by the use of oils.

Phlegmatic persons, with sallow skins and dark complexions, benefit more by cod-liver oil, it is said, than persons of a sanguine temperament, with florid complexions.

Cod-liver oil is often very serviceable in chronic rheumatism, rheumatoid arthritis, chronic gout, chronic skin affections, syphilitic or otherwise. It is also particularly useful in emphysema of the lungs and chronic bronchitis; in the former checking lung degeneration, in the latter controlling expectoration.

Many persons, especially the aged, complain of much sinking, or a sensation of "craving," at the epigastrium, relieved, for a short time only, by food, a condition sometimes connected with atonic dyspepsia, and sometimes dependent on the general state of health. If the intestinal canal is not in an irritable condition, cod-liver oil will remove this sinking. Middle-aged patients, suffering from that anomalous group of symptoms called hysteria, sometimes complain of the same irksome symptom, which also oil will remove, while the other symptoms of the group are often simultaneously relieved.

Cod-liver oil and quinine is the best treatment for giddiness occurring in the aged, when not ascribable to serious organic disease of the brain, but probably to atheromatous changes in its vessels, or to a weak heart.

Fats are of especial use in the chronic diseases of children, arising from mal-nutrition. On restoring nutrition and growth to the healthy state, the local malady will generally disappear.

Cod-liver oil often renders the course of laryngismus stridulus, rickets, chorea, the middle and after stage of whooping-cough, and chronic coughs, both milder and briefer.

The obstinate constipation met with in children sometimes yields to cod-liver oil.

Chronic diarrhœa, of a few pale, stinking, pulpy motions daily, reduces a child a few months old almost to a skeleton. The skin becomes leathery and wrinkled. Its food is perhaps rejected. When brought to this dangerous pass, thrush breaks out. Whilst combatting the diarrhœa or vomiting, a teaspoonful or half a teaspoonful of cod-liver oil given to the child nightly before he is put to sleep, gradually increasing the quantity and frequency, will neither increase the vomiting nor the diarrhœa, but will promote nourishment, growth, greatly improve the general health, and rescue the patient from its perilous condition.

Hitherto, fats have been spoken of for the most part in common, but they certainly are not all equally useful therapeutic agents.

Animal fats, as we have seen, are to be preferred to vegetable fats; and liver fats are generally esteemed beyond all others. Whether cod-liver oil is superior to that of the livers of other animals, is difficult to decide—as much of the cod-liver oil of commerce is derived, no doubt, not only from the livers of various fish, but likewise, it is said, from those of other marine animals.

The superiority of liver oils has been thought to depend on the minute quantities of iodine, phosphorus, or bile they contain,—a conjecture clearly wrong, for the effect of these substances in disease is dissimilar to that of cod-liver oil.

The superiority of liver oils is ascribable to their easy toleration by the stomach, for they can generally be taken without inconvenience for months or years, while other fats and oils often produce nausea, loss of appetite, and diarrhœa. Moreover, there is reason to think that cod-liver oil is more easily absorbed than other oils.

Cod-liver oil at first, often excites nausea, vomiting, and disagreeable eructations, and occasionally the difficulty in overcoming the distaste for this medicine is almost insuperable. Generally, however, this disgust is overcome, and in a short time the oil is taken even with relish; children, indeed, often come to look on the oil as a treat. Sometimes at the

commencement of the course a child becomes languid, appetiteless and appears worse; but this should not always discourage us, for usually after a week or ten days the oil begins to be tolerated, and then improvement sets in.

The nausea and vomiting sometimes caused by this remedy arises not uncommonly from the undue largeness of the dose. At first, a teaspoonful only, or even less is enough, and if the stomach manifests any intolerance of it, one dose only should be given daily. It is a good practice to take it at night-time, immediately before lying down to sleep.

Cod-liver oil is often administered in quantity so large, that it can scarcely be borne even when the stomach is accustomed to it. Weeks, and even months may elapse, before much oil can be digested and absorbed; hence, if swallowed in undue bulk, it merely passes off by the motions, and by its decomposition is liable to disorder the intestines. An examination of the motions shews whether the oil is given in unnecessarily large quantities.

Cod-liver oil should be taken after food on orange or ginger wine, or weak brandy and water, or some agreeable bitter like tincture of orange-peel. It should be so poured upon either, as not to touch the glass, but to float on the surface as a globule, then tossed off, and some agreeable food or condiment will completely remove the taste. A little salt taken immediately before and after the oil often removes the taste and prevents nausea, and it is said that a few drops of ketchup added to the oil will cover its taste.

A mixture composed of equal parts of cod-liver oil, fresh mucilage of gum acacia and water, has very little taste, and the addition of two minims of oil of lemons to each ounce of this mixture, conceals effectually the fishy flavour.

A cod-liver oil jelly has recently been prepared, containing 70 per cent. of oil. Bolted like jelly it is almost tasteless.

Notwithstanding these ingenious devices, it is not uncommon to meet with patients unable, even after repeated trials, to tolerate the oil, on account of the resulting eructations, loss of appetite, nausea, or vomiting. In some cases this intoler-

ance is due to dyspepsia; but it is generally owing to that inability to digest and absorb fat so commonly noticed in consumption, even before its development. This fact has been much dwelt on by Dr. Balthazar Foster, who, led by some suggestive experiments of Claude Bernard, uses ether as a means of assisting the digestion and absorption of fat in the case of patients otherwise intolerant of oil.

Claude Bernard has shown that the action of ether "is twofold—(1) it stimulates the pancreas and glands of the duodenum to pour out their secretions freely,* and (2) at the same time it facilitates the absorption of those very substances which these secretions are designed to digest. In other words, ether not only obtains for us the secretions required to digest," but promotes the absorption of these fats when digested. After a prolonged investigation of the influence of ether, Dr. Foster finds that by its aid, oils and fats which otherwise caused nausea and sickness are retained and digested, and that the combination increases appetite, nutrition, and weight. Dr. Foster employs ether purus of the Pharmacopœia in doses of from ten to fifteen minims to every two drachms of oil. The ether may be given either separately or with the oil; but as the ether masks the unsavouriness of the oil, he generally combines them.

Lime-water mixed with the oil sometimes obviates nausea, and even diarrhœa.

Fats are consumed in the body, but sometimes a small quantity escapes with the fæces and urine. The quantity escaping by the urine is, however, insignificant, except in the disease called chylous urine, when fat is often present in considerable quantities. In Bright's disease a little fat is voided with the uriniferous casts in the urine.

* Bernard maintains that fats are chiefly absorbed by means of these secretions.

CASTOR OIL.
CROTON OIL.

These oils consist of a bland oil with a variable quantity of an acrid irritating purgative matter, which imparts to these oils their characteristic properties. It exists in small proportion in castor oil and in a larger quantity in croton oil. Croton oil irritates the skin, producing redness, vesication, and, after a strong application, even pustulation, followed by scars. The irritating effect is increased by the admixture of alkalies, and liquor potassæ is sometimes added to intensify the effects of croton oil.

Its action is very variable, sometimes several applications on successive days produce but slight vesication, whilst sometimes a single moderate application produces great irritation, much vesication, and even pustulation. Caution is therefore needful for the first application. Sometimes when applied too energically, or continued too long, croton oil liniment produces superficial white round scars with a hair follicle in the centre. These scars gradually disappear. Croton-oil liniment applied to the chest of phthisical and bronchitic patients is highly esteemed by some as a counter-irritant. Owing to the vesication it produces it cannot generally be repeated more than once or twice on successive days; sometimes only one application can be borne. Some prefer croton-oil liniment to mustard poultices, in bronchitis and phthisis, and indeed certain patients aver that croton oil gives them greater relief than mustard poultices. The vesication, however, being a decided disadvantage, the patient must carefully avoid conveying any of the croton application to tender parts of the skin, lest troublesome or severe inflammation be excited in the face or scrotum. Dr. Tilbury Fox states that croton oil sometimes produces a symmetrical erythema of the face, lasting for a few days, where no direct application of the drug could have occurred. The author too has seen this erythema of the face occur during the employ-

ment of croton oil; it is difficult to decide whether the erythema depends on the action of the croton oil after its absorption into the blood, or on the volatile acrid principle reaching the face through the air, or by means of the hands.

Pure castor oil is almost tasteless. Croton oil possesses an acrid burning taste. Neither remedy is used for its topical effect on diseases of the mouth.

These oils behave in the stomach and intestines, for the most part, like other oils. Large doses of croton oil inflame the stomach. If not quickly expelled from the intestines, they become absorbed into the blood, and serve the same purposes as other oils.

The acrid matter of these oils, irritating the mucous membrane of the intestine, excites slight catarrh, and by this means purges. As alkalies intensify the action of the acrid principle, the purgative effect of these oils is heightened by their admixture with the alkali of the bile.

These oils, especially castor oil, are commonly used as purgatives. Castor oil is a speedy, certain, and somewhat mild purgative, producing only one, two, or three motions, with little griping. It is said to purge when injected into the veins; and if this statement is true, it must have an especial affinity for the intestines. It is commonly used as a purgative for children, women with child, after parturition, in fever, piles, and fissure of the anus. It is not a good purgative in habitual constipation, as it increases the torpid habit of the bowels, an effect constantly witnessed in children.

Croton oil is a powerful purgative, producing watery stools, with much depression. It is an uncertain purgative, sometimes acting in half an hour, at other times requiring much longer; large quantities, even six or eight drops, may be required; hence it is seldom used, unless, as in apoplexy, coma, and mania, it is important to administer a purgative of small bulk. It is sometimes employed in obstinate constipation when other purgatives have failed. It is a good plan to give a quarter or a third of a minim every hour; by this means a much smaller dose often succeeds than a large quantity given in

one dose. Owing to its acrid taste it is generally administered in the form of pill, except to patients in a state of insensibility, when it is mixed with a little butter or lard, and conveyed to the back of the tongue, and is swallowed involuntarily, or trickles down the throat.

As these oils remain but a short time in the intestines, the greater part passes out with the motions. But little of the acrid matter probably passes into the blood, since, unless croton oil is swallowed in large quantities, those serious symptoms witnessed when it is injected into the veins, do not occur.

Like other purgatives these oils may influence distant organs, as the kidneys, and act as diuretics.

Croton oil has been used in hydrocephalus, and it is asserted to have removed the excess of fluid from the ventricles of the brain.

Mr. Sewell, of Ottawa, Canada, recommends croton oil in sciatica, obstinate pleurodynia, and crick of the neck. He states that other purgatives cannot be effectively substituted for croton oil. He lays great stress on the evacuation of blackened fæces by croton oil. No doubt some cases of sciatica depend on a loaded rectum or descending colon, when any purgative will be useful; but apparently these are not the cases referred to by Mr. Sewell. This treatment sometimes relieves, or even cures, patients who are not constipated, but it produces a good deal of temporary weakness.

Diarrhœa of children sometimes yields to eight or ten drops of castor oil suspended in mucilage, but unfortunately the indications for this treatment are unknown; hence it often fails, and is inferior to other methods.

In the early stages of diarrhœa it is a common practice to administer a dose of castor oil, or some other purgative, to carry away the irritant exciting the discharges.

A drop of castor oil introduced into the eye will often allay pain and intolerance of light, produced by a fine irritant, as sand.

Castor oil may be taken, without much taste, in beef-tea

highly peppered and well salted, or the oil may be beaten up with an equal quantity of the froth of porter, and tossed off before the constituents have separated. A mixture consisting of castor oil, half an ounce; fresh mucilage of acacia, three drachms; distilled water, five drachms, has very little taste. It may be flavoured with oil of peppermint or oil of lemons.

GLYCERINE.

Glycerine is a useful application for chapped lips and hands, and for rough, furfuraceous, and inelastic skin, left after eczema or other skin complaints, restoring suppleness to the tissues, and allaying burning, tingling, and smarting. Glycerine of starch is still better. Glycerine undiluted may cause inflammation and smarting, hence it should be mixed with an equal quantity of rose-water or eau de Cologne. Glycerine of starch renders the skin soft and supple. In xeroderma a bath should be taken daily, and the ointment rubbed in after wiping the body thoroughly dry. Glycerine is a good application for dryness of the meatus of the ear; and when the tympanum is ruptured it covers the opening in the tympanum with a thin film, supplying for a time the place of the lost membrane.

Dr. M. Rosenthal recommends glycerine as a solvent for alkaloids employed hypodermically. One drachm of glycerine will dissolve ten grains of muriate of morphia, twenty grains of sulphate of quinia, and only one grain of curare.

The lips, tongue, and gums, when dry and coated with dried mucus in acute diseases, should be washed and kept moist several times a day by glycerine, which greatly improves the comfort and appearance of the patient. If the sweet taste of glycerine is unpleasant, it will answer as well if diluted with an equal quantity of water or lemon juice.

In the last stage of chronic diseases, as phthisis, the mucous

membrane of the mouth becomes dry, red, shiny, and glazed, a condition which causes much distress, and is usually accompanied by great thirst. This harassing state is relieved by rinsing the mouth with a wash of glycerine and water. Undiluted, glycerine is apt to make the mouth clammy and sticky. Glycerine will sometimes cure thrush.

Glycerine of carbolic acid is a useful application to fœtid sores and open cancers of the surface of the body or of the uterus. It removes the offensive odour of the discharge, and improves the condition of the sore.

Glycerine of borax is a good application in pityriasis of the scalp, aphthæ, and thrush.

Glycerine has been used in place of sugar, as in diabetes. It has also been recommended as a substitute for cod-liver oil, but experience has failed to support the recommendation.

One of the best preventives of bed-sores is glycerine or glycerine cream. The part exposed to pressure should be washed morning and evening with tepid water, and carefully dabbed quite dry with a soft towel, and then gently rubbed over with a little glycerine or glycerine cream. If the skin is sore or tender, the glycerine cream is best. A draw-sheet made of linen, and sufficiently large to be firmly tucked in at both sides of the bed, (as any folds or creases are very apt, by irritation, to produce tenderness, and eventually sores), will prevent soiling of the bed-clothes. This preventive treatment should be commenced before the on-coming of redness or tenderness.

ON DIFFERENT KINDS OF TANNIN. ON GALLIC ACID.

These substances produce little or no change in the unbroken skin, but are astringent to sores and mucous membranes, checking secretion by contracting the vessels and condensing

the tissues. They precipitate albumen, and thus coat over wounds; in some measure protecting them from the injurious action of the air, whence tannin-containing substances are applied to excoriations, profusely discharging sores, and luxuriant granulations. Tannin is conveniently employed in the form of glycerine of tannin. This combination is useful in ozæna. After measles, scarlet fever, or some other diseases, the inside of the nose becomes not uncommonly excoriated and reddened, and discharges freely a thin sanious or thicker purulent fluid, which, on drying, scabs up the nose, and often excites eczema of the upper lip. If the inside of the nose is well brushed out with glycerine of tannin, the discharge ceases, even after a single application; but, if the scabs are thick, they must be thoroughly removed to enable the application to act on the sore secreting surface. Glycerine of tannin cures syphilitic ozœna of children; it arrests the discharge, reducing the swelling of the mucous membrane producing the characteristic sniffling, and, by enabling the child to breathe through the nose, permits sound refreshing sleep and proper suckling.

Occasionally among adults we meet with an impetiginous eruption of the inside of the nose, most severe near the orifice where the hairs grow, but extending higher in a milder form. Scabs block up the nose, especially at night. The alæ, and sometimes the whole of the nose, is thickened, dusky red, and very painful. The swelling may extend to the adjacent structures, and may merge into repeated attacks of erysipelas of the face. Glycerine of tannin, applied once or twice daily to the whole cavity of the nose, speedily reduces and even cures this disease. The upper part of the nose is the most easily cured, but the disease situated in the hairy part is much more obstinate, and is very prone to recur again and again. Epilation is useful in obstinate cases. Glycerine of starch or zinc ointment, applied several times a day, keeps the tissues moist and supple, and is a serviceable supplementary application.

Glycerine of tannin will generally check the nasal discharge

of thick, lumpy, greenish-black, and stinking mucus, and even if it fails it ordinarily removes the offensive smell. In other forms of ozœna, especially when the disease affects the upper and back part of the nose, with its numerous recesses, it is preferable to flush the nose with a deodorizing and astringent wash, in the way described (*vide* page 177) which besides benefiting the mucous membrane, carries away the inspissated putrefying discharge on which the stench of ozœna generally depends.

Glycerine of tannin is very valuable in otorrhœa, a common complaint of weak unhealthy children after severe illnesses. The external meatus must be filled with the application, and retained there by cotton wool. One application usually suffices, but a slight discharge may remain, or return in a few weeks, when a repetition of the application is necessary. In the acute stages of inflammation of the meatus this treatment is inapplicable. Glycerine of tannin often cures the chronic vaginitis of children; but this complaint is generally more obstinate than either ozœna or otorrhœa.

Glycerine of tannin is useful in some stages of eczema. After the removal of the scales, if the inflamed, red, swollen, and weeping raw surface is painted with this preparation, it notably abates the discharge, redness, heat, and swelling. A poultice must be applied at night; and if the glycerine of tannin excite much pain, the poultices must be continued night and day. In a less active stage, when the tissues are not so red, swollen, and weeping, eczema yields still more readily to glycerine of tannin, applied twice or thrice daily. A poultice is useful at night. This application quickly allays the troublesome itching, tingling, and burning, so common in eczema; hence it prevents tearing with the nails and rubbing, which hinder healing, nay, even cause the eczema to spread. Tannin-glycerine may not entirely remove the disease, but only reduce it to the desquamative stage, with a tendency to crack and ooze, when tar, carbolic acid, or other ointments become necessary to complete the cure. The same treatment is useful in impetigo. A poultice must be applied

each night to remove the scabs, and the tannin application should be employed during the day. While treating these skin diseases, the state of the digestive organs must not be overlooked.

Eczema of the ears, common in middle-aged and old people, readily yields to glycerine of tannin, unless the inflammation runs high with great swelling, heat, and weeping. This remedy is very efficacious too, in eczema, behind the ears of children. After one or two applications, the eczema speedily dries up and heals, although it may have lasted for weeks or months. The gums, if red and swollen must be lanced, and other irritations removed.

Intertrigo is sometimes benefited by glycerine of tannin.

Glycerine of tannin is very useful in many throat diseases. Immediately after an acute inflammation, as the mucous membrane grows less red, less swollen, becomes moister, and covered with mucus or pus, glycerine of tannin painted on the pharynx, hastens recovery, prevents chronic inflammation with relaxation of the mucous membrane, which often follows the acute disease, heals superficial ulceration, occurring as the acute inflammation subsides, and cures hoarseness.

Glycerine of tannin is useful in aphthous sore throat, on the appearance of ulceration. In chronic inflammation of the throat, when the mucous membrane is relaxed, swollen, granular-looking, and covered with mucus or pus, a few applications of glycerine of tannin brace up the tissues, and lessen or remove the hoarseness. This kind of throat, often with slight enlargement of the tonsils, is common in children, and sometimes produces deafness, and still more often a frequent hacking cough, which may keep the child awake the greater part of the night. In children, this is so commonly the cause of cough, that it is well always to examine their throats. Glycerine of tannin applied daily speedily allays the cough, and cures the deafness. Throat deafness is the most common form of that infirmity in childhood; and when not due to enlarged tonsils, generally depends upon the kind of morbid throat just described.

Many coughs depend on the state of the throat, a fact accepted in theory, but little regarded in practice. In these coughs glycerine of tannin is very useful, allaying the cough and frequent deglutition excited by an elongated uvula, and the frequent hacking cough in phthisis, due to inflammation or ulceration of the throat. A good night's rest may be often obtained by painting the throat shortly before bed-time, and a small quantity of morphia added to the glycerine of tannin increases its soothing effect. The frequency and violence of the paroxysms of whooping cough are much reduced by mopping the pharynx, epiglottis, and adjacent structures with this application. It is of little use if the case is complicated with catarrhal or other inflammation of the lungs, or tuberculosis, or any irritation, as from teething; but in simple uncomplicated whooping cough it is very useful. The paroxysmal cough often left by whooping cough, which readily returns on catching cold, yields to this treatment. In whooping cough and the foregoing throat diseases, glycerine of tannin is better than a solution of nitrate of silver, as it excites less pain, and is less disagreeable to the taste, (see Nitrate of Silver). Glycerine of tannin is greatly superior to the tannin lozenges.

Glycerine of tannin is useful in ulcerative stomatitis, especially in that form affecting only the edges of the gums; but dried alum is a better application.

Trousseau successfully employed, in diphtheria and croup, a solution containing five per cent. of tannin, in the form of spray, several times a day, for fifteen or twenty minutes.

Tannin unites with albuminous matter in the stomach, forming an insoluble substance, and any tannin left uncombined constringes the mucous membrane, and lessens its secretions. As tannin likewise diminishes the solvent power of the gastric juice, it is inadvisable to give tannin-containing substances close to meal times.

It is asserted that tannin, by virtue of its astringency, cures slight catarrh of the stomach; hence tannin preparations are occasionally employed in irritative dyspepsia. Some give

tannin for pyrosis, but they do not discriminate whether it checks neutral, alkaline, or acid pyrosis, or all these forms of the complaint. In poisoning by alkaloids, as strychnine and morphia, tannin is given to render them less soluble. Tannin and gallic acid control bleeding from the stomach. The members of this group are astringent to the intestines, lessening their secretions, and probably their contractions; hence they constipate, and tannin-containing substances, as catechu, kino, red gum, rhatany, and hœmatoxylum, are very useful in most forms of acute and chronic diarrhœa. The members of this group are employed as anal injections to check diarrhœa, to destroy thread-worms, and to restrain prolapsus ani.

Few applications are so useful in irritable piles as gallic acid and opium ointment. It quickly relieves pain, and after a time even reduces the size of the hæmorrhoidal tumours. Calomel ointment too is highly spoken of by my friend Mr. J. Bartlett.

Owing to their low diffusion-power, the members of this group must pass but slowly from the intestines into the blood. After, if not before, their absorption into the circulation, they must become neutralized with albumen, and for this reason some authorities maintain that tannin and its allies do not act as astringents to organs distant from the intestines. Nevertheless, tannin and gallic acid are frequently employed with considerable benefit to check bleeding from the lungs, uterus, and kidneys, and with less apparent benefit to check over-abundant secretion of milk, and profuse sweating.

Tannin is sometimes administered to diminish the loss of albumen in chronic Bright's disease. George Lewald has experimentally tested its power in this respect. In a few, but carefully-conducted experiments, he found that the albumen was always lessened to an inconsiderable amount, the daily average diminution amounting to about 0·66 grammes. Tannin produced a much more decided increase in the quantity of the urine.

An injection of glycerine of tannin is very beneficial in the

after-stages of gonorrhœa, and in gleet. Undiluted glycerine of tannin commonly excites much pain; it is desirable therefore to add to it an equal quantity of olive oil or mucilage. Two drachms of this mixture is enough for each injection, or, if too much is used, it excites frequent and painful micturition. Gleet is very often speedily cured by this injection; but, like other injections, the discharge in many instances ceases only during its employment. Injections should be persevered with eight or ten days after the discharge has ceased.*

Tannin, either alone, or blended with other astringents, is useful as an injection in leucorrhœa. In obstinate cases, and when the os uteri is ulcerated, a suppository of tannin and cocoa-nut fat applied to the mouth of the uterus is very beneficial. Glycerine of tannin checks the great discharge, and destroys the stench, of cancer of the uterus. A mixture of glycerine of tannin and glycerine of carbolic acid is still more useful.

The effect of the members of this group on the natural constituents of the urine is unknown. Gallic acid "passes unchanged into the urine. It has been detected in one hour after being taken." Tannic acid "passes off by the urine in the forms of gallic and pyro-gallic acids, perhaps of a saccharine body." (Parkes).

HAMAMELIS VIRGINICA.

Various preparations of the witch hazel, have long been in vogue in America, indeed, this plant was used by the natives, and by them introduced to the English settlers.

It is chiefly employed in hæmorrhage, being most serviceable in passive hæmorrhage. Dr. Preston has employed it

* Urethral injections should not be employed at bed-time, as they are apt to excite seminal emissions.

largely and successfully in epistaxis, and his experience is confirmed by that of many other writers. It has been recommended highly in the hæmorrhagic diathesis, but in the case of a lad with this diathesis I employed it in vain on several occasions in bleeding from the nose. It has been found very serviceable in hæmoptysis and hæmatemesis. Dr. Hall recommends it in dysentery when the discharges contain much blood. I have known it arrest hæmaturia in four cases which had resisted many other remedies. It is very highly recommended in piles both to check bleeding and to cure the diseased veins. I have found it singularly successful and prompt in arresting this form of bleeding, even when excessive and amounting to half-a-pint a day, repeated almost daily for months or years. In piles it should be employed either as a lotion or injection as well as taken by the mouth. It has been recommended in varicocele, and I have seen one case in which during its employment the varicosities entirely, and apparently permanently disappeared.

Dr. Preston extols it in phlegmasia dolens. I have found it useful in checking that slight oozing of the blood sometimes following a confinement, and which may go on for weeks.

The dose is one or two minims every two or three hours. Large doses are liable to produce severe throbbing pain in the head.

TAR, CREASOTE, CARBOLIC ACID, PETROLEUM, OIL OF TAR, &c.

Carbolic Acid destroys the lowest forms of animal and vegetable life, and prevents fermentation and putrefaction. Whilst it prevents the fermentation of sugar, it is said not to prevent the conversion of starch into sugar nor the decomposition of amygdalin. It is largely employed to prevent the stenches of drains, water-closets, dissecting rooms, aud hospital wards. Unlike chlorine and permanganate of potash,

carbolic acid is incapable of destroying offensive gases; it only prevents their formation. Its destructive influence over the low forms of animal and vegetable life has led to its being considered a disinfectant, but no satisfactory proof exists of its capability to destroy the contagious elements of disease. Nevertheless it is extensively, and apparently effectually employed as a disinfectant. It is a good plan to hang a sheet, kept moist with a solution of carbolic acid, and large enough to cover the doorway of the sick chamber and to extend a little beyond.

Creasote and carbolic acid act energetically on the skin, producing opaque white patches, and exciting active inflammation, followed in a few days by desquamation. They coagulate albumen, and are stimulant and astringent; hence they may be employed to check bleeding.

According to Dr. J. H. Bill, carbolic acid locally applied is an anæsthetic, and Dr. Andrew H. Smith (*New York Medical Journal*) confirms this statement. Dr. Smith painted on his fore-arm a spot an inch in diameter, with an 85 per cent. solution of carbolic acid. For a minute it caused slight burning, then the skin became quite numb, whitened, and shrivelled; at this point he made an incision half an inch long without even feeling the knife. The wound healed as usual. Three hours afterwards, he thrust, without pain, a needle into the skin. Next he applied a blister to the carbolised skin without causing pain or vesication. He found that this application greatly lessened the pain from incising two whitlows.

Professor Erasmus Wilson employs carbolic acid as an anæsthetic, to diminish the pain arising from caustics, as potassæ fusa. Brushed over the delicate part or raw surface several times, the acid coagulates the albumen, "benumbs the surface, and permits the caustic action with a great reduction of pain." Mr. Wilson employs this method in lupus, epithelioma, and in disease of the glans and prepuce.

Carbolic acid applied as a stimulant and antiseptic to gangrenous and ill-smelling sores prevents the stench, and improves the condition of the wound.

Professor Lister employs carbolic acid largely in the treatment of wounds. His views may be briefly summarized, thus:—when blood is effused into healthy tissues, it is generally absorbed, exciting no inflammation, suppuration, or fever. If, however, the skin is broken, so that the wound communicates with the air, the effused blood quickly decomposes, exciting both inflammation and suppuration. These phenomena are not excited by the air itself, but by the organic germs floating in it, so that if the air coming in contact with the wound can be freed from them, then neither putrefaction of the blood, nor the consequent inflammation and suppuration can take place. Moreover, experiments show, that if these germs are prevented reaching wound or abscess, their granulations and walls will not form pus, but only a little serum. Now, as carbolic acid completely destroys these organic floating germs, he filters the air before it reaches the wound, through dressings impregnated with this agent.

Senator (*Centralblatt*, Jan. 25, 1873), finds that pus from wounds or ulcers treated by Lister's methods, when injected under the skin of dogs, does not produce any symptoms, whilst pus in the same quantity from wounds not so treated, unfailingly excites fever for many days.

Concerning contused wounds, Lister says, "All the local inflammatory mischief and general febrile disturbance which follow severe injuries, are due to the irritating and poisoning influence of decomposing blood or sloughs. For these evils are entirely avoided by the antiseptic treatment, so that limbs which otherwise would unhesitatingly be condemned to amputation may be retained, with confidence of the best results."

To destroy any septic germ already in contact with the lesion, Lister first washes the wound thoroughly with a watery solution of carbolic acid, containing, for contused wounds, one part of crystallized carbolic acid to twenty of water, and one part to forty for simple incised wounds. To prevent the subsequent access of septic germs, he formerly covered the wound with a piece of lint or linen soaked in a solution of carbolic acid and olive oil, carefully strapping

down its edges with plaster; but he now covers the wound with a lac plaster,* extending "freely beyond the wound at every part, so that the discharge may have to travel a considerable distance beneath the impermeable antiseptic layer." The greatest care is necessary in changing the dressing, especially with contused wounds. "For the antiseptic injected into the wound on the previous day having been absorbed, the extravasated blood and any portion of tissue killed by the violence of the injury, are as susceptible of putrefaction as if no such treatment had been pursued."

Lister, counselling adherence to the minutest details of his plan, observes that "experience leads him to believe that, if, when the dressings are removed, a single drop of serum were to be pressed out by the movement of the limb, and then regurgitate into the interior after being exposed, even for a second, to the influence of septic air, putrefaction would be pretty certain to occur." In redressing a wound he recommends "the employment of a syringe, the muzzle of which is inserted beneath the margin of the lac plaster, and as this is raised, a stream of watery solution of carbolic acid (one to forty) is made to play upon the wound till a piece of calico soaked with the same solution has been placed upon it." Any examination of the wound that may be desired is made with freedom through the transparent solution thrown over it by the syringe." Lister changes the dressing on the day following the injury, but afterwards the frequency of the dressing must be regulated by the amount of discharge. After the first day or two he protects the wound from contact with the carbolic plaster, to prevent irritation of the delicate

* This plaster is made with a mixture of three parts shellac to one of crystallized carbolic acid. This mixture "is incorporated with a soft cloth instead of being spread upon starched calico. It is thus rendered beautifully flexible, and at the same time much more durable." "As in this form it is very thin, it is well, where much discharge is anticipated, or where a long time is intended to elapse between the dressings, to use it in two layers." The plaster can be obtained of the old Apothecaries' Company, Glasgow.

structures and the formation of pus. He says, "after the first dressing, the object I always aim at is to have the material in contact with the exposed tissues approximate as closely as possible to the perfectly bland and neutral characters of the living healthy tissues." The material placed between the wound and the carbolic plaster he terms "the protective." "It is essential that the protective should be antiseptic at the moment of its application, otherwise there will be a risk of its communicating septic germs." The protective he employs is made of oiled silk "brushed over with a mixture of one part of dextrine, two parts of powdered starch, and sixteen parts of cold watery solution of carbolic acid (one to twenty). The carbolic acid solution is used rather than water, not for its antiseptic property, but because it makes the dextrine apply itself more readily to the oiled silk, and the granular starch is used for a similar purpose." "Oiled silk thus prepared becomes uniformly moistened when dipped in a watery solution of the acid, so that all risk of communicating putrefactive mischief along with it is avoided." The protective must be everywhere well over-lapped by the antiseptic lac plaster.

When this treatment is adopted after an operation, the ligatures should be cut short, and left in the wound, or the arteries closed by torsion.

Lister treats abscesses by a modification of the above plan. The incision is made whilst the spray (two per cent. watery solution of carbolic acid) is playing upon the surface of the abscess, the pus is then to be thoroughly squeezed out. The further dressing is to be conducted as with an incised or contused wound. If the discharge from the abscess is very abundant, the dressing must be changed every twelve hours.

This treatment, Lister says—and the author's experience fully bears him out—prevents, in some instances, suppuration in the cavity, the old stimulus being removed, and the new one of decomposing matter prevented. With small abscesses this favourable termination is indeed the rule, and, with large and even enormous abscesses, psoac and iliac, but little fresh

matter is formed, and the patient is thus preserved from the exhausting effects of an abundant and prolonged discharge. So striking are the good effects of this treatment, that in twenty-four hours the discharge often ceases to be puriform, and the walls of the abscess quickly unite. The dressings must be continued till the wound has quite healed. On no account must the lint be raised to inspect the wound unless protected by the spray, as such perverse curiosity will certainly ensure the complete failure of the treatment.

Professor Lister says it is of no consequence whether the opening into the abscess is dependent or not, as the contracting pyogenic membrane soon obliterates the cavity. It may not be out of place to again insist that the success of this treatment depends entirely on the rigorous care taken to carry out Lister's directions in order to prevent the passage of any septic germs into the wound.

Professor Lister has recently introduced a modification of his treatment of wounds. The superiority of oakum dressings, in some respects, to his antiseptic applications led to these improvements. Lister says, "Having heard reports from various quarters of the efficacy of oakum, I have lately put it to the test with granulating sores, and I have found it more than answer my expectations. The reason for its superiority over oily cloths is readily intelligible. Each fibre of the oakum is imbued with an insoluble vehicle of the antiseptic; so that the discharge in passing among the fibres cannot wash out the agent any more than it can when flowing beneath the lac plaster, to a narrow strip of which an individual oakum fibre is fairly comparable.

"Oakum not only proved efficient antiseptically, but presented several advantages over lac plaster. When the latter is left as a dressing for several days together, the discharge, even though small in amount, soaking into the absorbing cloths, loses the carbolic acid it had received from the plaster, and, putrefying from day to day, assumes an acrid character, and sometimes produces most troublesome irritation of the skin. This is, of course, avoided by the oakum. Again, the

lac plaster, being quite impermeable to watery fluid, keeps the skin beneath it moist, and, in fact, covered with a weak watery solution of carbolic acid, which, I suspect, insinuates itself, more or less, beneath the protective, and maintains a slight stimulating influence upon the parts beneath it. But oakum, draining away the discharge as fast as it is effused, avoids this source of disturbance. The result is, that if a granulating sore is thoroughly washed with an antiseptic lotion, and covered with 'protective' and a well-overlapping mass of oakum secured with a bandage, a dressing is provided which nearly approaches the ideal I have long had in view. For, as granulations do not form pus, or even exude serum except when stimulated, a persistent antiseptic, combined with an efficient protective, should constitute a more or less permanent dressing, under which discharge should cease, and cicatrization proceed with great rapidity. Accordingly, ulcers of the leg treated in this way have been found, when exposed after the lapse of several days, either entirely healed or greatly advanced in the process, while the moisture beneath the protective has been of a serous character, and the discharge collected in the oakum comparatively small in amount. Lastly, the lac plaster has this further disadvantage from the moisture beneath it, that it prevents efficient strapping in cases that require it. But under oakum an adhesive plaster retains its hold as well as under dry lint."

He now uses a folded muslin cloth of open texture, imbued with the following mixture: sixteen parts of paraffin, four parts of resin, and one part of crystallised carbolic acid.

"Cheap muslin gauze dipped in the melted mass, and well wrung or pressed while hot, is an elegant and convenient form of modified oakum. It should be folded into about eight layers; and in order to prevent the discharge from soaking too directly through it, a piece of thin gutta-percha tissue may be placed beneath the outer layer to guide the fluid towards the edge of the cloth.

The empyreumatic oils and their derivatives are very useful in many chronic skin affections, as chronic eczema, psoriasis,

erythema. The odour of oil of cade or oleum rusci is less disagreeable than that of tar, liquor carbonas detergens, and carbolic acid. Dr. McCall Anderson strongly recommends these oils, especially liquor carbonas detergens, oil of cade, and oleum rusci. In most cases they afford immediate relief from the tormenting itching of chronic eczema, psoriasis, erythema, and prurigo. If long continued, they excite inflammation of the air follicles, forming papules and pustules, with a black spot in their centre. Hebra terms this eruption tar-acne. They often excite considerable inflammation in delicate skins. The vapour even by its topical effects sometimes produces acne. The parts protected by clothes escape, showing that this effect is not induced through absorption by the lungs.

These oils are useful in chronic eczema, after the subsidence of inflammation, especially when only a little redness, itching, and some desquamation remain. Sometimes pure tar succeeds better than its ointment, but if there is inflammation, or if the surface is raw and weeping, it will then excite great pain and inflammation. In some instances local forms of eczema, as that kind occurring on the back of the hands, are much improved by the application of undiluted petroleum; but as this is generally very painful, other and milder remedies should first be tried.

Provided inflammation runs not too high, carbolic-acid ointment, composed of ten minims of the acid to an ounce of lard, moderates the weeping stage of eczema and allays the tingling and itching. It is useful in the eczema of the head of children.

The external application of these remedies in psoriasis is often very serviceable. Tar, or its ointment, seldom fails to benefit chronic psoriasis. Some of the most obstinate forms of this disease may often be cured by painting the patches of the eruption with pure undiluted tar allowing it to remain till it wears gradually away. If the unsightliness of the tar ointment is objectionable, the creasote ointment recommended by Mr. Squire may be substituted. It is composed of two

or three parts of creasote to one part of white wax. This powerful ointment must be applied only to the patch of psoriasis, not on the adjacent healthy skin, otherwise it will blister. To avoid staining exposed parts, Dr. McCall Anderson sponges the eruption three or four times daily with a wash composed of crystallized corbolic acid, two drachms; glycerine, six drachms; rectified spirits, four ounces; distilled water, one ounce. But he considers carbolic acid inferior to tarry preparations. He strongly insists on the necessity of rubbing in the ointments till they have nearly disappeared, and of washing them off lest they become rancid with soap and water before each fresh application.

Petroleum soap, cade soap, and carbolic soap are useful in both chronic eczema and psoriasis. As these soaps are made of different strengths, if one kind prove too strong and irritating, a milder form may be substituted. Doctors use carbolic soap, especially accoucheurs and surgeons, to free their hands from injections or noxious matters which might endanger the safety of their patients.

Carbolic acid is useful in eczema, psoriasis and prurigo, but is generally considered inferior to tar. It has the great advantage of being free from colour.

A weak solution of carbolic acid is a very useful injection or wash for the cavities of large abscesses, or in empyema, after the evacuation of pus. A like injection will correct the fœtor arising from cancer of the womb, or other uterine diseases. Carbolic acid, it is said, will remove the stench and lessen the discharge in ozæna.

A lotion consisting of one part of carbolic acid to one hundred parts of water is strongly recommended in pruritus ani. Dr. J. Thompson employs marine lint soaked in carbolic lotion. He pushes every night a small plug into the anus, a part being left as a pad outside. Carbolic acid is useful in pruritus pudendi.

The inhalation of creasote or carbolic acid, ten to twenty drops in boiling water, is useful in bronchitis, lessening in some cases over-abundant expectoration. It will generally

remove the breath fœtor occasionally met with in bronchitis, and sometimes even the fœtor due to gangrene of the lung. The inhalation of even ten drops produces with some persons giddiness and sensation of intoxication.

Creasote mixed either with tannin or opium, introduced into the hollow of a decayed and painful tooth, often gives relief.

A creasote or carbolic gargle or wash proves very efficacious in sloughs of the mouth or throat, removing the offensive odour, and producing a healthier action in the sore.

Small doses of creasote excite no particular symptoms in the stomach, but large quantities produce a sensation of burning at the epigastrium, accompanied by nausea and vomiting.

During its transit through the intestines, creasote appears not to undergo any change in its composition, as its characteristic odour may be detected in every part of the canal. Creasote checks the vomiting of various diseases, as that of pregnancy, sea-sickness, cancer, ulcer of the stomach, Bright's disease. It often relieves stomach pains occurring after food.

The investigations of Dr. Sansom, who first employed sulpho-carbolates in medicine, prove that these salts arrest fermentation in different degrees, sulpho-carbolate of soda being most efficient; then follows a salt of magnesium, then of potassium, then of ammonium. Administered to animals, they prevented putrefaction and decomposition of urine, although Sansom could not detect any of the salt in this excretion. He gave sulpho-carbolate, and afterwards collected and preserved the urine, which after six months had not decomposed.

Sulpho-carbolate of soda and carbolic acid are extremely useful in flatulence, especially when there is great distension, unaccompanied by pain, heartburn, or other dyspeptic symptoms. Extreme flatulence, producing copious eructations and considerable distension, symptoms not uncommon in middle-aged women and phthisical patients, are generally relieved

by sulpho-carbolate of soda, although they may have resisted other medicines. If the flatulence occurs immediately after a meal, ten or fifteen grains of sulpho-carbolate of soda should be taken just before food; if the flatulence occurs some time after meals, the medicine in the same dose should be taken half an hour after food.

We often meet with patients, generally women, who suffer from what is ordinarily called "spasms". The patient complains of considerable flatulence and distension often limited to one part or sometimes most marked in one part of the abdomen, and generally on the left side under the ribs, accompanied by severe pain, which like the flatulence is often most marked under the left side of the chest. The pain temporarily relieved by the eructation of a little wind soon returns and may endure many hours, and may frequently recur. In some cases the complaint is evidently a neuralgia of some of the abdomenal nerves, the pain being chiefl excited by flatulence. Sulpho-carbolates, by preventing the formation of wind, often afford considerable relief, but in some cases I have found phosphorus far more prompt and its remedial effect more permanent.

Creasote has been given in cholera and typhus fever, but apparently without much benefit.

Creasote passes into the blood, and its odour is detectable in most of the organs, showing that it probably remains in chief part, if not entirely, unaltered in the blood.

Tar, creasote, and carbolic acid have been given in bronchitis and in phthisis to check both the quantity of the expectoration and its offensiveness. Tar-water in two-drachm to half-ounce doses, is frequently given in bronchitis to diminish expectoration. Dr. Anderson gives tar in chronic eczema. He begins with three or four minims in treacle, pill or capsules, gradually increasing the dose to ten or fifteen minims three times a day. In gangrene of the lungs, creasote is employed to obviate the fetor of the expectoration, and as an inhalation it certainly succeeds, but it is of doubtful efficacy when swallowed.

Oppression of the head, epigastric pain, vomiting of dark-coloured fluid, and black motions sometimes occur after the application of tar, but rarely except when applied over a large area.

Carbolic acid is readily absorbed by the skin. Internally and even externally, it may even in small quantities produce sometimes serious symptoms, some being affected much more readily than others. It may excite severe vomiting, giddiness, delirium, even coma, or collapse, with weak pulse and cold sweat, symptoms which disappear in from fifteen minutes to an hour. These toxic symptoms arising from carbolic acid it is said are best removed by the free use of diluents; so doubtless the symptoms arising from tar would be benefited by the same means.

Tar and creasote are reputed to be diuretics; and, as some of the ingredients of tar pass off with the urine, changing its colour and odour, they may possibly act on the urinary tract. Thus tar, creasote, and carbolic acid, administered either internally or applied externally, cause sometimes at first dark-coloured, and sometimes black, urine, which gradually becomes lighter in tint. It is said that the urine is coloured dark more frequently from the external than from the internal use of carbolic acid; and Ferrier suggests that this is owing to its becoming oxidized before its absorption. Sometimes the urine is natural in colour when first passed, but becomes dark on standing. On the addition of sulphuric acid the odour of tar is readily perceived, and chloride of iron developes a beautiful blue colour. The local application ol fagi, ol rusci, ol cadini, occasionally affect the urine in the same manner. The urinary changes are especially marked within the first few days, but after a time these changes become scarcely perceptible. The urine remains clear throughout, rarely contains albumen, and does not exhibit an excess of iron, showing that the discolouration is not due to disintegrated blood corpuscles. The urine, in health, contains a trace of carbolic acid. Carbolic acid and creasote sometimes excite strangury. Carbolic acid and

sulpho-carbolates administered by the stomach prevent, as we have shown, decomposition of the urine; possibly these drugs may prove useful agents to preserve the urine sweet in cystitis, enlarged prostate, and paralyzed bladder.

Dr. Lloyd Roberts, of Manchester, was one of the earliest to draw attention to the virtues of carbolic acid, now often employed in ulcer of the os and cervix uteri, in chronic inflammation of the uterus and cervix, with excoriation, and in chronic uterine catarrh. "I use," says Dr. Roberts, "invariably the pure acid. A capital plan for maintaining the fluidity of the acid, devised by Mr. Weir, of Dublin, and recommended by Dr. Roe, is to add a few grains of camphor to a little of the acid. In simple ulceration, a free application of the acid drawn over the surface twice a week is sufficient. When it is necessary to apply the acid to the interior of the cervical canal of the uterus, I use a charged camel-hair pencil or a gum-elastic catheter, having previously removed, with a piece of lint or injection of water, any mucus likely to impede its proper application. In applying it to the interior of the uterus by injection, it is very important to have the cervical canal freely open, which, however, with the exception mentioned above, is generally the case. Where it is not so, recourse must be had to dilatation with a sponge tent, so that any superfluous injection may pass freely out; neglect of this precaution producing much uterine colic, and rendering the woman liable to metritis. Care should also be taken to ascertain the direction of the uterus by the sound, as in cases of retroflexion any of the injection passing beyond the curved portion of the organ, and retained there, would be certain to produce dangerous consequences. When injected into the uterine cavity, the acid should be diluted with glycerine and water, commencing with a weak solution, gradually increasing the strength as circumstances require. I also use the acid, dissolved as above, freely as an ordinary injection in vaginal leucorrhœa, uterine ulceration, and cancer; and it will be found an excellent cleanser, healer, disinfectant, and allayer of pain. Assuming the correctness of these views, I feel

warranted in repeating that carbolic acid as a local application in uterine diseases is especially useful, occupying as it does in escharotic power a position intermediate between the milder nitrate of silver and the more powerful corrosive caustics, potassa fusa, the mineral acids, acid nitrate of mercury, etc. More energetic than the first-named salt, it is at the same time free from the danger to neighbouring structures which attends the use of the more potent caustics. Although its action does not penetrate below the diseased surface, it possesses in equal degree with the stronger caustics the property of changing the vitality of the tissues, and produces rapid cicatrization, dissipates the inflammation and hypertrophy, and relieves pain. By its disinfectant action it destroys the offensive odour of purulent and other discharges, and acts beneficially upon the unhealthy, lax, and discharging vaginal mucous membrane. Unlike most other caustics, if applied only to the diseased surface, it does not cause pain."

An injection composed of twenty grains of sulpho-carbolate of zinc to eight ounces of water, used twice or thrice daily, is useful in gonorrhœa.

It is said that sponging the exposed part of the body with a weak solution of carbolic acid will drive away mosquitoes.

MUSK.
CASTOREUM.

These medicines, although highly esteemed, especially musk, by Graves and Cullen, are but seldom used. Their peculiar and characteristic odour is oppressive and sickening, and sometimes causes headache, giddiness, and even fainting; hence musk is ill adapted for the sick room. If used at all, stimulating and exhilarating scents are preferable.

These substances have a bitter taste.

Jorg asserts that musk, in two to five-grain doses, causes

weight at the stomach, eructations, dryness of the œsophagus, heaviness of the head, giddiness, headache, followed by sleepiness, faintness, and a sensation of heaviness in the whole body; and in very large doses, trembling of the limbs, and even convulsions. The pulse, it is said, is strengthened and quickened. Trousseau and Pidoux failed to obtain many of these symptoms, noticing only headache with giddiness; the pulse was unaffected.

These remedies are employed in melancholia, and for many of those anomalous but distressing symptoms grouped under hysteria. They have been given in chorea, epilepsy, whooping-cough, nervous palpitation, cramps of different parts of the body, and even in tetanus. Dr. Graves employed musk in typhus and other fevers, to prevent prostration, and to strengthen a weak and feeble pulse.

ALCOHOL.

For many reasons alcohol might be grouped conveniently with chloroform and ether, there being much similarity in the action of these three medicines. Each, at first, produces much excitement, with increased strength of the pulse, this stage after a time giving way to another of unconsciousness, which may be profound; but with this general similarity there is an important difference between alcohol on the one hand, and chloroform and ether on the other. With chloroform and ether the stage of excitement is brief, soon passing into that of insensibility, which may endure a long time without danger to life. But with alcohol the early stage of excitement and intoxication is of considerable duration, insensibility and unconsciousness not coming on till very large quantities have been taken, and some time has passed. In this stage of insensibility the danger of death is imminent from paralysis of the heart and of the movements of respi-

ration. It will be easily understood, therefore, that while chloroform and ether are used as anæsthetics, alcohol is inadmissible for this purpose, and is of service only in its early and stimulating stage.

Owing to its volatility, alcohol is sometimes employed to abstract heat, and cool the surface of the body, as in inflammation of the brain, etc., but it is not a very effectual refrigerator, and ice is preferable.

If its evaporation is prevented, it penetrates the skin, owing to its tolerably high diffusion-power, and excites the tissues beneath the cuticle, causing a sensation of heat and some inflammation. It may be thus employed as a counter-irritant.

It coagulates albumen, and is sometimes used to cover sores with a thin, protective, air-excluding layer, which promotes the healing process. Alcohol, in the form of brandy or eau de Cologne, is often applied to harden the skin of parts exposed to pressure, and to obviate the occurrence of bed-sores. This excellent practice should be adopted before the occurrence of abrasion, or even before redness.

It is a useful practice to bathe the nipple with brandy each time after a suckling, then carefully to wash the part, and dab it dry. The brandy may be applied some days before delivery, so as to harden the tissues, and prevent the formation of craked nipples, which give rise to so much pain and distress.

In virtue, probably, of its power to coagulate albumen, and perhaps of other properties, it constringes to a small extent the mucous membrane of the mouth, and is sometimes used, diluted with water, as an astringent gargle in relaxed throat, scurvy, salivation, etc.

In the stomach it exerts a double action. Thus it may affect both the gastric juice and the secreting mucous membrane. Its action on these will be considered separately. The effect of a small quantity of alcohol on the pepsine of the gastric juice is insignificant; but a large quantity destroys the pepsine and its food-dissolving property.

As with the gastric juice, so with the mucous membrane,

the effect of alcohol differs according to whether a large or a small quantity is taken. It has been experimentally proved that in very moderate doses it increases the secretion of the gastric juice, and every-day experience confirms this fact. Large quantities upset the stomach, destroy the appetite, inflame its mucous coat, cover it with a thick tenacious mucus, and abolish its secreting power.

Owing to this influence on the functions of the stomach, alcohol is a remedial agent, as the following examples will illustrate :—

I. Some persons after undergoing considerable fatigue are apt to lose all appetite and digestive power, and on taking food to suffer from an undigested load on the stomach. A glass of wine or a little brandy and water, taken shortly before food, will in such cases restore appetite and digestion.

II. In the convalescence from acute diseases, when digestion and strength may remain a long time depressed, alcoholic stimulants taken just before or at meal-times are often serviceable.

III. Many dwellers in towns, who lead a sedentary life, and suffer often from weak digestion, find that only by the help of alcohol in some form can they properly digest their food.

IV. Stimulants are most serviceable in the prostration from acute illness. In common with the other functions, digestion at this stage is much depressed, while it is most important to support the strength until the disease has done its worst. Strength can, no doubt, be best supported by food, but the weakened stomach can digest but sparingly. In such critical circumstances alcohol spurs the flagging digestion, and enables the patient to take more food.

Next, the time of giving the alcoholic stimulant is a matter of great importance. It should not be given at hap-hazard, as is too commonly the case. The stimulant should be given with the food, not at random. To a patient labouring under great prostration, in whom digestion is very feeble, food and stimulants should be mixed together, given in small quantities,

and frequently repeated; but a stronger patient had better take food at the ordinary meal-times, as from habit the stomach digests better under such circumstances.

It is necessary to insist on this point, as it is common with both medical men and the laity to trust to alcohol alone, forgetting that while it benefits by stimulating the heart, it also effectually aids the digestive process, and thus supports the patient in the best and most natural manner.

It has been mentioned that large quantities of alcohol excite catarrh of the stomach; but it is singular how considerable an amount a person prostrated by fever can take without producing this result. The same fact may be noticed in convalescence from exhausting diseases. Still, care must be exercised in the administration of stimulants, since it sometimes happens that if too freely given they upset the stomach so that all food is vomited, an untoward circumstance greatly adding to the patient's danger.

The prolonged indulgence in alcoholic drinks, after a variable time, seriously damages the stomach by producing chronic catarrh. The mucous membrane, coated with tenacious mucus, excites unhealthy fermentation in the food, while the structure of the membrane itself undergoes considerable alteration by great increase of the connective tissue, which, by its contraction, obstructs and destroys the secreting follicles and their lining cells. The mucous membrane thus becomes thickened, hardened, and uneven; and, owing to obliteration of the orifices of follicles, cysts are formed in its substance, which enlarge from the accumulation of cells within them.

In consequence of these serious changes, little gastric juice is poured out in response to the demand made by the food, while the unhealthy mucous coating of the stomach, by exciting morbid fermentations, induces the production of much gas, with various acids, such as butyric, acetic, etc., whence acidity and heartburn. Morning vomiting of a scanty, sour, bitter, and tenacious fluid is a characteristic symptom of this condition.

Owing to its high diffusion-power, alcohol passes readily into the blood, so that but little can reach far into the intestines. Spirits, especially brandy, are often successfully employed to control the after-stages of acute simple diarrhœa, after the removal of the exciting irritant, and when the relaxed condition of the mucous membrane allows the liquid parts of the blood to pass into the intestines, producing frequent watery stools.

Even in large quantities alcohol appears neither to promote nor to hinder the conversion of starch into sugar.

Observations on the influence of alcohol on the blood and organs have yielded contradictory results, the most recent and elaborate investigations of Drs. Parkes and Wollowicz clashing in most particulars with those of previous experimenters. Hitherto it was held that alcohol diminishes the oxidation of the body, but Parkes and Wollowicz's observations are opposed to this conclusion. Dr. G. Harley found that alcohol in small quantities added to blood withdrawn from the body lessened its absorption of oxygen and its elimination of carbonic acid.

As the result of a great many observations taken every quarter of an hour for several hours, on persons of all ages, the author, in conjunction with Dr. Rickards, found that alcohol, brandy, and wine diminish the body temperature. After moderate doses, the fall was slight, amounting to not more than 0·4° to 0·6° Fah., but after poisonous doses the depression in one instance reached nearly three degrees; in rabbits the fall was much greater, reaching to ten or more degrees. These observations have been confirmed by Professor Binz, of Bonn, and by Dr. Richardson, who asserts that all alcohols reduce the animal temperature. Drs. Parkes and Wollowicz, whose observations are opposed to the foregoing, gave to a healthy young man, in divided quantities, for six days, a daily amount of absolute alcohol varying from one to eight ounces, and on a subsequent occasion twelve ounces of brandy daily for three days. The temperature of the body was observed every two hours. The average temperature of

the alcohol and of the brandy-drinking days was found to be almost identical with that on days when only water was taken. These conflicting results it is difficult to reconcile; but it must be granted that a considerable quantity of alcohol repeated several times a day does not permanently reduce the body temperature. Dr. Parkes has recently re-investigated this question, and he finds that dietetic doses (2 fluid ounces of absolute alcohol) given to a healthy fasting man at rest, often reduces the rectal temperature rather less than half a degree; but when the alcohol is given with food even in doses of 4 to 8 ounces of absolute alcohol, it produces no effect on the temperature. In a boy aged ten, who had never before taken alcohol in any form in his life, through a large number of observations I found a constant and decided reduction of temperature. It is possible that alcohol when given in repeated doses may soon lose its power of depressing the temperature. Excessive habitual indulgence appears to have this effect; for Dr. Rickards and the author gave to an habitual drunkard, making him dead drunk, twelve ounces of good brandy in a single dose, without the smallest reduction of the temperature.

In their experiments on the urine, Böcker and Hammond found that "the formation of urea, of the extractives, and of sulphuric acid and phosphoric acid, was lessened by alcohol and beer; the water and free acidity of the urine was diminished;" but in Parkes' and Wollowicz's observations, alcohol, brandy, and claret produced no decreased elimination by the urine of urea, phosphoric acid, or free acidity. They however increased the amount of urinary water.

Edward Smith found that brandy and gin diminishes, while rum increases, the pulmonary carbonic acid. These conflicting statements it is impossible to reconcile; but Parkes' observations were so carefully conducted, and are so complete, that they must be accepted as authoritative.

How much alcohol is consumed in the body? The results of investigations to determine this point are so contradictory, that it is impossible to decide the value of alcohol as a food.

Bouchardat, Sandras, and Duchek conclude that alcohol is freely consumed in the body, little escaping by the urine, unless very large quantities are taken. On the other hand, Perrin, Duroy, and Lallemand deny that alcohol is consumed in the smallest degree in the body. Anstie concludes from careful experiments that the greater part of the alcohol is consumed, and he has undoubtedly proved that only a little escapes with the urine, while Parkes and Wollowicz believe that a considerable quantity escapes with the sweat and breath. Dupré's recent observations confirm those of Anstie, proving that only a fractional part of alcohol escapes from the body; and Anstie believes that this never occurs till a narcotic dose has been taken, which varies in different people.

Even if the greater part of alcohol is consumed and thus administers to the forces peculiar to the body, yet alcohol by depressing functional activity, favouring degeneration, &c., may do more harm than any good it may effect by the force it sets free in its destruction; even if taken in quantities too small to do harm, yet it can scarcely be classed as an economical food for the healthy. Granted that dietetic doses check oxidation in the healthy and thus protect the blood and tissues, still, unless it can be shown that in health there is constantly an excess of consumption over and above that required by the body, such a diminution of oxidation could only result in lessening the amount of force set free and put at the disposal of the organs, and consequently a diminution of the functional activity of the body. Physiology failing to guide our steps amid these conflicting statements, it is obvious that, in estimating the value of alcohol in health or disease, we must rely solely on experience, which plainly shows that, for the healthy, alcohol is not a necessary or even a useful article of diet. Varied, repeated, and prolonged experience, and the testimony of army medical men, prove that troops endure fatigue and the extremes of climate better, if alcohol is altogether abstained from. The experience of the celebrated Moscow campaign

showed this; so also quite recently the Red-river Expedition. During arduous marches it has always been found that the health of the men is exceptionally good without alcohol, but, as soon as spirits are allowed, disease breaks out. Modern trainers recognize the fact that the power of sustained exertion and resistance to fatigue is best promoted by abstaining from alcohol. The ill health of many athletes depends, not on the rigour of the system to which they are subjected, but on the excesses they indulge in after the contest for which they trained.

There can be no doubt that healthy persons capable of the fullest amount of mental and physical exertion without the stimulus of alcohol, not only do not require it, but are far better without it.

It must be recollected, however, that these remarks apply to pure alcoholic drinks, as spirits, and not to beers and wines which contain ingredients highly useful as food. The amount of alcohol in the lighter beers and wines is small, and can hardly be prejudicial to the robust, while they brace up and improve the flagging functions of the weakly, as town-dwellers, especially those who pass much of their time indoors, in an unhealthy atmosphere. Some indeed cannot properly digest their food without a stimulant.

Dr. Anstie speaks highly of alcoholic stimulants in the debility of old age, especially in the "condition of sleeplessness attended often with slow and ineffectual digestion and a tendency to stomach cramps." He employs "a generous and potent wine," containing much ether.

The pain of neuralgia may often be relieved by alcoholic drinks, especially by those containing a large quantity of volatile ether, the alcohol removing the temporary nervous depression which produces the paroxysm. The distressing symptoms occurring is so-called hysteria, generally met with in middle-aged women, are for a time relieved by alcohol; but, as the stimulant must be taken in increasing quantities, there is great danger lest the patient should acquire the habit of taking alcohol to excess. Nervous or neuralgic

patients often are prone to imbibe alcohol in excess and many women become in this way confirmed tipplers. It behoves, then, the doctor to be very guarded in his recommendation of alcoholic stimulants.

Whatever doubt may exist concerning the usefulness of alcohol in moderate quantities, there can be no question of its pernicious and poisonous effects when taken in excess. It then injures and degenerates the tissues of all parts of the body and produces premature old age. The lungs become prone to emphysema; there is diminution of both physical and mental vigour; the kidneys, liver, and stomach may become cirrhosed. Even when the effects of hard drinking are not very apparent in a state of so-called health they become evident on the occurrence of illness or accident, when the constitution manifests its undermined condition and its diminished power to resist disease. Thus drunkards succumb to accident or illness which temperate men easily overcome.

Delirium tremens is another alcoholic disease. It may arise in different ways; sometimes being produced by a single debauch, but commonly occurring in those who habitually take an excessive quantity of wine or spirits, without perhaps ever getting drunk. In an attack arising from an exceptional debauch, it is merely necessary to withhold spirituous drinks for a time, to allow the system to become free from alcohol. On the other hand, delirium tremens is often excited in habitual topers by altogether withholding intoxicating drinks, so that in treating these chronic drinkers a moderate quantity of some alcoholic drink must generally be allowed.

The influence of alcohol on the heart is most noteworthy. It strengthens the contractions of the heart, especially when this organ is weakened by debilitating diseases, which are always attended by a quickened and weakened pulse. Owing to its tonic influence on the heart, alcohol strengthens the pulse, and reduces its frequency. It must be considered one of the most powerful cardiac tonics. This tonic property,

together with its power to promote digestion by increasing the gastric juice, explains the great usefulness of alcoholic beverages both in debilitating chronic, and acute diseases.

In most diseases accompanied by weakness or prostration, alcohol in one or other of its forms often proves a very valuable remedy. It is of conspicuous service in acute diseases running a limited and definite course, in the treatment of which the cardinal point is to sustain the vital force beyond the critical stage.

Brandy or wine are the best remedies when the heart is suddenly enfeebled, from fright, loss of blood, accidents, or other causes.*

Great as are the beneficial effects of alcohol in disease, yet it may do harm as well as good. In its administration certain precautions must therefore be observed, and its effects on the different functions must be carefully watched. Although the heart affords the most trustworthy information on this point, yet the influence of alcohol on the other organs must not be overlooked, as it may happen that while alcohol benefits one system it injures another, doing good in one respect, yet on the whole inflicting much harm.

The following rules regarding the use of stimulants in fever, were laid down by Dr. Armstrong, and have been endorsed by Dr. Graves :—

1. If the tongue become more dry and baked, alcoholic stimulants generally do harm. If it become moist, they do good.
2. If the pulse become quicker, they do harm. If it become slower, they do good.
3. If the skin become hot and parched, they do harm. If it become more comfortably moist, they do good.
4. If the breathing become more hurried, they do harm. If it become more and more tranquil, they do good.

* In threatened fainting it is a good plan to direct the patient whilst sitting down to lean forward and place the head between the legs as low down as possible so that the blood may gravitate to the brain.

These excellent rules might be supplemented by a fifth: alcohol does good if it produce sleep, and quell delirium.

In judging of the influence of alcohol on the pulse, its compressibility is of more importance than its volume. Under the action of alcohol a soft and yielding pulse of large volume often becomes much smaller and less compressible, changes indicating an increase in the tonicity of the arteries, and in the strength of the heart.

Such are the rules which must guide us in the employment of alcohol in disease. They give us data as to the quantity we should administer, and whether we should continue, increase, or withhold the dose.

There are other circumstances which we must carefully regard in respect to the employment of alcoholic drinks. At the two extremes of age, the powers of the body being easily depressed, stimulants are accordingly called for early, and must be freely used. In the aged, especially, it is of great importance to anticipate prostration by the early employment of alcohol; for it is very difficult to overcome this condition, and to restore the patient to his former state. Young children prostrate from disease, take stimulants with benefit, even in large quantities. Next, the knowledge of the course a disease ordinarily runs, gives us timely indications in respect of this question. In some acute diseases, as typhus, in which often the depression is very marked, especially at the extremes of life, stimulants should be employed early.

Alcohol has been given lately, to fever patients in very large quantities on the Continent, and to some extent in England. Dr. Anstie is the chief supporter of this treatment in this country. Alcohol is given to reduce fever and to check waste. In fevers, no doubt there is great increased destruction, certainly of the nitrogenous tissues, shown by the large quantity of urea eliminated by the urine. At the same time all the functions of the body are much depressed, and can appropriate less of the force set free by oxidation than in health. From these two causes, and partly likewise from diminution of perspiration, so that the heat fails to pass off

duly by the skin, preternatural heat of the body takes place in fevers. Alcohol in large doses, it is maintained, lessens oxidation and prevents waste, and thereby lowers the temperature of the body and diminishes the amount of urea in the urine. But to effect this, very large doses must be given—doses which, in some cases at least, I should imagine might do harm in other ways; hence, the influence on the pulse, respiration, &c., according to the rules just laid down, must be carefully watched.

Several years ago, I made a large number of observations concerning the influence of alcohol on the temperature of fever, and found that in health, so in fevers, alcohol slightly reduces the temperature; but its power in this respect is so insignificant, and doses so enormous must be taken to produce even trifling results, that it is useless to give alcohol solely with this intention.

In my judgment there can be no doubt that alcohol is not required in all febrile diseases; on the contrary, many cases are best treated without it; and in no instance should it be given unless special indications arise. The enormous quantities of alcohol which used to be given a short time ago, and are indeed, now, sometimes administered, are, I believe, rarely needed, although sometimes very large doses are needed and are undoubtedly the means of saving life.

The kind of alcoholic stimulant employed is not a matter of great importance, provided its quality is good. It is undesirable to give several kinds of stimulants at about the same time, or they may derange the stomach; but they may be changed from time to time according to the patient's desire. Anstie recommends strong alcoholic drinks in fevers, as brandy in the early and middle stages; but when the heart flags, and the nervous system becomes weakened, he prefers wines containing plenty of compound ethers. Stimulants should not be given in large quantities to weakly persons at distant intervals of the day; it is far better to give them in small and frequent doses. A large dose at one time strongly stimulates the heart; then, as the alcohol is decomposed or elim-

inated, the heart is left unsustained, when great weakness may set in; whereas the frequent administration of smaller quantities keeps the heart more uniformly supported.

Some easily digested food in small quantities should be given with the stimulant, which, by promoting digestion, supports the patient's strength in the most natural and most effectual way. As a rule, where food is freely taken and digested, stimulants are little needed.

Weakly children derive more benefit by taking stimulants about an hour before rather than with food. This plan enables them to take more food, and to digest it better, than the more common one of giving the stimulant with food.

In common with ether and chloroform, alcohol is an antispasmodic, but in this respect ether and chloroform are more effective.

It does sometimes happen that one alcoholic stimulant is harmful, while another is found useful; a fact especially noticeable in coughs, which are aggravated by porter or beer, but are unaffected or even relieved by brandy or wine. Beer or stout sometimes produces sleepiness, heaviness, even headache, and flushing of the face, while the same person can take wine or brandy without inconvenience. Individual peculiarities abound in respect of wines; for example, one person cannot take sherry without suffering from acidity, while another is speedily seized with gouty pains on taking port.

The wish of the patient for any particular form of stimulant is often a correct indication of its desirability. A free draught of the weaker beers will often gratefully slake the urgent thirst of fever.

Stout is very supporting and nourishing to persons brought low by exhausting discharges, and to women weakened by suckling. In many cases unfortunately it disagrees, producing headache and sleepiness. The good old-fashioned remedy, rum or brandy and milk taken before breakfast, is useful in phthisis and in exhausting diseases. A little rum and milk an hour before rising is a good prop to town-

living women, to whom dressing is a great fatigue, who, without appetite for breakfast, suffer from morning languor and exhaustion, often lasting till mid-day, and to convalescents from acute diseases.

The ill effects of alcohol in gonorrhœa are well known. A cure is much more readily effected if the patient will abstain altogether from alcoholic beverages. Even when the cure seems near completion, a single indulgence in spirits, wine, or beer will bring back the scalding and discharge. Exercise too should be interdicted.

CHLOROFORM.

Chloroform, when applied to the surface of the body, speedily volatilizes and cools the skin; but it is seldom used as a refrigerator, being in this respect inferior to other agents.

Owing to its high diffusion-power, chloroform readily penetrates the animal textures. If evaporation is prevented it penetrates the cuticle and excites inflammation, and, thus applied, chloroform is rubefacient.

In quantity insufficient to excite inflammation, chloroform deadens sensation, and acts as a local anæsthetic. It is sometimes applied to relieve pain, and occasionally with good effect, although it often fails, and is inferior for this purpose to many other external applications. It has been used in neuralgias, sometimes with success, but it generally fails, and even when successful, the relief is ordinarily very temporary, the pain soon returning.

In faceache or toothache, two or three drops on a small piece of cotton-wool, introduced into the ear, gives occasionally complete and permanent relief; but if too large a quantity is used, it will excite inflammation, even vesication, and give much annoyance. The pain of cancer, when the skin is broken, leaving a painful, irritable sore, is relieved by play-

ing vapour of chloroform on the raw surface, and often the immunity from pain lasts several hours. The pain of cancer of the uterus, of ulceration of os uteri, of neuralgia of the uterus, and, in a less degree, the annoyance of pruritus pudendi, are relieved by a similar proceeding. The vapour must be made to play on the os uteri for some minutes. The author thinks that chloroform vapour may be tried in cancer of the rectum, spasms of the intestines, etc.; recollecting, however, that chloroform is easily absorbed by the large intestine.

According to Sir J. Simpson, a few drops of chloroform whilst evaporating from the palm of the hand held close to a photophobic eye, will enable it to bear the light without pain.

Dr. Churchill lessens the violence of the paroxysms of whooping-cough by the simple plan of directing the nurse to pour about half a drachm of ether of chloroform over her hand, and to hold it before the child's mouth. The child at first dislikes this treatment, but soon appreciating its benefit, will run to the nurse on the first warning of an attack.

The itching of urticaria, lichen and true prurigo may often be allayed by an ointment composed of half a drachm of chloroform to an ounce of lard; but, like most other ointments, it often loses its effects in a short time, hence anti-itching applications require to be changed from time to time.

Dr. Augustus Waller has shown that chloroform promotes to a considerable extent the cutaneous absorption of many substances. Thus chloroformic solutions of aconite, atropia, strychnia, or opium, applied to the skin, speedily destroy an animal with the characteristic toxic symptoms of the alkaloid employed. The absorption of watery or alcoholic solutions is far less rapid. He ascribes this property of chloroform to its power of rapidly passing through animal textures, carrying with it, in its passage, the dissolved alkaloid. The addition of a certain amount of alcohol to the chloroformic solution does not hinder the absorption of the alkaloid—indeed, it appears to hasten it; for when an equal quantity of alcohol is added to the chloroformic solution, the

absorption is more rapid than when chloroform only is used. This effect of chloroform should be borne in mind when we employ alkaloids as external applications.

It produces in the mouth a sensation of warmth, and, if undiluted, excites inflammation. Being a stimulant to the mucous membrane, it excites a flow of saliva. A few drops on cotton-wool inserted into the hollow of a decayed aching tooth often gives permanent relief. After the anæsthetic effect has ceased, the pain is sometimes aggravated, the chloroform having irritated the inflamed pulp. It is a good plan to fold over the hollow tooth a piece of linen moistened with chloroform, so that the vapour may remove the pain. Equal parts of chloroform and opium, or of chloroform and creasote, constitute a useful application in toothache.

Chloroform excites a sensation of warmth in the stomach, but in large doses it induces nausea and vomiting. Drop doses of pure chloroform are beneficial in flatulent distensions of the stomach, sea-sickness, and other vomitings.

Its high diffusion-power enables it to pass rapidly into the blood, little, if any, finding its way into the intestines. The physical and chemical changes produced in the blood by its admixture with chloroform are at present unknown.

When given in medicinal doses, to a healthy person, it produces very little change either in the frequency or strength of the heart's contractions, though it is said, when inhaled, judging by the hæmadynamometer, at the very first, slightly to increase their force. In disease, on the other hand, when the heart beats feebly, especially if due to some sudden and transient cause, chloroform certainly strengthens the heart's contractions, so relieving such symptoms as syncope, etc.; but it is in no way preferable to a glass of brandy and water or wine. It no doubt acts more quickly and evanescently than alcohol, and its effect on the heart certainly declines more speedily than is the case with alcohol. It is frequently administered to hysterical patients and others suffering from weakness, depression of spirits, nervousness, etc. By habitual ingestion it soon loses its effect, as indeed is the case with

all stimulants, especially with chloroform and ether, so that from time to time the dose requires to be increased, and even then it soon loses its efficacy.

In diarrhœa, after the removal of the irritant which caused it, spirit of chloroform, combined with astringents and opium, may be given with much benefit. It is useful in intestinal or stomach colic from whatever cause arising, and in renal and biliary colic, in hiccup, hysteria, and asthma, both primary and secondary; and from the relief it gives in these affections, it is ranked among antispasmodics. Its mode of action is at present unknown. Possibly by restoring the weakened muscular or nervous system to its natural physical condition it controls inordinate muscular action, and removes pain, thus becoming a true stimulant. In the treatment of any of the foregoing diseases it is usually combined with opium, and this combination succeeds admirably. No doubt much of the effect is due to the opium, its action it appears, however, being increased and sustained by the chloroform.

Chloroform, combined with small doses of morphia or opium, given with a drachm of glycerine, honey, sugar and water, or treacle and water, is often conspicuously beneficial in certain coughs. It is useful when the cough is paroxysmal and violent—violent out of proportion to the amount of expectoration; when, indeed, there appears to be much excitability or irritability in the respiratory organs, and when a slight irritation is followed by a distressing fit of coughing. In such circumstances the chloroform is of more service than the opium, and should be given in a full, while the opium should be given in a very small dose. This combination allays the cough in the fibroid form of phthisis, so frequently paroxysmal, wearing and exhausting to the patient.* Cough

* In fibroid phthisis, the long-continued teasing cough arises from a different cause and requires a different treatment. In this form of lung disease there is often such extensive induration, with thickening of the pleura, as to prevent any expansion of the lung, and consequently of the chest walls, so that little or no air enters the consolidated part of the lung, and no expulsive force can be brought to bear on the mucus. Here our attention should be given to check the abundant secretion, to lessen its tenacity, and so facilitate its expulsion.

often arises from a morbid condition of throat; and even when due solely to disease of the lungs, the application of this mixture to the throat and parts about the glottis is often beneficial, in accordance with a general rule that organs can be influenced through the nerves by remedies applied to the orifices communicating with certain organs, as the nipple, rectum and throat. For example, many coughs are allayed much more efficiently if the opium and chloroform mixture is swallowed slowly, and so kept in contact with the fauces as long as possible.

Being highly volatile, much chloroform passes off by the lungs, and its odour can be detected in the breath; some, probably for the same reason, escapes by the skin, and some probably by the urine. In its passage from the lungs it is unlikely in any way to influence the mucous membrane of the bronchial tubes, the quantity separated being very small; and even during and after the inhalation of chloroform we do not observe that it modifies in any way the secretion of this mucous membrane. Its influence, if any, on the kidneys and the urine, is at present unknown.

Harley's observations on the action of chloroform on the respiratory function of the blood tend to show that it lessens the oxidation of the blood, and diminishes the evolution of carbonic acid; but to establish this point we think that further experiments are needed.

Chloroform is of the most signal service as an anæsthetic, and we will now give a succinct and practical account of its administration.

Chloroform at first very often causes a sensation of tingling and heat in the lips and nose, and these parts, if accidentally moistened with it, may become inflamed even to blistering; an accident which can always be prevented with care, particularly if the nose and lips are first smeared with glycerine or cold cream, or some protecting substance.

The early sensations experienced vary much in different persons, being sometimes so agreeable as to tempt to the inhalation of this substance merely for the sake of inducing

them; but in the majority the sensations are more or less disagreeable, often intensely so.

At first there is a sensation of warmth at the pit of the stomach, spreading to the extremities, and accompanied by some excitement; then some or all of the following symptoms soon set in. Noises in the ears, lights before the eyes, great weight and oppression of the chest, great beating of the heart, throbbing in the large vessels, and a choking sensation. These symptoms betoken no danger, and need excite no apprehension. At the very commencement of the administration some cough is not unfrequently excited, or even a passing spasm of the glottis, sure signs that the vapour is administered in too concentrated a form, and that more air must be mixed with it, by opening the valve in Clover's apparatus, or by removing the lint farther from the nose and mouth.

At this early stage of the proceedings, women, by becoming hysterical, may give some trouble and alarm. They laugh, sob, or cry; their breathing is often extremely irregular and hurried—a condition which frightens the friends, and inexperienced chloroformizers; but this state is to be accepted as an indication to continue the administration, not to withhold it; for as the patient passes more deeply under the power of the anæsthetic, this condition soon subsides.

The pulse, at first quick, and it may be weak, if not due to the patient's illness, is the effect of nervousness and anxiety; and as soon, therefore, as unconsciousness sets in, the pulse falls in frequency, and gains in force.

A few seconds from the commencement of the administration all discomfort ceases, the patient becomes quiet, and breathes calmly. The consciousness is now more or less affected; questions are still heard, but are slowly answered, and not to the purpose. The induction of this medium stage is adequate for confinement, and for the treatment of renal colic.

All knowledge of the external world soon becomes lost, and is followed by a period of excitement. Various inco-

herent ideas occupy the mind. Some struggle, attempt to get up, and are often much irritated when they are restrained. The stage of complete unconsciousness required for capital operations is now fast approaching. Violent tonic contraction of the muscles of the body often occur before complete unconsciousness and perfect muscular relaxation set in. The extremities become rigid; the muscles of the chest are firmly fixed, and the respiration thus becoming impeded, causes, in combination with the general violent muscular contraction, duskiness or lividity of the face. The eyes are injected or prominent, the lips blue, the jugulars stand out like large black cords, the mouth is clenched, and a profuse perspiration breaks out on the body, especially about the face. In a few seconds all these symptoms pass away. They may be accepted as a sure indication of the immediate approach of utter insensibility and complete flaccidity of the muscles, and as a warning that the administration must be conducted with increased caution, or the patient will suddenly pass into a stage of danger, with noisy, stertorous, quick, shallow breathing, and quick, weak pulse. These violent muscular contractions, which greatly distort the face, and frighten the patient's friends, rarely occur in women or children, or in men weakened by exhausting illness; and it is a condition more frequently seen when the chloroform is administered too abundantly, and the patient brought too quickly under its influence.

As these movements cease, the muscles become flaccid, and the stage of perfect insensibility is reached. Reflex action is lost; the conjunctiva can be touched without producing winking. The limbs, when raised and let go, fall heavily. The breathing is calm, but a little superficial; the pulse is not much altered, but it may be a little more compressible. The face is moist with perspiration. The pupil is much contracted. This condition may be maintained with due precaution for a considerable time; but if now the chloroform is continued in undiminished quantity, the breathing becomes noisy and stertorous; the pupil greatly dilates;

the pulse loses its strength; the breathing becomes gradually more and more shallow, and less and less frequent, till both pulse and respiration stop. Even now, if artificial respiration is performed, the breathing often recommences, the pulse again beats at the wrist, and life is saved. On several occasions the author, while administering chloroform, has witnessed recovery from this critical condition.

On the other hand, it appears that sometimes, without warning, while the pulse is beating well and the breathing is deep and quiet, the heart suddenly stops, and respiration immediately ceases. This form of death arises probably from cardiac syncope, while the other form of death is probably due to gradual paralysis of the respiratory muscles.

With care, chloroform insensibility may be maintained for hours and even days.

In administering chloroform, the attention should be directed to the state of the pulse, the breathing, the conjunctiva and the pupil. The pulse usually retains throughout its frequency and force. Should it become quick and weak, or irregular, then the inhalation must be withheld, unless the frequency of the beats can be accounted for by the patient's struggles. The breathing often affords an earlier sign of danger than the state of the pulse. If the respiration become very shallow, and gradually less frequent, the chloroform administration should be suspended for a time.

The surest signs of safety, and the earliest of danger, are afforded by the state of the conjunctiva and pupil. While irritation of the conjunctiva causes reflex action, and is followed by blinking, there is usually no danger. The pupil is much contracted in the stages of insensibility when no danger is to be apprehended; but on the approach of peril from over-dose of the anæsthetic, the pupil dilates. When, on touching the conjunctiva, reflex action is annulled, and the limbs when raised, fall heavily, the patient is fit to undergo any operation.

One or two circumstances require a passing notice. Vomiting is liable to happen if food has been taken a short time

before the administration of chloroform, and occurs either as the patient is passing under its influence or more commonly on recovery from it. Vomiting ceases always when the full effect of chloroform takes place. Vomiting, happening after the full effects of chloroform, may be taken as a sign of returning consciousness; and if the operation is non-completed, the administration should at once be continued, when the vomiting will speedily cease. But to avoid vomiting, it is advisable that no food should be taken for three or four hours before chloroformization. At the same time, too long a fast should be avoided, or its very purpose may be defeated by inducing the tendency to vomit; and fainting and much exhaustion may occur from a small loss of blood during the operation. In case of vomiting, the head should be turned aside to assist the escape of the rejected food, and to prevent choking.

It should be borne in mind that operations on the rectum and vagina, even when the patient is quite insensible, often, nay generally, cause noisy catchy breathing, very much resembling stertorous breathing, often mistaken for it, and sometimes thought to indicate that too much chloroform has been administered; but this is not the case. The true state of things can generally be discriminated by a little attention to the circumstances. Thus, the noisy breathing does not occur until the rectum and vagina are manipulated, and is especially loud and noisy when the finger or an instrument is passed into either orifice with any force.

On discontinuing the administration, consciousness usually returns in a few minutes, but is sometimes delayed for a longer period. If perfect quiet is observed, its effects are often followed by sleep, which refreshes the patient, gives time for many of the disagreeable consequences of the inhalation to pass off, and allows the pain of the operation to subside.

Experiment, practice, and common sense all show that the danger of chloroform is in proportion to the percentage of vapour inhaled in the air. The importance of ascertaining

the minimum quantity sufficient to bring the patient speedily and safely to a state of insensibility is apparent. Mr. Clover has shown this to be in the proportion of 4 to 5 per cent. of chloroform vapour. It has been found that in animals killed by the inhalation of this proportion of chloroform, the heart continued to beat long after respiration had stopped.

With this percentage, insensibility can be produced in about five minutes, with the minimum danger of incurring the serious evils of an over-dose.

At the beginning of the chloroformization, Mr. Clover administers about 2 per cent. vapour, and as the patient becomes accustomed to its action he increases the quantity till 5 per cent. is reached.

The way in which chloroform destroys life is not yet well worked out, and much uncertainty still remains concerning its action on the heart. The sequence of events in animals killed by chloroform, when the percentage of its vapour is not sufficiently great to destroy life at once, is as follows:—The breathing grows gradually more and more shallow and infrequent, while the pulse becomes weaker and even ceases; soon after, breathing stops; but still, for a short time, the heart continues to beat languidly. This is the order of the toxic phenomena in animals, and that most frequently met with in the human subject. Here it is difficult to say whether the poison acts directly on the heart, and whether the enfeeblement of the heart-beats and the cessation of the pulse is due to the direct attack upon the heart, or whether it is simply connected, and depends on the gradual cessation of the breathing. It seems probable that the heart may be directly poisoned and paralysed by chloroform; for when a very large percentage of the vapour is breathed, the heart's movements cease immediately; and further, Dr. Harley has shown that a frog's heart suspended in chloroform vapour, ceases to beat much sooner than one suspended in watery vapour.*

* Dr. Richardson describes four modes of death by chloroform.—1. By syncopal apnœa. 2. By epileptiform syncope. 3. By paralysis of the

The direct action of chloroform on the heart is probably displayed in those cases in the human subject when, without warning, the patient becomes pulseless, breathless, and dies.

heart. 4. By depression from chloroform and surgical shock. Of the first kind he says, "Death by this mode is very rapid, occurring within the minute after the commencement of inhalation. The action of the vapour in this mode of death is by the immediate influence exerted by it on the peripheral nervous system. By this action respiration is for an interval suspended, there is accumulation of carbonic acid in the blood, irritation of the vagus, and arrest—from the irritation—of the action of the heart." Dr. Sansom rejects this explanation, and adduces experiments by Scheinesson, showing "that chloroform has equally the power of slowing the heart's action in animals whose vagi have been previously divided. Even when the spinal cord was divided in the cervical region, as well as the vagi and sympathetic, the heart's action was enfeebled by chloroform;" an experiment showing that chloroform may affect the heart otherwise than through these nervous channels, but by no means proving that it cannot arrest the heart through the vagi, chord, or sympathetic.

Of the second mode of death, by epileptiform syncope, Richardson says, "it occurs during the second stage of narcotism—the rigid stage, as it has been designated. In this stage the chloroform is acting as an excitant to the whole muscular system through the blood, which conveys it over the organism, and in this excitement the involuntary as well as the voluntary muscular fibres share." There is an intense arterial contraction, which drives the blood from the left side of the heart and arteries into the venous system, and death from syncope ensues.

"The third mode of death is one in which, from the slow and continued action of the narcotic, there is paralysis of the heart, with apparent paralysis of the muscular system generally." Death gives warning of its approach by intermittence of the pulse.

"The fourth mode of death is a compound death. There are in it two factors—depression from chloroform, and surgical shock. The combination may be in two or three ways. In a few instances hæmorrhage has brought to a fatal degree a depression which had commenced during and from the administration of chloroform. In other cases the patient has not been fully narcotised, and in a half-unconscious state, feeling the pain of the operation, has become faint, and died from syncope. Finally, under very deep narcotism, death may take place from severity of shock, incident to operative procedure."

Dr. Richardson thus summarises his views of death by chloroform.—"In the first stage of administration, the effect of the vapour is upon the peripheral nervous surface and the cerebral centres. In both there is excitation, and very early the cerebral centres lose their natural condition,

When any serious symptoms arise, and danger is apprehended, the chloroform administration should, of course, be discontinued, and artificial respiration, after Sylvester's method, practised instantly and assiduously, whether the breathing has ceased or is growing slower and shallower. Where the breathing has been extinguished in a gradual manner, in a few seconds after the employment of artificial respiration, provided it is instantly adopted, the patient, in most instances, fetches a deep gasp, which is soon repeated, and presently the breathing grows more frequent, till it becomes natural, and he is saved. Even when the chest has ceased to move, the pulse to beat, and when the patient presents all the appearances of death, life may yet generally be restored. Little is to be hoped, however, from artificial respiration in those cases where the breathing and pulse both cease immediately, and without any warning. Besides the use of artificial respiration, cold water should be dashed over the face and chest, air should be freely admitted, and all hindrance to breathing removed; indeed, everything hampering to the breathing, as stays or a tight dress, should be

becoming suspended in function. Following immediately upon this, the chord, the sympathetic system, and the true nervous system of the heart, become excited. Thirdly, the nervous excitation generally ceases, and there follows calmness or even depression of action; and if the administration be continued, the medulla fails, the sympathetic fails, the cardiac nervous centres fail. This then is the natural order of death of each part—brain, chord, sympathetic centres, cardiac centres.

"In all the modes of death from chloroform we see a fatal disturbance of the balance between the inhibitory action of the vagus and the motor nervous system of the heart.

"In the first mode—by syncopal apnœa—we see the direct action (inhibitory it is called) of the pneumogastric upon the heart. In the second mode—by epileptiform syncope—we see the direct effect of excitation of the centres, which supply the outer contractile elements of the vascular system. In the third mode—by failure of muscular motion—we see the effect of the poisonous agent upon the motor system carried to paralysis; and in the fourth, when surgical shock combines with depression from chloroform, we see direct paralysing action, both on the sympathetic and pneumogastric."

removed before the administration of chloroform is begun. The most serious impediment to the breathing, sufficient to endanger life, may be caused by the patient lying prone for the convenience of the operator. The author has several times witnessed cases of imminent danger from this cause. When this position must be assumed, the most anxious care must be paid to the state of the breathing; for this prone posture is itself quite adequate to arrest feeble breathing, which without this impediment would go on safely.

It is a question of importance whether galvanism should be used in danger from chloroform. The committee appointed by the Medical and Chirurgical Society are of opinion that this agent is useful, but that it is far inferior to artificial respiration; but some authorities are wholly opposed to its use, on the score of its influence to arrest a very feebly acting heart, and so diminishing any slight remaining hope of recovery. It is advised to apply it to the phrenic nerve, to stimulate the diaphragm to action, and thus maintain breathing till the chloroform shall have had time to evaporate from the blood, and the system become freed from its effects. But breathing can be much better maintained by artificial respiration.

It has been proved that a certain per-centage of chloroform, amply sufficient to produce, in a short time, complete unconsciousness, can be inhaled with safety for an almost indefinite time. It is therefore obvious that the method required should enable us to give with certainty as much chloroform as we may wish, so that the quantity compatible with safety shall never be exceeded. The contrivance which best fulfils this condition is the ingenious apparatus of Mr. Clover. Its advantages are so great as to outbalance fully the slight inconvenience connected with its use. If this apparatus is not at hand, the use of a simple piece of lint and a towel, or Dr. Simpson's method, may be adopted.

Are there any conditions of age or health which forbid the use of chloroform as an anæsthetic? Provided due care is observed, the author thinks it may be given to all persons,

irrespective of their condition. He has given it in serious heart disease, in every stage of phthisis, in Bright's disease, cancer, chronic bronchitis, etc., to patients almost dead of exhaustion from loss of blood, to children of a few weeks, and to persons close upon an hundred years old, without any threatening symptoms. No doubt a dilated or a fatty heart adds to the patient's risk, and enforces on the operator more care and anxiety. The two extremes of age are conditions which exact close watching during its administration.

For minor operations ether spray is undoubtedly to be preferred to the inhalation of chloroform; but for the more formidable operations chloroform must be used. In addition to its more obvious and inestimable advantages in operations, chloroform has been found to reduce the mortality.

Chloroform inhalation is now frequently used with much advantage during delivery; it eases the uterine pains, without increasing the danger to mother or child. It is not necessary to obtain complete unconsciousness, but to give only sufficient chloroform to dull the pains; if this recommendation is disregarded, and the anæsthetic is pushed to the stage of complete unconsciousness, it weakens the contractions of the womb, and retards delivery. It is true that even if only slight unconsciousness is produced, the uterine contractions are probably somewhat weakened, but accoucheurs maintain that this disadvantage is more than compensated by the relaxation of the parts, and the abatement of spasm. Dr. Playfair who thinks chloroform inhalation is too indiscriminately used, says, he has often observed the pains alter and become less effectual after chloroformization, and when it is prolonged he thinks it favours *post-partum* hæmorrhage, (see Chloral).

In dental operations the patient incurs some additional risk of syncope, owing to his sitting posture. Chloroform should be forbidden in dentistry. Indeed, it is now superseded by nitrous oxide.

Chloroform may be used with signal benefit in renal and biliary colic. In the author's experience it is inferior only to

morphia injection, and is very far superior to opium, warm-baths, and the ordinary treatment in vogue. It removes the severe pain before unconsciousness is reached; indeed, it is never necessary to carry the administration of chloroform very far. The pain often speedily returns, but may be quelled again; and after two, at most three, administrations it is usually permanently removed.

Chloroform in the treatment of chorea is sometimes most valuable. It is applicable especially to those serious cases in which violent and constant movements prevent sleep, and even the swallowing of food, so that speedy exhaustion and death are to be apprehended. In such cases chloroform often induces a refreshing sleep; indeed, the sufferer passes from the insensibility of chloroform into that of natural sleep, and after, perhaps, some hours, wakes up soothed, refreshed, and with a marked abatement in the movements. So great sometimes is this improvement, that patients, who before the chloroform could scarcely be restrained in bed, after waking, sit up troubled with only slight involuntary movement, and eat and swallow with ease. Soon, however, the movements return, when the inhalation must be repeated. At first it should be administered three times a day; then, proportioned to the improvement, twice, and, after a time, once a day. It is stated that this treatment will cure the disease on an average of twenty-eight days. In delirium tremens, when the usual means of treatment fail to induce sleep it has been advised to produce unconsciousness by chloroform inhalation.

Chloroform will arrest convulsive fits, especially in children, sometimes permanently. Chloroform inhalation is of great service in puerperal convulsions. It is necessary in some cases to maintain unconsciousness for hours, or even days, allowing the patient to wake every three or four hours to take food.

In the reduction of hernia its use is obvious. It may be used to assist the diagnosis of abdominal tumours, when deep-seated, and when the walls of the belly are hard and rigid, It is useful also in determining the nature of phantom

tumours, which disappear entirely when the patient is made insensible by chloroform.

Chloroform inhalation gives relief in neuralgia, sciatica, colic of the intestines, if the pain is very severe, in distressing dyspnœa, whether this is due to asthma,* aneurisms, &c. In asthma the inhalation of a few whiffs without producing unconsciousness sometimes affords permanent relief; and if the paroxysm returns on the effect of the chloroform passing away then the inhalation may be repeated. A small quantity of chloroform given in this way often suffices to prevent an attack, though in most cases the effects are only transient, the paroxysm returning as the influence of the drug wears off.

It is said insomnia, tremulousness and inability to fix the attention are apt to follow the repeated use of chloroform inhalation.

ETHER.

The physiological action and therapeutic use of ether and chloroform are for the most part identical.

As a local anæsthetic in neuralgia, toothache, etc., ether is less frequently used than chloroform.

In the form of spray, after the method introduced by Dr. Richardson, ether is commonly employed to abolish temporarily sensation of the skin; the rapid evaporation of the ether and consequent great abstraction of heat, freeze the tissues and deprive them of sensation. Ether spray is frequently used in minor operations, as the opening of abscesses, the removal of small tumours, etc. It has been successfully em-

* Mr. Gaskoin reports a case of bronchitic asthma much benefited by rubbing the chest for an hour daily with liniment of chloroform. He attributes the success to the friction, and refers to a Widow Pau who has obtained a reputation in Paris and who uses friction in cases of asthma.

ployed in amputation of the leg and in ovariotomy, but it is not generally available in such serious and prolonged operations. The skin or mucous membrane, when sufficiently frozen to permit of an operation without pain, becomes pale, shrunken, tallowy-looking, and feels as if oppressed with a great weight. Whilst recovering the natural condition, the frozen tissues tingle and smart, sometimes so intensely as to exceed the pain of the operation. The obvious advantage of ether spray over chloroform inhalation is its perfect safety.

Ether for many years preceded chloroform as a general anæsthetic; and although at the present time chloroform has almost completely superseded ether, yet each has its respective advantages. Ether differs from chloroform in several particulars. Ether must be inhaled in larger quantities, and for a longer time; its effects pass off sooner, consciousness often returning almost immediately the inhalation is suspended; and it produces much more excitement than chloroform. The committee of the Medical and Chirurgical Society instituted to investigate the action of chloroform and ether, state that at first both strengthen the heart's contractions; soon, however, the heart grows weaker and weaker as the animal passes more deeply under the influence of chloroform; while the tonic effects of ether persist, and the heart's pulsations often continue strong till the moment of death, which in almost every instance depends on paralysis of the muscles of respiration. Thus ether and chloroform each destroy life by arresting respiration; but in regard to chloroform there is an additional danger from its depressing action on the heart.

In America ether is used in preference to chloroform. Mr. C. Tomes writing from America to the British Medical Journal, says, that ether is there considered so safe that the pulse is rarely watched and the patients when fully under the influence are put into any position without fear of danger. The ether is very freely used, sometimes half a pound is consumed for a single operation. He says "two or three ounces of pure anhydrous ether are poured upon a conical

sponge previously moistened with water, and this is placed over the patient's mouth and nose. Ether is lavishly poured upon the sponge so that it often runs down the patient's face and neck. Sometimes it excites a good deal of spasm of the expiratory muscles, stridulous breathing and laryngeal spasm, and sometimes a degree of asphyxia far transcending that which I have seen during the administration of nitrous oxide, but no anxiety is felt, the sponge is merely removed for half a minute. It is not a pleasant anæsthetic, patients are apt to be noisy on recovery; vomiting during and after the administration is common." Equally strong testimony regarding the comparative safety of ether is given by numerous authorities in this country, so that it is surprising that it is not more generally used. As ether is highly inflammable Mr. Hutchinson cautions against using it by gas or candle light or when employing actual cautery.

Full doses of ether or spirits of chloroform often act as soporifics and are very useful in angina pectoris, sometimes even giving more prompt and permanent relief than nitrite of amyl.

Freezing the skin with ether spray sometimes permanently removes sciatica or neuralgia, but generally the relief is only temporary.*

* In an interesting lecture on anæsthetics, Dr. Richardson discussed the merits of the following substances, differing only in the amount of chlorine they contain.

C	H	H	H	Cl	Chloride of methyl.
C	H	H	Cl	Cl	Bichloride of methyline.
C	H	Cl	Cl	Cl	Chloroform.
C	Cl	Cl	Cl	Cl	Tetrachloride of carbon.

"All these substances," he says, "possess the power of producing anæsthesia when they are inhaled as vapour by men and animals.

"Chloride of methyl exists in all ordinary temperatures as a permanent gas. It is very soluble in ether; and when ether is saturated with it, the compound is one of the most perfect of anæsthetics. Unfortunately this compound is not very stable, the sleep produced by it is rapid, gentle, profound and prolonged, and I found in an animal, where I may say I forced the animal to die by increasing the quantity of the vapour, that the muscular irritability was perfect one hour and five minutes after death." It is soluble

IODOFORM.

IODOFORM is a healing and easing application to spreading

in water, and water charged with it will take up four volumes. Chlormethyl water is rather agreeable to drink, and is a potent intoxicator. Half an ounce has a very decided but transient effect.

"Bichloride of methyline is a colourless fluid, having an odour much like the odour of chloroform. It is pleasant to inhale as vapour, and produces very little irritation of the fauces and air passages. Its specific gravity is 1·344. From its position physically it combines many of the properties of chloroform with those of ether, and these peculiarlties must be remembered in its administration. From its easier evaporation it requires more free administration than chloroform, and from its greater density of vapour it requires less in quantity than ether." The bichloride of methyline sometimes excites vomiting. Dr. Richardson, to whom we are indebted for the introduction of this anæsthetic, thinks it less dangerous than chloroform. In an interesting letter to *The Lancet*, Mr. T. C. Morgan says that bichloride of methyline has many advantages over chloroform; for, 1st, it is safer; 2nd, its action is more rapid, complete unconsciousness being usually induced in two minutes; 3rd, recovery is more prompt, the patient regaining complete consciousness in one to three minutes; 4th, dangerous symptoms subside sooner, lividity disappearing in a few seconds on discontinuing the inhalation; 5th, if during the operation consciousness returns, it may be abolished by a few inspirations. Mr. Morgan thinks it excites vomiting about as often as chloroform.

He has administered it over 1800 times to persons of all ages and has sometimes continued the inhalation for three-quarters of an hour, but never lost a patient. He employs "a perforated card-board frame, covered with flannel, and fitted with lappets to lie over the face so as to completely exclude air. Two drachms are put into the inhaler, and it is so closely held before the face as to allow no air to be breathed except what passes through the flannel. In less than two minutes the patient is usually completely insensible. Another drachm is then put into the inhaler, and given as required." He does not care to watch the pulse though this is sometimes much retarded, sometimes beating only twelve strokes per minute without any alarming symptoms. He watches the lips and breathing, when the lips become white and bloodless he stops the administration, fearing pallor, not lividity, for patients die from syncope, not coma.

Mr. F. Searle's testimony is similar, but he states that it rarely excites vomiting, and that it is important not to allow the patient to recover before the administration is completed, otherwise excitement ensues. Mr. Miall and Mr. Gaine also speak highly of this anæsthetic.

and sloughing sores, as bed sores and soft chancres. The sore dusted over with iodoform is covered with some bland application, as glycerine spread on lint. Iodoform has been successfully employed in ulceration of the nose and throat. It relieves the pain of cancerous sores. When employed in uterine cancer, a bolus containing eight to sixteen grains made up with cocoa-nut fat is inserted into an excavation produced by sloughing or ulceration. An iodoform suppository is also useful in painful diseases of the rectum and bladder.

Dr. Tanturri recommends an Iodoform ointment of (3j to ℥j) for Prurigo.

Iodoform is said to relieve the pain of neuralgia and gout. A saturated solution of iodoform in chloroform is advised in neuralgia.

Iodoform must not be applied to inflamed tissues, or it will increase the inflammation.

Given internally, it produces a kind of intoxication, followed by convulsions with tetanic spasms, and the breath and tissues of the animal smell of iodoform.

HYDRATE OF CHLORAL.

We owe most of our knowledge of this valuable medicine to Liebreich, whose experiments and conclusions Dr. Richardson has in the main confirmed.

Chlorine acting on alcohol ($C_2 H_6 O$) first produces aldehyde ($C_2 H_4 O$), and afterwards chloral ($C_2 H Cl_3 O$), which forms a crystalline soluble hydrate.

Liebreich believes that the alkali of the blood decomposes hydrate of chloral, forming chloroform, and that the properties of chloral are due to the chloroform slowly formed in the blood. Dr. Amory concludes from his experiments that

chloral hydrate does not decompose in the blood, and that its effects are consequently not due to chloroform. He could not detect chloroform in the blood and excreta, (breath &c.,) of animals poisoned with chloral; whilst in animals poisoned with chloroform this substance was easily detected in the blood and excreta.

The following are Liebreich's conclusions concerning the effects of chloral:—

1. "That chloral in efficient doses quickly produces deep sleep; and when carried far enough. complete anæsthesia.
2. "That the action is without excitement.
3. "That the agent leaves no bad after-effects.
4. "That the nervous power of the heart is the last that suffers."

Liebreich, Tay, Hammond, and others find that hydrate of chloral depresses the temperature sometimes to the extent of three or four degrees after a full dose of 40 to 80 grains.

Dr. Levenstein reports the extraordinary case of a man aged 35 who was poisoned by six drachms of hydrate of chloral. When first seen the man lay in a profound sleep with congested face, heavy breathing, and a pulse of 100. An hour after the poisoning he became livid, the veins were distended, the respirations were intermittent, and his temperature was 103° Fah. An hour and half after the dose he became pale, pulseless with contracted pupils, and his temperature had sunk to 91·2. Nitrate of strychnia enough to produce twitching was then injected hypodermically and the heart at once began again to beat, and the thermometer marked 91·9° Fah, Collapse, however, returned in a few minutes, the circulation appearing to stop. Artificial respiration was performed and nitrate of strychnia again injected with the same result as the first injection. In ten hours the pupils acted to light; in twelve the temperature was 100·4; in twenty-two hours he could be roused, and after thirty-two hours he awoke "quite refreshed" and did not complain of any gastric disturbance. Dr. Fothergill in his important

lectures *on the Depressants of the Circulation* says that Dr. Lauder Brunton finds that after large doses of chloral the temperature falls till it can no longer be measured by an ordinary clinical thermometer. Having determined what dose would kill an animal when exposed to the air, he gave this quantity to two similar animals, wrapping one in cotton wool. The one wrapped up survived, the other died. Then he found out the fatal dose to an animal wrapped up in cotton wool, and gave that quantity to two similar animals wrapping up one in wool and putting the other in a warm chamber; and he found that the one in wool died, the other recovered. A still larger dose was fatal to the animal in the warm chamber. These experiments show that the loss of heat is one, but not the sole, cause of death.

Dr. W. A. Hammond's observations throw some light on the way hydrate of chloral produces sleep. At first chloral congests the retina, but in five or ten minutes the opposite condition commences, and increases till the retina assumes a pale pink colour. As the retinal circulation corresponds with the cerebral, he concludes that chloral affects the brain in the same way as the retina, and has proved the correctness of this inference by means of an instrument called the cephalohæmometer, invented independently by himself and by Dr. Weir Mitchel. Dr. Hammond says that while the brain is congested there is some mental excitement; but as the vessels contract, drowsiness supervenes; and on this wearing off, the retinal and cerebral vessels enlarge till they assume their accustomed size. In his lectures on vascular depressants Dr. Fothergill ascribes this anæmia of the brain to the effect of chloral on the general vascular system. He refers to Ludwig's and Scheff's experiments showing that in health the arterial system is constantly in a state of semi-contraction and that by relaxation of the vessels the capacity of the vascular system may be doubled. Dr. Fothergill points out that chloral dilates the arterioles especially of the skin; hence blood is withdrawn from other organs and from the brain which thus becomes comparatively anæmic. In common with

most other authorities he believes that the anæmic state of the brain is one condition favouring sleep, but that chloral like other narcotics in producing sleep, acts besides in other, but as yet unexplained ways.

Liebreich asserts that strychnia is an antidote to chloral.

Hydrate of chloral is employed to produce sleep or allay pain. Chloral sleep is generally calm, refreshing, and dreamless, not too profound to prevent waking to cough, take food, etc. As a general rule, chloral causes no giddiness, headache, nervous depression, constipation, sickness, or loss of appetite. A patient roused from chloral sleep will eat a hearty meal, then lie down and immediately fall sleep again.

Chloral at first sometimes causes a good deal of heaviness and sleepiness on the following day, but this effect soon wears off. It occasionally produces frightful dreams, and sometimes much excitement, intoxication, and even delirium without sleep.*

* Dr. Reynolds narrates the following case. Similar effects have been witnessed by others. "After a dose of fifty grains, in the course of an hour some 'faintness' was felt; and when I saw the patient this had increased to an alarming degree. Two hours had passed since the medicine was taken, and I found the patient with cold extremities; an excessively rapid, weak, irregular, and intermittent pulse; jactitation of limbs; an intolerable sense of sinking, and oppression at the pit of the stomach; gasping breathing, and confusion of thought.

"I observed at this time, and for three-quarters of an hour subsequently, that the radial, temporal, and tibial pulses were all of the character I now describe—frequent, weak, irregular, in both force and rhythm, and frequently intermittent—but that the heart was acting regularly, although with increased frequency and diminished force.

"Stimulants, with white of egg, were administered freely, warmth was applied to the extremities, sinapisms were put on the cardiac region, fresh air was introduced plentifully into the room, and at the end of an hour from my first seeing the patient the pulse had become much steadier, though still very frequent and very weak. The syncopal feeling had diminished, the feet were warm and there was a tendency to sleep.

"This state of comparative freedom from urgently dangerous symptoms lasted for longer than an hour, when, without any apparent cause, they returned with increased severity. The patient now seemed in the gravest

Sleep comes on sometimes in a few minutes, but more commonly half an hour, after a dose of chloral. Like other soporifics, it should be given shortly before bed-time, and the patient should avoid excitement, and keep quite quiet, or the medicine, instead of sleep will produce restlessness. It has been given for months without any bad results. Sometimes its effects wear off, but in a far less degree than is the case with opium.

Chloral has been found useful in a variety of circumstances. It subdues the sleeplessness of old people, and the wakefulness induced by excessive mental fatigue, succeeding where opium, bromide of potassium, and other remedies have failed. In delirium tremens it produces sleep, and calms delirium; but is especially successful when administered at the onset of the symptoms, often averting a serious illness. Large doses have been given, even sixty grains or more, repeated several times. Dr. Da Costa cautions against its administration to patients with a weak heart. He advises its combination with opium. In paralysis of the insane, full doses induce sleep at night, and a moderate dose calms excitement by day. Dr. Macleod avers that it is superior to digitalis or the hypodermic injection of morphia. He has given it daily to the same patient, without bad effects, for upwards of three months. Luke, Clouston, Gardiner Hill, G. Crawford, recommend it in acute mania.

It is employed in puerperal mania and in puerperal con-

danger. The superficial pulses were almost imperceptible; and when they could be detected, presented the character I have described. Still the heart was regular in its beat, although feeble and intensely rapid in its pulsations. The mind wandered much; there was utter prostration of muscular strength, the limbs being extended, the head low, and the aspect was at times that of impending dissolution. There was great dyspnœa, a sense of suffocating oppression at the base of the chest (in front), and urgent thirst.

"The treatment previously adopted was again pushed vigorously, and at the end of an hour and a half relief was obtained, and sleep followed. The next morning I found the pulse quite regular, and of its normal frequency."

vulsions, (Hay, Adams, Teller.) It is conveniently administered to the insane in porter.

Dr. James B. Russell, of Glasgow, recommends it in typhus, to produce sleep and allay excitement. He finds it most useful in violent boisterous delirium. Dr. Russell much prefers it to opium, as the patient can be roused to take food, and readily wakes to clear the bronchial tubes, hence there is much less danger of congestion of the lungs. He states that it is a much more certain hypnotic than bromide of potassium.

Dr. Hughes Bennett finds it useful in phthisis, stating that it produces sleep, allays cough, and sometimes checks sweating, without producing any of the harmful effects of opium.

Chloral sometimes restrains the involuntary movements of chorea, but in many cases it is powerless in this respect. It is most useful in those cases where the violent movements render sleep impracticable, the want of sleep in its turn aggravating the choreic movements, till even deglutition may become almost impossible. In these urgent cases ordinary remedies like arsenic are useless, and recourse must be had to narcotics. Large doses of chloral, frequently repeated, will often produce profound refreshing sleep, from which the patient wakes calmed and less convulsed. (*vide* Chloroform).

E. Lambert recommends chloral in parturition in fifteen grain doses every quarter of an hour till the patient falls asleep; and he states that this treatment does not weaken the uterine contractions, while it prevents pain, and insures calm repose after delivery. Dr. Playfair thinks that chloral acts far better than chloroform inhalation, as chloral does not lessen the strength of the contraction whilst it greatly lessens the suffering. Moreover, it is chiefly applicable at a period when chloroform "cannot be used, that is towards the termination of the first stage, before the complete dilatation of the os." The patient falls into a drowsy state—a sort of semi-sleep. Dr. Playfair gives fifteen grains, and repeats the dose in about twenty minutes, leaving its subsequent administration to circumstances.

Chloral is often useful in the convulsions of children. Given in a dose sufficient to induce sound sleep of some hours, the convulsions cease, and often do not recur when the child wakes. If the child cannot swallow, five grains given by the rectum soon makes the child fall into a deep sleep, and the convulsions then cease, at least temporarily.

Five grains of chloral given twice or thrice daily will often remove a common condition characterized by restlessness, irritability, and nervousness.

Dr. Bradbury and Dr. Thompson speak very highly of the efficacy of chloral in nocturnal incontinence of children.

Liebreich recommends chloral in sea-sickness.

The shortness of breath affecting the emphysematous on catching cold often yields to chloral. When the dyspnœa occurs at night, a full dose (twenty-five to thirty grains) at bedtime calms the breathing, and gives sound refreshing sleep. When the difficulty of breathing is continuous, small doses (two to six grains) should be given several times daily.

It is necessary to give chloral with caution to patients with emphysema and bronchitis accompanied with obstructed circulation, causing lividity and dropsy; for an ordinary dose, besides drowsiness, may produce muttering delirium and a notable increase in the lividity; these effects often lasting several days, and attributable possibly to the slow destruction of the drug in the blood. These effects are not owing to any peculiarity on the part of the patient, as the author has seen chloral produce these symptoms in a patient who had previously taken the medicine with benefit.

A full dose of chloral is often useful in a paroxysm of asthma.

Some cases of tetanus have apparently yielded to chloral in large doses; and in some instances this drug has prolonged life and eased pain.

The statements concerning the influence of chloral on pain are conflicting, some asserting that it produces anæsthesia, while Demarquay states that in many instances it excites hyperæsthesia. Chloral it is said simply makes a patient

oblivious of pain; but if the pain is too urgent to permit of sleep, chloral fails to give relief. This metaphysical explanation is certainly incorrect; the truth being that for some unexplained reason, chloral in certain cases subdues pain, while in other instances, apparently similar, it fails. Chloral sometimes relieves the pain of neuralgia, chronic rheumatism, gall stones, colic, gastralgia. In doses of ten grains, three times a day, it has relieved most severe pain of cancer, without inducing drowsiness. Injected hypodermically, it is liable like chloroform to excite inflammation, and to produce an abscess followed by a scar.

The addition of a small quantity of morphia considerably intensifies the narcotic effects of chloral.

When equal parts of chloral and powdered camphor are rubbed together, they form a syrupy liquid, which, painted on the painful part or gently rubbed in, often affords relief in neuralgia. My friend, Dr. George Bird, has used this compound in several cases of neuralgia and pleurodynia with great success. I have known it cure, promptly, neuralgia of the inferior dental branch of the fifth and neuralgia in the temporal region. It is said often to relieve toothache even when applied externally. I have known it succeed when introduced into the cavity of the carious aching tooth, but like other applications for neuralgia it often fails without apparent cause, in cases very similar to those it had benefited. When successful it generally affords almost instantaneous relief. I have known it afford relief in severe pleurodynia.

Valuable as chloral undoubtedly is, it has scarcely sustained its early reputation. It is not so certain a hypnotic as the first overdrawn accounts of its virtues led us to believe. Not unfrequently it produces great excitement, even intoxication, without inducing sleep. Sometimes we meet with a patient who has hitherto taken chloral with good effect, yet, on the occurrence of an acute illness, not only has this drug failed to induce sleep, but, on the other hand, has induced restlessness, even delirious, with a parched dry skin. Yet with all its drawbacks it is a most valuable remedy.

HYDRATE OF CROTON-CHLORAL.

We are again indebted to Dr. Oscar Liebreich for introducing this valuable medicine into the service of medicine. This distinguished experimenter finds that in animals it produces anæsthesia of the head without loss of sensibility of the rest of the body; and in man, anæsthesia of the fifth nerve only. In large doses it produces sleep, and in fatal doses it destroys by paralysing the medulla oblongata. He recommends it in trigeminal neuralgia, but speaks of it as affording only temporary relief; but he greatly underrates its efficacy.

In this country, Dr. Wickham Legg first drew attention to the singular usefulness of this drug in facial neuralgia. He tried it on twenty patients, mostly women, varying in age from 17 to 44, and almost every patient had carious teeth. This remedy afforded great relief in all but two cases, in which apparently it increased the pain. Mr. Benson Baker and Dr. Yeo have also published some cases of trigeminal neuralgia promptly cured by this remedy. I, too, have employed it largely and very successfully in the same form of neuralgia, and I have met many doctors who highly praise this remedy; and so far as one is justified in speaking from the somewhat limited experience of the present time, croton-chloral promises to be the most efficacious remedy in facial neuralgia. In neuralgia due to carious teeth; in facial neuralgia in old people, in whom the disease is generally most obstinate and severe, it is alike beneficial. I am not aware whether, as yet, it has cured that severe form called epileptiform tic. I have found it very serviceable in neuralgia of the back of the head, and also of that of the neck with pain radiating to the shoulders. At present there is but little evidence of its effects on neuralgia of the other parts of the body; but Dr. Yeo publishes four successful cases, and my friend Dr. Louis Lewis has promptly cured by its means several severe cases of dysmenorrheal neuralgia. Hitherto, it has not proved successful in my experience in neuralgia of

the trunk and extremities; but at present my experience of it in this respect is but limited.

Conflicting statements have been made concerning the dose of croton-chloral. According to some writers croton-chloral is treated as a powerful and dangerous remedy, requiring to be given with great care; but this is certainly erroneous. Mr. Baker's patients obtained relief from two or three hourly doses of one grain. Dr. Legg administered it in five, ten, and twenty-grain doses. I have usually given five grains every two or three hours and sometimes hourly. In one case—a delicate woman, I gave it hourly in five-grain doses for a fortnight, without producing drowsiness or any other apparent effect beyond its influence over pain. Usually five grains every three hours is sufficient, giving freedom from pain in a few hours, though in some unusual cases relief may not be obtained for two or three days. After discontinuing the drug slight pain may return, but it yields again to the medicine. It sometimes promptly relieves toothache, but not uncommonly it fails; and I have known it relieve widespread neuralgia of the fifth, but leaving unaffected the accompanying toothache. Indeed I have known toothache to come on during the use of this remedy, in five-grain doses every three hours.

I have found it very effective in those severe forms of headache called nervous sick-headache, bilious sick-headache, or megraine; but only in cases of the following kind:—

A woman has been subject for years to nervous sick-headache. Then owing to some great trouble, or to excitement, fatigue, or flooding, or prolonged suckling, or most frequently at the change of life, the headache becomes much more severe. The headache is continuous for weeks, perhaps months, but is intensified greatly by fatigue, excitement, or at the catamenial period. If not actually continuous the headache comes on daily, lasting perhaps for many hours, or several attacks may each day occur. The pain is often intense, and whereas, previous to this worst shape of headache the pain was probably limited to one brow, it now affects both

and perhaps the greater part of the head. The skin is generally very tender. There is also a sensation of bewilderment, or as some term it a stupid headache, and the patient often says she feels as if she should "go out of her mind." The sight may be dim, especially during the exacerbations of pain. Some patients of this class are very excitable and irritable, and are upset with the slightest noise. Nausea and even severe vomiting may occur, with each exacerbation of the pain. Five grains of croton-chloral every three hours or even oftener, will give in most cases considerable relief. I need hardly say that the drug does not entirely free the patient from her attacks, but in one or two days the pain ceases to be continuous, then the attacks recur, but only once or twice a week, the interval gradually extending till an onset occurs only every week, then about every fortnight or even longer, till the illness assumes its old type and periodicity. In some cases a week's treatment suffices to bring back the headache to its original type of an attack once in three or four weeks. Then the croton-chloral appears to be far less serviceable, manifesting but slight effect on the periodical attacks. In many cases of ordinary periodical headache, the patients say, that in the milder forms the drug distinctly lessens the severity and duration, but in the severer forms it is without effect, even when sickness is absent. In those cases accompanied by severe vomiting and retching croton-chloral is useless, being speedily rejected.

Croton-chloral, I have found, will relieve the slight attacks experienced by some delicate and nervous women after any slight fatigue or excitement.

In the continuous sick headache just described, as the pain grows better so the cutaneous tenderness disappears. It seems to me that in many instances two kinds of headache coexist, one sometimes predominating, sometimes the other. One appears due to affection of the cutaneous nerves, and is generally accompanied by tenderness. Patients describe the other as a "stupid headache," "a feeling of bewilderment" "a bewildering headache." After the dispersion of

the first form by croton-chloral this stupid headache often continues but may ordinarily be relieved by bromide of potassium. Indeed in many cases I have found it useful to combine these remedies. Bromide of potassium alone is often sufficient in certain sick headaches; for instance, if the other symptoms point to this drug, when in addition to the bewildering or stupid headache, the patient complains of broken sleep, harassed with disagreeable or frightful dreams, when she is very irritable and excitable and feels as if she should "go out of her mind." Again bromide of potassium is often useful where the continuous or almost continuous form of sick-headache is associated, and is probably due to uterine derangement, as menorrhagia. The drug's efficacy is not due to simply checking the loss of blood, and so indirectly improving the health, for the good effects are apparent before the occurrence of the next flooding. In cases like this it may be usefully combined with cannabis indica.

Liebreich who recommends croton-chloral as a soporific and gives as much as sixty grains for a dose thinks it superior to hydrate of chloral, as whilst it produces sleep it does not affect muscular tone, nor interfere with the circulation or respiration; he thinks it applicable in cases of heart disease. Much smaller doses are said to produce sleep; thus, Dr. Yeo states that sometimes two grains will suffice. I have given five and ten grain doses in a considerable number of cases but never knew either dose to produce sleep, or even drowsiness.

Dr. Yeo recommends croton-chloral in the "distressing night cough of phthisis."

NITRITE OF AMYL.

To Dr. Brunton belongs the credit of first using this remedy, and the rare merit of inferring correctly its therapeutic effect from its physiological action. It must give him the highest satisfaction to know how great a boon his scientific insight has provided for the hitherto almost helpless patients under the anguish of angina pectoris.

In thirty to forty seconds, whether inhaled, subcutaneously injected, or swallowed, it flushes the face, and increases the heat and perspiration of the head, face, and neck. Sometimes the increased warmth and perspiration affect the whole surface; or while the rest of the surface glows the hands and feet may become very cold; and this condition of the extremities may last many hours. It quickens the pulse in a very variable degree, sometimes, as Dr. Talfourd Jones points out, doubling its pace. Jones finds that this augmented beat of the pulse precedes the flushing by a few seconds. It causes the heart and carotids to beat strongly, and sometimes produces slight breathlessness and cough. It often causes slight giddiness, mental confusion, and a dream-like state. Dr. Brunton shows that it relaxes the whole arterial system, probably by partially paralysing the sympathetic ganglia, and motor nerves. This paralysing effect of the arterial system is well shown by the sphygmographic tracings, the flushing of the face, and the increase in the size of visible arteries like the temporal, which often becomes notably large, sometimes, indeed, being doubled in size, and branches previously invisible become plainly apparent; and by the interesting fact observed by Talfourd Jones, who while cupping a patient over the loins and finding that the blood would not flow, administered nitrite of amyl by inhalation when the cuts immediately began to bleed freely. After an inhalation the larger arteries are slower in recovering their normal size than the capillaries, a phenomena well observed in the tem-

poral artery, which remains enlarged half a minute or longer after the blush has quite left the face.

Dr. Brunton first employed nitrite of amyl in angina pectoris with signal success, and found it more effective than any other remedy in this painful and dangerous disease. During an attack his patient suffered from throbbing of the heart and carotids as high as the ears, with severe precordial pain extending to the right arm. The usual characteristic "sense of impending death" was absent. The pulse was slightly quickened and the sphygmographic tracing became modified, for as Dr. Brunton states, "as the pain increased the curve became lower, both the ascent and descent more gradual, and dichrotism disappeared. This form of curve clearly indicates that the arterial tension is much increased, and can I think be due only to contraction of the small systemic vessels." The increased tension first led Dr. Brunton to employ nitrite of amyl. In the case in question he considers that the attack consisted of spasmodic contraction of some, if not all, of the small systemic and pulmonary vessels, which state of arterial tension gave way, on inhaling the nitrite and the pain then disappeared. On the recurrence of an attack the patient inhaled the nitrite of amyl and always obtained instantaneous relief.

Dr. Anstie reports a well marked case of angina greatly relieved by this treatment. He says, "the first sniff produced after an interval of a few seconds the characteristic flushing of the face, and sense of fullness of the head; the heart gave one strong beat, and then he passed from the state of agony to one of perfect repose and peace, and at his usual bed-time slept naturally. This experience has, I am happy to say, been repeated on several occasions, and with this fortunate result; that so confident now is the patient of being able to cut short the paroxysm that he has discarded all use of ether, and greatly reduced his allowance of stimulants." Dr. Talfourd Jones also finds it very useful in angina. Since the previous edition of this work nitrite of amyl has been largely used in angina, and with considerable success. Indeed, in most cases

no other remedy affords so much relief. As might be expected, it is not uniformly successful. Thus, in one case due as we discovered after death, to aneurism of the heart immediately below the aortic valve, an inhalation always arrested the pain, but it returned after a few seconds or minutes, even if the administration were several times repeated, and was as severe and lasting as when no amyl was used. In another case whilst it gave great relief, always arresting the paroxysm, it took ten minutes to effect this, and was in no way superior to a full dose of ether, which the patient preferred, as the amyl produced so much giddiness and sensation of fulness in the head. In three other cases, however, it proved strikingly successful. In one desperate case, the slightest exertion brought on intense pain, but by the aid of amyl the patient could always at once cut short the attack, so that now he can walk several miles, though he is obliged during his journey to employ the amyl several times. It has appeared to me that by at once checking the paroxysm the attacks come on less frequently and less severely, and after a time a much smaller quantity suffices to control the pain; so that amyl really contributes to the prolonged relief of these unhappy patients.

Dr. Talfourd Jones found it remarkably successful in very severe attacks of asthma, removing the dyspnœa immediately and averting its return. Others have found it very useful in asthma. He found it useful also in a case of cardiac dyspnœa, accompanied by extreme anasarca, due to a dilated and hypertrophied heart.

Dr. Sanderson suggests that it may be a relaxer of spasm generally, and Dr. Anstie has used it with success in cases of spasm of the stomach.

Dr. Talfourd Jones advises inhalation of the nitrite in syncope and thinks it should be of service in the paroxysms of whooping cough. It is useful in neuralgia, at least in neuralgia affecting the fifth nerve. It often eases the pain at once, and in some cases a single administration has averted further attacks, but so signal a result as this is probably ex-

ceptional. Dr. Richardson finds that nitrite of amyl arrests in frogs the convulsions due to strychnia, and in this way he has saved their lives; and he advises a trial of the nitrite, either by inhalation or subcutaneous injection, in strychnia poisoning and tetanus. In the foregoing diseases it is better to administer this remedy by inhalation, for, according to Brunton, it will not answer with anything like the same certainty when given by the stomach; for in the striking case of angina pectoris just cited he gave ten minims in brandy by the stomach with the effect of staying the pain for only a short time, but a single inhalation afforded perfect and permanent relief from the attack. It should be borne in mind that it affects some persons much more than others; one individual being able to inhale five or ten drops from a handkerchief, or to breathe the fumes from the bottle held close to the nose, while another on smelling a whiff from the bottle held at a distance will become affected with great giddiness, much mental confusion, and general weakness. Jones directs five or ten drops poured on a handkerchief, or the fumes from the bottle held close to the nose, to be inhaled till the pulse quickens, when the inhalation should be discontinued; but this plan is far too potent for some persons, especially feeble and sensitive women, who in the first instance should inhale a much weaker dose. As Jones points out, patients become habituated to it so that after a while it must be inhaled several times before it affords relief. This habituation is well exemplified in the internal administration of the remedy. Jones also finds that by exposure it gets "flat" and loses its efficacy.

Nitrate of amyl is generally considered a powerful and even dangerous remedy whose administration must be watched with great care, and only a measured quantity employed. I am sure it is not nearly so dangerous as is generally imagined, though it is true that nervous, sensitive women are far more powerfully affected by it than men. No doubt its administration at first should be conducted by a doctor, in order to ascertain how far the patient is susceptible to its influence, and that the patient may learn when he ought to

discontinue the inhalation. But after one or two inhalations patients soon learn how to administer it to themselves. I have now five patients with angina pectoris, who always carry with them a small bottle of this medicine, and on the first warning of an attack they at once begin to sniff at the bottle, whether walking or standing, this they have done for months, and one patient for just a year, using the inhalation many times daily, so that he consumes about two drachms a fortnight with still unfailing relief. Except in relieving the angina, the amyl seems to produce no other effect on the system.

Dr. Jones recommends a trial of it in epilepsy. To an epileptic patient, who, in addition to severe and repeated attacks, suffered from much mental confusion and was haunted many times a day with an indescribable dread and sensation as of an oncoming fit, although it came on only once or twice a week, the author gave it in 3 drop doses thrice daily and an additional dose on the earliest warnings of a fit. Amyl lessened considerably the frequency of the fits and entirely removed the harrassing sensations. Dr. Crichton Browne has lately published some valuable observations on the use of nitrite of amyl in this disease. In two rabbits made artificially epileptic, he prevented the oncoming of the convulsions which otherwise follow the application of the electrodes to the brain, by making them inhale nitrite of amyl. By the same means he has likewise arrested epileptic attacks on the occurrence of the aura before the onset of the fit and has even cut short the fit after its commencement. He has, too, obtained very satisfactory results in that form of epilepsy called status epilepticus — a condition consisting essentially of a succession of fits, linked together by intervening unconsciousness, the fits recurring with greater frequency till at last no sooner is one fit ended, nay, before it has finished, another fit begins. Fits like these he has arrested and has rescued several patients out of this desperate plight. Amongst other successful cases, Dr. Weir Mitchell reports one, where the remedy was used immediately the aura was

perceived, and other cases where the spasms lasted for hours, one fit following another. These two gentlemen give it by inhalation. Since my last edition I have given this remedy with considerable success to several epileptic out-patients, in whom the attacks have been very frequent. In some it has appeared to be more useful than full doses (20 to 30 gr.) of bromide of potassium thrice daily, in another case whilst it decidedly lessened the frequency of the attacks, it was less serviceable than bromide of potassium. I have given it in two to five minim doses suspended in mucilage, every three hours or three times a day, and have not found these doses produce any unpleasant effects in these epileptics, nay, in some cases they have not even caused flushing, whilst in other cases patients have told me that they flush with each dose, but only whilst swallowing it.

The patient should take the medicine whilst lying down; and as some patients, especially women, are very readily affected by the drug, it is well in the first instance to give it in smaller doses. But until the remedy is pushed to two and in some cases to five minims every three hours, I have failed to obtain conspicuous results. Dr. Crichton Browne maintains that epileptics are more sensitive than others to inhalation of amyl administered in this way. I imagine that this medicine will be useful only where the attacks are frequent, and that it cannot be given thus, where they occur only at comparatively long intervals, as three weeks or a month.

Inhalation of nitrite of amyl has been recommended in sick headache, and one successful case is reported by O. Berger.

The author has used this remedy extensively with considerable success in cases of the following kind.—A woman, perhaps, from the sudden arrest of menstruation, depraved health, or nervous depression, or, more frequently, at the change of life, suffers from frequent attacks of flushings or "heats" starting from various parts, as the face, epigastrium, &c., thence spreading over the greater part of the body. The face, and even the backs of the hands, are often deeply reddened, the veins of the hands in some cases dilating to double

the previous size. Sometimes, although the patient feels deeply flushed, the skin remains natural. The sensation of heat may be so urgent that the patient opens her clothes or removes the greater part of the bed covering, and even throws open the window in the coldest weather. These heats may last a few minutes only, or an hour or more, and may be repeated many times a day. Sometimes they occur chiefly at night, greatly disturbing sleep. They are generally followed by perspiration, often very profuse, at other times the skin remains dry, the attacks are then commonly termed "dry heats," the "heats" are often accompanied by great throbbing throughout the whole body and are followed by much prostration, the patient feeling scarcely able to rouse herself.

After the heats pass away, the skin sometimes becomes cold and clammy and may turn very pale. The least exertion or excitement may bring on these heats, and such a patient generally complains of cold feet and sometimes of cold hands. The flushings are occasionally peculiarly and abruptly limited, reaching to the thighs, knees or elbows, and while all the parts above these feel burning hot, the parts below feel icy cold; sleep too is often much broken, the patient waking with frequent starts, and in the morning feeling unrefreshed. In many cases palpitation or "flutterings at the heart" occur on the slightest excitement, or even without apparent cause.

Nitrite of amyl prevents or greatly lessens these flushings or "heats," and averts the profuse perspiration, throbbing of vessels and great prostration. Sometimes it warms the feet and hands and controls the fluttering of the heart, but in most cases it leaves these symptoms unaffected, and for their cure other remedies, as iron, are required. Amyl removes also giddiness, confusion of mind, heaviness in the head, and even headache; it generally produces calm refreshing sleep.

When the flushings and perspiration are slight, this remedy is scarcely needed; moreover the perspirations are generally considered vicarious and beneficial at the change of life. These symptoms, in many cases, form only a minor part of the troubles of the patient, who may

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rest. – (May be ind.ᵈ by Strychnia)
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complain of great sinking at the epigastrium, or severe pains in different parts of the body, and other sufferings incident to this period, over which nitrite of amyl has little if any influence; but when flushings &c. constitute the chief part of the patients' troubles this medicine is most serviceable.

The nitrite of amyl in ten days completely cured the following singular case of a woman who had been horribly tormented, for three years, with attacks, repeated several times daily, of severe burning sensation over the loins, from whence a glow of heat spread over the whole body, followed by perspiration. The burning sensation was so unendurable that she was constrained to open the window at night even in winter, and sometimes to rush out of doors.

For the symptoms just described, the author has generally administered this drug by the stomach, though inhalation answers as well. In respect of dose it must be borne in mind that like glonoine (nitro-glycerine) its effects vary very greatly with different persons. One, two, or even three minims produce in some only flushing of the face and slight giddiness, while with others even a drop will induce various disagreeable symptoms. Thus one woman immediately after a drop dose turned deadly pale, felt very giddy, and then became partially unconscious, remaining so for ten minutes. In another patient the same dose produced a sensation as if "a vapour spread from the throat through her head" and rendered her quite powerless for one or two seconds. A third of a minim dose sometimes excites great nausea or a tickling in the throat; and one delicate woman after one thirtieth of a drop, passed for a few minutes after each dose into a trance-like state, everything to her seeming unreal, and the breathing becoming rather panting. The author began with a minim dose, but was obliged to reduce this quantity, and he ultimately found that, for the most part, those patients can bear one third of a minim without any disagreeable symptoms, but that a tenth, nay, even a thirtieth of a minim will in some patients produce the desired effect on flushing. It may be dissolved in rectified spirit: two minims to the drachm, and of

this three to five drops should be taken on sugar every three hours, with an additional dose as soon as a flush begins. Relief generally ensues immediately, but sometimes not till the medicine has been taken for a week. As the patient grows accustomed to the remedy the dose must be increased.

R. Pick from observations on himself and others, finds that after inhaling amyl if the eye is fixed on a spot on a blank wall, the spot itself and the surface around it appears of a yellowish hue, the yellow circle being surrounded by a violet blue halo, with undulating lines at the edge.

CAMPHOR.

At the temperature of the body camphor is solid, but it slowly volatilizes even at a lower temperature. But little soluble in water, it freely dissolves in oils and alcohol. Camphor destroys most plants, except those of the lowest organization, as the fungus commonly called mould. It is said to be poisonous to fleas, bugs, spiders, and other insects. Camphor excites redness and heat, indeed slight inflammation in the unbroken skin, and of course irritates more powerfully wounds and delicate structures like mucous membranes, and may produce, not only active inflammation, but even sloughs and ulcers. Camphor has been applied to stimulate indolent sores. It is a useful addition to dusting powders to allay the heat, tingling, and itching of eczema and intertrigo. Camphor is a common ingredient of tooth powders, and is used as a corrective of foul breath.

Camphorated alcohol has been recommended as a remedy for boils at their earliest stages, applied three times a day for half a minute, afterwards letting the skin dry and then smearing it with camphorated oil. It is said that a few applications will usually disperse the coming boil.

Inhaled or taken by the stomach, camphor exerts a decided

influence on "cold in the head;" employed at the beginning of an attack (it is useless after the first stage) camphor sometimes arrests an ordinary cold, and failing this, it abates its violence, obviating or lessening frontal headache, and lessening the sneezing and running at the nose.

Camphor inhalations are sometimes useful in that troublesome and chronic complaint characterized by attacks of incessant sneezing and profuse watery running at the eyes and nose, the patient remaining well in the intervals of the seizures. These attacks may occur daily, beginning early in the morning, and may last for a few minutes only, or persist for several hours; and they may occur at any hour of the day, recurring several times daily. Sometimes several days intervene between the attacks, which may last twenty-four hours or even longer. They are generally accompanied by severe frontal headache, and in some instances are preceded by itching of a point inside the nose a short time before the attacks. This affection lasts for years.

In catarrh and this unnamed affection the patient should either sniff up finely-powdered camphor, or inhale by the nose some of the alcoholic solution poured on a handkerchief or into boiling water; but when boiling water is used it is needful to protect the eyes from the camphor vapour, to obviate smarting and inflammation. At the same time he should take four to six drops of the alcoholic solution of camphor every fifteen minutes for the first hour, and hourly afterwards.

For drowsiness or headache occurring at the change of life, or from perverted action of the uterus, Dr. Tilt orders eau de Cologne saturated with camphor to be rubbed into the head.

Camphor excites in the mouth and stomach a sensation of coldness, followed soon by a sensation of warmth. Large doses excite epigastric pain, nausea, and vomiting. After death from poisonous doses, the stomach and intestines are reddened and sometimes even ulcerated, the amount of mischief depending on the mode of taking the camphor, which, if

swallowed in solution, quickly passes into the blood, the stomach being but little affected; but if swallowed in the solid form, owing to its high melting point, it remains long enough in the stomach to excite severe inflammation, and most of it escapes undissolved with the motions.

Few if any remedies are comparable to camphor in summer diarrhœa and cholera. Its benign influence in cholera is most conspicuous; for it generally checks the vomiting and diarrhœa immediately, prevents cramps, and restores warmth to the extremities. It must be given at the very commencement of the disease, and must be administered frequently, otherwise it is useless. Four to six drops of strong spirits of camphor must be given every ten minutes till the symptoms abate, and hourly afterwards. It is a good plan to mix it with a little brandy, but it acts admirably alone.

Dr. George Bird employs spirits of camphor with good results in the acute diarrhœa of infants. He administers it in milk. Camphor generally restrains the diarrhœa excited by the effluvia of drains. Some persons, especially women, on exposure to cold, suffer from diarrhœa accompanied with severe cutting pains. Standing on cold objects is especially liable to excite this diarrhœa. The pain may be very severe, continuing till the bowels have acted three or four times. Camphor generally relieves the pain, and restrains this diarrhœa.

Camphor readily passes into the blood, and manifests itself there and in most of the organs of the body by its odour. Its influence on the blood is unknown. Its influence on the heart appears to be capricious. Large doses often slacken, but sometimes quicken, and generally weaken the pulse. Moderate doses, it is said, quicken and strengthen the pulse. Large doses sometimes disturb the brain, causing at first, increased activity with a rapid flow of pleasant ideas; but subsequently, and in some cases even at first, it produces great faintness, giddiness, noises in the ears, much delirium, and even convulsions, with coldness of the surface, shrunk features, and clamminess of the skin. Large doses often

induce some smarting and pain of the urinary organs, with urgent desire to pass water.

It is mainly given in adynamic fevers, and according to Graves and others, it is very valuable. It is said to strengthen while reducing the frequency of the pulse, moistening the skin, and removing the delirium, especially when of a low and muttering character. To control delirium it must be given in considerable quantity, to the extent of twenty grains or more every two or three hours, and its effects must be watched. Some practical authorities, however, deny the efficacy of camphor in fever delirium.

It has also mainly been recommended in melancholia, in spasmodic affections, in nervous palpitation, and hiccup.

It is reputed on high authority, that camphor, given in considerable doses, will control inordinate sexual desire. It is said to relieve strangury. Drachm doses of the spirit relieve chordee.

Camphor is eliminated by the breath, probably with the perspiration, and a small proportion with the urine. The irritation it produces in the urinary mucous membrane, and the small amount separated by the urine, has led to the assumption that some of the products of its decomposition in the body escape with that secretion, irritating the mucous membrane over which this passes; but on this point nothing definite is known, and at present there is no proof that camphor is consumed in the body.

TURPENTINE.

Turpentine applied to the skin excites a sensation of warmth, with some redness; and if the application is sustained, blistering takes place. It is in common use as a rubefacient and counter-irritant. Over a flannel wrung out in hot water some turpentine or turpentine liniment may be sprinkled, and ap-

plied till it produces redness, tingling, and smarting. It is well to bear in mind that as the smarting arising from the application of a turpentine stupe, goes on augmenting for some time after its removal, it should not be kept on longer than just sufficient to excite a moderate degree of pain. An equal quantity of yolk of egg and turpentine is a useful form, to be dabbed on the skin with a piece of sponge. Turpentine stupes may be employed as a rubefacient, for the same purposes as a mustard poultice.

Turpentine in the stomach excites a sensation of warmth, and large doses sometimes produce nausea and vomiting. It generally acts as a purgative, but not invariably; and if, after large doses, purgation does not take place, serious symptoms sometimes arise from the absorption of the turpentine, and from its action on the organs at a distance from the intestinal canal. Thus, when administered in considerable doses, it is desirable to give, either simultaneously or soon afterwards, some more active and certain purgative, as castor oil. Even after large doses, the stomach and intestines of animals have been found free from inflammation.

This drug is successful as a tapeworm poison, but it has now given place to milder and more efficient remedies.

Turpentine injected into the rectum will destroy thread-worms. Many other substances are just as good vermicides.

In staying hæmorrhage from the stomach, arising from chronic ulcer or other causes, from the intestines in typhoid, etc., few remedies are more successful than turpentine given in small doses of five to ten drops, very frequently repeated. Later on we shall speak of the use of turpentine in controlling hæmorrhages from other organs.

Turpentine proves useful in certain states of typhoid fever, probably from its direct action on the intestinal mucous coat. Thus Dr. Wood has drawn attention to its value in ten-minim doses repeated every two hours, when the tongue parts with its fur in flakes, and instead of becoming and remaining moist, looks dry and glazed, a condition usually observed towards the end of the disease, and accompanied always by

an increase of the tympanites, and an aggravation of the other symptoms. In "the course of twenty-four or at most forty-eight hours some amelioration of the symptoms may be observed. The tongue becomes gradually moister, and covers itself with a whitish fur; the tympanitic distension ceases to augment, and after a time diminishes; the pulse becomes less frequent and the skin less dry and harsh, and the patient enters slowly but regularly into convalescence often without any other remedy. As the case improves, the quantity of the oil should be diminished, but care should be taken not to omit it too hastily." Dr. Wood further says, "I will repeat, that oil of turpentine may be used, with great hope of benefit, in any case of enteric fever in the advanced stage, with a dry tongue."

Dr. Graves employed it in the same disease, in drachm doses every six hours in extreme tympanites, and he pointed out that the remedy is of no use if, before and during the production of the flatulent distension, there is diarrhœa, when acetate of lead is invaluable. With the tympanites there is very often much prostration, with muscular tremblings, and picking of the bed-clothes, and low, muttering delirium—symptoms all, according to Graves, in many cases, benefited by the use of turpentine.

Turpentine passes readily into the blood, and may be detected in the breath and sweat, and in an altered state in the urine, giving to this excretion an odour of violets or of mignonette.

In large quantities, and especially if it fail to purge, and thus escape soon by the rectum, turpentine produces in most persons some excitement, with giddiness, confusion of sight, quickened pulse, and, in extreme cases, insensibility, with dilated pupils. In many instances it produces bloody and scanty urine; or, indeed, it may suppress this secretion; occasionally it excites pain along the urinary tract, with frequent and painful micturition.

As we have said, it is very efficacious in bleeding from the various organs of the body, as the lungs, nose, uterus, kid-

neys, and bladder. A drachm should be given every three hours: a dose which sometimes causes sickness, diarrhœa, and even blood in the urine: but on discontinuing the drug the blood soon disappears. Given to check bleeding from the kidneys, as in Bright's disease, it must be administered in very small quantities. It is also reputed to possess the power of checking bleeding in the hæmorrhagic diathesis, and to be useful in purpura.

Puerperal fever has been treated with large doses of this medicine, but authorities are divided as to its usefulness.

According to some authorities, it has been employed with great success in sciatica, in half-ounce doses, given for four or eight successive nights, when, if it fail to give relief, it may be pronounced useles in that particular case.

It is asserted that turpentine is an antidote to phosphorus, and Dr. Letheby says that at a lucifer-match factory at Stafford the workmen prevent necrosis of the jaw by wearing near their breasts a small open vessel containing turpentine.

The experiments of Personne on fifteen dogs support this view. To five dogs he gave phosphorus alone, and they all died. To five others, an hour or two after the phosphorus, he gave turpentine and only one died. To five others he gave turpentine immediately after the phosphorus, and only one dog died. These experiments, however, are not so satisfactory as they easily might have been, as he does not appear to have given an identical dose of phosphorus in all his experiments. Personne thinks that phosphorus produces asphyxia by becoming oxidized and abstracting oxygen from the blood. Pyrogallic acid absorbs oxygen from the blood, and Personne asserts that it produces the same symptoms and *post-mortem* appearances in dogs as phosphorus. He thinks that turpentine prevents the oxidation of phosphorus, so that it is eliminated unchanged without inflicting injury to the body.

Kohler confirms Personne's statement of the antidotal power of turpentine, but controverts his explanation of its action. He gave to twenty-five animals, without injury, from

0·006 to 0·09 grms. of phosphorus and 4·5 grms. of turpentine. On killing the animals the tissues showed no fatty degeneration or other signs of phosphorus poisoning. Kohler says that a compound of phosphorus and turpentine is formed, which is eliminated through the kidneys, giving to the urine a smell like opodeldoc and not of violets.

Turpentine is reputed to be diuretic, and is sometimes administered in small doses with this intent in Bright's disease.

It has been used in chronic cystitis, in gonorrhœa, and in gleet.

It has been given, with apparent advantage, in biliary colic.

Group containing:—

NUTMEGS.
CLOVES.
CANELLA BARK.
CINNAMON BARK.
CAJEPUT OIL.
OIL OF ANISE.
FENNEL FRUIT.
CARAWAY FRUIT.
CORIANDER FRUIT.
DILL FRUIT.
ELDER FLOWERS.
LAVENDER OIL.
OIL OF ROSEMARY.
OIL OF PEPPERMINT.
OIL OF SPEARMINT.
OIL OF RUE.
OIL OF LEMONS.
CUBEBS.
BUCHU LEAVES.
BALSAM OF TOLU.
BALSAM OF PERU.
COPAIBA.
MEZEREON.
SASSAFRAS.
STORAX.
JUNIPER.
BENZOIN, etc.

This group consists of volatile oils, or substances containing volatile oils. Some of the members, containing a bitter constituent, are tonics.

The ethereal oils penetrate the cuticle, and excite slight

inflammation. Some have been employed as rubefacients to rheumatic and gouty joints, to the face in toothache, etc., but they are in no respect superior to turpentine and other "counter-irritants." Dr. Alfred Wright of Finchley, however, says that in China he learned from the natives the practice of painting oil of peppermint on the face in facial neuralgia. He uses it also for gout, the relief it gives in both instances being almost instantaneous. Balsam of Peru is a useful adjunct to ointments for broken chilblains. Dr. Copland states that in the form of ointment, for which he gives a formula, it stimulates the growth of the hair.

All the essential oils destroy lice, whether situated on the head, trunk, or pubis; but oil of rosemary and powdered pyrethrum are generally preferred in "louse-disease."

Many excellent authorities extol storax and Peruvian balsam in itch. The following preparations are very useful:— Storax, an ounce; olive oil, two drachms. Or, rectified spirit, two drachms; storax, an ounce; olive oil, a drachm; the first two ingredients are mixed together, and the olive oil added to them, The whole body, except the head, is carefully rubbed with either compound. One application it is said kills the insects; but, to avoid the risk of failure, it is better to employ a second application in twelve or twenty-four hours. Although not necessary to the success of this treatment, yet, for the sake of cleanliness, a warm bath should be given before and after these inunctions. These applications cause no irritation of the skin, and they possess the additional advantage of an agreeable odour.

Dr. McCall Anderson praises storax highly, asserting that it is as certain as sulphur, while, unlike sulphur, it soothes instead of irritates the skin.

The members of this group have a warm, and many of them an agreeable taste. Oil of peppermint, orange-flower water, oil of cinnamon, oil of lemons, are used to conceal the flavour of disagreeable medicines.

These oils excite a sensation of warmth in the stomach; some of them are used to increase appetite and digestion. In

large doses they excite slight inflammation of the stomach and intestines. Many of them, as oil of cloves, oil of cinnamon, oil of anise, oil of fennel, oil of coriander, oil of caraway, oil of peppermint, are employed to prevent the griping pains of purgative medicines.

Some of these substances, as cloves and cinnamon, are useful in diarrhœa as adjuncts to astringents. Their stimulant action on the muscular coat of the stomach and intestines removes colic, and expels wind; oil of cajeput and oil of cloves are generally preferred in flatulence. Spirit of horseradish, in half-drachm to drachm doses, is highly approved in flatulence.

These oils probably pass readily into the blood, and for the most part act like turpentine. Many of them have been employed as antispasmodics, but they are inferior to chloroform and ether. Whether they undergo any changes in the blood is at present unknown.

Balsam of Tolu, and balsam of Peru, and copaiba, are given in chronic bronchitis with a copious secretion of pus.

Mezereon and sassafras are reputed to be useful in syphilis and chronic rheumatism.

Lavender, rosemay, rue, cinnamon, and some other members of this group, are given as stimulants to nervous and hysterical persons affected with depression of spirits and other symptoms. They soon, however, lose their effects, unless given in increased doses.

These oils, and the resins derived from them, escape from the body in part with the breath and perspiration, but chiefly with the urine, and in their passage along the urinary tract they stimulate or irritate its mucous membrane. Copaiba sometimes causes bloody urine, with strangury and pain in the bladder.

Copaiba, cubebs, and especially buchu, are commonly used in chronic inflammation of the bladder and urethra.

Copaiba and cubebs are used in gonorrhœa and gleet. Copaiba benefits, it is said, the chronic, but aggravates the acute stages of gonorrhœa; while cubebs, which must be

given in large doses, is considered only useful at the commencement of an attack. Copaiba has been used, especially for women, as an injection for gonorrhœa.

Balsam of copaiba in ten to fifteen minim doses sometimes acts as a powerful diuretic. Dr. Wilks who has used copaiba with much success finds that the diuretic properties reside in the resin. Copaiba has been found very useful in some cases of ascites, entirely removing the abdominal dropsy, and also in Bright's disease. I have used the resin in ten to fifteen grain doses in many cases and often with great effect, I have seen it answer in cardiac dropsy and in ascites where the kidneys were healthy, I have seen it successful in ascites where there was fatty degeneration of the kidneys, and in Bright's disease, where after death the kidneys were much contracted, granular, red, firm, the cortex much contracted, with numerous small opaque buff-coloured spots, the kidneys seemed the seat of fibroid change and fatty degeneration. I have also seen it remove, speedily and entirely, extensive dropsy, due probably to pale fatty kidney. I have known it also benefit the chronic disease left by an attack of acute Bright's disease, and prevail over a case of cardiac dropsy, with a small amount of albumen in the urine, and with signs of general decay. Yet in cases which appeared exactly similar I have known it entirely fail, leading me to think that success or failure depends less on the nature of the disease than on some individual peculiarity. In some cases copaiba causes bloody urine, in others I have seen a large amount of blood in the urine quickly disappear under the influence of copaiba resin.

Copaiba occasionally produces a rash, sometimes like urticaria, sometimes very closely simulating the papules of measles; but there is no fever with copaiba-rash, and the papules last many days if the medicine is continued, and the rash does not begin on the face, then spreading downwards over the body, but is patchy, and shows a preference for the neighbourhood of joints. In doubtful cases, where patients deny that they have taken copaiba, it may be detected in the

urine by the smell, and with still greater certainty by chemical re-agents; for, if copaiba is present, nitric acid makes the urine turbid, which heat dispels. Copaiba may also be extracted from the urine by shaking it up with ether.

Oil of sandal-wood, in doses of fifteen minims three times a day, is strongly recommended in acute and chronic gonorrhœa.

Probably most of these ethereal oils escape from the body with the urine; but from Weikart's experiments, quoted by Parkes, this does not appear to be the case with copaiba, the volatile oil being destroyed in the body, and only its resinous acid appearing in the urine.

Many persons highly esteem juniper as a diuretic in scarlatinal dropsy.

Compound tincture of benzoin painted on the skin sometimes allays itching from urticaria, eczema, &c. In quantities of a drachm added to boiling water, and used as an inhalation night and morning, it is often useful in bronchitis and even in chronic phthisis—easing cough and lessening expectoration.

VALERIAN.
VALERIANATE OF ZINC.
VALERIANATE OF QUININE.
VALERIANATE OF AMMONIA.

Like turpentine and the volatile oils, valerian produces a sensation of warmth in the stomach, a quickened pulse, some mental excitement, and after a large dose, even delirium.

Neligan considers valerian a powerful anthelmintic, and especially recommends it when the worms excite convulsions.

Valerianate of zinc is useful for those numerous, distressing and changeable symptoms, included under hysteria, most

often occurring in women at the time the catamenia cease. Thus it often removes "flushings of the face," "hot and cold perspirations," restlessness, nervousness, depression of spirits, sensation of suffocation in the throat, throbbing of the temples, fluttering at the heart. In many instances, these symptoms depend on uterine derangements, piles, dyspepsia, or constipation; but after the removal of all discoverable disease, or in cases where no cause for the symptoms can be detected, valerianate of zinc often proves of great service. Oxide of zinc does good, but is certainly inferior to the valerianate. In many instances, however, valerianate of zinc fails in the very cases we should expect it to be useful. Our knowledge of the conditions indicating the employment of these medicines is not at present sufficiently precise to enable us to predict in what cases they will be likely to succeed.

Some prefer valerian or its tincture, and ascribe most of its efficacy to the volatile oil. Other authorities prefer the salts of valerianic acid.

Valerian has been used with occasional advantage in epilepsy; but we are ignorant whether the cases were true epilepsy, or merely the hysterical form of the disease.

Valerianate of zinc, or valerianate of ammonia, in twenty-grain doses, sometimes relieve neuralgia of the face or head. It is recommended in megrim, in doses of from two to five grains thrice daily. It is said that preparations of valerian will control the paroxysms of whooping cough, and the involuntary movements of chorea. Large and increasing doses of valerian are stated to be useful in diabetes insipidus.

SAVINE.

Savine is an irritant, and excites inflammation in the tissues. It is sometimes used to keep blistered surfaces open and discharging.

It is employed both in menorrhagia and amennorrhæa due to a want of tone in the uterus. It is used by ignorant people to produce abortion.

ASSAFŒTIDA.
AMMONIACUM.
GALBANUM.

These medicines act very similarly on the body; but assafœtida, probably from its containing most volatile oil, is the most powerful.

Assafœtida has a warm taste; it stimulates the stomach and intestines, and expels wind. In large doses it often excites nausea and vomiting. It increases the secretion from the mucous membrane of the intestines, and hence acts as a mild purgative. Probably the active principle of these drugs does not pass quickly into the blood; for it makes the eructations offensive for twenty-four hours, or longer.

They generally quicken, but sometimes slacken the pulse.

After a full dose of assafœtida general exhilaration occurs, and sometimes "various nervous or hysterical phenomena, and a general sense of *malaise* (Jörg, quoted by Stillé). It often produces headache and giddiness. It is said to increase the bronchial secretion and perspiration. All persons, however, are not thus affected, as Pidoux took enormous doses of assafœtida, and experienced no inconvenience, except from the offensive smell of his excretions.

Assafœtida is very useful in hysteria, in many cases remov-

ing hysterical headache and peculiar sensations in the head. It is also useful in hysterical flatulence.

Assafœtida is useful in the flatulence of young children, unconnected with constipation or diarrhœa. A tea-spoonful every hour of a mixture containing a drachm of the tincture to half-a-pint of water, is strong enough to relieve distension speedily, and is readily taken by children. When the flatulence is due to constipation or diarrhœa, assafœtida does very little good.

Assafœtida has been recommended in asthma, and all members of this group are useful in chronic bronchitis, with much wheezing and abundant discharge, symptoms commonly met with in elderly people; but in cases like these, ammoniacum is generally preferred to assafœtida.

ON CANTHARIDES, BLISTERS, AND COUNTER-IRRITATION.

The preparations of cantharides are chiefly used as rubefacients or vesicants, to control disease in neighbouring or distant parts.

That impressions made on the skin, and other parts do affect deep-seated and even distant parts, is proved by the following facts:—

I. Dr. Inman and others have shown that blisters and other counter-irritants, applied to the chest or abdomen, excite in many instances inflammation of the corresponding part of the pleura or peritoneum. An irritant applied to a knee distended by synovitis or rheumatism, increases the distension for a day or two.

II. Inflammation may spread from one part to another by mere contact, a fact well exemplified in that form of ulcerative stomatitis affecting the edges of the gums; the cheek and tongue opposed to the inflamed and ulcerated gums be-

coming often inflamed and ulcerated. Similar extension of inflammation and ulceration by mere contact is witnessed in the spread of non-specific as well as specific sores from the glans to the prepuce, or *vice versa.* Rindfleisch describes a case where from a cheesy mass a group of tubercles formed on the pulmonary pleura, on the opposing part of the costal pleura there was found a group of tubercles, although no adhesions existed between the pulmonary and costal membranes. Here the disease probably travelled by mere contact.

III. Brown-Séquard states that on irritating the skin over the kidneys, the renal arteries contract. Cold applied to part of a bat's wing causes contraction of the vessels of the corresponding part of the opposite wing.

IV. A local irritation will produce neuralgic pains at a distance from the point of irritation, well exemplified in neuralgia of the different branches of the fifth nerve from a diseased tooth. Indeed, cases are on record, where irritation of one nerve has excited neuralgia in another nerve anatomically unrelated to it; for instance, injury to the ulnar nerve has produced neuralgia of the fifth. Various serious nutritive changes may take place over the secondary seat of pain, the implicated tissues becoming red, swollen, very tender, and even indurated. Neuralgia of the temple often turns the hair of the temple rapidly grey. Neuralgia of the eye leads to serious inflammation, sometimes even ulceration, of that organ. Secretion, too, may become modified; thus each paroxysm of pain may increase, diminish, or alter the salivary or lachrymal secretions.

V. The application of aconitia ointment over a painful neuralgic nerve often relieves distant neuralgias, and sometimes sickness. (See Aconite.) For instance, we often witness a case of neuralgia of the ophthalmic branch of the fifth nerve followed in some hours by neuralgia of the auricular or occipital nerve. Here the ointment, by relieving the supra-orbital pain, will prevent the neuralgia of the other nerves. Again, in neuralgic sick headache this ointment, by

abolishing the supra-orbital pain which often radiates far above the brow, will prevent the consequent sickness.

In these instances of a local irritation producing serious alterations of nutrition at a distant part, how are these changes effected? Where there is continuity of texture between irritated skin and the part secondarily affected, as in the case of inflammation of the pleura or peritoneum, induced by blistering the chest or abdomen, there may be, either simply an extension of the inflammation through the chest or abdominal walls, or, as Dr. Inman suggests, the irritant itself may permeate and inflame the tissues, and affect the deeper parts in the same manner as the skin. Where there is no textural communication between the irritated skin and the part secondarily affected, the influence must travel through the nervous system.

In what way do local applications act through the nerves? Neuralgia and its ally megraine are generally held to depend on change, functional or organic, of some part of the central nervous system. It is sometimes said that in neuralgia, the local application benumbs or paralyses the nerve, and so prevents the occurrence of those changes in the nerve which produce pain. Others hold that the disease being central, the pain is merely referred to those territories supplied by sentient nerves in connection with the diseased centre. If this view is tenable, then local applications to the extremities of these nerves must produce some change in the central nervous system, and that this view is correct is I think shown in those neuralgias where several nerves are affected,—for instance, where the pain is felt first in some part of the region supplied by the fifth nerve, but on the subsidence of this pain, after a variable pause, but sometimes immediately, pain comes on in the region supplied by another nerve, as the back of the head or neck. In such a case a local application like aconite, veratria, &c.. quickly subdues the pain in the fifth nerve, and prevents the onset of the pain in the back of the head or neck. In megraine, again, a topical application will sometimes arrest the supra-orbital pain and prevent the sickness. Further, the influence of local applications on the central nervous system, is well exemplified in some cases of epilepsy preceded by an aura. Here a local application to the seat whence the aura apparently departs, arrests the threatened epileptic attack. It may be objected that in this case the aura starts from the extremity of the nerve and travelling to the brain excites the paroxysms of epilepsy, and the local application by arresting the aura prevents the exciting cause of the epileptic attack, but I believe that it is now very generally held that the aura itself depends on central changes, and

that the peculiar sensation, as of some impression travelling up to the brain, is in the category of referred sensations. In some cases attacks of epilepsy, neuralgia or megraine are no doubt excited by some local irritation; for instance, a neuralgia depending on a carious tooth or a megraine due to derangement of the stomach, liver or uterus. Of course a topical application capable of allaying this irritation, may either prevent its producing these central changes which excite pain in neuralgia, or pain, sickness, and other disturbances in megraine; or allow the central disturbance to subside. But local applications succeed when applied both in neuralgia and megraine to the painful tract, where this region cannot be considered the exciting cause, where for instance the attack is clearly produced by fatigue or excitement. It is often said that in megraine accompanied by derangement of the stomach or of the bowels or of the liver, it is useless to give medicines to act on these parts, for these disturbances which occur only during the attack are produced by the affection of the central nervous system, but if local applications to the seat of the pain itself will arrest both this pain and the intestinal derangements, there is no reason why remedies which may affect the termination of the other sympathising nerve, namely the pneumogastric should not also modify the change in the nervous centre, and thus control the supra-orbital pain. In fact, I have no doubt that in some cases remedies which correct the gastric, hepatic or intestinal derangement, (see Podophyllin), may considerably curtail the paroxysm. In certain instances therefore, it would appear that local applications affect distant parts by controlling or obviating those central nervous changes on which these affections of the distant organs depend, whilst in other cases the distant effect appears to be a true reflex act as where a local application causes contraction of the bloodvessels of a distant part.

When applied to the surface of the body, cantharides soon excites tingling, smarting, and a sensation of heat; the papillæ of the skin shortly become reddened and raised; next, in a variable time determined by the strength of the application, on these papular elevations minute vesicles form, which gradually enlarge, and by their lateral extension soon coalesce, so that blebs of different sizes are produced. These vesicles and blebs are filled with a fluid rich in albumen, and generally contain some fibrin.

In employing these applications, it is of great importance to recollect that their effects on the body are very different when extensive vesication is produced than when their effects are limited to the production of redness, with the formation of a few small miliary vesicles. Dr. Graves insisted on the

different and even opposite effect of blisters, according to the degree of their action. Their first action is that of a stimulant to the body generally, and to the individual organs in whose neighbourhood they are applied; but if allowed to remain long enough to produce much vesication, and to form large blebs, they depress the bodily powers by acting as depletives in proportion to the amount of serum withdrawn from the vessels, and so lost to the system; a lowering effect often witnessed in weakly people, who are apt to remain depressed for several days through the loss of serum. As the serum of blisters contains almost as much albumen as the blood itself, we might as well bleed the patient to the same amount.

Should it be held desirable to reduce somewhat the strength of the patient, and at the same time to produce a counter-irritant effect on any of the individual organs or tissues of the body, then a blister may be applied, even to vesication; but as the good effects of blistering are for the most part insured by a milder application, such energetic and depressing treatment is seldom called for.

Dr. Graves commonly employed blisters as a general stimulant in certain critical conditions. In acute diseases, as the idiopathic fevers and inflammations, a patient sometimes already much prostrated drifts into a dangerous, apathetic, and unobservant state, which goes on till it reaches even partial insensibility or coma, so that he can be roused only with difficulty, and then wears a stunned, stupid and vacant aspect, and understands very imperfectly what is said to him. With this depressed mental condition the body generally sympathises, its functions becoming more and more languidly performed, till those necessary to life altogether cease. It is a condition which may be compared not inaptly to that produced by opium poisoning, where there is partial coma, which produces a lethargy in the functions of the body, their activity growing less as the coma continues and deepens. But with a patient in the partially comatose state of which we are speaking, there is no true and refreshing sleep; but in

this condition sleep is urgently needed, and an opiate and plenty of stimulants carefully given, often produce a refreshing slumber, out of which the patient wakes strengthened and much improved. (See Opium). If the functions are very languidly performed, then this blistering treatment may well precede the use of opium.

In a precarious condition like this, it is of all things essential to rouse the patient from his lethargic state, for then the functions of the body will act with renewed force, and he will pass from imminent danger to comparative safety. Blisters or mustard poultices of large size should be applied in quick succession for a short time to different parts of the body; for instance, to the chest, the abdomen, and to the thighs and calves. The great value of flying blisters in these circumstances will be the better appreciated if we bear in mind that the critical condition just described generally occurs near the end of an acute illness, when, if the patient can be kept alive for one or two days, the danger of death nearly passes away, acute diseases having a definite duration, so that if the patient can be sustained to this point his life is saved. By rousing the patient, and spurring the flagging vitality, counter-irritants may save an almost hopeless life.

Preparations of cantharides may be applied as stimulants of special parts of the body; for instance, when with a general condition like that just described, there is fear of hypostatic congestion of the lungs, and of pneumonia, in which such congestion often ends; flying blisters applied to the chest, and perhaps, as recommended by Dr. Graves, along the course of the pneumogastric nerves, may brace up the vessels, and avert a serious and often fatal complication. Or we may stimulate the heart, and in intense weakness strengthen its contractions for a short time, by flying blisters or mustard poultices placed over the precordial region, and then maintain the advantage thus temporarily gained by the free administration of alcoholic drinks.

Flying blisters are largely employed in various diseases of the deep-seated organs, as pleurisy, pneumonia, asthma, biliary and renal colic, &c.

Blisters are frequently employed in pneumonia and pleurisy. Yet among members of the profession great divergence of opinion exists as regards not only the stage of the disease in which they are useful, but even as to their utility at all. Some maintain that during the febrile stage of these diseases blisters increase the fever, and this is held to be sufficient reason to forbid their use. If blistering augment the fever, the increase is certainly very slight; for the author has not been able to excite fever by blisters in fever-free persons, nor has he ever seen them increase an already existing fever. The advocates of blistering in pneumonia maintain that it removes the pain, quiets the cough, and lessens the expectoration; but many competent authorities discredit the efficacy of blistering in pneumonia.

Whatever doubt may exist as to the influence of blistering in acute pneumonia and pleurisy, most observers agree that they lessen the pain, and must therefore benefit the patient by removing the restlessness and oppression consequent on pain, and so permitting sleep. But in estimating the effect of blistering, it must be recollected that in these acute affections the severe pain is of short duration, and spontaneously lessens or disappears in about forty-eight hours. It is, perhaps, not superfluous to recaution against too free vesication.

Opinion is more agreed on the usefulness of counter-irritation in pleurisy, after the subsidence of inflammation and fever. If at this stage flying blisters of large size are promptly applied, often repeated, and quickly healed, they further the absorption of the fluid in the pleural cavity, and lessen the risk of the disease remaining indefinitely chronic. The counter-irritant, we have said, should be frequently applied, and the vesication, if it occur, healed at once; for all the good of counter-irritation is effected during the first few hours while it stimulates the skin. The hope sometimes entertained that, by free vesication and the maintenance of the discharge by irritating ointment, the fluid may be, as it were, drained off from the loaded pleura, is altogether fallacious. This barbarous treatment drains from the system

important nutritive material and weakens the patient when strength is most needed. We have already referred to the fact that blisters will redden and even inflame the pleura. Many consider counter-irritation worse than useless when the pleural effusion has lasted a long time. The production of a free discharge of serum is no doubt useless; but, although the chance of improvement in a long-standing case of effusion by any treatment is but slight, yet mild flying blisters will in some cases conduce to the absorption of the fluid. These applications may prove serviceable, if in no other way, by removing the troublesome intercostal pains often accompanying chronic pleurisy; but here a mustard poultice is to be preferred to a blister.

Counter-irritants are often of signal service in removing the oppression of the breathing in asthma, especially of bronchitic asthma, and the shortness of breath accompanying bronchitis with emphysema.

They relieve the pains arising from the passage of renal and biliary calculi.

Counter-irritation is useful in many other diseases, as phthisis, phlebitis, sciatica, facial paralysis, gleet, leucorrhœa, rheumatism, gout, and pleurodynia.

In certain forms of phthisis, counter-irritation proves of the greatest benefit. In the acute and rapid forms of this disease it is of little other service than to remove pain. But when the disease is chronic, when we have to treat what is now called the fibroid lung, when the cough is paroxysmal and violent, or frequent and distressing, preventing in either case rest and sleep, active counter-irritation of the chest corresponding to the seat of the disease often quickly quiets the cough, greatly diminishes the profuse expectoration, and thus obviates a severe drain on the strength. In blistering these weakly patients, vesication must be avoided or the exhaustion produced by the loss of serum may be so great as even to endanger life. Iodine liniment is a better counter-irritant than blisters in phthisis.

In phlebitis of the superficial veins a blister applied over

the course of the inflamed vein reduces the inflammation, hastens absorption or liquefaction of the coagulated blood, and so assists the restoration of the circulation through the obstructed vessel.

Blistering is of the greatest service in neuralgia. A flying blister to the temple or behind the ear generally relieves frontal or facial neuralgia. That obstinate form of facial neuralgia, dependent on a diseased tooth, rebellious to all treatment except the extraction, often yields to blisters; the neuralgic pains ceasing, although the toothache may continue. Blisters relieve the shifting neuralgic pains common in nervous sensitive women, although the pain is apt soon to fix upon another nerve; but flying blisters will drive it from place to place. In this migratory form the pain may alternate between a few, or may affect in succession most of the nerves, producing in addition to pain great cutaneous tenderness, or the nerves supplying the viscera may be affected and without pain produce functional disturbance, as nausea, sickness, diarrhœa, &c. This form of neuralgia, though it is right to say the disease lacks many of the more distinctive characters of neuralgia, is most difficult to cure. The obstinate intercostal neuralgia left by shingles, and occurring mostly in old people, generally yields to blisters. Anstie points out that blisters applied over the seat of pain aggravate the pain; "but, on the other hand if they are applied to a posterior branch of the spinal nerve trunk from which the painful nerve issues, a reflex effect is often produced of the most beneficial character."

Blistering paper, although mild in its action, requiring some hours' application, generally produces enough irritation to relieve facial and frontal neuralgia; but, if the pain continue unabated, a stronger preparation of cantharides should be tried.

Blisters are of the greatest service in sciatica.* They should

* The most obstinate forms of sciatica are sometimes benefited by the insertion of a needle for an inch or more in one or two places along the course of the sciatic nerve. More relief is sometimes obtained by allowing the needles to remain imbedded in the tissues for half an hour or even longer.

be applied every day or second day in the neighbourhood of the sciatic nerve, reaching in severe cases from the buttock to the knee. Free vesication sometimes succeeds where slight vesication has failed. Other counter-irritants, as mustard poultices, croton-oil liniment, iodine paint, are useful in neuralgias; but cantharides is superior to them all.

Blisters behind the ear, and especially to the temple, are very useful in rheumatic, gouty, and simple inflammation of the eye; relieving pain quickly, and subduing inflammation, but less rapidly. As it is important to repeat the application frequently, blistering paper is preferable to stronger preparations. Obstinate forms of tinea tarsi sometimes yield to repeated applications of flying blisters to the temples. Counter-irritation, by blistering fluid or croton-oil liniment behind the ear, often removes earache.

Pain and obstinate vomiting, due to disease of the stomach, are often allayed by counter-irritation at the epigastrium.

Mr. Furneaux Jordan employs counter-irritation to remove enlarged glands. "In enlarged glands, in abscess, carbuncle, boils, erysipelas, the best locality for the counter-irritation is around or adjacent to the disease. Blisters or iodine may be employed." "In enlarged cervical glands a large patch of iodine irritation at the back of the neck, which may be prolonged below the glands, will certainly prove successful in a short time.

Dr. McCall Anderson recommends blistering in erythematous lupus, and in chronic skin affections, especially in eczema of the hands, when the tissues are thickened and cracked, thereby hindering free movement.

Paralysis of the seventh nerve, dependent on alterations in its periphery from draughts or cold, in some cases is quickly removed by painting the skin over the paralysed muscles with blistering fluid. The earlier it is applied, the greater is the probability of good results.

When gleet obstinately resists all the usual methods for its removal, it is sometimes benefited by a blister applied to the perinæum and along the course of the urethra. A blister

applied over the sacrum is sometimes useful in obstinate cases of leucorrhœa, a treatment, however, which cannot be recommended.

In rheumatism, blisters are of the greatest service. Flying blisters, applied in proximity to an inflamed and painful joint, often quickly remove the pain, and with the ease thus brought about sleep often ensues, and a concurrent general improvement in the patient's condition. But blisters have been of old recommended as the sole or chief treatment of acute rheumatism, and some apply them, to the extent of free vesication, with the unfounded hope of removing from the blood the poison on which rheumatism is supposed to depend. This method has the disadvantage of reducing the strength of the patient in proportion to the quantity of serum lost, the depletion tending to prolong the attack, and to retard the convalescence, usually sufficiently tedious after a severe attack of rheumatic fever, which induces more anæmia than most other diseases. The advocates of free vesication assert that this method moderates and shortens the attack, and lessens the danger to the heart; but the author thinks that due regard is not paid to the great influence age exerts on the duration of an attack of rheumatic fever; moreover, the reported cases appear not to have recovered more speedily than frequently happens in persons of the same age, and manifesting the same body temperature, to whom no medicine at all is given.

The nightly application of a flying blister greatly relieves the pain and swelling of chronic and subacute gout, gonorrhœal rheumatism, and chronic synovitis; but if this mild application fail, strong vesication should be tried.

Pleurodynia usually yields to anodyne liniments or mild counter-irritants, but sometimes strong vesication is necessary, although the weakening loss of serum may increase the pain for a day or two.

The active principle of cantharides being soluble in oils it is useful to smear a little simple oil over preparations of cantharides. The oil, moreover, helps to maintain the application in contact with the skin.

It must be borne in mind that blistering paste and blistering paper act slowly, requiring several hours to produce a blister, and that blistering paper rarely produces much vesication. If a speedy and sharp action is necessary, we must employ blistering fluid, which sometimes vesicates in twenty minutes to half an hour.

Applied to the skin, the active principle of the Spanish-fly may become absorbed in sufficient quantity to produce congestion of the kidneys, strangury, and its other characteristic toxic effects; hence, in the treatment of acute or chronic Bright's disease, cantharides should be avoided, as we are unable to regulate the quantity which may be absorbed, and a damaging amount may be taken up by the skin.

We hope it has been made sufficiently plain that, in the great majority of cases, preparations of cantharides should not be applied long enough to cause much vesication. The vesicles should not be opened, but be covered with a layer of soft cotton wool, till the effused serum is absorbed, when a superficial desquamation follows, and no troublesome consequences need be apprehended. If blistering is carried far enough to produce large blebs, the serum will not become absorbed, and the bleb will at last burst; even in this case it is not advisable to open the blister, but to allow the underlying dermis first to heal partially, when no ulceration need be feared. If the bleb is punctured, the air will perhaps irritate the raw surface, producing much inflammation, which may end in an extensive slough, an untoward event, especially apt to follow the blistering of young children or old people, or persons whose health is broken down, as the victims of Bright's disease, etc. Hence it is generally considered advisable in such cases to use other counter-irritants. (*Vide* Mustard).

Preparations of cantharides, taken internally, produce an unpleasant burning taste, and, if in a large quantity, inflammation and vesication of the mouth.

The effect of cantharides in the stomach is in all respects similar to that in the mouth. Even small doses cause smart-

ing in the œsophagus, pharynx, and stomach; but a larger quantity produces inflammation of these parts and of the intestines, with vomiting, and diarrhœa of bloody and slimy stools, much pain and difficulty in swallowing, and often general peritonitis, with which the system sympathises, as indicated by high temperature and quick pulse.

The active principle of cantharides passes from the stomach and intestines into the blood. Its passage, it is true, has not been chemically demonstrated, but the symptoms following the administration of this drug render this certain; for, after a large dose, all the indications of acute inflammation of the kidneys set in, with much irritation or even inflammation of the urinary and generative organs, and after a poisonous dose, headache, loss of sensibility, convulsions, and death.

The changes cantharidine produces in the blood are at present unknown.

The tincture or powder used to be given in chorea and epilepsy; but this treatment has now fallen into complete disuse.

Little is known concerning the separation of the cantharidine from the body. It is conjectured that, from its volatility, some may pass off by the lungs; but, if so, it produces apparently no changes in the mucous membrane of the air-passages in its transit through the lungs. Owing to the same property, it is probable that some of the cantharidine passes off by the skin, and the internal use of preparations of Spanish-fly are recommended by several eminent French dermatologists in psoriasis, eczema, lichen, and prurigo. The chief portion of the active principles of cantharides escapes by the kidneys, and, as we have said, acts as a strong irritant to the urinary and sexual organs.

The preparations of cantharides have been recommended by high authority in certain forms of Bright's disease, but in this disease it has for years past been regarded as a most dangerous drug.

The discrepancy respecting the effects of cantharides arises, perhaps, from the difference in the dose administered by dif-

ferent observers. The author is convinced of its usefulness in acute Bright's disease, when the active inflammation and fever have subsided, as they invariably do about the fifth to the eighth day. A chronic state often follows the subsidence of the more acute stage, and the urine continues small in quantity, contains albumen, and perhaps blood. If, just at this time, that is, on the immediate subsidence of the acute inflammation, a one-minim dose of tincture of cantharides is given every three hours, the blood will almost always quickly disappear, while the albumen decreases more gradually, and the urine becomes more abundant. At a crisis like this it is true that a like amendment not unfrequently takes place without any treatment; but the influence of the cantharides can often be put to a conclusive test. To a patient in the condition described above, passing urine containing albumen and much blood, give minim doses in the way pointed out, and he will begin to improve; now, withhold the medicine and both blood and albumen return in their original quantity, and both may be augmented and lessened again and again by intermitting and reverting to the cantharides; but its influence over the blood is speedier and more decisive than over the albumen of the urine. Sometimes it checks the greater part of the blood but a small quantity remains for some weeks. This is especially the case when the patient gets up, for it is remarkable what influence even a small amount of exercise often exerts on the renal bleeding. Merely sitting up in bed in some cases notably increases the bleeding.

Cantharides, in a similar dose, has been recommended even in the acute stage of Bright's disease; and when the kidney, having undergone fatty degeneration, secretes very little urine.

After its separation by the kidneys, cantharides acts as an irritant to the urinary tract, and may be employed in cystitis, gonorrhœa, and gleet. A drop of the tincture, although five are sometimes required, given three or four times a day, is particularly useful in cases where there is frequent desire

to make water, accompanied by great pain in the region of the prostate gland, and along the urethra, while at other times severe twinges of pain are felt in the same part. The urine may contain a small amount of pus.

Women, especially middle-aged women, often suffer from frequent desire to pass water, or inability to hold it long, sometimes only in the day on moving about. Micturition causes no pain, neither is there any straining, and the urine is natural. Other women cannot help passing a little urine on straining, or sneezing, or coughing; sometimes women are troubled with both sets of symptoms, which appear due to weakness of the sphincter of the bladder. One or two drops of tincture of cantharides three or four times a day, will in many cases afford great relief and sometimes cure with astonishing rapidity, even where the symptoms have lasted months or years.

Tincture of cantharides is useful in the incontinence of urine of the aged, even when due to paralysis, and sometimes in that of children. With children, however, it is inferior to belladonna. Unfortunately, each remedy fails in a not inconsiderable number of cases.

A drop of the tincture, three times a day, will remove chordee in the majority of cases.

Cantharides affects the generative organs. Large quantities of the drug congest and inflame these parts, and often produce erection of the penis, effects generally attributed to the sympathy existing between the genitary and urinary tracts. It certainly excites the sexual appetite and has been often given criminally for this purpose. Full doses of cantharides, twenty to thirty drops of the tincture, or half a grain of the powder with full doses of sesqui-chloride of iron and phosphoric acid, or nux vomica three times daily, is a combination effective in some cases of impotence; in the impotence of old age, and in that resulting from self-abuse or sexual excess, it has proved successful and the patient has begotten children. Cantharides and iron combined are useful in some cases of seminal emissions.

Cantharides has been employed, sometimes successfully, to produce abortion; but the dangers are so great as to deter any medical man from so employing it.

MUSTARD.

Mustard is in common household use as a poultice, as a counter-irritant, or an excitant. Much that has been said of blisters applies to mustard poultices. (See Cantharides). As has been elsewhere stated, cantharides need seldom be applied to produce much vesication, and with regard to mustard, vesication should be carefully avoided, as the sore so produced is intractable, healing slowly, and paining greatly. Although mustard may be used in all cases where we should employ cantharides, short of vesication, still there are differences in their action. A mustard poultice is more painful than a blister, producing a severe burning pain, soon becoming unendurable; and if not speedily removed, it will produce troublesome vesication: therefore a mustard poultice cannot generally be borne for more than twenty minutes or half an hour; and if the skin is delicate, as in children and many women, it cannot be endured for so long a time as this. Owing to the pain it gives, and to its prompter action, a mustard poultice is more effective than a blister when applied to rouse a patient drowsy and comatose from poisoning by opium or alcohol, or in certain conditions occurring in course of fevers. (See Cantharides.)

When a mustard poultice is employed to affect deep-seated diseased organs, as in bronchitis, pleurisy, or pneumonia, its action should be sustained for a long time, over a considerable extent, as the larger the tract of skin attacked, the greater is its influence on the organs beneath. Small mustard poultices are less useful, except when employed to remove a localized pain. The poultice should be of a large size, diluted with

bread or oatmeal, sufficient to cover the front or back of the chest, or both, and should be continued for five, six, or more hours. There is a prevalent idea, perhaps a true one, that the action of cantharides, is more searching and affects more thoroughly the deep parts of the body.

In bronchitis the whole chest of a child should be enveloped in a jacket-poultice, which may be retained in its proper place by the following contrivance:—the poultice is spread on a piece of linen, sufficiently large for the purpose, to which tapes are to be tacked, that they may be tied over each shoulder, and at three places in front of the chest. The poultice must be made with tepid water, for boiling water evaporates the active principle, vinegar destroys it, and alcohol prevents its formation. On removing the poultice, the skin should be sponged with warm water, or, if the smarting is severe, with ether, when the application of a layer of cotton-wool, although for the first few minutes it aggravates the pain, soon subdues it altogether.

A general mustard bath, when appropriately used, often does great good. Although it is almost exclusively used for children, yet is is just as serviceable for adults. It may be employed on the recession of the rash of any of the eruptive fevers, to bring it back to the skin. Again, in severe general bronchitis of children, this form of bath proves of great service as a general counter-irritant. A table-spoonful of mustard should be added to a bath sufficiently large for the child, who should be held in it by the nurse till her arms tingle and smart.

When the catamenia are arrested, a mustard sitz-bath may be used to redden and irritate the skin of the buttocks and thighs, a few days before and during the time the missing discharge is due and intermitted at other times. A course of these baths assists considerably the restoration of the uterine functions.

Added to a hot foot-bath, mustard is used to relieve headache, congestion of the head, and inflammation of the internal organs. A mustard poultice, or the more convenient mustard

leaf, applied to the nape of the neck, is often serviceable in various forms of headache.

It excites in the stomach a sensation of warmth and slight pain, which may be mistaken for hunger, giving rise to the notion that mustard sharpens the appetite and promotes digestion; but it has been proved that mustard does not increase the secretion of gastric juice.

It is somewhat strange that a substance which acts so powerfully on the skin should affect so slightly the mucous membrane of the stomach; for considerable quantities may be swallowed without other effect than the production of nausea and sickness. The mild action of mustard on the mucous membrane cannot be explained by its expulsion by the vomiting it produces; for even when retained, it excites only a little catarrh of the stomach. Mustard is not uncommonly used as an emetic when no other more appropriate is at hand, and when no time is to be lost. Cases of obstinate and even dangerous hiccup are reported, which were immediately cured by drinking an infusion of mustard made with a tea-spoonful of mustard steeped in four ounces of boiling water for twenty minutes and then strained.

Mustard appears to have very little action on the intestines, beyond making the motions moister.

Some of the active principle passes into the blood, but it is unknown what influence sinapine exerts on the organs to which it is conveyed. It is reputed to be diuretic, but this is doubtful; moreover, its advocates fail to discriminate the cases in which it is supposed to be beneficial.

It is said to be useful in whooping-cough.

CAPSICUM.

Capsicum irritates and inflames the skin, producing redness, a sensation of warmth or burning, and even vesication, but its preparations are rarely employed as rubefacients. The tinc-

ture is sometimes lightly painted over unbroken chilblains, but this application is inferior to the ointment or the tincture of iodine. The following capsicum preparation of De Rheims is highly lauded for chilblains :—

"Make a strong tincture of capsicum-pods by steeping them for several days in a warm place, in twice their weight of rectified spirits of wine. Dissolve gum-arabic in water to about the consistency of treacle. Add to this an equal quantity of the tincture, stirring it together with a small brush or a large camel's hair pencil until they are well incorporated. The mixture will be cloudy and opaque. Take sheets of silk or tissue paper, give them with the brush a coat of the mixture ; let them dry, and then give another. Let that dry, and if the surface is shining, there is enough of the peppered gum ; if not, give a third coat. This paper applied in the same way as court-plaster to chilblains that are not broken, and burns that are not blistered, speedily relieves the itching and the pain. It acts like a charm, and effects a rapid cure. The same with discoloured bruises. It likewise allays rheumatic pains in the joints."

My friend, Mr. Henry Buck of Newport, Essex, employs the following application in recent lumbago, neuralgia, toothache, rheumatic pains and acute torticollis. He infuses a large handful of crushed capsicum pods in a pint of hot or cold water for thirty-six hours ; to the affected part he applies a piece of lint soaked in this liquid, covering it with thin gutta-percha. It never vesicates, and indeed a stronger preparation may be used. The effects, he says, are often very striking ; for instance, he cures acute torticollis in ten minutes. A quack doctor in the west of England, who told his secret to Mr. Buck, had long and successfully employed this preparation.

Preparations of capsicum have a burning, tingling taste, and act on the mucous membrane as on the skin. The tincture as a gargle, in the proportion of a drachm to half-a-pint of water, is useful in some sore throats, and may be applied under the same conditions which indicate the use of nitrate of

silver. Thus, in the very early stage of tonsillitis or pharyngitis, each of these substances, which acts as an irritant, will check the inflammation; but when the deep parts become involved, and the tissues much swollen, irritants of any kind do great harm. In malignant sore throats capsicum gargle may be used with advantage to stimulate the tissues into a healthier condition, and here again its action is similar to that of nitrate of silver. In relaxed throats, when the mucous membrane is bathed with a grey mucous or with pus, the same gargle may be employed, although it is probably not superior to the glycerine of tannic acid.

It acts as an irritant in the stomach, and if taken in large quantities will produce gastro-enteritis. It is often used as a condiment to spur digestion, but whether it is effective in this respect is undetermined. The stomach becomes accustomed to capsicum, and at last large quantities must be eaten to produce any effect.

The author can endorse Dr. Lyon's strong recommendation of capsicum in dipsomania. Ten-minim doses of the tincture obviate the morning vomiting, remove the sinking at the pit of the stomach, the intense craving for stimulants, and promote appetite and digestion. It should be taken shortly before meals, or whenever depression and craving for alcohol arises. Capsicum also induces sleep, especially in the early stages of delirium tremens. Dr. Lyon sometimes gives twenty or even thirty grains made into a bolus with honey, and repeats this dose in three hours if the first fails to induce sleep. He says the quantity does not disturb the stomach.

Capsicum is very useful in summer diarrhœas, and in diarrhœas persisting after the expulsion of the exciting irritant. It may be used in flatulence.

IPECACUANHA AND ITS PREPARATIONS.

When applied to the skin, ipecacuanha after some time produces a sensation of warmth, attended with redness, and the formation of papules; sometimes it produces even pustules, which on healing are not followed by pitting or scarring.

It has a bitter, disagreeable taste, and thus excites of flow of saliva.

In some persons the minutest quantity produces peculiar effects on the membrane covering the eyes, and lining the nose and respiratory tract. On smelling the drug, or even entering a room where it is kept, they are affected with swelling of the loose tissues around the eyes, with injection of the conjunctiva, repeated sneezing, abundant discharge from the nose, severe tensive frontal pain of the head, much oppression at the chest, with frequent cough, and the signs and symptoms of bronchitis. Ipecacuanha thus excites symptoms and appearances similar to those met with in hay fever; that is, it excites a catarrhal inflammation in the mucous membranes just described. It is highly probable that ipecacuanha produces similar results in all persons, although generally to a scarcely appreciable extent, and that its action differs only in degree. Indeed, it is probable, as we shall see, that ipecacuanha affects all the mucous membranes of the body.

Small doses produce in the stomach a slight feeling of uneasiness, with increase of mucus. Larger doses excite nausea and a still greater secretion of mucus from the stomach and from the bronchial tubes. Increase of mucus occurs with all nauseating medicines, but probably ipecacuanha excites the secretion of mucus independently of its action as a nauseant and emetic. Large doses are stated to produce in animals inflammation of the mucous membranes of the stomach, intestines, and bronchial tubes.

This remedy is frequently used in catarrh of either the stomach or lungs. It is especially useful when the secretion from the lungs is abundant and tenacious.

In larger doses it produces both nausea and vomiting, and, like all other emetics, some general weakness, with sweating; and if there is any spasm, relaxation of it. Thus in nauseating doses, the drug is both diaphoretic and anti-spasmodic.

It is a mild, tardy, but certain emetic. It produces repeated vomiting, unaccompanied by much nausea or prostration; in these respects, and also in its slighter action on the bowels, it differs from tartar emetic. Its tardy action renders it an unfit emetic in cases of poisoning and the sulphates of zinc or copper are to be preferred.

On account of its slight irritant action on the mucous membrane of the stomach, and perhaps by the strong movements it produces in that organ when it excites vomiting, ipecacuanha is found of use in irritative dyspepsia, both of the acute and chronic kind. It is a favourite plan with some practical authorities to give occasionally in such cases ipecacuanha in emetic doses. It is sometimes given to produce vomiting in children with bronchitis, labouring under great obstruction to the breathing from mucus in the bronchial tubes. The movements of vomiting expel much mucus mechanically, and temporarily improve the breathing. The mildness of its operation fits ipecacuanha for such cases, and as an emetic for delicate persons.

The quantity required to excite vomiting varies greatly in different people. With some the smallest quantity is sufficient, while with others large doses are inoperative. As a rule, children require large doses, and babies only a few months old may need ten or twenty grains of the powder.

Whether ipecacuanha produces vomiting by its action on the stomach, on the nervous centres, or on both, are unsettled questions. When emetina is injected into a vein, or under the skin, it excites vomiting; so does tartar emetic; but this drug can certainly excite vomiting by its influence on some part other than the stomach, as shown by Magendie, who, after removing the stomach of a pig, and substituting a bladder, yet excited vomiting by the injection of tartar emetic

into the veins. In this instance it is observable that the tartar emetic did not excite vomiting by its effects on the stomach, but by its influence on some other part of the body, probably the nervous centres which govern vomiting. Ipecacuanha may possibly act in the same way.

Few remedies are so efficacious in checking some kinds of vomiting as ipecacuanha. The author in numerous instances has witnessed the efficacy of the wine administered in drop doses, every hour or three times a day, according to the urgency of the case in checking the following kinds of sickness:—

1. It will check the vomiting of pregnancy. This vomiting is not always of the same kind. It occurs only in the morning in some cases, and is excited by the first waking movements. In most instances this form will yield to ipecacuanha, taken in the way described. Should it fail, however, relief in many cases follows the administration of the medicine to the patient on waking, and some time before any movement is allowed. In other instances the vomiting occurs not only in the morning, but frequently during the day, recurring whenever food is taken, and may be so severe that no food is retained, while during the intervals of meals there may be constant nausea and great loathing of all kinds of food. Vomiting and nausea of this kind ipecacuanha will in most instances immediately arrest, when the appetite returns, and the stomach will bear almost any kind of food. Ipecacuanha may check the nausea and vomiting, with the exception of the attack recurring on first moving in the morning, when on taking a dose immediately on waking this will also generally cease; but in some cases this early morning vomiting continues in spite of the treatment.

In other instances the early morning vomiting may be absent and the attack may occur only on taking food, increasing in severity as the day advances, and becoming most severe in the evening. Should ipecacuanha, as is sometimes the case, fail to check this kind of sickness, then nux vomica may be substituted and will generally give relief.

In some pregnancies, besides the sickness and nausea, there is much heart-burn, and perhaps great flatulence, symptoms which in many cases yield quickly to ipecacuanha; but here again, should this remedy fail, nux vomica will generally afford relief, but if both remedies are employed the symptoms yield more surely. It is singular that while ipecacuanha will remove, in pregnant patients, even excessive flatulence, co-existing with sickness; yet if the flatulence occurs without sickness, this medicine is generally unavailing, and recourse must be had to nux vomica, charcoal, sulphurous acid, or sulpho-carbolate of soda; and of all these drugs most reliance is to be placed on the sulpho-carbolate, in doses of five to fifteen grains dissolved in water, and administered immediately after a meal.

It has been stated just now that, in some instances, nux vomica succeeds when ipecacuanha fails; and this is notably the case when the tongue is coated with a creamy fur, when the stomach is out of order, and when there is much acidity and heart-burn. In these cases it is often a useful practice to give both nux vomica and ipecacuanha simultaneously.

It must be confessed, however, that in certain instances, at present unexplained, ipecacuanha fails to afford the expected relief. In these, it may be, the vomiting is kept up by a displacement of the uterus, or by a chronic inflammation of this organ, or of its cervix, or os, as was long since pointed out by Dr. Henry Bennett, when the treatment should be directed to the removal of these affections.

2. Some women, who, during pregnancy, were untroubled with nausea and vomiting, yet suffer with both these symptoms during the whole or part of the time of suckling. These symptoms usually begin after the first few weeks of suckling, and continue till the child is weaned, and may be so severe, and produce so much exhaustion, as to compel the mother to wean her child prematurely. The nausea and vomiting may be accompanied by great flatulence. All these symptoms will commonly soon cease on the employment of drop doses of ipecacuanha wine, administered three times a day.

3. Similar troubles to those just pointed out afflict some women at each menstrual epoch, occurring immediately before, during, or directly after the period. These cases will generally yield to ipecacuanha.

4. The morning vomiting of drunkards; but this morbid state can be more effectively controlled by arsenic.

5. The morning vomiting which sometimes accompanies general weakness, and is met with in convalescents from acute diseases.

6. Ipecacuanha will control at once the vomiting in children, with acute catarrh of the stomach. Indeed, this remedy appears to have a greater influence over the vomiting of children than over that of adults.

Arsenic also succeeds admirably in removing the vomiting of acute stomach catarrh; and either remedy may advantageously be given with aconite, to subdue the inflammation, and reduce the fever.

7. Ipecacuanha often removes or lessens the vomiting of whooping-cough, when this is produced by the violence of the cough, although it may in no way lessen its severity. Cases occur of vomiting from this cause which are unaffected by ipecacuanha, but yield immediately to alum. (See Alum.)

8. A species of vomiting occurs after meals, without nausea or pain, or even discomfort, the food being merely rejected, partially, and often very little, digested. This complaint may endure a considerable time, but in many instances is quickly stayed by ipecacuanha wine. Arsenic, however, is a still better remedy.

Ipecacuanha, in the author's experience, proves of little use in the following forms of vomiting:

(a.) In children, where the vomited matters are composed of hard, large lumps of curdled milk. In such a case, if diarrhœa is present, lime-water mixed with the milk is the best remedy, but if the child is constipated, bicarbonate of soda must be substituted for the lime-water; and, should these remedies both fail, recourse must be had to a diet altogether free of milk.

(b) Ipecacuanha is not generally useful in that form of vomiting met with in young children, a few weeks or months old, who, almost immediately after the ingestion reject it with considerable force, either curdled or not, perhaps through both nose and mouth. At the *post-mortem* examination nothing may be discovered to explain this fatal form of vomiting; but sometimes the mucous membrane of the stomach is extremely soft, and looks as if made of water arrowroot. This form of vomiting is best treated by hourly small doses (one-third of a grain) of grey powder, or by calomel (one-tenth of a grain.)

(c) In hysterical vomiting.

Ipecacuanha is sometimes effective in checking the vomiting from cancer of the stomach, and has succeeded sometimes after the more commonly used remedies have entirely failed.

Ipecacuanha excites an increased production of mucus in the mucous coat of the intestines, and becomes in this way slightly purgative, and is reputed to assist the action of other purgative medicines, as jalap. It is also stated that constipation, depending on great torpor of the intestines, may be relieved by taking a grain of powdered ipecacuanha each morning while fasting. The same treatment, it is said, will remove the dyspepsia frequently associated with constipation, and characterised by depression of spirits, some flatulence, coldness of the extremities, and the food lies on the stomach "like a heavy weight."

It is well known that this drug is used in dysentery largely and beneficially. In some epidemics it answers admirably, while in others it appears to fail. Large doses are required, and will often succeed where small ones fail. Sixty to ninety grains of the powder are given at a dose, and repeated if required, oftentimes without the production of either nausea or sickness; but, should these symptoms arise, they may generally be obviated if the patient, after taking the dose, remains quietly on his back. In chronic cases, not requiring prompt treatment, it is a good practice to administer the first dose at night when the patient has gone to bed. Should the

few first doses excite sickness, it soon ceases on the continuance of the medicine.

E. S. Docker, who has had a very large experience of this treatment, extols ipecacuanha. He states that its effects on suitable cases are almost instantaneous; the motions in the very worst cases bccoming natural in frequency and character. Ninety grains of the powder cut short at once very severe attacks of dysentery, not only restraining the discharge off-hand, but freeing the patient from pain immediately, while inducing natural stools without straining or griping. The disposition to relapse, so common in acute dysentery, is not observed after the ipecacuanha treatment; and there is no need for after treatment, nor for any great precautions concerning the quality of the food. After a large dose, as sixty or ninety grains, Docker recommends an interval of ten or twelve hours before repeating it, and should the bowels meanwhile remain quiet, to forego the medicine altogether. It is recommended to give ipecacuanha as an injection especially when it is rejected by the stomach.

The dysenteric diarrhœa of children, whether acute or chronic, will generally yield speedily to hourly drop doses of ipecacuanha wine. The especial indications for this treatment are slimy stools, green or not, with or without blood. Vomiting, if present as is commonly the case, affords an additional reason for the adoption of this treatment, and it will even cease, often after the first or second dose of the medicine, and generally before the diarrhœa is checked. Sometimes it happens that although the ipecacauanha abates the number and the dysenteric character of the evacuations yet other treatment may be required to effect a cure.

The active principle of ipecacuanha, without doubt, enters the blood, and we have next to consider its action on the distant organs of the body.

It produces an increased secretion from the bronchial mucous membrane. Some maintain that this occurs only when ipecacuanha excites nausea, and that the action of the drug is solely due to the production of this physiological state.

As is well known, during nausea an increased secretion takes place from most of the surfaces of the body, and, amongst others, from the mucous tract we are now speaking of. Others consider that it can affect this mucous membrane irrespective of the production of any sensation of sickness; and that this is the correct view, is borne out by the powerful effect of even a minute quantity of this medicine on the bronchial tract of some persons, in whom the same dose fails to produce sickness or even nausea.

In the form of wine, ipecacuanha is of almost constant use in bronchitis, when the expectoration is profuse, and difficult to expel.

The successful use of a secret remedy by a well known practitioner induced the author in conjunction with his friend Mr. William Murrell, to try the effect of inhalations of ipecacuanha spray in those obstinate complaints, Winter Cough, and Bronchial Asthma, and our results have been most satisfactory. Our observations were made during January and February. Whilst undergoing this treatment, the patients took only coloured water and continued their usual mode of living in all respects. First, regarding winter cough, we made observations on twenty-five patients, whose ages varied between 45 and 72, with one exception, that of a woman of 32 years. We purposely chose severe cases. The following is a general description of these cases which will serve in most points to illustrate the condition of the patients: The patient had been troubled with winter cough perhaps for many years. During the summer he is pretty well; but during the cold months, from October to May, he suffers sometimes without any intermission, occasionally getting a little better and then catching cold; or perhaps he may lose his cough for a few weeks but again takes cold on the slightest exposure. So short is the breathing that he can walk only a few yards, especially in the cold air, and finds it very hard work to get upstairs, and is often quite unfitted for active life. The breathing grows worse at night, so that he cannot sleep unless the head is propped up with several

pillows. He is troubled, too, with a paroxysmal dyspnœa, usually at night, which may last several hours, and which compels him to sit up. Sometimes the breathing is difficult only on exertion, and in most cases it is made much worse by fogs, east winds or damp. The expectoration varies greatly. In a few cases there is very little; usually, however, it is rather abundant, often with little or no rhonchus in the chest. It is generally difficult to expel. The cough is very violent, frequent, hacking and paroxysmal, and the fits may last ten to twenty minutes and even excite vomiting. They are generally brought on by exertion; nay, in bad cases, so easily are they provoked, that the patient is afraid to move or even to speak. The cough and expectoration are much worse in the morning on waking. Sometimes the cough is slight and then the expectoration is generally scanty; the distressed breathing being the chief symptom. The patient generally wheezes loudly, especially at night. In a bad case the legs are swoollen. The patient is emphysematous: there is often no rhonchus, or only sonorous and sibilant or a little bubbling rhonchus at both bases.

In this common but obstinate complaint our results have been very striking, although in many of our patients, so bad was the breathing, that on being shown into the out-patients' room, they dropped into a chair, and for a minute or so were unable to speak or only in monosyllables, having no breath for a long sentence. We used the ordinary spray producer with ipecacuanha wine, pure or variously diluted. At the first application it sometimes excites a paroxysm of coughing which generally soon subsides; but should it continue, a weaker solution should be used. The patient soon becomes accustomed to it, and inhales the spray freely into the lungs. At first a patient often inhales less adroitly than he learns to do afterwards, as he is apt to arch his tongue so that it touches the soft palate, and consequently less enters the chest than when the tongue is depressed. The spray may produce dryness or roughness of the throat, with a raw sore sensation beneath the sternum; and sometimes it causes hoarseness,

whilst, on the contrary, some hoarse patients recover their voice with the first inhalation. As they go on with the inhalation they feel it getting lower and lower into the chest, till many say they can feel it as low as the ensiform cartilage.

The dyspnœa is the first symptom relieved. The night after the first application the paroxysmal dyspnœa was often improved, and the patient had a good night's rest, although for months before the sleep was much broken by shortness of breath and coughing. The difficulty of breathing on exertion is also quickly relieved, for often after even the first administration the patient walked home much easier than he came to the hospital; and this improvement is continuous, so that in one or two days, or a week, the patient can walk with very little distress; a marked improvement takes place immediately after each inhalation, and although after some hours the breathing may again grow a little worse, some permanent improvement is gained unless the patient catches a fresh cold. I have heard patients say that in a week's time they could walk two miles with less distress of breathing than they could walk a hundred yards before the spray was employed. In some instances two or three days daily spraying elapse before any noticeable improvement takes place, this comparatively slow effect being sometimes due to awkward inhalation, so that but little ipecacuanha passes into their bronchial tubes. The effect on the cough and expectoration is also very marked, these both greatly decreasing in a few days; though the improvement in these respects is rather slower than in the case of the breathing, sometimes for the first few days the expectoration is rather increased; it speedily alters in character so that it is expelled much more readily, and thus the cough becomes easier, even before the expectoration diminishes. Treated in this way the patient is soon enabled to lie down at night with his head lower, and in a week or ten days, and sometimes earlier, can do with only one pillow. This improvement occurs in spite of fogs, damp, or East winds, nay, even whilst the weather

gets daily worse, and when the patient is exposed to it the chief part of the day. All these patients came daily to the hospital. Of course it is much better to keep the patient in a warm room.

All but one of the twenty-five cases were benefited. In one case the improvement was very gradual, but there was evident temporary improvement after each inhalation. In twenty-one cases, the average number of inhalations required was 9·4, and the average number of days was twelve, before the patients were discharged cured. The greatest number of inhalations in one case was eighteen, and the smallest three. The case longest under treatment required twenty-four days, the shortest four.

In employing the ipecacuanha spray in order to insure as far as possible only its topical effects, we were careful to direct the patient to spit out, and even to rinse out the mouth at each pause in the administration, for a much larger quantity of the wine collects in the mouth than passes into the lungs. If this precaution is not adopted, sometimes enough is swallowed to excite nausea and even vomiting, by which means the bronchial mucus is mechanically expelled, and of course in this way effects temporary improvement. Even when this precaution is observed, a protracted inhalation will excite nausea and sometimes vomiting by the absorption of the wine by the bronchial mucous membrane. Though strange to say when thus induced, vomiting was long delayed, even for several hours, nay, sometimes till the evening, though the inhalation was used in the morning. In our cases, however, the improvement was not due to the nauseating effects of the spray, for we took care to avoid this contingency, by administering a quantity inadequate to produce this result. The duration of each inhalation will depend on the amount of spray produced by each compression of the elastic ball or the susceptibility of the patient to the action of ipecacuanha. As a rule, the patient at first will bear from twenty squeezes of the spray without nausea, and will soon bear much more. After two or three squeezes, especially on

the commencement of the treatment, we must pause awhile. It is necessary to look at the patient's tongue, and tell him to learn to depress it; for if the tongue is much arched, it will hinder the passage of the spray to the lungs. It is a good plan to tell the patient to close his nose with his fingers, and to breathe deeply. The inhalation should be used at first daily, and in bad cases twice or thrice in the day, afterwards every other day suffices, and the interval may be gradually extended. If the ipecacuanha wine is diluted, then the spray must be used a longer time. In cold weather the wine should be warmed.

We have tried the spray with very satisfactory results in a few cases of the following more severe, though closely allied, disease. A patient for several years has suffered from severe "winter cough," with much dyspnœa, cough and expectoration, and on several occasions has spat up a considerable quantity of blood. The physical signs denote slight fibroid consolidation with excavation of both apices with much emphysema, perhaps atrophous in kind. There is little or no rhonchus, and no fever. The expectoration may be slight or very abundant, muco-purulent or purulent. The dyspnœa is perhaps so very severe, and is so paroxysmal as to justify calling the case bronchial asthma with emphysema and fibroid phthisis.

In these cases the ipecacuanha spray is almost as beneficial as in the preceding. It soon controls the dyspnœa, thus enabling the patient to sleep, greatly lessens expectoration and cough, and by these means really improves the general health. As in the previous cases the first inhalation may considerably improve the breathing, the effects of inhalation are not permanent, the dyspnœa returning in the evening, so that spraying is needed night and morning and may be necessary for weeks or months, the ipecacuanha appearing rather to give relief than to permanently cure the dyspnœa.

We have used this spray in two cases of true and severe bronchial asthma, with very opposite results. In one severe case accompanied by a great deal of bronchitis it gave very

great relief. The other patient, not so ill, had been all his life asthmatic, and on catching even a slight cold his breathing became greatly oppressed. In this instance each application of the spray considerably aggravated the dyspnœa even when the wine was diluted with an equal quantity of water. Possibly a still weaker solution might have been borne, but we are inclined to think that in this case any quantity of ipecacuanha would have disagreed as the tightness of breathing increased almost immediately the inhalation was begun. The successful case was a very severe one. For years this woman had suffered from bronchitic asthma, and when she applied to the Hospital was unable to lie down, owing to violent paroxysmal dyspnœa. The worst attack began about 3 A.M. compelling her to start out of bed and struggle for breath. She was very emphysematous, the expiration enormously prolonged. She was very hoarse. The first inhalation removed the hoarseness in a few minutes, and much improved her breathing which continued freer till midnight when the dyspnœa returned. The cough was eased and she expectorated more freely. Each inhalation always gave her very great and marked relief. She walked to the Hospital with great difficulty and was constrained to stop frequently. On entering the room she could not speak but laboured violently, and with loud wheezing to get her breath. A few inhalations would gradually set the breathing free, so that the air entered more and more freely and the wheezing gradually left, till by the completion of the inhalation, she could breathe without difficulty. As the breathing improved she could feel the spray descending lower and lower in her chest. At first it would seem to reach only the back of the tongue, then the top of the sternum, then descend to mid-sternum, and at last she felt as if it reached as low as the pit of the stomach. This improvement was maintained through the day, but at evening a relapse would occur, so that her nights though at first bad, were still decidedly better than before the treatment. Soon, however, the effects became more lasting and she slept well. On discontinuing the spray, however, her breathing again

grew worse, and she was obliged to revert to the treatment, but unfortunately she so easily caught cold, and so bad was the weather that she was obliged to stay away for days together. Whilst her breathing improved, the cough and expectoration likewise improved, but these two symptoms continued rather troublesome. Probably in bad bronchitic asthma, the spray must at first be used twice a day or oftener, and must be continued for some time to ward off the dyspnœa, for in these obstinate chronic cases the bronchitis may take a considerable time to cure. So marked was the benefit from the spray that the patient and her friends expressed their astonishment especially at the prompt relief it gave.

Dr. Hyde Salter strongly recommends ipecacuanha in hay asthma, and in other forms of asthma, employing it to cut short a paroxysm of dyspnœa. He considers that in common with tobacco and antimony, it controls by virtue of its action as a depressant. He prefers it to the other two remedies just named, and gives it in doses large enough to cause depression, but too small to excite vomiting. Like other depressants it must be given at the very beginning of the attack of dyspnœa; for, if this is fully developed, the power of the remedy is considerably lessened. He prefers the powder to the wine, and seldom gives less than twenty grains. This treatment, directed only against each attack of dyspnœa, leaves the complaint in other respects untouched, and more permanent relief must be sought in an appropriate diet, and a climate suited to the patient.*

* Dr. Hyde Salter, in a recent lecture, has drawn particular attention to the influence of diet on pure asthma. As persons prone to asthma suffer from tightness of the breath for some hours after a meal, and the smallest quantity of food greatly aggravates an attack of asthma, therefore the meals must be small, and composed of most digestible food. Asthmatic attacks occur most commonly at night, seeming to be favoured by sleep, an attack being often warded off by the patient keeping awake. The attacks are especially liable to occur after a late meal, therefore an asthmatic should take a light tea, and go without supper; in fact, should take no full meal after two o'clock. Breakfast should be the chief meal. Asthmatics must rise early, to avoid a too prolonged fast. Their food must be plain, well-

Ipecacuanha is useful in many cases of whooping cough. It may lessen the severity and frequency of the paroxysms,

cooked, and nutritious. Milk and eggs form a good diet. Cocoa is better than tea, but milk is better than either. Mutton is superior to beef or lamb, while pork and veal must be prohibited; new boiled potatoes or succulent vegetables may be permitted. Fish is suitable. Cheese, dessert, preserved meats or fruits, must not be eaten, and stimulants of any kind are generally bad. Heavy malt liquors, especially those containing much carbonic acid, are the worst of drinks. The quantity of food should not be large, although food does not produce the paroxysm by its bulk, as the attack generally occurs some hours after a meal, when the stomach is becoming empty. Most asthmatics may eat what they like at breakfast. Dr. Pridham, who has had great success in his treatment of asthma, and who long ago pointed out the importance of a regulated diet, orders for his patients the following regimen.—Breakfast, at eight, half a pint of green tea or coffee, with a little cream, and two ounces of dry stale bread. Dinner, at one, two ounces of fresh beef or mutton, without fat or skin, two ounces of stale dry bread or well-boiled rice. Three hours after dinner, half a pint of weak brandy and water, or toast and water *ad libitum*. Supper, at seven, two ounces of meat and two ounces of dry bread. He prohibits drinking for an hour before dinner or supper, and till three hours after meals. When digestion has improved, he allows his patients three ounces of meat twice a day. The following excellent remarks on the climates suitable for asthmatics are Dr. Salter's.

(*a.*) Residence in one locality will radically and permanently cure asthma resisting all treatment in another locality.

(*b.*) The localities most beneficial to the largest number of cases are large, populous, and smoky cities.

(*c.*) That this effect of locality depends probably on the air.

(*d.*) That the air which would be imagined to be the worst for the general health is, as a rule, the best for asthma; thus the worst parts of cities are the best, and conversely.

(*e.*) This is not always the case, the very reverse being sometimes so.

(*f.*) That there is no end to the apparent caprice of asthma in this respect.

(*l.*) That possibly there is no case of asthma that might not be cured if the right air could be found.

(*m.*) That the disposition is not eradicated, but merely suspended.

In the chapter on nitre I have dwelt on the uncertain action of nitre paper. Patients have told me that a paper which suits one asthmatic, fails in another and vice versa. A considerable recent experience leads me to conclude that these papers would prove much more relieving if somewhat differently prepared, and if pieces were burned sufficiently large to fill the room

and it will often arrest the vomiting they produce. Dr. Phillips and some other observers consider it to be especially useful when the attacks of coughing are accompanied by retching and vomiting. Like other whooping-cough remedies, it fails often in cases apparently in all respects similar to those it benefits, and in certain epidemics it appears to be all but useless.

It is also supposed to be a diaphoretic, and of course excites sweating when it excites nausea; but even without this condition it may be perhaps a diaphoretic.

It has been highly praised for its usefulness in hæmorrhages, as in epistaxis,* bleeding from the lungs or womb, and the flooding after delivery. Some of its advocates give even drachm doses of the powder.

In flooding after delivery, Higginbotham recommends ipecacuanha, in quantity sufficient to produce vomiting, and ascribes to this effect its great efficacy in arresting hæmorrhage; in his hands, this treatment has been successful in the

with fumes. The most efficacious paper is made by dipping ordinary white blotting paper in a boiling saturated solution of nitrate of potash and chlorate of potash. Paper thus prepared burns with a flame. A large piece of this, the size of course depending on the dimension of the room, often succeeds when other prepared papers fail. A piece ten inches square, and sometimes two or three pieces are required. Recently when ordinary papers have failed, I have used in some cases with advantage a pastile compounded of two parts of nitre, one part of chlorate of potash with two parts of lycopodium powder. My friend Mr. William Murrell is using with much success a thick paper soaked in a boiling saturated solution of nitre and chlorate of potash. This thick paper, made by the adhesion of six sheets during crystallization, contains when dry twice its own weight of salt; and a piece of paper six inches square, takes up nearly half an ounce of the mixed salt. Certain cases require a greater quantity of nitre smoke than others. I am convinced that the reason why papers appear in so many cases to fail, is that they are not adequately impregnated with nitre, and are too sparingly consumed.

* Dr. Martin of Geneva, arrests epistaxis (the blood generally coming from one nostril) by compressing the facial artery of the side upon the upper jaw, near the nose. Thus lessening the supply of blood to the nose. Is it possible to arrest flooding by compressing the aorta in the way employed by Dr. Murray in aneurism?

most desperate flooding cases. It may well be doubted, however, whether beyond its emetic effect ipecacuanha exerts any influence over uterine hæmorrhage. Zinc would probably answer equally well. Dr. George Bird tells me that he once witnessed, in the case of a Syrian Jewess, the prompt suppression of flooding by her attendant, who crammed down the patient's throat a handful of her hair. Probably the mechanical excitation of vomiting would prove useful in flooding.

Trousseau recommended ipecacuanha to be taken for some days immediately after childbirth as a useful means to promote the natural functions peculiar to that time.

Ipecacuanha acts most surely as an emetic when given in divided doses at short intervals; as five grains in a little warm water every five or ten minutes.

VERATRUM VIRIDE.
VERATRUM ALBUM.
VERATRIA.

Veratria ointment excites a sensation of warmth and pricking followed by coldness. Unless applied for some time it does not excite inflammation, but then it produces a red itching rash. It is a very valuable remedy for neuralgia, and like aconite has most influence over neuralgia of the fifth nerve. An ointment of the pharmacopœial strength is generally strong enough when applied to the face, but in other neuralgias a stronger ointment is required. Dr. Turnbull, who largely employed veratria ointment, used a preparation containing twenty and sometimes even forty grains to the ounce. These strong ointments not uncommonly prove very useful in sciatica when rubbed along the course of pain for twenty minutes to half an hour twice or three times a day. This strong ointment is sometimes useful in the neuralgic pain

consequent shingles. The susceptibility to its action varies; thus, in some persons numbness and a sensation of coldness is easily produced, and may last several days.

Like aconitia ointment, it is often useful in sick headache, where the pain is accompanied and followed by tenderness of the skin. It should be well rubbed over the seat of pain on the very commencement of the attack. It excites less irritation and sometimes succeeds better than the aconite, often very quickly subduing the pain and preventing the vomiting, and reducing the duration of an attack to one or two hours, or even a few minutes, while previous to the veratria treatment it used to last one, two, or three days.

Dr. Turnbull used a strong ointment to rheumatic joints, and no doubt it relieves some cases, although, unfortunately, it more generally fails.

Turnbull also applied the ointment to the chest of patients suffering from heart disease, with rapid irregular pulse, hurried breathing, much lividity and dropsy, palpitation and inability to lie down—to cases indeed usually benefited by digitalis. The ointment not uncommonly relieved these symptoms, the patients passing a large quantity of urine, even six pints a day. He maintains that it acts differently on the system when absorbed by the skin than when administered by the mouth. He likewise employed a strong ointment to the painful joints at the onset of an attack of gout. Care must be taken, especially with the stronger ointments, not to apply them to the broken skin, or they will excite much pain and inflammation.

When sniffed up the nose the smallest quantity excites violent sneezing, sometimes lasting for hours.

Mr. Bullock, of Philadelphia, describes two alkaloids existing in veratrum viride, called respectively veridia and veratroidia; one soluble, the other insoluble, in ether. According to Horatio Wood they differ greatly in their action on the body. Both depress the pulse and Dr. Wood thinks the functions likewise of the spinal cord. Veridia is but slightly, if at all, a topical irritant, and neither purges nor vomits.

Veratroidia is somewhat irritant, and is an emetic, and sometimes is cathartic. Neither alkaloid affects the brain.

In large doses the veratrum preparations produce nausea and vomiting sometimes severe and prolonged. V. viride is said to act often as a purgative, but this is far from being frequently the case, even after doses large enough to cause great prostration and vomiting. Veratrum album is said to be more purgative than V. viride. These effects occur when the medicine is injected under the skin (Oulmont). In animals poisoned by veratrum no trace existed of inflammation of the intestines.

The active principles of these substances pass readily into the blood, as is sufficiently proved by the symptoms they occasion; dull, heavy, frontal headache, sometimes accompanied by shooting or stabbing pain over one or both brows, in the pit of the stomach, and at the region of the heart. The heart is greatly affected; for the pulse grows slow and weak, and may sink from 70 or 80 to 40 or 35 beats in the minute, becoming at the same time so weak as to be scarcely felt at the wrist. Pushed to the full extent this drug prostrates greatly the muscular strength, to the extent, perhaps of rendering walking impossible, and the muscles may twitch and jerk spasmodically. The surface is bedewed with a clammy sweat, the features are pinched, and there may be complete blindness and deafness, but delirium is rare. Dangerous as these symytoms appear, yet if the drug is discontinued they speedily pass away. Some self-experimenters have experienced dull, aching pains, made worse by movement, and tonic and atonic contractions of the muscles, sometimes violent, especially of the face and extremities. This substance has the same prostrating effect on birds, and in America is sometimes used to destroy these animals; it makes them too weak to fly, and thus they are easily caught; but if left awhile, the effects of the drug pass off, and they escape.

Veratrum has been compared, on the one hand to digitalis; on the other, to aconite. Like digitalis, it is said to strengthen the contractions of the heart, and to weaken them

only when the dose is excessive. The properties of veratrum appear to be more allied to those of aconite.

Kölliker's experiments lead him to conclude that varatria excites the medulla oblongata and spinal cord, producing slight transient tetanic convulsions; that it directly affects the striped muscles, paralysing them, but that probably it does not affect the brain, the sensory, or motor nerves. He further believes that it paralyses the heart by its direct action on that organ, and not through the pneumo-gastric nerve; for after destroying the functions of this nerve by curare, veratria still paralysed the heart.

Dr. Paul Guttman has investigated minutely the physiological action of veratria injected under the skin, or swallowed. A very small quantity soon excites in frogs heightened reflex irritability, powerful muscular contraction being excited by the movements of the animal, or by irritation. The frog soon becomes tetanized, while voluntary movement and muscular contractility on galvanic stimulation become quickly abolished, the brain apparently remaining unaffected. Veratria produces paralysis, likewise, in warm-blooded animals, but tetanus very rarely, these animals dying either from respiratory or cardiac paralysis. The general paralysis of the voluntary muscles is not owing to muscular exhaustion produced by powerful tetanic contractions; for paralysis is produced in warm-blooded animals without tetanus, and in frogs muscular contractility is lost in limbs protected from tetanus by division of their nerves; for on severing the femoral nerve the muscles lose their irritability equally as soon as those of a limb with an unsevered nerve, although, owing to the division of the femoral nerve, no tetanic convulsions in the limb took place. Further, by tying the abdominal aorta to protect the posterior extremities from the influence of the poisoned blood, they became tetanized, but retained their irritability for a considerable time. The paralysis is not owing to any alteration in the trunks of the motor nerves; for, so long as the muscles contract under direct galvanic stimulation, so long do the nerves conduct impressions to the muscles. The loss of motion de-

pends, therefore, either on changes produced in the muscles or in the terminations of the motor nerves. As the motor nerve trunks are unaffected, and nerve poisons spread either centripetally, like curare or conia, or centrifugally, like the cyanides, there being no known instance of a poison affecting solely one end of a nerve, veratria probably affects the muscles, and not the terminations of the motor nerves. The rapid occurrence of rigor mortis and acid reaction of the muscles makes it probable that veratria kills the muscles; for these phenomena do not set in early after nerve-poisoning. Veratria induces rigor as soon as muscular irritability is destroyed. Veratria produces no morphological change in the muscles till rigor mortis sets in.

As veratria affects the frog's heart much less than the other muscles, and, as unlike the effect of most other cardiac poisons, the cessation of the heart's contractions takes place in physiological order, Guttman concludes that it is less markedly a heart-poison than many other poisons.

Veratrum has been said to lower the temperature in health; but according to Dr. Squarey's observations on University College Hospital patients, this is not the case.

Veratrum viride has been employed in the convulsions of children, chorea, typhoid fever, scarlet fever, measles, pneumonia, and pleurisy. In regard to pneumonia and pleurisy, some authorities consider that veratrum is useful only in the sthenic forms, acting then like tartar emetic or aconite; others, however, as confidently recommend this remedy in the asthenic forms. The numerous published cases tend to support the efficacy of this remedy in pneumonia. Out of forty cases published by Dr. Kieman, five died, making a percentage of 12·5; but of these some were in a desperate condition before undergoing treatment, so that the percentage is probably higher than it would have been had the medicine been employed at the beginning of the attack. Dr. Drasche has recorded seventy-three cases, showing the beneficial effect of this remedy. It greatly lessened the pulse, and lowered the temperature from 1° to 3° C., quieted the breath-

ing, changed the character of the expectoration to a light yellow colour and rendered it scantier, and calmed the patients. It did not appear to shorten the acute stage, but seemed even to lengthen it. This observer states, that veratrum retards the resolution of the lung, and sometimes produces vomiting of watery grass-green fluid, and occasionally diarrhœa. On discontinuing the remedy before the decline of the disease, the pulse again immediately rises. The experience of others, though favourable to the veratrum treatment, has not been so successful; indeed, it is obvious how very difficult it is to ascertain whether the effects attributed to it were really due to the veratrum. According to some observers, veratrum reduces the pulse, but often only temporarily, and if its effects are to be maintained, it must be given in increasing doses. Further, while it is admitted that the temperature is reduced, it is not lowered to the extent stated by Drasche, nor is the inflammation checked or shortened.

Typhoid fever, it is said, may be beneficially treated by veratrum.

Oulmont has pointed out that the alkaloid veratria will not produce on the body the effects just described, which must therefore be owing to some other constituent of the plant; hence the tincture, not the alkaloid, should be used.

In the treatment of the foregoing diseases it is better to give small doses, as one or two minims every hour, rather than larger ones at longer intervals. It has been pointed out already, that it is requisite to augment the dose gradually in order to keep the pulse down, otherwise it will sometimes suddenly rise to 120 or 140 beats, which, however, may be reduced again in a few hours by a small increase of the dose.

Veratrum is said to be efficacious in removing the pain of acute rheumatism, and in controlling and shortening the fever. It is also said to be of service in neuralgia, sciatica, and lumbago, and in the "congestive headache" which occurs at the menstrual period.

Veratrum album has been used with success in the vomiting and purging of summer diarrhœa.

COLCHICUM.

While the physiological effects of colchicum are very similar to those of veratrum, yet one cannot be therapeutically substituted for the other.

Strong preparations of colchicum, applied to the skin, irritate, excite redness, pricking, and smarting, and the powder of the colchicum sniffed up the nose excites sneezing and watery discharge from the eyes and nose.

Colchicum is acrid to the taste, produces much irritation of the fauces, and increase of saliva, sometimes in such quantity as might well be termed salivation.

Colchicum is an irritant to the stomach and intestines, and produces its effects, whether swallowed, or injected into the veins.

Small doses, continued for some time, produce a coated tongue and disagreeable taste, impair the appetite, excite more or less thirst, with pain at the epigastrium, rumblings of the stomach, and looseness of the bowels.

Should vomiting occur, the ejected matters are bilious, or composed of mucus, and after a large dose may contain blood. The stools are soft, or even liquid, and of a high colour; but after a large or poisonous quantity they are at first of the character just mentioned, but afterwards become dysenteric, consisting of slime and blood, accompanied with much straining and cutting pains in the belly.

Colchicum is rarely used in diseases of the alimentary canal. It has been employed as a cholagogue, and, it is said, with success in cholera.

Colchicum, it is supposed, is most serviceable in both gout and rheumatism when it purges; but others hold purgation to be not only unnecessary but injurious; and there is no doubt that colchicum will as quickly cure an attack of gout without purging.

Colchicum quickly enters the blood, and in full doses soon excites warmth at the stomach, with a glow and outbreak of

perspiration of the whole surface of the body, throbbing of the vessels, and reduction of the force and frequency of the pulse.

Poisoning by this plant or its preparations produces profound prostration, sometimes pain in the head, pinched features, perspiring, clammy skin, small, weak, or intermittent quick pulse, and not unfrequently strong muscular twitchings, accompanied by pain; indeed, pains have been felt in all the extremities, and Dr. Henderson narrates a case in which most of the joints were painfully affected. Colchicum is said to cause pain in the urinary tract, with smarting on micturition.

After a quantity sufficient to produce the symptoms just detailed, the stomach and intestines are found much congested and inflamed.

It is reputed to be diuretic, and to stimulate, even in healthy persons, the secretion of a large quantity of urinary water and uric acid; but these statements have not been confirmed by the observations either of Böcker or Garrod, which show that if it acts at all on the kidneys, colchicum rather lessens the amount of excreted water, urea, and uric acid.

To Dr. Garrod the profession is indebted for an exact knowledge of the nature of gout. This philosophical observer has shown that in gout there is a retention, with possibly an increased formation, of uric acid in the system. From the urine of gouty patients, very little, or, in some cases, even no uric acid can be obtained, while plenty can be detected in their blood. The urates thus circulating through the tissues are deposited in various parts of the body, and excite active and painful inflammation.

Colchicum, it is well known, gives prompt relief from the pain, inflammation, and fever of gout. But how? Does colchicum cause the elimination of uric acid from the system through the kidneys, and so remove the condition on which the gout immediately depends? Now Dr. Garrod has experimentally shown that colchicum exerts no influence on the elimination of uric acid in gouty people. Colchicum must

therefore control gouty inflammation without in any way affecting the condition on which the gouty inflammation in the first instance depends. Colchicum, therefore, is merely palliative, removing for a time the patient's sufferings, but, as experience abundantly proves, in no way protecting him from their recurrence. For it is on all hands accepted that colchicum is inoperative to prevent a return of the attack; nay, many who suffer from it are of opinion that, while the medicine removes altogether an existing attack, it ensures the speedier return of another. Hence, gout-ridden people commonly advise their fellow-sufferers to abstain from colchicum. But a gouty sufferer is apt to continue gout-engendering habits, and to forget that, as he grows older, his gouty tendency grows stronger.

The effect of colchicum on the gouty inflammation is very rapid; for a large dose of the medicine, say a drachm of the wine, often removes the severest pain in the course of one or two hours, and soon after the swelling and heat subside. Some observations, conducted by Dr. Rickards and the author, show that, while the pain is thus quickly subdued, the temperature of the body falls very little during that day, but on the following morning there is generally a considerable decline, and often a return to the healthy temperature; but, should the fall be postponed a longer time, then on the second day after the use of the colchicum a continuous decline of the temperature takes place, till all fever disappears.

There are two methods of employing colchicum. Some give small doses, others give a drachm of the wine, others even two drachms at a time. The larger dose sometimes produces sickness, diarrhœa, and great temporary weakness, but it extinguishes the pain at once. Small doses give like results only after some days.

Colchicum is sometimes of use in the treatment of various diseases occurring in gouty persons: for instance, bronchitis asthma, chronic urticaria and other eruptions, dyspepsia, etc.

Seeing the rapid effect of colchicum on gouty inflammation, it is singular how little influence this drug manifests on other kinds of inflammations, as pneumonia, erysipelas, or acute rheumatism. Many employ it in acute rheumatism, some giving it in the synovial, others in the fibrous form of rheumatism.

PODOPHYLLUM.

Podophyllum is a powerful purgative, and is generally considered a cholagogue.

Dr. Anstie, who has studied the action of podophyllum on dogs and cats, found that in from two to ten hours after the injection of an alcoholic solution into the peritoneal cavity, and after the effects of the alcohol had ceased, podophyllin excited vomiting and almost incessant diarrhœa. Dr. Anstie does not usually describe the character of the stools; but in one experiment he states that they consisted of glairy mucus, and in two other experiments the stools were highly coloured with what looked like bile. In many of the experiments the stools contained blood. The animals suffered great pain, and soon became exhausted. At the *post-mortem* examination the œsophagus was healthy, but the stomach somewhat congested, induced, as Dr. Anstie suggests, by the violent efforts of vomiting. The small intestines, especially at the lower part of the duodenum, were intensely congested, and in some instances the lower part of the duodenum was extensively ulcerated. The large intestines were but slightly inflamed. Although the injections were poured into the abdominal cavity, the peritoneum itself was not at all inflamed, not even around some unabsorbed granules of podophyllin. The contents of the intestines were liquid. In all the instances in which the effect of the medicine on the heart and respiration is mentioned, respiration ceased before the heart stopped.

From these experiments it is evident that podophyllin has an especial affinity for the small intestines, and chiefly for the duodenum.

The results of these experiments, and the fact that podophyllin produced no apparent change in the liver, led Dr. Anstie to conclude that it is not a cholagogue. The Edinburgh Committee carefully investigated the action of podophyllin on healthy dogs. Their reporter, Dr. Hughes Bennett, states that doses of podophyllin varying from two to eight grains diminished the solid constituents of the bile, whether they produced purgation or not, and that doses which produced purgation lessened both the fluid and solid constituents of the bile.

But, assuming that podophyllin is incapable of increasing the secretion of bile in health, it by no means follows that in this respect it is inoperative in disease. It is quite conceivable that podophyllin and other remedies may remove certain morbid conditions of the liver which arrested the secretion of bile, and so act indirectly but efficaciously as cholagogues; and surely it is far better to promote the secretion of bile by restoring the liver to health, than to give a drug (if such exist) to compel a diseased liver to secrete. In the one case we remove the hindrance to the secretion of the bile; in the other, if it is possible, we compel the secretion in spite of this obstacle. The experience of those who have largely used this drug is strongly in favour of its possessing cholagogue properties; and the author's experience leads him to a like conclusion.

For instance, its effects are very marked on the motions of children with the following symptoms:—During the early months of life, and especially after a previous attack of diarrhœa, obstinate constipation may occur, with very hard motions, crumbling when broken, and of a clay colour, often mottled with green. Sometimes the passage of the hard stools through the sphincter of the rectum occasions great pain, causing the child to scream at each evacuation. At the same time there may be much flatulent distention of the belly,

which excites frequent colic, this, in its turn, making the child cry, often without cessation. This morbid condition of the motions is frequently observed in children of one or two months old, who are fed instead of suckled. The author knows nothing so effectual in bringing back the proper consistence and yellow colour to the motions as podophyllin. A grain of the resin should be dissolved in a drachm of alcohol, and of this solution one or two drops are given to the child on a lump of sugar, twice or three times in the day. The quantity administered must be regulated by the obstinacy of the bowels, which should be kept open once or twice a day. Under this treatment the motions often immediately become natural, the flatulent distention of the belly gives way, and the child quickly improves. The restoration of the colour to the motions is probably owing to the increased secretion of bile by the action of the podophyllin.

That disagreeable cankery taste, unconnected with excess in alcoholic drinks, generally occurring only in the morning, but sometimes continuing in a less degree all day, gives way usually to podophyllin; and, if it fail, mercury generally answers. It is true that this symptom, when due to constipation, is removable by many purgatives, but podophyllin and mercury answer best.

Small doses of podophyllin are highly useful in some forms of chronic diarrhœa. Thus a diarrhœa with high-coloured motions, with cutting pains, is generally relieved by small doses of podophyllin, the bowels becoming regular, and the pain speedily subsiding. This medicine is especially indicated if this form of diarrhœa occur in the early morning, compelling the patient to leave his bed several times, but improving after breakfast or by the middle of the day; or sometimes diarrhœa does not occur after breakfast, but returns early next morning. Indeed podophyllin will generally cure this morning diarrhœa, even if the motions are pale and watery. By means of podophyllin the author has cured chronic diarrhœa of watery, pale, frothy motions, with severe cutting pain, even when the diarrhœa has lasted for

many years. Two or three minims of a solution containing a grain of podophyllin in two drachms of rectified spirit should be given three or four times a day.

Podophyllin is very useful in some forms of sick headache. The nature and the order of the symptoms differ greatly in different cases of sick headache. Some, for instance, are accompanied by constipation, others by diarrhœa, and in each of these kinds the stools may be either too light or too dark in colour. But there are, besides, many other varieties of sick headache. Where the headache is preceded, accompanied, or followed by a dark-coloured bilious diarrhœa, podophyllin generally does good. Two or three minim doses of the solution just mentioned, given three times a day, will restrain the diarrhœa, lighten the colour of the motions and, if the medicine, is persevered with, either prevent the attacks, or considerably prolong the intervals. When the diarrhœa is of a light colour, and the motions evidently contain too little bile, it is considerably benefited by a hundredth part of a grain of bichloride of mercury, given three times a day. Again, when the headache is accompanied by constipation, and the motions are of a dark bilious character, a free podophyllin purge every day or alternate day is very useful. Even in those nervous headaches, occurring either just before, at, or directly after, the menstrual period, if associated with constipation and dark-coloured stools, purgative doses of podophyllin often give relief.

I know that it is now generally held, and on conclusive evidence, that in sick headaches or as they are often termed nervous headaches, megraine, hemicrania, the origin of mischief is situated in some part of the central nervous system, and it is asked therefore:—Of what use is it to give medicine to act on the stomach, liver or intestines?

It is further urged that when sickness, diarrhœa, or constipation accompany or follow the headache, they are the result and not the cause of the attack. Granted that the central nervous system is the seat of the complaint, yet it is excited in various ways in different people, one cause producing an

attack in one person, but failing to excite one in others. Thus a single or several articles of diet will with some surely bring on an attack. In some persons the fit is preceded by diarrhœa, bilious or pale; in others by constipation; again in others it is clearly traceable to uterine derangement. It is true that even in any of these cases certain circumstances common to all will precipitate an attack, as fatigue, over excitement or nervous exhaustion. Yet these patients in many of their attacks experience, almost unfailingly, warning by symptoms due sometimes to the stomach, or the bowels, or the womb. It appears therefore to me that the treatment of this disease must be of three kinds. One treatment should be directed to the removal of the affection of the nervous system; another to the prevention of the exciting cause; and lastly a third treatment to the subdual of an attack, as for instance by means of applications to the seat of pain, and also as I believe by means of medicines which act on the stomach, or liver, or intestines, or womb. (See Counter-irritation.)

Experience certainly leads me to hold firmly that the foregoing directions, with respect to treatment are correct; that where the attacks are preceded by hepatic or intestinal disturbances, podophyllin or mercury are very useful agents, nay, I am inclined to believe that they are serviceable even when the symptoms only accompany the pain, and are probably the result and not the cause of the attack. Although it may be urged that it is folly to treat the effects in order to remove the cause, still, as we have seen in the section treating of counter-irritants, that local applications to the seat of pain appear to control the central nervous disease, there is no reason why remedies which affect the termimations of the other affected nerve, namely, the vagus should not also be able to modify the central affection.

Some American physicians go so far as to say that this drug fulfils all the indications of mercury. In America it is called vegetable mercury.

The injection of podophyllin under the skin has been

recommended. It is readily soluble in equal parts of liquor potassæ and water; and, if the drug is pure, this solution is not precipitated by the addition of water. The injection of this solution to the extent of one-third to one-tenth of a grain quickly purges, sooner, it is said, than when given by the stomach, and it causes no pain.

Podophyllin is a rather uncertain purgative. The pure drug causes very little griping. In too large doses, it is very apt to produce slimy and bloody stools, particularly in children.

STAPHISAGRIA.

This seed, made into an ointment, is employed only as an external application, to destroy the lice which infest the bodies of dirty persons.

Formerly the seeds were ground to a meal, which was mixed with a simple ointment. On account of the large quantity of oil in the seeds the meal was always very coarse, and the ointment thus made was a gritty and uncomfortable application. This inconvenience Squire has remedied. "Finding" he says "that this meal contained a certain amount of oily matter, the author had the oil removed from a small quantity of the meal by percolation with ether, and found that the meal was then capable of being reduced into a fine powder." This powder he tried in several cases of phthiriasis (louse disease), and found it quite inert. He found that the proportion of oil extracted from the meal amounted to as much as one half (by weight) of the meal. On making trial of the oil, suitably diluted with olive oil, he found it as efficient as any remedy he has ever tried against phthiriasis. "A cheap way of preparing the oil for application is to digest the seeds in melted lard, and strain

while hot. The filtrate is an ointment of the seeds of staves-acre. Two drachms of the bruised seeds should be used to an ounce of lard."

ACTÆA RACEMOSA.

This medicine is used much more extensively in America than in England. It has been employed for centuries by the Indians and settlers, for chorea and many uterine diseases, and to assist the uterus to expel the child. Those most experienced in the employment of this drug speak loudly in its praise.

Although not used as a local application to the skin, some assert that given internally it will prevent the pitting of small-pox.

Actæa is said to be useful in simple and malignant sore throat, and in that troublesome, chronic, and obstinate disease in which the mucous membrane of the pharynx is quite dry, and spotted over with inspissated mucus.

This remedy is not, as far as the author knows, used in stomach or intestinal disease.

Absorbed into the blood, it depresses both the force and frequency of the pulse. Some compare it to aconite, and use it for similar purposes. It has been given, it is said, with much success, in influenzas and catarrhs, accompanied with headache, stiffness of the muscles, dull, aching pain in the bones, and a bruised sensation as if the body had been beaten all over.

This plant has been much used in acute rheumatism and it is stated that it quells the pain speedily. It is also extolled for lumbago and sciatica; and it is said to subdue lumbago more effectually than any other remedy.

The author has given this plant a patient trial in lumbago and sciatica, and in those cases of chronic rheumatism where

one part of a tendon, muscle, or articulation in the back or elsewhere, is exquisitely painful on movement, and in cases characterized by great stiffness of the muscles of the back, loins, and hips, but unfortunately with very little if any success.*

In his hands, however, this remedy has yielded very satisfactory results in certain forms of chronic rheumatism; for instance, in rheumatoid arthritis, where the joints are enlarged and much stiffened. It does not, however, suit all alike, but those cases best when the pains are worse at night; and the remedy may be considered especially indicated when the disease is traceable to some previous derangement of the uterus, as sudden suppression of the menses, an abortion, a painful and difficult confinement, or to the disappearance of the catamenia at the natural term. The joints, it may be, are not enlarged, and the pains may flit from joint to joint instead of lodging steadily in one place. Painful cramps of the legs sometimes torment such patients. The symptoms are aggravated by wet and cold weather, and by certain winds. The sleep is much broken by the pains. In these cases, actæa not unfrequently gives considerable relief from pain and cramps, and induces quiet and refreshing sleep, independently of its possible narcotic action. But, while the indications just given are for the most part to be depended upon, it must be confessed that this remedy does sometimes relieve chronic rheumatism and rheumatoid arthritis occurring in men, and is sometimes serviceable in those cases in which the pains are worst during the day.

Again, in a case like the following, actæa is signally beneficial:—A patient is first troubled with pains, apparently rheumatic, in most of the joints, but with scarcely any fever or swelling. The disease soon seats itself in one part, as the wrist and hand; the tissues here become much thickened, the bones of the wrist enlarged, till after a time all movement is lost, and the member becomes useless. Warmth allays the

* My friend Mr. Joseph Bartlett has recently employed this remedy in these cases with considerable success.

pain, and it almost ceases at night. The attack presents many of the characters of gonorrhœal rheumatism, but there is no history of gonorrhœa. The author has witnessed, several times, the almost instant relief given by this drug in cases like that just described, after iodide of potassium and other remedies had been fairly tried in vain, the pain giving way at once, and the joints becoming again supple and useful.

Chorea, it is said, whether rheumatic or otherwise, yields to actæa. The author has put this statement to the test of experience, and has found that actæa fails altogether when there is no history of rheumatism, but apparently succeeds sometimes when the chorea is of rheumatic origin. It is greatly inferior to arsenic in chorea.

According to American therapeutists, this plant operates powerfully on the uterus. Its action on the uterus is said to be very similar to that of ergot. It stimulates the contractions of the parturient uterus, and hastens the expulsion of the child. Ergot produces a continuous contraction of the uterus, while actæa merely strengthens, but does not prolong the contractile movements, and therefore endangers less the life of the child, and the soft structures of the mother.

Actæa is said to be useful in preventing after-pains, and to expel the placenta; but ergot is preferable, as it produces more persistent contractions. Actæa has been recommended in amenorrhœa, dysmenorrhœa, and in menorrhagia. It certainly controls menorrhagia, although it is inferior to other remedies.

Again, when the menses are suddenly checked from cold, shock, or mental emotion, or when, from similar circumstances, the lochia are suppressed, distressing symptoms are apt to occur, as more or less severe pain in the head, in the back, and down the legs, stiff sore muscles, and bearing-down pains. Actæa racemosa it is said will restore the secretions, and remove the accompanying symptoms.

The same remedy has been given to prevent miscarriages in irritable uterus and prolapsus uteri.

Actæa is said to be serviceable in that common and distressing headache occurring in nervous hysterical women, especially at the menstrual period, or when the flow is too frequent and too profuse, or at the change of life.

The pleurodynia dependent on uterine derangements is also enumerated among the many troublesome complaints over which actæa is said to prevail.

Actæa is said by Sir. J. Simpson to be highly beneficial for women who during pregnancy and after confinement occasionally suffer from great mental disturbance, sometimes amounting to madness. (See Bromide of potassium.)

Actæa has been given to relieve the headache arising from over-study or excessive fatigue.

The tincture, made in the proportion of four ounces of the plant to a pint of proof spirit, is the form in which this medicine is generally employed. Five minims may be given every hour, or fifteen to thirty minims three times a day.

ACONITE AND ITS PREPARATIONS.

Perhaps no drug is more valuable than aconite. Its virtues are only beginning to be appreciated, but the author ventures to predict that ere long it will be extensively employed.

Aconite is used externally in the form of liniment or ointment, to relieve pain. In the neuralgias, especially of the brow or face, these applications are often of the greatest use, and relieve the distressing pain either permanently or at all events temporarily. It is decidedly more useful in facial than other forms of neuralgia and yet in facial neuralgia it not seldom fails notably in those severe forms termed epileptiform neuralgia.

With our present knowledge, we are unable to predict, with any certainty, the cases wherein aconite will succeed or fail. This much, however, is clear, that neuralgias depend-

ing on diseased bone, or on tumours pressing on nerves, are beyond the control of aconite; but these are not the only forms of neuralgia which will not yield to aconite. Facial neuralgia due to decayed teeth is often obstinate, yet even these cases frequently yield to the external application of strong aconite preparations. Sometimes a case will require the assiduous application of the aconite preparation during three or four days. In neuralgia, however, due to this cause, aconite sometimes quickly loses its effect and the pain returns with its former frequency and severity.

As no harm can follow the employment of aconite externally, it should always be tried; and if unsuccessful, then recourse can be had to other modes of treatment. If aconite succeed at all, it will generally succeed at once; hence, if relief does not come speedily, it is useless to continue it. The preparation should be sufficiently strong to produce decided numbness and tingling in the skin.

A piece of the ointment, the size of a bean or nut, should be applied with friction, which enhances its efficacy. This quantity should be repeated until it induces a sensation of tingling. The liniment, applied with a brush, may be mixed with one half the quantity of chloroform liniment to assist absorption.

In cases where many branches of the fifth are affected it is often sufficient to apply the aconite over the seat of the most intense pain; and again in cases where other nerves, like the great occipital and auricular nerve, are likewise involved, the application of the aconite only over the branches of the fifth most severely affected will often give complete relief.

Then we meet with cases of which the following may be taken as a type:—A woman suffers from severe neuralgic sick headache, preceded by general malaise and a dark discolouration round the eyes; the pain affects, perhaps, only a small branch of the fifth and not uncommonly that twig situated near the outer canthus of the eye, and when this happens, a neighbouring vein often becomes greatly swollen. The pain lasts with great severity a variable time, extending even

to one, two, or three days, and is accompanied with more or less severe vomiting, the rejected matter being, perhaps, intensely acid. As this pain declines, the patient feels severe shooting pains passing up the back of the neck and head behind the ear, affording a sure indication of the approaching decline of the attack; this secondary pain lasts three or four hours, then ceases, leaving the patient weak from the effects of the attack.

The application of aconite ointment or aconite liniment, at the very beginning of the attack, over the affected branch of the fifth nerve, will cut short the pain, prevent sickness, and the occurrence of the secondary pain in the back of the neck and head. In some cases veratria succeeds better than aconitia ointment.

When the auriculo-temporal nerve is affected, the salivary secretion may be increased, diminished, or altered in character, and the secretion of tears may be modified in the same manner when certain branches of the supra-orbital nerve are affected. The aconite application, by removing pain, will restore these secretions to their natural state.

Aconite is often of great service in sick headache, and is indicated when the attack is accompanied and followed by tenderness of the painful region. The aconite application not unfrequently arrests the pain; moreover, in arresting the pain it prevents the sickness,* thus affording an excellent example of a local application affecting a distant organ.

* Dr. Wilks recommends guarana for sick headaches. He was induced to try it by Mr. Helmken of British Columbia, and Dr. Wood of Montreal. Dr. Wood recommends it where the pain affects the right side of the head. It shortens the attacks and increases the interval between them. A powder should be taken every night, and on the occurrence of an attack every three hours. Guarana consists of the seeds of paullinia sorbilis, growing in Brazil and contains an alkaloid identical with that in tea and coffee.

Galvanism is sometimes useful in an attack of sick headache. Dr. Anstie uses the constant current, and he cautions against the use of more than five or at most ten cells. The author, with the interrupted current, has often succeeded in lessening the pain and removing the "stupid feeling" so often complained of during an attack.

While using these powerful poisonous applications, care should be taken not to rub them into wounds or cracks of the skin, and to avoid contact with absorbent tissues, as mucous membranes and the conjunctiva. Spinal irritation, and intercostal neuralgia, and sciatica, in some instances, yield to aconite ointment; but spinal irritation and intercostal neuralgia yield more readily to belladonna preparations.

Given internally, aconite at first induces a sensation of warmth at the pit of the stomach, sometimes with nausea and vomiting. The sensation of warmth spreads over the body, and tingling of the lips, tongue, and adjoining parts is soon perceived: the uvula, and the tongue feel as if swollen and too large, and deglutition is frequent. A large dose induces tingling and numbness at the tips of the fingers, thence spreading over the whole body, accompanied by diminished sensibility and some muscular weakness, which, if the dose was very large, becomes extreme, and is one of the most prominent and important symptoms of the drug.

The action of aconite on the circulation and respiration is most noteworthy. Moderate doses greatly reduce the number of the heart's beats, even to 40 or 36 in the minute; but after a larger and dangerous dose the pulse beats faster, and may become irregular; even a small quantity of the medicine sometimes excites irregular heart action. Whether increased or lessened in frequency, the pulse always loses strength, showing retardation of the circulation. Dr. Achscharumow and Dr. Fothergill, (see digitalis), show that aconite paralyses the heart of frogs, arresting the contractions in the diastole. The effects on respiration are very similar. Moderate doses render the breathing slower; but a large and poisonous quantity often makes it short and hurried.

During the administration of aconite, cutting pains are often complained of in the joints and other parts of the body. An eruption of itching vesicles sometimes breaks out on the skin. Delirium occurs in some cases, but after fatal doses the mind often remains clear to the last. Blindness, deafness, and loss of speech occurred in some fatal cases. The muscu-

lar weakness produced by this drug is extreme, and frequent faintings occur.

From a rather scanty number of experiments Achscharumow arrives at the following conclusions.

1. Aconite kills through its poisonous action on the cardiac ganglia, thus paralysing the heart; the feeble circulation causing asphyxia.

2. Aconite irritates the medulla and thus the nucleus of the pneumogastric, and so slows the heart.

3. The pneumogastric becomes exhausted and then paralysed when the heart beats quickly and irregularly.

4. It paralyses both the trunk and terminations of the cerebro-spinal motor nerves but leaves the muscles unaffected.

He tied the aorta of frogs, thus protecting the hind extremities from the poisoned blood, and then injected aconitia under the skin of the back. All except the protected parts speedily became paralysed, and the nerves of the upper extremities failed to conduct impression to the muscles, whilst electrical stimulation of the sciatic nerve provoked energetic muscular contraction. The muscles subjected to the influence of the poisoned blood contracted on the direct application of galvanic stimulus, though they failed to respond to irritation of the motor nerves distributed in them.

As irritation of the skin over poisoned parts excited contraction of the ligatured hind limbs he concludes that:

5. The reflex action of the cord and conductivity of the sensory nerves is unaltered.

6. Aconite probably stimulates the sympathetic of the neck.

7. It depresses temperature and lessens blood pressure.

8. It exerts no influence on the brain.

.9 It produces no local action on the pupil.

As aconite diminishes sensibility, it has been used internally in various painful diseases; but for the relief of pain other remedies have for the most part superseded it.

Aconite is to be the most esteemed for its power, little less than marvellous, of controlling inflammation, and subduing the accompanying fever. It will sometimes at once cut short an inflammation. It will not remove the products of inflammation, but by controlling the inflammation it prevents their formation, so saving the tissues from further injury. It is

therefore in the early stage of inflammation that this plant is conspicuously serviceable: still, although the disease may have advanced to some extent, and injured the organs by the formation of new and diseased products, yet while the inflammation is still extending aconite does good. Its beneficial effects are often visibly apparent in pharyngitis, tonsillitis, etc.

Dr. Fothergill has recently advanced some ingenious views regarding the way cardiac depressants, like aconite, reduce fever and inflammation.

First, regarding their influence on the preternatural heat of fever. Dr. Fothergill holds that aconite slows and weakens the heart, hence the circulation becomes less rapid with corresponding decrease in its chemical changes, and with this diminished oxidation there must be of course diminished heat. Aconite likewise increases the flow of blood to the skin, rendering a dry skin moist and perspiring, and so yet more heat is lost by radiation and evaporation.

Now by making a dry skin moist, we must of course abstract a certain amount of heat by evaporation, and to this extent cool the patient, but I think various reasons may be given why the loss of heat produced in this manner plays but an insignificant part in causing that great fall of temperature so often produced by aconite.

1. Whenever aconite promotes perspiration a proportionate reduction of temperature ought to take place in all diseases; but whilst in many cases as in tonsillitis, &c., the fall of temperature is considerable, in other forms of fever though the perspiration may be very free, yet scarcely any, or even no, fall of temperature takes place, for instance, in many cases of erysipelas, pneumonia, pleurisy, and especially in the specific fevers over which, as we shall see, aconite exerts very little control, the fever continuing unchecked by it.

2. We not uncommonly see aconite quickly reduce the temperature without promoting sweating, especially with children in whom this drug in many instances fails to produce perspiration.

3. Sometimes we see cases like the following:—A typhoid or scarlet fever patient, with a hot dry skin, to whom we give aconite, becomes in a few hours freely bathed with perspiration which continues several days, but then in spite of aconite the skin again becomes quite dry. Now in a case like this we find that the temperature undergoes no change, remaining as high during the sweating as it was before giving aconite, and not rising on the cessation of the perspiration.

4. In order to test the influence of perspiration on the temperature of fever, I have three times performed this experiment, in conjunction with Mr. Alfred Gould. We gave to a fever patient with a dry skin, a hot-air bath, with the exception of her head and face. When very free perspiration

came on, the bath was removed and the patient covered lightly with clothes, in this state the perspiration continued some hours afterwards. Whilst in the bath the temperature did not increase, nor did it fall at all after the bath, notwithstanding the free perspiration and light clothing. If it be objected that the clothing prevented evaporation and the consequent reduction of temperature, we may reply that these are the same conditions under which aconite in so many instances causes such a marked falling of temperature.

Fothergill attributes the effect of aconite and other cardiac depressants on inflammation to their influence on the vascular system. It has been shown that the vascular system is always in a state of semi-contraction, and that by paralysing the vaso-motor nerves, it is possible to double its capacity.

Aconite dilates the arterioles and greatly increases the capacity of the vascular system, and by this means drains blood away from the inflamed organ, in fact this drug "bleeds the patient into his own vessels." As the vessels leading to an inflamed organ are already paralysed, aconite does not augment the supply of blood to it. Were this view correct a remedy should produce the same effect on all inflammations, but we know that whilst colchicum promptly subdues gouty inflammation, it possesses very little influence on other inflammations, as pneumonia. Again, many observers believe that aconite exerts an especial action in tonsillitis. The inflamed tissues it may be urged, are here of small extent, so that the depletion will consequently be much more effectual than when a larger tract of tissue is involved.

The results of aconite are most apparent when the inflammation is not extensive, or not very severe, as in the catarrh of children, in tonsillitis, or in acute sore throat. In these comparatively mild diseases, especially if the aconite is given at the earliest stage, when the chill is still on the patient, the skin, dry, hot, and burning, becomes in a few hours comfortably moist; and, in a little time longer, is bathed in a profuse perspiration, often to such an extent that drops of sweat run down the face and chest. With the sweating comes speedy relief from many of the distressing sensations, as restlessness, chilliness, heat and dryness of the skin, aching pains and stiffness; and at the same time the quickened pulse becomes much reduced in frequency, and in a period varying from twenty-four to forty-eight hours both pulse and temperature reach their natural state. A quinsy or sore throat, if caught at the commencement, rarely fails to succumb in twenty-four to forty-eight hours. After the decline of the fever the sweat-

ing may continue for a few days on slight provocation. The appearance of the inflamed part exhibits soon, in a striking manner, the beneficial effects of the drug, if administered early enough. Thus large, livid, red, glazed, and dry tonsils, will in twenty-four hours present that appearance which indicates the subsidence of the acute stage of inflammation evidenced by the disappearance of the swelling and most of the redness, whilst the mucous membrane becomes moist, and bathed with mucus or pus. If just at this stage we apply some strong astringent, as glycerine of tannin or nitrate of silver, it will remove most of the remaining diseased appearance, and the pain, if still present. To those who may not have tried it, these visible effects of aconite on inflamed tonsils, etc., may seem exaggerations, but they may be witnessed by any one who will employ the aconite in the way we are about to point out.

Its effects on catarrhal croup, or as it is sometimes termed spasmodic laryngitis, are just as conspicuous. It removes the urgent dyspnœa in a few hours, and in a short time longer subdues the fever, so that an attack usually lasting three or four days is almost extinguished in a few hours. It apparently checks spasms and croupous breathing, when there is little or no fever, and in those rarer cases where these symptoms continue after the subsidence of the fever. Aconite is equally serviceable in severe colds, with much chilliness, great aching of the limbs, a hot, dry skin, and quick pulse.

In pneumonia, pleurisy, and the graver inflammations, the effects of this valuable drug, though not so rapid, are equally manifest.

In pericarditis, accompanied with violent throbbing and extreme pain, aconite will speedily quiet the undue action, and so relieve the pain.

Most observers ascribe its influence on inflammation to its power over the heart; and, as they truly point out, the remedy is of most use in the sthenic forms of disease; and where there is great weakness, and the heart beats feebly, unless care is taken, it may do harm.

It appears to me that in fevers we can considerably reduce the frequency of the pulse without lessening the rapidity of the circulation. A moderate dose of aconite, whilst it makes the pulse less frequent, renders it fuller, stronger, and less compressible. This indeed we should expect, for if the heart does the same amount of work after it beats slower, each individual beat must do much more work, and that if we reduce the pulse from 120 to 60, the heart must do twice as much work after it has been slowed by aconite. It may be said that though each beat is stronger, yet the heart is doing less work than when it was beating quicker. As tending to support the view that aconite weakens the heart's contractions, it must be admitted that sometimes, even small doses after a time make the pulse unsteady and even irregular.

I would venture tentatively to suggest whether the slowing effect of aconite may not be useful by increasing the heart's period of rest and nutrition. The diastole of the heart occupies nineteen out of twenty-four hours, and is the period for rest and nutrition. When the heart is made to beat quicker the acceleration takes place at the expense of the diastole, thus shortening the time for rest and nutrition. By slowing the heart aconite prolongs the diastole, and thus increases the time for the heart's nutrition and sleep.

The method of employing the drug has much to do with its efficacy. It should be given, as already stated, at the very beginning of the disease; the medicine should never be delayed; every hour is of importance. Half a drop or a drop of the tincture, in a teaspoonful of water, should be given every ten minutes or quarter of an hour for two hours, and afterwards hourly; and if there is much prostration, with feeble and weak pulse, a still smaller dose.

We feel constrained to point out here the signal service rendered by the thermometer in enabling us to decide whether or not aconite should be given. Indeed, in the treatment of inflammations, the thermometer and aconite should go hand-in-hand. If the symptoms and physical signs are not sufficiently developed to decide whether an acute inflammation of some deep-seated part has set in or not, this instrument will often decide the doubt. No acute inflammation can exist without preternatural heat of the body. Hence if, in a doubtful case, the temperature, after careful investigation, is found natural, the case is not one for aconite; while, on the other hand, if the other symptoms doubtfully indicate an in-

flammation, a rise in the thermometer will add considerably to the probability of an inflammation, and will indicate the advisability of employing aconite. Sometimes the throat is swollen, very red, and presents the appearance of an ordinary sore throat, accompanied by fever, but fever is absent. Without the thermometer these two kinds of inflamed throat cannot be discriminated with certainty. The non-febrile form is affected very little, if at all, by aconite. A want of discrimination between the two forms has often led, no doubt, to the mistaken use of aconite, so bringing discredit on this valuable drug.

Again, the use of the thermometer after scarlet fever is very important; for, as is well known, acute inflammation of the kidneys is then liable to occur, the first onset of which would at once be indicated by a rise in the body temperature. It is well, therefore, during the convalescent stage, to direct the nurse to take the temperature night and morning; and if this should rise beyond the healthy standard, she should at once give aconite, so as not to allow some hours to elapse before the patient can be visited by the medical attendant. The fever, it is true, may depend on some other cause than inflammation of the kidneys; but even then it will probably be inflammatory in character, arising from gastric catarrh, over-feeding, and the like, and in any case aconite is indicated.

It is doubtful whether aconite will shorten the fever of acute specific diseases, as scarlet fever, measles, etc., but it has a beneficial influence in these diseases, soothing the nervous system, and favouring sleep, by inducing free perspiration. Whether this remedy can lessen the severity of the fever, or diminish the duration of the acute specific diseases, is doubtful; but there is no doubt it can control and subdue the inflammatory affections which often accompany them, and which by their severity may endanger life. Thus aconite will moderate, but neither prevent nor shorten, the course of the inflammation of the throat in scarlet fever, and the catarrh and bronchitis in measles, and in this indirect manner lessen the height of the fever.

In certain epidemics of febrile inflammatory sore throat, aconite proves useless. These cases are met with chiefly during the prevalence of scarlet fever. The throat is much swollen, and of a very dusky red colour; the pulse very frequent and very weak. There is great prostration, and the symptoms are of a marked typhoid character. Here stimulants, with the application of a strong solution of nitrate of silver, do most good.

The thermometer, again, renders notable service whilst treating with aconite the acute specific fevers and the sore throats just described. Under the influence of this drug, the skin becomes moist and the pulse falls perhaps to its normal state, and we might conclude that the temperature likewise had become natural, but that the thermometer shows that it remains unaltered.

Aconite is of marked service in erysipelas. Administered at the commencement, it often at once cuts short the attack; and even when the disease continues in spite of it, aconite will reduce the swelling and hardness, lessen the redness, and prevent the inflammation from spreading.

In children, after vaccination, perhaps when the spots have nearly healed, an erysipelatous redness occasionally appears, spreading over the arm and a great part of the trunk, usually ceasing in one part, and then successively attacking contiguous parts, and leaving a yellow discoloration and desquamation. The redness is often intense, the tissues being very hard, painful, and shiny. This inflammation may continue for weeks. It may run down the arm, involve the hand, and implicate the greater part of the chest; or it may appear in the leg, and gradually spread to the foot; or, again, it may spread from the hand up the arm, and once more down to the hand, and this may be repeated many times. Sometimes the inflammation terminates in small abscesses. In cases like these, aconite generally at once arrests the inflammation; and even when it persists, the redness is rendered less intense, and the swelling less hard and painful. The troublesome inflammation often arising after vaccination of adults gener-

ally yield, to aconite, especially if supplemented by the local application, twice daily, of belladonna ointment.

In the treatment both of simple inflammations and acute specific diseases, aconite may be appropriately administered in conjunction with any other remedy which may be indicated.

Aconite has been much praised by eminent authorities in the treatment of acute rheumatism, and there can be no doubt of its usefulness; still its good effects are not so apparent as in acute inflammation. Acute rheumatism having no regular course or duration, may last untreated only a few days, or endure for many months. It is difficult therefore, to decide whether, in certain cases, the speedy decline of the fever is a natural decline, or due to the aconite. It is certainly ineffectual in many cases, which appear to run their course uninfluenced by this drug; so that it is still required to determine in what class of cases it is useful, and in what class of cases it is useless. It often appears to be of service, however, in subduing the pain from inflamed and swollen joints.

Gouty pains are said to yield to this remedy, and in many instances it has been given in neuralgia, apparently with good results.

It has been elsewhere shown that aconite lessens the rapidity of the circulation. It may therefore be used in all cases where it is needful to subdue vascular excitement; in fact, it may be given in precisely those cases which were formerly treated by bleeding.

When the menses are suddenly checked, as from cold, this remedy will often restore the flux, and thus obviate the distressing and peculiar train of symptoms produced by arrested menstruation.

Dr. Bayes recommends aconite in otitis and states that it quickly relieves the pain.

Small doses of aconite, administered frequently, will often quickly check the bleeding at the nose of children and of plethoric people.

The "fluttering at the heart" of nervous persons, and also

nervous palpitations, generally yield to this remedy. More general treatment is usually required; but when the conditions causing the disturbance are undetectible or irremovable, then aconite may be usefully employed.

The acute stage of gonorrhœa may be satisfactorily treated by a drop of tincture of aconite each hour; and it is even said to remove chordee.

DIGITALIS AND ITS PREPARATIONS.

Large doses of this drug excite nausea, vomiting and diarrhœa; the matters voided either from the stomach or bowels, being of a grass-green colour, due to the action of the gastric juice on some constituent of the digitalis. These symptoms and appearances may follow even a medicinal dose.

The digitaline passes unchanged, readily, from the intestines into the blood; for the same phenomena ensue whether the alkaloid is injected into the veins, or is swallowed.

The action of digitalis on the heart is the most noteworthy, and our knowledge of its influence on this organ, either healthy or diseased, is becoming daily more exact.

Drs. Fagge and Stephenson have published some interesting and important investigations concerning the influence of digitalis on the frog.

"Its effect on the frog is the production of irregularity of the heart's action, followed by complete stoppage of the pulsations, the ventricle remaining rigidly contracted and perfectly pale after it has ceased to beat, the muscular power of the animal at the time being unimpaired, and persisting as long as in frogs in which the circulation has been stopped by other means, such as ligature of the heart. The irregularity of the heart's action, which precedes its stoppage under the influence of the poison is peculiar. The rhythm is but little altered, and the beats are not necessarily diminished in num-

ber, as has been supposed. Sometimes, however, the ventricle makes only one pulsation for two of the auricles, the number of its contractions being therefore lessened by one half." "More frequently the irregularity consists in one or more portions of the ventricle (especially the apex) becoming rigid, white, and contracted, while the remainder of the organ continues to dilate regularly. When the yielding portions are small, a peculiar appearance, as if the wall of the ventricle formed crimson pouches or protrusions, is produced."*

In these experiments the digitalis certainly did not weaken but strengthened the heart's contractions and at last tetanized this organ; at the same time the contractions were rendered peculiar and irregular.

Dr. Fothergill finds, "that first the contractions became somewhat quicker and more complete; then the distension became less complete, especially at the apex, which remained white, and firmly contracted. Here and there were little sections apparently belonging each to a separate cardiac ganglion which did not seem affected, and in the general contraction pouched out, contrasting in colour with the contracted and whiter portions."

Two other experimenters, Eulenberg and Ehrenhaus, have ascertained the influence of solutions of digitaline, applied directly to the frog's heart after its separation from the body, in order to learn if the effects of digitalis are due to its action on the pneumogastric nerve. The still pulsating heart, when partly submerged in a solution of digitaline, composed of one-fourth of a grain of the alkaloid to the ounce of water, had its contractions increased in force, but every now and then a pause occurred in its beatings.

With a still weaker solution (gr. i. to ℥ viii.) the same phenomena were observed. The pulsations grew fewer and fewer, while the duration of each contraction was proportionately lengthened. The heart continued to pulsate two hours and a half.

* These authorities point out that "upas antiar, helleborus viridis, and perhaps other species of helleborus, the Tanghinia venenifera, the dajaksch, the carroval, and scilla maritima influence the heart in the same way."

From these investigations it appears that digitaline strengthens the contractions of the heart, and prolongs the systole, while it does not at all shorten the time the heart usually continues to contract after its removal from the body.

Dr. Nunneley has made numerous observations on the action of digitaline on frogs. The following, in his own words, is a summary of what he has observed.—

"The physiological action of digitaline on the heart of the frog would appear to be widely different from its therapeutical action on the dilated and weakened human heart in disease. In the former case the heart is thrown into violent and disorderly contractions, which quickly end in a cessation of movement.

In the latter, clinical examination of the heart and pulse appear to show an increase of contractile power, and a restoration of its regular performance.

"1. The first visible effects on the heart occur a short time after the injection of a moderate dose under the skin of the frog, and consist in a diminished range of the heart's movements, whilst the organ itself appears somewhat shrunken. The most marked alteration, however, is a certain embarrassment and want of smoothness in the contractions, as if the separate muscular fibres acted with undue energy, but in an irregular manner, or as if there was a want of co-ordination in the contractions of the individual fibres.

"2. The heart does not contract with greater frequency after a dose of digitaline, and no change at all occurs in this respect until its action becomes embarrassed, when the frequency of pulsation is diminished, and does not again increase.

"3. The ventricular systole is lengthened, but it presents a very different appearance to the systole in health. The ventricle seems no longer to act as a single large muscle, but as if made up of numerous small ones, which contract energetically but in an irregular and disorderly way; hence there are projected bundles of contracted muscular fibres which give the ventricle a rough and uneven surface and an irregular out-

line. During the diastole the ventricle does not everywhere assume a red colour, but one or more red spots appear, as if the ventricle were so tightly compressed that only a small quantity of blood could enter it by chance. Sometimes a red spot is elevated a little above the general surface, forming a kind of pouch. These spots become smaller and smaller, until at last the ventricle is left very pale, strongly contracted, and motionless, while the auricles are distended with blood.

"4. The rhythm of the contraction of the three cavities is generally little interfered with. Two contractions of the auricles sometimes occur to one of the ventricles, but often there are also two ventricular contractions, one of them being very slight and transient.

"Sometimes, after the injection of a dose under the skin, the frog has paroxysms of gasping movements, in which it remains perfectly still, leaning on its fore-paws which are widely separated, and holding its head up, and opening its mouth widely. Whilst in this state, which lasts from about half a minute to a minute and a half, or more, the frog scarcely notices irritation of its skin, or shaking of the dish containing it, and the mucous membrane of the tongue and mouth are seen to be extremely pallid in consequence of the small quantity of blood sent from the heart. When the paroxysm has passed off, the frog jumps about with energy. It is worthy of remark that whilst the embarrassment to the action of the heart is continuous, the gasping movements are paroxysmal, as in human beings where the cardiac dyspnœa occurs in fits, whilst the condition of the heart remains constant. The posture and appearance of the frog are chiefly noticeable, however, from the vivid picture they present of extreme and urgent dyspnœa."

It thus appears that in the main all these experimenters agree as to the action of digitalis on the frog's heart.

Messrs. Bouley and Reynal in giving large doses to horses found the circulation became more rapid, the heart beats more abrupt, their energy much increased and accompanied

after a certain time with a vibratory thrill, with a decided metallic tinkling; and as poisoning went on a distinct bellows' murmur was heard, becoming more audible on exertion; the heart-beats then show a decided intermittence and the pulse is small, thready and intermittent.

In doses less rapidly fatal there is at first slight excitement of the heart, with a little quickening of its beats. Soon they grow less frequent and fall to 25 or 20 a minute. The cardiac sounds are more clearly heard, more distinct from each than normally, and with a different rhythm, there being occasional intermissions occurring regularly, or irregularly, and after a time a vibratory thrill is detected, followed by a bellows' murmur. As death approaches the beats become rapid, 90, 100 or 141. Dr. Brunton who has heard the blowing murmur several times, says, it occurs in horses, dogs and the human subject, and that it is probably due to mitral or tricuspid regurgitation from irregular contraction of the columnæ carneæ.

Dr. Fothergill found that when introduced into the circulation, digitalis contracted the heart of minnows till no cavity could be seen, the heart being hard and glistening like gristle; the auricle was distended and could not drive the blood into the firmly contracted ventricle; hence the blood regurgitated into the venous sinus behind, which on being pricked, the auricle drove out the blood and became firmly contracted showing that in these animals at least this agent affects the auricle in the same way as the ventricle. Dr. Fothergill likewise found that digitalis given to sparrows contracted the left ventricle, the right side of the heart being very distended and the lungs congested; showing that this drug affects either exclusively the left side or affects it earlier and more powerfully than the right side, otherwise the right cavities should become as contracted as the left.

Dr. Fothergill records likewise the following curious and important observations, showing the opposite action of digitalis to aconite on the heart under certain circumstances. On poisoning a frog with aconite, the ventricle became gra-

dually more and more distended, its contractions slower and more feeble, until each contraction drove only a small quantity of blood off the top of the distended ventricle, and at last the greatly distended heart ceased to beat; at this crisis he administered digitalis, and soon contractions at long intervals imperfectly took place, the gaps becoming shorter and shorter and the contractions more and more complete till the heart beat naturally. Then on poisoning a frog with digitalis he found that aconite acted but little on the heart and was incapable of dilating it.

Many modern writers as Handfield Jones, Fuller, Winogradoff, Traube, Brunton, Balthazar Foster, in opposition to the views formerly held, consider that digitalis strengthens the heart's contraction; for it strengthens a feeble dilated heart, and as we have seen the ventricles are found strongly contracted in frogs, minnows, sparrows, and occasionally in mammalia. In addition to this effect it produces irregular and disorderly action in frogs; different parts of the ventricle appearing to act without any relation to each other, and a similar disorderly action probably occurs in the hearts of other animals.

Sometimes after a large dose the pulse, as we shall see, becomes very frequent and feeble, but this does not show that the heart itself is weak, for at this very time the heart may be beating strongly. The weak pulse is due to dilatation of the arterioles whereby the blood passes quickly and easily from the arteries into the veins. Traube and Brunton, however, evidently regard digitalis as a heart-tonic only when given in moderate doses, for as will be shown presently, they consider that large doses paralyse the nervous ganglia of the heart.

Boehm's experiments tend to comfirm the view that digitalis strengthens the heart's action. The isolated heart of a frog was made to pump serum through a glass tube; then on applying digitalis, the heart acted with greater force, but larger doses diminished its power. Finally the heart stopped with every drop of serum squeezed out of the ventricles.

Each individual beat of the heart was greatly increased in strength, in some instances nearly doubled. The loss of power after large doses appeared to be due partly to the great slowing of the heart, partly to the incompleteness of the diastole, and the consequent imperfect filling of the ventricles.

Blake, Brunton, Foster, and others find that digitalis increases arterial tension, sometimes considerably. Digitalis injected into a vein causes the tension to reach its maximum in four to ten minutes. This heightened blood-pressure Brunton attributes chiefly to contraction of the arterioles. Dr. Boehm finds as Traube has stated, that after section of the cervical spinal cord destroying communication between the arterioles and the vaso-motor centre, digitalis causes no rise in arterial pressure. Dr. Fothergill has seen the arterioles in the web of the frog's foot contract on the local application of digitalis; on the other hand, Dr. Nunneley carefully investigated this subject, and concludes that digitalis locally applied to the web of the frog's foot, produces no effect whatever in the calibre of the small arteries, nor any alteration in their size when it is injected under the skin, until the irregular and more or less persistent contractions of the ventricle diminish the blood stream to which the arteries then to some extent adapt themselves. Dr. Boehm, too, has often examined the small arteries of the frogs mesentery, studying for hours the action of digitalis upon them, but has never found them affected by it. Dr. Brunton having reinvestigated this question, with the aid of Traube's modification of Ludwig's kymographion, holds to his original conclusion, that digitalis causes contraction of the arterioles. For example, he paralysed a dog with morphia, and inserted a canula into the crural artery, and then compared the curves indicating the blood-pressure before and after the injection of digitalis. After the injection the pulse grew slower, and an increase in the mean blood-pressure occurred, while the height of the wave due to each cardiac pulsation remained much the same; and the blood-pressure continued to rise, although the pulse grew

slower and slower, and the oscillations of the mercurial column at each pulsation diminished in extent. This increase of blood-pressure may be due either to the heart propelling at each pulsation a great quantity of blood into the aorta, or to the contraction of the arterioles, lessening the facility of the blood-flow from the arteries, through the capillaries, to the veins.

A study of the form of the pulse wave proves that the increased pressure is due to contraction of the arterioles, since a much longer time was occupied in the descent of the pulse wave after digitalis, showing that the blood passed more slowly out of the arteries into the veins. With heightened blood-pressure, the arterioles remaining unchanged, the blood would pass quicker into the veins, and consequently the descending line of the pulse wave should occupy a shorter instead of a longer time.

A poisonous dose of digitalis after a time paralyses the arterioles, which therefore dilate, and the arterial tension falls.

According to Saunders, Jörg, Hutchinson, and others, digitalis, in moderate doses in the first instance, quickens the pulse. Other observers, however, deny this effect. But all agree that moderate doses render the pulse less frequent, and that if the drug is pushed the pulse becomes irregular, very frequent, and feeble; feeble, according to Brunton, owing to the paralyses of the arterioles, whence the blood passes more readily from the arteries into the veins; and quick and irregular as Traube apparently believes, owing to the previously stimulated vagi becoming paralysed.

Various and often opposing explanations have been advanced regarding the way digitalis affects the heart.

The following seem to be the phenomena requiring consideration:

1. Increased contraction, ending in tetanic contraction of the ventricles, as evidenced in the case of frogs and many other animals.

2. The slowing of the heart's action in man and the higher

animals, followed, after large doses, by very frequent and feeble pulse.

3. Irregular action of the heart.

4. Increased arterial tension.

It has been proved that moderate stimulation of the vagus slows the heart, but if the vagi are divided, it beats quickly, and tumultuously, and irregularly. We have just seen that in the higher animals, digitalis at first slows the heart, but that poisonous doses make the heart beat very quickly and irregularly. These facts induced Traube to conclude that digitalis at first stimulates, but afterwards paralyses the vagi; thus, he found a moderate dose injected into the veins of dogs, greatly reduced the frequency of the pulse, but a larger dose increased it in one case from 32 to 160 beats, and in another case from 33 to 202 beats. Seven further observations he made to learn if this effect were really exerted through the vagus. After slowing the pulse by digitalis, he cut the vagi when the pulse at once became very frequent. Further, after dividing the vagi, the digitalis in most cases reduced the pulse very little. Subsequently it was shown that whilst stimulation of the vagus reduced the blood-pressure, digitalis greatly heightened it; showing that the effects of digitalis are not applicable without admitting the influence of the cardiac ganglia ("musculo-motory") as well as the vagi ("regulatory")* This led Traube to reinvestigate this question. After paralysing the vagi by the injection of woorari to obviate the effects from their section, and performing artificial respiration, he divided the vagi and injected infusion of digitalis into the veins, and found that a great increase of the blood-pressure (arterial tension) took place; a result which led him to the conclusion that digitalis at first stimulates the vagi and the nervous ganglia of the heart itself, but afterwards paralyses both.

Dybkowskly and Pelekan maintain that digitalis affects solely the regulating and musculo motory (ganglia) appara-

* But this increased arterial tension may, and certainly is, in large part due to the contraction of the arterioles by digitalis.

tus of the heart itself, and not through the vagi, as its action is not affected by destruction of the medulla oblongata, or division of the vagi, nor by their paralysis by woorari.* Eulenburg and Ehrenhause have shown that digitalis will produce its effects through its action on the heart itself, for as we have seen, when the lower third of the extirpated heart of a frog is placed in a strong digitaline solution, its contractions are arrested; whilst a weaker solution renders the movements slow and intermittent. Brunton, from whose excellent monograph a greater part of these remarks are taken, considers that Traube's experiments prove that digitalis likewise acts through the vagus, and that after division of the vagi, digitalis acts on the terminations of this nerve, but less energetically than on the trunk, and consequently produce less effect than when the vagi are intact. Brunton believes that digitalis "acts on the regulating apparatus of the heart chiefly through the vagus, thus causing slowing of the heart, and stimulates the musculo motary apparatus (ganglia and nerves of heart), causing increased force of the cardiac contractions. This primary stimulation then gives way to paralysis at first partial then complete." Subsequent observations lead him to conclude that digitalis slows the heart in part by its contracting influence on the arterioles, thus heightening arterial pressure, and not altogether by direct influence on the vagus, for after slowing the heart-beats by the drug he administered nitrate of amyl, and thus induced dilatation of the arterioles and diminution of the blood-pressure. Whenever the blood-pressure fell after the inhalation of amyl, he found that the pulse became quick. On the other hand, Traube finds that cutting the cervical spinal cord of a frog, thus separating the arterioles from the vaso-motor centre, digitalis induces marked slowing of the pulse simultaneously with great diminution of arterial pressure, this proving, as he believes, that this slowing is not due to increased arterial pressure. Dr. Boehm likewise finds that after section of the cervical spinal cord of

* The heart is made to contract by stimulation of these ganglia, whilst its action is controlled and regulated by the vagi.

rabbits, digitalis produces no increase of arterial pressure, showing that this drug affects the arteries through the vaso-motor centre.

Brunton, Foster, and others, are led to conclude from sphygmographic observations, that in the healthy human subject digitalis, while diminishing the frequency of the heart's beats, increases the force of each beat, and increases arterial tension.

We can conceive that in a given disease digitalis may afford relief in one of the four following ways :—

I. By strengthening the action of a weak heart.

II. By reducing the strength of the beats of a heart acting too powerfully.

III. By lessening the frequency of the heart's beats.

IV. By correcting irregular action of the heart.

It is possible, that in different affections, digitalis may give relief through each of these effects, or through one or more of them in combination. Then, further, it is a question of interest whether digitalis affects both sides of the heart or the left only, and whether it affects both auricles and ventricles, and if so, whether in an equal degree. These questions cannot be solved satisfactorily, but from the narrated experiments on animals, and from the fact that digitalis equally reduces the frequency of the contractions of the different cavities of the heart, it is probable that it affects the whole heart, but especially the ventricles.

Dr. Balthazar Foster ascribes the effects of digitalis on most diseases of the heart to the reduction in the frequency of its beats, and explains the influence of the drug in certain heart diseases in the following manner. In most cases of aortic regurgitation it is well known that digitalis does harm, and effects it in this way; by slowing the heart more time is allowed the blood to regurgitate into the ventricle, and by increasing arterial tension it correspondingly increases the regurgitation and thus greatly aggravates the severity of the symptoms. In mitral obstructive disease it is serviceable, for "by slowing the action of the heart the period of time during

which the blood from the distended auricle can flow into the ventricle is increased, and as the extra time allows more blood to pass through the narrowed mitral orifice before the final effort of the auricle is made, that effort is made on a smaller quantity of blood, and is consequently more effective." He thinks that digitalis also strengthens the contraction of the auricle.

The author believes that we obtain better indications respecting the advisability of using digitalis, by considering all the symptoms rather than by confining the attention simply to the nature of the valvular affection, and therefore heart diseases in which the drug will prove useful, and those in which it will be found of little or no use, will be fully described.

Digitalis will be found of eminent service to a patient presenting the following symptoms and physical signs:—there is dropsy, which may be extensive; the breathing is much distressed in the earlier stages of this condition only periodically and especially at night; but when this reaches its worst stage, the breathing is continuously bad, although it becomes paroxysmally worse. The patient cannot lie down in bed,* and is perhaps obliged to sit in a chair, with the head either thrown back, or more rarely leaning forward on the bed or some other support. The jugular veins are distended, and the face is dusky and livid; the pulse is very frequent, feeble, fluttering, and irregular. The urine is very scanty, high-coloured, and deposits copiously on cooling. The heart is seen and felt to beat over a too extensive area; and the chief impulse is sometimes at one spot of the chest and sometimes at another. The impulse is undulating, and the beating very irregular and intermittent. The physical examination be-

* Patients thus afflicted, and those who from oppression of the breathing from other diseases of the heart are often unable to sleep, and becom much exhausted, may obtain relief from the dyspnœa, and sleep more or les refreshing, by the hypodermic injection of small quantities of morphia (one-sixth or one-twelfth of a grain) without fear of any disagreeable consequences.

trays great dilatation of the left ventricle, with often a not inconsiderable amount of hypertrophy. A murmur is ordinarily heard having the characters of one produced by mitral regurgitant disease, and there may be also disease of the aortic valves.*

A case presenting these symptoms and physical signs will very generally respond quickly to digitalis, if given in the way here set forth. In all treatment, the object should be to obtain the greatest therapeutic effects with the smallest possible dose of medicine. This is particularly important with a powerful drug like digitalis; for large doses sometimes appear to increase the heart's embarrassment, and relief comes only when the dose is diminished. Further, it is important not to give a larger dose than is necessary, since it is very likely the patient may require to take it for a long period; for in a case like that just described, the patient after a time becomes accustomed to the medicine, and the dose which at first did good seems to partially lose its effect, and requires augmentation; but this could be done only with the greatest caution, and even then with some hazard, if the maximum quantity had been given in the first instance.

The writer believes that in giving digitalis the formula has much to do with the success of the drug. The fresh and well made infusion generally gives better results than the tincture. It is advisable to begin by using a drachm of the infusion twice, or not more than three times a day, and in many instances this quantity will suffice. The effects on the pulse, the urine,

* Dr. Foster ascribes the symptoms, in cases like the above, to mitral obstruction, and considers that digitalis affords relief by slowing the heart's beats; but this view fails to explain those cases in which, after digitalis has relieved the patients, the drug may be discontinued for a long time without a return of the symptoms. Dr. Foster says, that digitalis strengthens the heart, thus increasing arterial recoil, so promoting its own nourishment, and thus permanently strengthening the heart; but this hypothesis fails to throw light on those cases in which, after two or three days, the medicine may be discontinued without return of the symptoms; for in so short a time the heart can hardly have become permanently strengthened by increased nutrition.

and the dropsy, are to be carefully watched. When the drug is properly administered, the pulse grows considerably stronger, more regular, and much slower, till, in very many cases, all irregularity ceases, and it becomes natural in frequency and rhythm. At the same time the urine, which previously may not have amounted to more than half a pint in the twenty-four hours, increases to one, two, four, or even eight pints a day, and in proportion to this increased flow, the dropsy diminishes till it disappears. Should the influence of the drug be small or unnoticeable, the quantity may be increased in a few days; but it must be remembered that the good effects of digitalis may not become apparent for three or four days. A drachm may be given every three or four hours, as circumstances indicate, or one drachm may be given in the morning, two in the middle of the day, and two at night; and should the symptoms resist this additional dose, another augmentation must be made in a few days. A small dose often succeeds admirably at first in removing much of the dropsy, but fails to effect all that is desired; when a gradual increase in the quantity of the medicine is required.*

When a patient with the foregoing symptoms dies, the *post-mortem* examination reveals great dilatation of the left ventricle, with much true hypertrophy of its walls in most cases. Sometimes there is incompetence of the aortic or mitral valves, or of both; but by no means rarely, both these sets of valves are healthy, and admit of no regurgitation when tested with water, although a murmur of a mitral character had existed during life.

Digitalis will be found especially useful when there is much dilatation and hypertrophy of the left ventricle without valvular disease, although a mitral murmur may have been heard during life; but unfortunately in many cases it is at present impossible to decide before death whether there is mitral disease or not.

Eminent authorities have asserted that in aortic disease

* The cases we are now treating of, require in most instances free alcoholic timulation and the best agent, on account of its diuretic action, is gin.

digitalis is worse than useless, and will embarrass the heart still further, and increase the difficulty of breathing; but after a prolonged and careful investigation of this question the author is convinced that, in a case presenting the physical signs and symptoms above described, the existence of aortic disease, whether obstructive or regurgitant, or both, does not in any way contra-indicate the employment of digitalis.

The irregularity of the pulse is the most important indication of the necessity of giving digitalis.

Earlier stages of the foregoing condition are not unfrequently met with, when the symptoms, though troublesome, are not yet very severe. These forms are not uncommonly seen in children, some time, after an attack of rheumatic fever. In such cases the strong and heaving impulse of the left ventricle of the heart, sometimes strong enough to shake the the patient, gives evidence of great dilatation and hypertrophy; and there is generally a systolic apex murmur (mitral), with perhaps systolic apex thrill. These patients at first are troubled only with palpitation on exertion; but after a variable time, perhaps many years, paroxysms of palpitation set in, accompanied by urgent dyspnœa, and the attacks may be so often repeated, that the child, unable to lie down at night, is obliged to be propped up with pillows. At a further stage the dyspnœa is continuous, but becomes paroxysmally worse, and the child is unable both night and day to assume a horizontal position. In all these stages of the disease the pulse is ordinarily quite regular,* but is generally very frequent and feeble, although at the same time the heart throbs violently against the chest. There is no dropsy, or it is slight and transient, appearing for a few days, and then passing away, till for some reason the heart again becomes embarrassed.

Now digitalis often speedily removes these symptoms, quelling the tumultuous strongly beating heart, at the same

* The heart rarely beats irregularly in children under twelve years old. This probably accounts for the fact that digitalis certainly is less useful for children than adults.

time strengthening the pulse, reducing its frequency, and improving the patient in every respect; it must be given till the pulse falls to 60 or 70 beats. In these cases very large doses are sometimes required, even two grains of the powdered leaf every three hours.

In cases such as we have just described, two important circumstances may be frequently witnessed; the pulse may be very weak and feeble, while the heart contracts with unnatural strength; and while the digitalis strengthens the pulse, it subdues the unnatural force of the heart's beats.

The first circumstance is of great importance, as in the cases now treated of, it is commonly thought that the weak pulse indicates a correspondingly weak heart, whence it is concluded that, as digitalis is eminently suitable for the cases in question, it is useful when the heart is feeble,—a conclusion certainly erroneous; for, as we have said, while the pulse is very weak, the heart can be felt to strike the chest with considerably increased force; and further, when these patients die, the left ventricle is found, largely dilated it is true, but also greatly hypertrophied.

This want of correspondence between the pulse's strength and the heart's contraction becomes still more apparent when these patients are seized with an attack of palpitation. The heart then sometimes beats with sufficient strength to make its movements visible through the clothes, or even to shake the bed, yet at the same time the pulse is very small and feeble. Where this discrepancy between the vigour of the heart's contractions and the strength of the pulse is permanent, it would appear as though patients were troubled with a perpetual palpitation, which, however, becomes paroxysmally worse. This discrepancy between the pulse and the heart, which may be viewed as a form of irregularity on the part of the heart, digitalis often corrects; hence, while under its influence the heart's action becomes quieter, the pulse grows stronger as well as slower, affording one illustration of the power of digitalis to control a heart contracting too strongly.

An early stage of the severe disease just depicted may also be witnessed in older people, in whom there is much irregularity of the heart's action, with irregular and intermittent but not very weak pulse. A mitral murmur may very generally be detected, and perhaps an apex systolic thrill. These persons may suffer from constant dyspnœa; and from attacks of palpitation, during which the embarrassment of the breathing is much aggravated. There is no dropsy, nor lividity of the skin, and the urine is secreted in natural quantity. Here digitalis will give complete relief, quieting the palpitations, removing the dyspnœa, and regulating the pulse.

The existence of aortic valvular disease in any of the milder (as also in the severer) forms, is not to be considered an indication against the administration of digitalis.

An important question is, how long can digitalis afford relief and preserve life? As might be expected, its good results will depend on the more or less advanced stage of the disease. In its earliest stages the relief may be so complete as to permit the discontinuance of the medicine, and the patient may remain relieved for months or many years; but generally occasional returns of the symptoms recur, which may be again and again removed by a fresh recourse to digitalis. Thus life may be greatly prolonged and made useful, although the sufferer is unfit for very arduous work. Even when dropsy has appeared, and even become extensive, great and permanent relief may sometimes be obtained; but in most cases where the disease has much advanced, and has lasted for some time, the relief—although it may be very great, and all the dropsy and dyspnœa may be removed—is of short duration, and the disease, as it were, over-rides the medicine, and progresses in spite of it. It is of bad augury if a considerable dose is required to mitigate the symptoms, or when it is necessary to give the drug in increasing doses to maintain the ground at first gained.

If no dropsy is present the digitalis will not notably increase the quantity of urine, and will not therefore act as a

diuretic; for usually where there is no dropsy the urine is excreted in natural quantity.

The disease just described appears to run the following course:—At first, from valvular disease, or from some at present unexplained cause, the left ventricle dilates, and, as it dilates, becomes hypertrophied. When the dilatation and hypertrophy have progressed in some degree, the heart's impulse becomes strong and heaving, and is felt over an extensive area of the chest, while the patient is affected, at first on exertion only, with attacks of palpitation and dyspnœa.

Next, as the disease advances, either gradually or suddenly, the impulse becomes still stronger, more extensive, and more heaving, and the contractions are very frequent. The breathing simultaneously is permanently difficult, but becomes with each attack of palpitation paroxysmally worse—so bad, indeed, as to give rise to the idea that the patient cannot live through it. In this stage the pulse is frequent, small, and weak, and in strength is altogether out of proportion to the strongly contracting, heaving, tumultuously acting, left ventricle.* As the disease still further increases, to the above symptoms are added irregularity of the heart's action and irregularity of the pulse. With all the foregoing symptoms and physical signs, there is at first neither fulness nor pulsation of the jugular veins, nor any lividity of the face, nor dropsy; but with the further advance of the malady these symptoms arise, and are probably produced in the following way.

In consequence of the irregular action of the walls of the heart and its columnæ carneæ, the mitral valves become incompetent, and permit regurgitation. There may also be disease and incompetency of the mitral valves, with permanent regurgitation from the ventricle to the auricle, which regurgitation will be increased by the irregular action of the heart. This regurgitation causing considerable obstruction

* Digitalis controls this over-strong action of the left ventricle, and thus affords an instance of its usefulness in some cases of hypertrophied and too powerfully acting heart.

to the passage of the blood through the lungs, the right side of the heart becomes distended, and its valves in their turn become incompetent, leading to regurgitation into the veins, to general dropsy, and lividity of the skin.

When the disease has reached its worst stage, the heart's action is so embarrassed that, although its walls are hypertrophied, it strikes with each beat feebly against the chest, and its impulse may be scarcely perceptible.* The pulse is frequent, feeble, irregular, and intermittent.

In some cases, and especially with children, the disease may advance to a great extent without any irregularity of the heart's action; but with other cases irregularity occurs early.

The *post-mortem* examination shows that the left ventricle is very considerably dilated, and very greatly hypertrophied. The mitral, often, and not unfrequently the aortic valves, are more or less diseased, admitting of a variable amount of regurgitation. These statements are founded on *post-mortem* evidence.

For such a heart, digitalis will be found of great service.

The following explanation of its action is suggested:—By restoring order to the heart's movements, the regurgitation caused by the irregular action of the columnæ carneæ is obviated, and regurgitation from the left ventricle to the auricle, and thence through the lungs to the right side of the heart, is prevented. If this be the explanation of its action, then digitalis will remove the symptoms completely, only when the mitral regurgitation is dynamic, and will fail to remove those which depend on organic disease of the mitral valves; and where, as frequently happens, there is in addition to irregularity of the heart's action, organic disease of the mitral valves admitting of regurgitation, the digitalis, by quelling the irregularity, will remove so much of the dropsy and concomitant symptoms as are referable to this condition, but will leave

* In such a case digitalis quiets the heart, removes the embarrassment, and strengthens each beat very considerably, and illustrates the fact that it will strengthen the beats of an apparently weak heart.

unaffected the dropsy, and that share of the symptoms dependent on the structural valvular disease. This view explains the fact that digitalis is generally less useful in the cardiac dropsy of children than in that of adults, for in children we rarely meet with irregular action of the heart, and the symptoms are generally owing to serious disease of the mitral valves.

The truth of this statement may be verified by cases which unfortunately too often occur. A patient with dropsy, and with symptoms and physical signs like those just described, receives partial benefit from digitalis, which removes much of the dropsy and dyspnœa, but the medicine fails to give complete relief. There is found after death much disease of the mitral valve permitting regurgitation, and the left auricle is in consequence much distended. Such condition of the mitral valves the digitalis of course could not remove, but that share of the dropsy and other symptoms produced by the irregular action of the heart the digitalis could remove. The truth of these statements may be verified by *post-mortem* examination, combined with clinical observation. Such testing investigations will show that digitalis is useful generally in proportion to the degree in which the dropsy, etc., are due to irregular action of the heart, and are independent of organic disease of the mitral valves.

It must be admitted, however, that sometimes the foregoing explanation altogether fails: thus, we meet with cases of which the following is a type. A patient, generally a child, suffers from mitral regurgitant and obstructive disease, with ventricular dilatation, but chiefly on the right side. There is unintermitting inability to lie down, paroxysms of severe palpitation lasting hours or days with a pulse at these times very frequent, but always regular. Dropsy sets in; digitalis checks the palpitation, and removes completely the extensive dropsy by greatly augmenting the kidney secretion and gives great relief. In this condition sometimes better, and sometimes worse, the patient remains perhaps for years, then the pulse becomes irregular but without any increase in the

severity of the symptoms. These from time to time recur, but on each occasion give way promptly to digitalis, as soon as it has greatly lessened the frequency of the pulse. It also regulates the pulse, but as we shall presently see, the improvement is not due to this effect in these cases. After death the mitral orifice is found much contracted, the valves united, leaving only a small circular opening. Such is the diseased condition of the valves that it is impossible for the columnæ carneæ to affect them so that any irregularity in the action of the columnæ carneæ could not increase regurgitation, a condition this which explains why no aggravation of the symptoms took place on the occurrence of irregular action of the heart. The *post-mortem* shows that the chief disease is mitral obstruction. Now, in such a case digitalis could have no beneficial influence on irregular action, for it removes the symptoms before the occurrence of irregularity; and irregular action of the columnæ carneæ, as we have seen, could not increase the regurgitation; we are then constrained to assume that digitalis acts in the way suggested by Dr. Foster either by strengthening the auricle or by slowing the heart. There are, however, difficulties in accepting either of these views, for after a few days' administration of digitalis, and as soon as it has considerably reduced the pulse in frequency (a circumstance much in favour of Dr. Foster's view), the digitalis may then be discontinued and the patient will remain weeks or months ere the symptoms recur. Yet, still, the mechanical impediment to the passage of the blood from the auricle to the ventricle remains, and we should expect that the tonic or slowing influence of the digitalis must be kept up, unless it be that the auricle becomes, temporarily, much distended, and thus weakened, and the tonic or slowing action of the digitalis removes this embarrassing distension.

Many authors believe, and Dr. Fothergill has recently espoused this view, that the good effects of digitalis in the foregoing diseases are owing to its strengthening the contractions of the heart. Very likely digitalis does act as a tonic, and it appears to be serviceable, in certain instances where, from

exertion or other causes the heart becoming embarrassed, and perhaps, as Dr. Fothergill supposes, the left ventricle becoming distended, severe symptoms are suddenly produced.

I cannot help thinking, however, that the tonic theory, regarding digitalis, fails in most instances to explain its usefulness in heart disease. Admitting that digitalis strengthens the heart, it seems to me that the clinical evidence is very small as to its efficacy in this respect.

1. Thus: in aortic disease when the left ventricle is weak and unable to overcome the obstruction offered by the diseased aortic valves, the good effects of the drug are very slight, and indeed in my experience *nil*.

2. In fatty and other degenerations of the left ventricle, digitalis is not only useless but harmful.

3. In obstruction to the circulation in the lungs, from emphysema or from extensive retraction due to pleurisy, (especially if the other lung become emphysematous,) causing tricuspid regurgitation, digitalis appears to have little or no strengthening effect on the right ventricle in enabling it to overcome the lung obstruction.

4. In many of the cases most successfully treated by digitalis, the heart is not weak, but, on the contrary, is felt to beat with excessive force, and after death the left ventricle is found well nourished and much hypertrophied as well as dilated.

5. The efficacy of digitalis is most decided in cases where the heart acts irregularly, and not where it simply acts weakly.

It is said that irregularity is a sign of weakness, (of the muscular or nervous structure?) and that the tonic virtue of digitalis removes this condition. But firstly, over and over again, we meet with great cardiac weakness without irregularity; secondly, we may have much irregularity without weakness of the heart's impulse or the pulse; and thirdly, we find the heart well nourished and hypertrophied in cases in which digitalis proves of marked service; the irregularity being the only sign of weakness. It is indeed, a strong-acting, well-nourished heart, misapplying its force through imperfect co-

ordination; with no weakness of the contractile power, only disordered co-ordination.

Moreover, in estimating the effect of digitalis on the heart, we must be careful to discriminate its influence on that organ, from its influence on the pulse. Under the influence of digitalis, the pulse, no doubt, grows fuller and less compressible; but it must be borne in mind that digitalis slows the heart, and therefore, if the heart does only the same amount of work each beat must be stronger: for instance, if we reduce the pulse from 120 to 60, the heart, to do an equal amount of work must, with each beat, pump double the quantity of blood, and thus each beat will feel stronger. Again, digitalis contracts the arterioles, thus increasing arterial tension and rendering the pulse larger and less compressible.

In the heart disease of children with regular pulse, it is difficult to explain the good effects of digitalis by its influence in regulating an irregularly acting heart; but I think the difficulty is still greater in ascribing the good results to the tonic action of digitalis. Dr. Fothergill holds, that in these cases the left ventricle is weak and becomes distended, being too feeble to empty itself, and that digitalis strengthens the left ventricle, which then contracts fully, empties itself, and the dilatation diminishes. The pulse, it is true, is very feeble and frequent; but at the same time the heart beats forcibly and even violently enough to shake the patient. What prevents this powerfully acting ventricle from emptying itself, or at all events, propelling enough blood to produce a full instead of a very weak pulse? And can digitalis be required as a tonic for a heart beating already with such undue force, which after death is found hypertrophied and well nourished, there being no obstruction to the circulation from the left side? In these cases, with a very feeble pulse, we find a powerfully acting heart misapplying its force. This misappropriation of force may be due to want of co-ordinated action—a form of irregularity amenable to digitalis. Certainly digitalis prevents this waste of heart-power, for whilst this drug notably strengthens the pulse, the heart's action be-

comes much weaker, so that a far less powerful ventricular contraction propels more blood. It may be objected that the strong impulse is due, not to the left but to the right ventricle; that from mitral regurgitant or obstructive disease causing impediment to the circulation through the lungs, the right side becomes unduly distended and contracts with great force This explanation, however, fails entirely in many cases where the physical signs and *post-mortem* examination prove that the impulse was mainly due to an hypertrophied, dilated left ventricle. No doubt the strong cardiac impulse is sometimes due to the right ventricle, and when the impediment to the free circulation depends on mitral obstructive disease, digitalis probably acts beneficially in the way explained by Dr. B. Foster.

Cases of the following kind not uncommonly occur, which may be greatly benefited by digitalis:—A patient (who has been, perhaps, troubled with slight palpitation of the heart for some years) on catching a cold is attacked with bronchitis, and finds in consequence, the palpitations much increased. These palpitations in their turn excite severe paroxysms of dyspnœa. The heart may appear healthy, or there may be only a slight mitral murmur. In such a patient the palpitations may be quelled and the breathing made calm, by digitalis.

This medicine, however, leaves the bronchitis untouched, except that by easing the breathing it indirectly assists expectoration, and by the same means enables the patient to obtain refreshing sleep. In this indirect way digitalis may benefit the bronchitis, but the medicine here acts on the heart; and if with bronchitis much palpitation or irregularity of the pulse occurs, this remedy is indicated.*

M. Jaccoud teaches, that diminished cardiac energy and arterial pressure indicate the administration of digitalis, and that when the energy of the heart and the arterial pressure

* If during a fit of palpitation the heart beats very violently, one or two drops of tincture of aconite, given every quarter of an hour, may succeed in quieting it better even than digitalis.

are augmented, it is contra-indicated. Digitalis and caffein, he says, stimulate the heart and give tone to the blood vessels.

Da Costa strongly recommends digitalis in the condition termed by him "irritable heart." This disease occurs frequently among soldiers. It may come on suddenly or gradually, and begins with proneness to fatigue, palpitation and dizziness. It is characterized by pain, generally persistent, but also paroxysmally intensified, lacerating, or more rarely burning or tearing, increased by exertion and situated most frequently over the apex of the heart, sometimes radiating in all directions and shooting down the left arm, and accompanied by hyperæsthesia of the cardiac region, increased by each attack of palpitation. The patient complains also of palpitation varying in frequency and severity, occurring at all times of the day, accompanied by much distress and pain. The palpitation is generally brought on by exertion, although it may occur while in bed. These attacks are accompanied by dull headache, giddiness, and dimness of sight. The violent seizures may even produce insensibility. The sleep is much broken and troubled by disagreeable dreams. The patient usually cannot lie on the left side. The pulse is rapid, varying from 100 to 140 per minute, small, compressible, and sometimes jerking, often irregular in force and rhythm,—always remarkably affected by posture, being very frequent while standing, much slower while lying down, the difference amounting to from 30 to 40 beats per minute. Palpitation greatly increases the frequency, in one instance to the extent of 192 beats per minute. The respirations are but little hurried, varying from 24 to 34, and the patient complains of oppressed breathing rendered worse by an attack of palpitation. The impulse of the heart is extended, but is "quick, abrupt, or jerking," and the heart may beat irregularly. The first sound is deficient in volume, "feeble or short and valvular, like the second sound." Murmers, as a rule, are absent. This condition is produced by overwork and fatigue, and is fostered by depressing influences. It commonly leads to hypertrophy,

when of course the physical signs are modified. When the heart is not hypertrophied, Da Costa found tincture of digitalis in ten minim doses thrice daily quieted the excited organ, reduced the frequency of, and often strengthened the pulse, and rectified irregular action of the heart. If much hypertrophy existed, then digitalis proved less serviceable and sometimes failed to give any relief; but here, aconite in three to six minim doses was very useful: but in purely nervous cases, this remedy was not only useless but often even increased the frequency of the pulse. In much irritability with slight hypertrophy a combination of digitalis and aconite did good. Belladonna was useful in cases accompanied by irregularity of the pulse, but proved of little service in other cases, modifying but little the frequency of the pulse. It was of no service in cases complicated with hypertrophy. He often continued the digitalis for months without producing any toxic effects. In addition to the foregoing treatment Da Costa employed rest in the recumbent posture.

In the cases of cardiac dropsy, previously described, so much benefited by digitalis, it appears to the author that in these a condition existed closely related to, if not identical with, that set forth by Da Costa under the term "irritable heart," but in a more advanced form; that this condition is more or less associated with a variable amount of valvular disease, mostly but not necessarily of the mitral valves, and that it is this peculiar "irritable" state, probably due to some affection of the nerves supplying the heart, that digitalis controls and benefits so effectually. Hence, if all or most of the symptoms are due simply to irritability of the heart, digitalis cures either all or most of the symptoms; but if the symptoms are mainly or entirely due to valvular disease then digitalis proves much less serviceable.

Digitalis is often very useful in pure hypertrophy of the heart. This condition may be due to valvular disease, especially of the aortic valves, or it may be due to Bright's disease or to excessive muscular exertion. In all these forms, digitalis will afford relief by quelling the attacks of palpita-

tion. In aortic disease the hypertrophy is compensatory and hence in most cases, especially of aortic obstruction, no treatment is needed for the hypertrophy itself.

B. Foster recommends it in aortic regurgitant disease when there is more compensatory hypertrophy than the impediment to the circulation requires, indicated by violent action of the heart, bounding vibratory arteries, visible all over the body, almost constant headache, flushed face, noises in the ears These symptoms, however, it must be borne in mind occur only in severe cases, and that digitalis is useful where the symptoms are much less pronounced. Dr. Balthazar Foster points out that in these instances the action of the medicine must be watched, for too large a dose may induce alarming symptoms, the patient complaining of great prostration, and the palpitations instead of being lessened are increased. Foster attributes these effects to the slowing of the heart by digitalis and increasing the regurgitation at each diastole; but although this explanation may be partially, it is not, wholly true, for the same consequences follow too large a dose of digitalis in other forms of hypertrophy unassociated with valvular disease. In cases like these, two to five minims of the tincture is as much as can be tolerated. For the most part they are best treated by one to three drops of tincture of aconite given thrice daily.

Digitalis exerts little or no control over certain forms of heart disease which may produce dropsy.

General dropsy dependent on heart disease is in some instances produced by the lungs becoming degenerated, then emphysematous, and obstructing the free circulation of the blood from the right to the left side of the heart. To meet and overcome this condition the right ventricle grows hypertrophied, but only to an extent sufficient to meet the obstruction offered to the circulation; and, unlike the healthy heart, little reserve power is left in this organ; so that on the occurrence of any sudden access to the obstruction of the circulation through the lungs, the right ventricle becomes unequal to the task thrust upon it. This happens frequently in an attack

of bronchitis when the blood, unable to pass readily through the lungs, accumulates in the right cavities of the heart, overloads them to distention, till the tricuspid valves become incompetent, and permit of regurgitation from the ventricle to the auricle, and thence into the veins, when, if there is considerable obstruction in the lungs, dropsy will ensue; and the dropsy will vary with the amount of bronchitis; as this increases or declines, so does the dropsy augment or diminish. If the distension of the right cavities lasts a considerable time, then, on the subsidence of the bronchitis, the cavities fail to regain their natural size, the tricuspid incompetency and the dropsy become permanent.

Digitalis here appears to possess very slight, if any, power to strengthen the heart to overcome the obstruction in the lungs, unless indeed the heart acts irregularly. A considerable degree of cardiac irregularity, even without either hypertrophy or dilatation of the left heart, or disease of its valves, adds to the difficulty of the breathing, diminishes the quantity of urine, and produces dropsy, or increases it if already present. This irregularity, digitalis will remove, together with so much of the symptoms referable to this cause.

Cases like the following will exemplify the inefficiency of digitalis to strengthen the heart, and thus enable it to overcome any obstruction offered in the lungs. A patient of middle or advanced age, whose heart, acting irregularly, is much dilated on the left side, and who has consequently suffered from dropsy, dyspnœa, etc., symptoms which have been thoroughly removed by digitalis, on catching cold, and on the occurrence of bronchitis, the dyspnœa, lividity, dropsy, etc., return, and it would naturally be inferred that digitalis, having previously removed the same symptoms, would again give relief. But this is not necessarily the case, and a nice discrimination must be made of the circumstances producing the return of dropsy, etc.; for instance, if there is much emphysema of the lungs, the relapse is not uncommonly due solely to the obstruction in the lungs caused by the bronchitis

and emphysema, and is in no way dependent on any effect the bronchitis has produced on the dilated left ventricle. Digitalis can effect no good, but remedies are needed to control the bronchitis. If, however, as is not unfrequent, the bronchitis affects the dilated left ventricle, and brings back the conditions which existed when the digitalis did so much good, then a return to this medicine will again afford relief. In deciding the question whether digitalis should be given or not, attention must be directed to whether on the return of the dropsy, etc., fits of palpitation come on, with attacks of dyspnœa, and if the heart is excited to beat irregularly, in which case digitalis is required; but, on the other hand, if although there is hurried breathing and a very quick pulse, yet the symptoms just mentioned are absent, the patient will derive no benefit from digitalis.

Digitalis does no good in other serious diseases of the heart inducing dropsy; and indeed, unless care is taken, it may do much harm. For instance, a patient, often in the prime of life, and it may be without any history of rheumatic fever, has suffered for some time, perhaps for many years, from palpitation after exertion. Auscultation reveals an aortic obstructive or regurgitant murmur, or both combined. To overcome the obstruction to the circulation occasioned by the aortic valvular disease, the heart becomes hypertrophied, and this compensation saves the patient for a time from any troublesome symptoms except some palpitations; but after a variable time, serious symptoms arise, which generally increase rapidly in severity, and in the course of a few weeks or months the patient dies. This aggravation of the disease is denoted by paroxysms of palpitation, accompanied by urgent dyspnœa. The attacks may be occasioned by the slightest exertion, or may occur without any such provocation.

The dyspnœa soon becomes constant as well as paroxysmal, and about this time dropsy invades the legs, and rapidly extends till it involves the greater part of the body, and is often in excess in the pleural or peritoneal cavities. During its whole progress, and to the termination of the disease in

death, *both heart and pulse beat regularly and without any intermissions*, and the pulse often manifests the characters significant of aortic regurgitant disease. There is no lividity of the skin, but, on the contrary, it is strikingly pale and waxy looking; nor is there any fulness or regurgitation into the jugular veins. In addition to the aortic murmurs, one may exist having the character of mitral regurgitation, but after death the mitral valves are generally found healthy and competent.

The pathological history of such patients appears to be that disease of the aortic valves induces hypertrophy of the left ventricle, thus enabling it to overcome the obstacle to the circulation offered by the valvular affection. While the compensating hypertrophy keeps pace with the disease, the patient is troubled only by the increased action of the hypertrophied heart, and he may live many years in this condition but little incapacitated for work. Continuing in this state for a variable time, the disease of the heart may produce at last serious and fatal symptoms, in the following ways, the effect on the circulation in each case being the same.

In one instance the disease in the aortic valves advances with great rapidity, so quickly indeed as to make it impossible for the left ventricle to hypertrophy sufficiently to combat the obstruction to the circulation offered by the aortic disease, whence ensues much derangement of the circulation, on which depend the serious symptoms just detailed.

In the other instance the disease of the aortic valves remains either stationary or progresses very slowly, but the left ventricle undergoes degeneration, sometimes with great rapidity, and becomes consequently too enfeebled to meet the increased work thrust upon it by the diseased aortic valves, whence arises disturbance of the circulation, the setting in of dyspnœa, palpitations, etc., as described in the previous case.*

* It is commonly asserted that the dropsy associated with aortic disease is due to tricuspid regurgitation, that the aortic disease leads to hypertrophy of the left ventricle, and that the consequent increased strain on the mitral valves from the strong contraction of the left ventricle produces disease and incompetency of the mitral valves, with mitral regurgitation,

Digitalis will do little or no good in cases like these. Brunton points out that by contracting the arterioles it causes increased obstruction to the circulation, thus throwing more work on the weakened and inefficient heart and hence he explains the bad effects of digitalis in fatty heart. Sometimes, indeed, it appears to control in a slight degree the palpitation and the paroxysms of dyspnœa; but it happens not unfrequently that the pulse grows both feeble and intermittent, an effect the author has witnessed in a case of great degeneration of the substance of the left ventricle. When it does relieve by controlling dyspnœa and palpitation, it effects no permanent benefit, for the other symptoms as dropsy &c. gradually increase, and the patient dies, life apparently not being prolonged by digitalis.

Before concluding these remarks, I ought to add that the administration of digitalis must always be to some extent experimental. It is easier to tell in what cases it will fail than in what cases it will succeed. It is impossible to know how much benefit it will confer or how long the benefit will last. It is not easy to tell the dose that may be required. Thus we meet with cases apparently in all respects identical with others that digitalis has wonderfully improved, to whom the drug does little or no good, or may even do harm, weak-

congestion of the lungs, distention of the right ventricle, and tricuspid regurgitation with dropsy. Mitral disease no doubt frequently follows aortic, but in most of these cases the dropsy seems to me independent of the mitral disease. For in many cases there is no mitral murmur during life, nor apparent mitral disease found after death, though it may be said the left ventricle becomes distended, and thus mitral regurgitation is produced when no pathological evidence of this will be found after death. But ordinarily the appearance of the patient with aortic dropsy, is very dissimilar from that of a patient with tricuspid regurgitation; with aortic dropsy there is waxy pallor and no fullness of the jugular veins. Thus in a case presenting such appearances without a mitral murmur during life, and with no disease of the mitral valve detectible after death, we must admit that simple aortic disease with a weak left ventricle, may produce dropsy without tricuspid regurgitation, nay even where mitral disease exists, the marked waxy pallor and the absence of fullness of the jugular veins would show that in most instances the dropsy is not due to tricuspid regurgitation.

ening the pulse and rendering it still more irregular. Where it does but little good, it appears to me that the symptoms are mainly due to the valvular affection, and do not depend much on the irregularity; where the medicine does marked harm, the left ventricle is degenerated.

Digitalis is a diuretic, acting directly on the kidneys as well as through its influence on the heart, it is, therefore, useful in some cases of Bright's disease. When it lessens the cardiac disease, its diuretic effects are astonishing. I have been led to believe that the diuretic action of digitalis is limited by the dropsy, for when the dropsy disappears the remedy no longer causes an increased secretion of urine. This also is the case with some other diuretics.

How does digitalis cause so great an increase in the quantity of urine in some heart diseases? First, it removes those kidney conditions secondary to the heart disease, which diminish the kidney function, then the unburdened organ acts as in health and secretes a natural quantity. But in the cases now referred to, we find the urine increased from, perhaps, half a pint, to three, four, or even eight pints daily. Is this excess of urine due to the direct action of the digitalis on the kidneys? If this were the true explanation, then this excessive secretion should continue as long as the digitalis is administered; but we find, as I have said, that when the dropsy has disappeared the kidneys no longer secrete in excess. Hence, the following must be the explanation of the very copious flow of urine. Digitalis relieving the heart, removes the conditions producing the dropsy, when the dropsical fluid returns quickly into the circulation, and this excessive quantity of water in the blood is separated by the kidneys.

Digitalis has been employed in the treatment of acute inflammation. Mr. King, of Saxmundham, held that no good was to be done in inflammation, unless with a large dose; and he gave from half an ounce to an ounce of the tincture. He asserted that with such formidable doses he could subdue most inflammations, if attacked at their very commencement, and before the organs involved became disorganized. He

administered a dose and then waited twenty-four hours to watch its effects; and if, at the expiration of the time, the pulse did not become much less frequent or irregular, he repeated the dose. He gave as much as two drachms of the tincture to a child of nine months old.

Vomiting sometimes quickly follows these very large doses. In the course of his extensive use of this drug in these heroic doses, Mr. King never met with serious or dangerous symptoms attributable to it. Aconite, it is believed, will be found far safer and better than these huge doses of digitalis in the treatment of acute inflammation.

Dr. Royston Fairbank finds digitalis useful in inflammations, employed both locally and internally. He narrates cases of acute inflammation of joints, acute inflammation of the leg from varicose ulcers, severe inflammation of the breast and of erysipelas, greatly benefited by fomentations, made by infusing a small teaspoonful of the dried leaves in half a pint of boiling water, or by adding a drachm of tincture to half a pint of boiling water, by means of flannels wrung out with this decoction. Sometimes, after simple hot fomentations he rubs in some tincture.

Digitalis will reduce the temperature of fever, though large doses are often required. This treatment is now freely used on the continent in all febrile affections, and doses are given which most doctors here would think highly dangerous.

In typhoid fever, Wunderlich recommends digitalis, asserting that in two or three days it will reduce the temperature of the body by 2° or 3° Fah., and will slacken the pulse, it may be, by thirty or forty beats in the minute.

Digitalis controls epistaxis, hæmoptysis, and menorrhagia. In cases of menorrhagia, unconnected with organic disease, this medicine, independently of the state of the circulation, is said to be more efficacious than any other remedy; and that when organic disease gives rise to this form of bleeding, the effect of the medicine is scarcely less manifest, although the advantage may be temporary.

The late Dr. Brinton highly esteemed it in bleeding from

the lungs, stating that when it reduced the frequency of the pulse the bleeding ceased. The infusion is to be preferred for hæmorrhages, and large doses may be required.

In rare instances digitalis occasions great strangury, with a desire, almost incessant, to pass water, accompanied by great and painful straining, and, in women, by strong "bearing-down" pains.

Few remedies are more successful in arresting spermatorrhœa than digitalis. A drachm or two drachms of the infusion twice or thrice daily is generally sufficient. The free application of cold water to the testicles and perineum aids the effects of the medicine; and it is a useful practice to let the testicles hang in cold water night and morning for five and ten minutes at a time.

The late Mr. Jones of Jersey, excited considerable astonishment by the announcement of the good effects he obtained from very large doses of tincture of digitalis in the treatment of delirium tremens. He recommended the administration of half an ounce of the tincture to be repeated if necessary in four hours; and should no effect be produced, again in six hours; and afterwards if needful the medicine may be continued in two-drachm doses. Mr. Jones says of this treatment, "the pulse, so far from being lowered in force, becomes fuller, and stronger, and more regular, soon after the first dose. The cold clammy perspirations wear off and the skin becomes warmer. As soon as the remedy produces its full effect, sleep for five or six hours commonly follows. Sleep is the guide to the repetition of the dose. No action on the kidneys is evinced by an unusual secretion of urine. Sometimes the bowels are acted slightly on, but not commonly." Mr. Jones never saw any alarming symptoms follow the use of these large doses, although he treated in this way about seventy cases of delirium tremens. It would appear that he adopted this treatment only in the severer asthenic forms of delirium tremens.

With regard to this treatment of delirium tremens, the following conclusions appear to be established :—

1. The medicine may be given in the manner directed without danger.

2. That it very often does good, producing speedily in most cases, refreshing, quieting sleep; and even when it fails to induce sleep, it generally calms undue excitement.

3. That some cases appear to be uninfluenced by the drug.

It yet remains, however, to ascertain the forms of the disease amenable to digitalis.

There can be no doubt that under this treatment some severe asthenic cases, in which, on account of the great prostration of strength, death seemed imminent, have rallied astonishingly and ultimately recovered. The evidence of this is too strong to be disputed. Under the influence of digitalis, the weak, rapid, and fluttering pulse grows strong and steady; the skin comfortably moist and warm; while, with the improvement in the circulation and state of the skin, the general condition of the patient has mended. On the other hand, it appears equally certain that the sthenic forms of the disease are also amenable to this drug. In several instances the author has seen this disease yield speedily to these huge doses of digitalis; but on two occasions the patients suddenly fell back dead, although, to the moment of death, no warning occurred of this sudden and untoward termination. Whether in these instances death was to be ascribed to the digitalis or to the disease, it is impossible to say; for it is well known that delirium tremens, however treated, ends sometimes suddenly in this fatal manner.

TOBACCO.

A poultice of tobacco leaves is said to relieve pain, and an ointment, made by boiling half an ounce of tobacco in eight ounces of lard, kept constantly applied to the breasts, is said to arrest the secretion of milk. In this respect it is probably inferior to belladonna (*vide* Belladonna).

Several deaths having occurred through the application of tobacco to the abraded skin, it must be applied externally with caution.

Tobacco dilates the pupil when introduced into the eye, or when taken by the stomach.

Tobacco produces nausea and sickness, accompanied by great weakness and faintness. It confuses the ideas, dims the sight, enfeebles the pulse, and makes the skin cold and clammy with profuse sweating. Owing to the prostration, it removes spasm; and tobacco in the form of clyster, or administered by the stomach, has been employed in colic of the intestines, and in strangulated hernia; but in spasmodic diseases it is quite superseded by chloroform. Tobacco-smoking excites an abundant secretion of saliva; hence some persons maintain that tobacco-smoking aids digestion. Smoking acts on the intestines as a slight purgative, and no doubt a pipe or cigar smoked after breakfast is often sufficient to ensure an easy and satisfactory relief of the bowels; and is a practice not without advantage for persons troubled with habitual constipation.

Smoking in excess is, no doubt, a very harmful habit; it disorders digestion, greatly lessens the appetite, produces much restlessness at night, with disagreeable dreams, and weakens both mind and body. Chronic pharyngitis, the mucous membrane looking like dirty-red velvet, with constant hawking, and also chronic dyspepsia, may in some instances be clearly traced to smoking in excess. Even amaurosis is said to be sometimes produced by excessive smoking. The habitual smoker has generally a thickly coated tongue. The symptoms produced by excessive smoking soon cease when the habit is discontinued. The evil consequences are much less marked if the tobacco is of good quality, and contains but little nicotine. In the cultivation of the tobacco plant, it is a point of importance to develope much of the aromatic principles, and but little nicotine.

At present it has not been satisfactorily determined what structures tobacco affects. Kölliker teaches that (1) nicotia

quickly paralyzes the brain, and destroys voluntary movement; (2) that it excites the medulla oblongata and the cord, producing tetanus, which continues only a short time, and is unaccompanied by increased reflex irritability; (3) that the motor nerves are paralyzed, and if the tetanic movements are severe they assist in producing this paralysis; (4) that the sensory nerves do not appear to be affected by nicotine; (5) that the heart continues to pulsate long after nicotine poisoning; (6) that the muscular irritability is unaffected by nicotine. Other observers teach that nicotia feebly paralyzes the motor nerves, and destroys muscular irritability.

Nicotia appears to tetanize the heart; for when, from a mechanical cause, this organ has ceased to contract after death, on the direct application to it of nicotia the pulsations recommence, and the heart soon becomes rigidly contracted —tetanized, in fact—and then of course, the beating again ceases. In birds and mammals killed by chloroform, when the ventricles are immobile and dilated, and respond most imperfectly to stimuli, a drop of nicotine, directly applied, immediately occasions strong contractions in the heart, and causes the organ to respond energetically to mechanical and galvanic stimuli.

The experiments of Fraser and Brown show that nicotia, like other tetanizing substances, as strychnia, brucia, thebaia, codeia, and morphia, when converted into ethyl or methyl compounds, loses its tetanizing properties; but, unlike these, the methyl and ethyl compounds of nicotine do not possess any paralyzing action on motor nerves. This difference inclines them to believe that the convulsions of nicotia are not produced in the same way as those arising from strychnia, brucia, thebaia, etc.

Nicotia has been highly praised in tetanus, and many recorded cases appear to show its usefulness in this very fatal disease. It must be administered either by the rectum or hypodermically; for when put into the mouth, it very generally excites a severe paroxysm, which, by firmly fixing the muscles of the chest till asphyxia is produced, may destroy life.

Tobacco-smoking commonly affords some relief in spasmodic asthma; but like all other asthmatic remedies, it succeeds much better in some instances than in others.

Whether the active principle of tobacco is destroyed in the system, or is eliminated with any secretion, is at present unknown.

Nicotine is supposed to be diuretic, but we are not told under what circumstances.

CONIUM AND ITS PREPARATIONS.

The statements of the physiological action of this medicine, made by various observers, coincide in the main; but they contain a few contradictions which cannot at present be reconciled.

We are chiefly indebted to Christison, Schroff, Kölliker, and Guttmann for our knowledge of the action of this medicine.

Paul Guttmann, who has lately published some excellent investigations on the action of this alkaloid, says it is one of the most active and powerful poisons, being in this respect scarcely second to prussic acid; yet some vegetable-feeders, as the goat, sheep, and horse, are said to eat hemlock with impunity.

This medicine exerts no influence on the unbroken skin, even when applied in large quantities; but strong preparations applied to wounds excite inflammation, with its usual accompaniments of heat and pain.

The preparations, or the pounded leaves, or the expressed juice smeared over a poultice, ease the pain of ulcers both simple and malignant, and at the same time improves the character of the sore. The pain-easing property of hemlock rests on the evidence of highly competent observers, and cannot be gainsayed; yet this remedy is now rarely employed

for this purpose, although formerly it was in constant use as a soothing application to broken cancers and malignant sores.

The alkaloid, whether directly applied to the eye, or swallowed, causes dilatation of the pupil, sometimes with subsequent contraction. According to Harley, the dilatation is never very great.

The smell of conium has been compared to the urine of cats and mice. It has a burning, acrid taste, provoking an increased secretion of saliva. Conia, dissolved in alcohol, introduced into a hollow, painful tooth, has been employed to remove toothache.

Hemlock has scarcely any influence on the stomach and intestines. It may produce nausea, vomiting, and diarrhœa; but such occurrences are not common. Walshe has seen it useful in relieving the pain of cancer of the stomach.

That conia enters the blood is proved by the symptoms arising when it is swallowed; but what physical or chemical changes, if any, it produces in the blood are at present unknown. Added to blood after its removal from the body, it produces in it no perceptible alteration.

The deficient coagulability and dark colour of the blood noticed by some observers after death from this drug, are according to others often absent; and when present, is probably due to the fatal asphyxia.

The effects of conium on man and animals is very similar. The best account of the symptoms occurring in a human being from a poisonous quantity of the plant, is given by Dr. H. Bennett, who has recorded the case of a man who ate hemlock in mistake for salad. Weakness of his legs, so that his gait was faltering, was first noticed; as the weakness increased he staggered, as if drunk, and at the same time his arms began to be similarly affected. Perfect loss of all voluntary movement followed, and he was unable even to swallow. Lastly, the muscles of respiration were slowly paralyzed, and he died of asphyxia. Up to his death his intelligence was apparently unaffected, but his sight was

destroyed. Slight movements in the muscles of the left leg took place.

The same, or nearly the same, sequence of events happens in animals poisoned by hemlock. With rabbits, however, early and severe convulsions occur; but in frogs these are absent. In all the experiments and observations of Guttmann, gradual paralysis of the voluntary muscles, and then of the respiratory muscles, took place. The paralysis began first in the hind extremities, affected next the anterior, soon afterwards the muscles of the trunk, and lastly those of respiration.

How this paralysis is produced will be next considered. It is to Kölliker and Paul Guttmann we are indebted for most of our exact knowledge on this subject.

The paralysis is certainly not due to the action of the hemlock on the muscles; for an animal completely paralysed by conia, to such an extent that galvanic irritation through the nerves entirely fails to excite contractions, yet energetic contractions are excited if the current is made to pass through the muscles themselves. Nay, further, the irritability of muscles through which blood poisoned with conia has been permitted to flow is as great and as enduring as that of muscles of the same animal protected from the action of the poisoned blood by a ligature of the blood-vessels.

Nor does hemlock paralyze by its effect on the spinal cord, for if a limb is protected from the influence of the poisoned blood by ligature of both its artery and vein, and the animal (frog) is then poisoned and thoroughly paralysed by conium, it can still manifest powerful movements in the ligatured limb. Moreover, irritation of any of the paralyzed parts is answered by energetic contractions in the ligatured limb.

This last experiment greatly narrows the question before us; namely,—Through what tissues does hemlock paralyse? In this experiment the only muscles which retained their power of movement were those protected from the poisoned blood by the ligature of the vessels; and it follows that conia operates on some of the tissues thus protected, that is, either on the nervesor muscles; and it follows as conclusively that

the paralysis is due in no respect to the action of the poison on the brain or cord; for these parts were freely supplied with poisoned blood, while their nervous communication with the ligatured leg was intact, and yet this limb remained quite uninfluenced. We have, therefore, to decide whether conia affects nerves or muscles; but this question has been answered already, when it was proved that the poison exerts no influence on the contractility of muscle.

The investigation may be carried a step further; for an experiment of Guttmann proves that the poison affects the periphery of the motor nerves earlier than their trunks. The leg of a frog, after the vessels leading to it had been tied, was separated from the trunk, except by the chief nerve, and the animal was then poisoned. The uninjured limb in free vascular communication with the trunk, the extremities of the nerves being exposed to the action of the poisoned blood, became quickly paralyzed, while at the same time contractions through the femoral nerve were easily produced in the limb protected from the poison by its partial separation from the body. In this experiment the main trunk of the nerve of each leg was equally subjected to the poison, but the termination of the nerve in one instance was exposed to the poison, but in the other was protected from its influence. The paralysis, as we have seen, occurred speedily in the limb whose peripheral nerves were subjected to the poison, showing that the primary action of conia is exerted on the terminations of the nerves. But, ultimately, the trunks themselves become paralyzed; for after a time the partially severed limb became paralyzed below the point of section, even when the trunk of the nerve exposed to the poison was irritated.

Are the sensory or afferent nerves in any way affected? Apparently not, as they can certainly convey to the cord or brain afferent impulses in an animal rendered quite motionless by the poison.

The following experiment shows this:—If the legs of a frog are protected by a ligature of both arteries and veins, and the animal is then completely paralyzed by conia, energetic

movements can be excited in the ligatured limbs by irritation of the paralyzed parts. Whether these movements are purely reflex, or whether they are voluntary, and are occasioned by pain, it is in this case impossible to decide; but at all events this experiment conclusively shows that in frogs the afferent nerves of completely paralyzed parts can convey impulses to either the cord or brain. When the paralyzed parts of animals higher in the scale than frogs, such as rabbits, are pinched, they exhibit signs of pain, if we may judge from their aspect and from the noise they make, till the face and larynx are themselves affected, and it is therefore probable that sensory nerves convey impressions to the brain, even when the animal is almost perfectly paralyzed in respect of voluntary movement.

The vaso-motor nerves also of some parts appear to be affected by conia; thus the arteries of the frog's foot fail to contract on irritation when the animal is poisoned by hemlock, but the motor nerves of some other involuntary muscles are uninfluenced by conia, as the peristaltic contraction of the intestines of the rabbits, killed by the alkaloid, continued active after death.

When applied directly to the nerves, hemlock destroys their conductivity. The poison produces no pain.

Its influence on the brain will next be considered. No doubt both man and animals remain conscious of pain so long as they are capable of giving any signs of it; that is, before the muscles of expression become paralyzed. Still this is possible, while at the same time the brain may in some way be affected. Schroff states that a short time after the poison is taken it is followed by a feeling of heaviness in the head, with giddiness, inability to think, great impairment of common sensibility, blunted taste, dimmed sight, dilated pupils, and a sensation as of insects crawling on the skin.

The foregoing observations show that the mind is in some degree weakened, and that many of the special senses suffer. In Dr. Bennett's case there was total blindness, but the hearing was but little, if at all, dulled. Some observers assert that the mind remains quite uninfluenced by hemlock.

At an early part of this section it was stated that convulsions resulted from poisoning by this substance. These occur in some animals, not in others. Rabbits appear to suffer from convulsions, but frogs die unconvulsed. These spasms, Kölliker has suggested, may be due to asphyxia from paralysis of the muscles of respiration. This explanation, however, appears to be insufficient, as the convulsions often occur among the earliest symptoms, before any asphyxia has resulted; nay, if a tube is introduced into the trachea, and artificial respiration is performed, they still occur. In man, convulsions are certainly sometimes absent, and in the case recorded by Bennett only slight movements in the left leg were witnessed.

In their recent investigations, Drs. Crum Brown, and Fraser for the most part confirm the conclusions of Kölliker and Guttmann. They have shown, however, that specimens of conia are not of identical composition; for while each specimen produced the same symptoms, they find that these were not always produced in the same way. In other words, some specimens affect chiefly the motor nerves, while others act on both motor nerves and cord. Their observations on hydrochlorate of conia, methyl-conia, and iodide of dimethyl-conium, in a great measure explain these differences. They conclude that conia "produces paralysis solely by influencing the motor nerves," and that hydrochlorate of methyl-conia acts "on the motor nerves and spinal cord; with large doses the former action is completed before the latter, while with small doses the latter action is completed before the former." They conclude that commercial specimens of conia consist of mixtures in variable proportions of conia and methyl-conia; sometimes methyl-conia is present in small, at other times in large quantities. This variety of composition will explain the varied physiological effects of different specimens of conia.

Their observations on iodide of dimethyl-conium "show that the paralysis produced by dimethyl-conium is dependent on an action on the motor nerves primarily restricted to the

peripheral terminations," and that the substance "is entirely free from spasmodic and paralyzing actions."

Dr. John Harley's physiological experiments lead him to the conclusion that succus conii is a depressant of the motor tract of the cord, and the motor ganglia of the brain. Dr. Fraser's observation that succus conii generally, if not always, contains methyl compounds of conia, serves to explain the discrepancy existing between Guttmann, Kölliker, and Harley.

Concerning the action of this poison on the heart, very conflicting statements have been made. Thus, some authorities state that it reduces the frequency of the pulse, especially when the heart beats too quickly from disease, as from fever, etc. Even a small dose under such conditions, they say, suffices to produce a very decided effect on the pulse, while in health the same quantity exerts no influence. Such are the conclusions of Wertheim.

Kölliker, Guttmann, and J. Harley, conclude that conium does not affect the heart. Harley says, "excepting as a transient emotional effect in nervous individuals upon the sudden accession of the symptoms after a first dose of hemlock, the heart and bloodvessels are absolutely unaffected by its operation. I have carefully determined this in persons of all ages—in the weakly infant not three months old, in the strong and debilitated, and in those who have intermittent action of the heart." He gave the medicine in sufficient quantities to produce partial paralysis.

In experiments with warm-blooded animals poisoned by hemlock, the heart, it is true, soon ceases to beat; but this can be for a long time retarded if artificial respiration is performed, and in the case of the frog the poison appears to leave the heart unaffected. Hemlock has been recommended in fevers and acute rheumatism, and in these diseases its efficacy has been supposed to be explained by its action on the heart. But, as we have just seen, it is very doubtful if conia exerts any influence on the heart.

Harley says, conium, in doses sufficient to produce physiological effects, may be taken for months without affecting

nutrition. It has been supposed to be useful in whooping and other kinds of coughs. The succus conii in one to four drachm doses, or even more, has been recommended lately by J. Harley in chorea; and these large doses certainly control the movements temporarily, and impart steadiness to the patient; but these effects wear off if the medicine is not soon repeated. Some cases, no doubt, are cured by this treatment, but in my experience, in most instances, it only palliates; for on discontinuing the drug, the symptoms returned with their former severity. In order to maintain the effects of conium on the choreic movements, the dose must be quickly increased, for patients speedily become tolerant of conium, and after a short time will bear enormous doses without any physiological effect. Thus, on one occasion, I gradually increased the dose, till the patient—a child—took seven drachms of succus conii hourly, except when asleep.

We have the high authority of Dr. Neligan in favour of hemlock in various painful affections, as cancer, rheumatism, and neuralgia. In no well-authenticated case has it yet been shown, that conium produces either sleep, coma, or delirium.

Considering the physiological action of conia, it would appear that this is not indicated in convulsive diseases dependent on the affections of the cord, as tetanus and strychnia poisoning; for the effects of this drug and the symptoms of these diseases are not antagonistic. Guttmann, from whose valuable paper on the action of conia the chief part of our remarks has been extracted, put to the test of direct experiment the power of conia to arrest or check in any degree the tetanus from strychnia. He strychnized frogs, and then gave them conia; but, even when administered in doses sufficient to completely paralyze the animals, this drug failed to check, in any degree, the tetanic spasms produced by the strychnia.

Professor Christopher Johnson, of Maryland, however, reports cases of recovery from severe traumatic tetanus under the use of conia. In one case he injected hypodermically, every two hours, fifteen minims of a solution composed of two

minims of conia, one minim of dilute sulphuric acid, to one drachm of water. In the second case, he commenced with twenty minims of the same solution every three hours; then he increased the conia to one-third, then to two-thirds of a drop, and ultimately to rather more than a drop every hour, when the symptoms abated. Afterwards he used two minims of conia hourly, but owing to the weakness of the pulse he returned to one minim every two hours, but the spasms returning, he again used two minims every hour, and immediately the spasms diminished. But these cases, unfortunately, are much less satisfactory than they might have been. In the first case, the cicatrices of the wound were removed by a hot iron, and in the second, bromide of potassium and morphia were administered. But Dr. Johnson says, that the spasms were considerably reduced after each conia injection.

Dr. Crichton Browne strongly recommends conium in acute mania. He believes in common with Dr. John Harley that it represses undue activity of the motor centres.

It will be obvious how very similar the action of conia is to that of curare. One difference there is between these substances which has not been noted. Curare, when swallowed, is not poisonous, but is strongly toxic when injected under the skin; conia in either way is equally poisonous.*

Dr. Neligan draws particular attention to the fact that the only preparation of any value is the juice; and so true is this, that the various statements made concerning the success and failure of this remedy in various diseases must be accepted with caution, unless the conclusions have been deduced from observations founded on the use of this preparation.

* Claude Bernard believes that the innocuousness of curare administered by the stomach is due to its slow absorption, as contrasted with its much more rapid elimination by the kidneys, so that a very minute quantity is retained in the blood.

CALABAR BEAN.

The following account is for the most part an abstract of Dr. Fraser's very valuable and elaborate investigations concerning the physiological action of the calabar bean.

He finds that this poison destroys birds most easily, while frogs require as much as will kill a dog.

Little is known at present of the influence of the Calabar bean or its alkaloid on the structure of the stomach. Dr. Fraser has ascertained that gastric juice does not destroy the power of this drug; and further, when solutions of it are injected into a vein, they may be detected in the contents of the stomach, whence it has been concluded that the active principle is eliminated by this organ. It is, however, possible for it to find its way here by mere imbibition.

The active principles of Calabar bean quickly enter the blood. After small but fatal doses, the animal at first, and very speedily, manifests a slight tremulousness, which, beginning in the hind-quarters, spreads thence to the rest of the body. Soon the posterior limbs grow powerless, next the anterior extremities, and then the trunk, till muscular movement ceases, and the whole animal frame becomes limp and flaccid. There is general paralysis. The bowels and bladder are emptied involuntarily, and the pupils generally contract. At this stage all reflex action of the cord is destroyed; for if the animal is anywhere irritated, no contractions respond to the call. Under the influence of the poison, respiration grows gradually slower and slower, and at last ceases. So long as the animal retains the power of expression, evidence of consciousness appears to be preserved throughout. Immediately after death the pupils dilate. After death the muscles appear to be unaffected; for they contract as they are cut, and respond to irritation of their nerves. The heart, moreover, continues to beat the usual time after death, its parts ceasing to contract in their definite order. After a large fatal dose, the symptoms and *post-mortem* appearances

are much the same as those just described, but of course death occurs sooner, and the symptoms follow each other in quicker succession. After a very large dose, death may be almost instantaneous. It appears to be owing to syncope; for when the body is open, the heart is found motionless, dilated, flaccid, and contracts but languidly on stimulation. The vermicular movements of the intestines are also more sluggish than after a smaller dose.

Whether Calabar bean produces its effects by influencing the muscles, nerves, cord, or the brain, are questions which will now be severally considered.

As muscular contraction could be easily and abundantly excited by direct irritation of the muscles, after the motor nerves had quite lost their power to conduct impressions, Dr. Fraser concludes that this poison exerts no influence on the voluntary muscles. Moreover, the contractility continued a long time after death, and in frogs the rigor mortis was long postponed, while it certainly was not hastened in warm-blooded animals,—additional evidences of the absence of any paralyzing influence on the muscles by Calabar bean. The tremors in warm-blooded animals were generally slight, but were sometimes excessive, and might indeed be called convulsions, and were due probably to the direct action of the poison on the muscles, like curare; for if the sciatic nerve was divided before poisoning the animals, the limb thus cut off from nervous connection with the nervous centres still trembled; while, on the other hand, if the sciatic nerve was uninjured, but the arteries leading to the limb were tied or divided, then, while the muscles of the body generally trembled, those of the ligatured limb remained at rest. This tremulousness often continues after death, and is excited by exposure and by the knife in cutting. It does not affect the whole muscle at the same time, but different parts in succession.

Observing that consciousness is intact when paralysis is marked and progressing, and that if a frog's brain is removed before the animal is poisoned, paralysis ensues as

usual, Dr. Fraser concludes that the paralysis is not produced by any changes in the brain; but from the effects of the drug on himself he thinks the bean does exercise some influence on the faculties of the mind.

That paralysis is not produced by the action of the poison on the spinal nerves is evident; for long after the induction of general paralysis, and even after death, they conduct motor impressions to the muscles.

But though muscular paralysis and death are not to be accounted for by the action of the poison on the motor nerves, but in another way, as we shall shortly see, still after a time the poison does affect these nerves, and robs them of their power to conduct impressions to the muscles. As with conium, so probably with Calabar bean, the peripheral terminations of the nerves are first affected, and next their trunks. The afferent nerves remain unaffected, and certainly their power of conduction is not lessened; indeed, Fraser thinks it is increased.

The spinal cord, then, is the only part left on which the paralysis can depend, and Fraser has shown that the paralysis of the muscles is due to changes effected by Calabar bean on the cord. Thus he found he could excite no muscular contractions by galvanizing any part of the cord of an animal poisoned by the bean, while the motor nerves still retained their functions, and easily transmitted impressions to the muscles, which on their part freely responded to very slight stimulation of their proper nerves.

The reflex functions of the cord were destroyed long before the nerves lost their conducting power. For after the loss of reflex power in animals poisoned by Calabar bean, pretty active muscular contractions could be excited by mild galvanic stimulation of the motor nerves, showing that the arrest in reflex action is not owing to lowered activity of the motor nerves. Again, if the lower half of the cord is protected from the poisoned blood by ligature or section of its vessels, while the blood is permitted to flow to all other parts of the body, and the animal is then poisoned, reflex action

is speedily lost in the anterior, while it is retained for hours in the posterior limbs. As the nerves of every part of the body are equally subjected to the poison, the loss of reflex power cannot be due to alterations in them, otherwise the hind and front limbs would be equally paralyzed. The only part protected from the poison was the lower half of the cord, and it must be that Calabar bean destroys reflex power through the changes produced in the cord itself.

From its physiological action on the cord, Fraser recommends the ordeal bean as an antidote to strychnia, and he points out its superiority to curare, which paralyzes only the motor nerves, while the Calabar bean paralyzes first the cord, and then, after some time, the motor nerve.

Large doses of the bean instantaneously arrest the movements of the heart; smaller doses reduce their frequency.

Fraser contrasts Calabar bean with other cardiac poisons, such as antiaris toxicaria, tanghinia venenifera, digitalis, helleborus niger, helleborus viridis, and the green resin of nereum oleander, all of which, after a time, diminish the frequency of the heart's contractions by prolonging the systole, and finally stop the heart in the systolic act. Physostigma also diminishes the number of the heart's contractions, but it lessens the duration of each systole, and at last the heart ceases to beat in the diastole.

How does Calabar bean effect these changes in the functions of the heart? The paralysis of the heart in diastole, and the diminution in the frequency of its contractions by protracted periods of rest in a *dilated condition*, as well as the frequent renewal of its action after a long pause in diastole, might, in the first place, suggest the interference of the inhibitory functions of the vagi nerves. Fraser, however, adduces conclusive experiments against this supposition. Thus, he finds, after section of each vagi, or after paralyzing them with curare, (which it effects in a few minutes in both the motor and vagi nerves,) Calabar bean acted on the heart just as before. Again, when, previous to their being poisoned, the brain and cord of frogs were destroyed, the bean produced the same effects on the heart.

Physostigma is no doubt a respiratory poison, and in many instances destroys life by asphyxia; but Fraser has shown that it is likewise a cardiac poison. He poisoned a retriever dog, and while the respirations were actually increased by one in the minute, the pulsations of the heart were diminished by one half. This poison must, therefore, be considered to act on the heart directly, and not solely by its secondary effects on the respiration. Fraser concludes that the bean does not affect the heart through the vagi nerves, but through the cardiac ganglia.

Solutions of Calabar bean added to blood made the red corpuscles of rabbits and dogs irregular, but effected no changes in those of birds or frogs, nor in the white corpuscles of any animal Dr. Fraser examined.

The solutions appear to produce no change in the respiratory function of the blood.

The lymph hearts of frogs became paralysed at an early stage of the experiments.

The intestines of animals poisoned by the bean moved at first with increased vigour, but at last contracted so as considerably to lessen the calibre of the gut, which afterwards became dilated again. The movements continued some time after death, except after a large dose of poison, when the movements were slight, and soon ceased.

In rabbits poisoned by this bean Fraser noticed peristaltis in the cornua and body of the uterus, and in the ureters.

Calabar bean when swallowed, as is well known, causes the pupil to contract; but this effect is still more marked if a solution is dropped into the eye. Whether this contraction is produced through the sympathetic or otherwise is still an open question.

Dr. Robertson, who has paid great attention to the effect of Calabar bean on the eye, finds that even before the pupil begins to contract, the power of accommodation is lost, and that objects can be seen only at a limited distance of about a foot, all beyond appearing hazy and indistinct. The accommodating power, being affected before the pupil, is also the first

to recover itself. Objects at all distances appear nearer, and larger, than they really are. The bean induced in the affected eye a sensation as of much straining and heaviness, like that occurring after a close inspection of fine objects.

About twenty minutes after the application of the solution, the pupil contracted to one half, and the field of vision was still further shortened. The contraction may increase for an hour or more, the sight of the other eye meanwhile remaining natural. The contraction ultimately slowly yields, but more than twenty-four hours may pass before the pupil resumes its natural size. The contraction may be extreme, when, but little light finding its way through the narrowed pupil, the opposite pupil may dilate sympathetically.

Dr. Robertson has further shown that, in their action on the eye, belladonna and Calabar bean are directly antagonistic. The bean is freely used to produce contraction of the pupil.

Dr. Fraser has obtained some curious results from the topical application of solutions of Calabar bean to different structures of the body, He applied some solution of Calabar bean to the trunk of the sciatic, choosing this nerve on account of its comparative freedom from bloodvessels, and found to his astonishment that sensory conductivity was lost sooner than motor, and became at last completely destroyed. This loss of power to conduct sensory impression was not produced by mere imbibition of the fluid altering the physical state of the nerves, as other nerves kept moistened by water for a like time underwent no similar functional alteration. The completeness of this loss of power to conduct afferent impression was well shown by poisoning the animal by strychnia, after which no convulsive movement could be excited by irritating the structures below the poisoned sciatic nerve.

The irritability of the gastrocnemius was also destroyed by the local employment of strong solutions of the bean. This, too, was proved not to be due to mere imbibition.

When the solution was painted on parts of the intestines, these became relaxed, and the vermicular movements, on

reaching these points, skipped over them, and continued in the portions beyond.

We now come to the therapeutical application of this remedy. It was some time ago suggested that the Calabar bean might prove of much service in tetanus and chorea, and Dr. Fraser has lately written an interesting paper on this subject, from which we again largely borrow. Finding that the effects of strychnia on the frog can be arrested, he believes that the bean may be used with the greatest benefit in tetanus. Dr. Fraser very naturally insists on the importance of employing the drug at the very beginning of the attack, and enforces the value of this advice by the remark, that it has now been shown that when muscles contract they beget a substance which excites muscular contraction; and, further, that at the beginning of tetanus only a limited part of the cord or of the ganglia of the brain is affected, but, on the continuance of the attack, the whole of the structures become speedily involved. He disadvises the employment of the powder, mainly, on account of its tardy action. The extract should always be used either in the form of pill or in a solution in weak spirit of sp. gr. 0·920 (thirty-two grains to the fluid ounce). Dr. Fraser says that "Physostigma may be administered by the mouth, anus, or subcutaneously; and the special peculiarities of each case will be the best guide in determining which of these should be used. I should myself feel inclined always to commence the treatment by subcutaneous injection, to repeat such injection until the system is decidedly affected, and then to administer the remedy by the mouth, in a dose three times as large as is found necessary by subcutaneous injection.* Such a plan might be quite safely followed in a child of even nine years. If the remedial effects continue to be produced by administration by the mouth, it

* Dr. Eben Watson has not obtained good effects from hypodermic injection and prefers to administer the drug by the mouth or rectum. He insists on the necessity of giving enough of the extract to produce relaxation of the spasms. He has given it to the extent of seventy-two grains in twenty-four hours.

should be persevered with; for such administration has obvious advantages as far as the convenience of the practitioner is concerned. In the more severe cases, however, I believe subcutaneous injection should be alone employed. The distress and increase of spasm caused by swallowing, or the impossibility of introducing substances by the mouth, will render this necessary. I cannot, also, urge too strongly that subcutaneous injection should always be used when severe and continuous spasms occur, when a fatal result is imminent from the exhaustion caused by prolonged and frequent convulsions, and when apnœa threatens at once to close the tragic scene. By it we obtain the quickest and most powerful effects. Administration by the anus will be rarely necessary. It may, however, be employed to relieve the stomach, and will then be occasionally useful.

"From the preceding remarks it cannot be expected that any arbitary rules of dosage can be laid down. For an adult, one grain of the extract by stomach, or one-third of a grain by subcutaneous injection, will be generally sufficient to commence with. This should be repeated in two hours, when its effects will usually have passed off, and the succeeding doses may be modified according to the experience that will thus be gained. When used by subcutaneous injection, the dose of extract should be carefully mixed with ten or fifteen minims of water. This mixture has always an acid reaction, which is sometimes so decided as to produce slight irritation of the cellular tissue; but this can be avoided by carefully neutralizing the mixture with a solution of carbonate of soda. Suppositories, made with oil of theobroma and white wax may be employed when administration by the anus is desired. Each of these should contain two grains of extract. For children we must be guided by the general rule of employing, according to age, one-third or one-fourth, or even less, of the above doses. It will be found necessary to repeat these doses frequently—every hour, every hour and a half, or every two or three hours—and, of course, the severity of the disease and the effect of the remedy will be the best indication

for this. The great object is to produce as quickly as possible, and then to maintain, the physiological effect of physostigma in diminishing reflex excitability. The doses must, therefore, be continued in increasing quantities until this physiological effect is produced, or until the sedative action of the drug on the circulation is carried to a dangerous extreme, or until constant nausea and vomiting compel us to desist.

"This nausea is, I believe, due to the action of physostigma in causing energetic contractions of the stomach and intestines. To this cause may also be referred a peculiar epigastric sensation, which is one of the first symptoms of the action of this drug, whether it be administered by the stomach or subcutaneously, and which is always relieved by eructation. The catharsis that physostigma causes—probably an advantageous effect in tetanus—is another result of this intestinal contraction, though it is also due to an increase of secretion by the intestinal glands.

"Another physiological effect of physostigma is excessive perspiration. This is most strikingly observed when a large dose is administered by subcutaneous injection. It may be of some importance in the treatment of tetanus, for sudorifics are vaunted as reliable remedies for this disease; but as I am at a loss to understand why perspiration should in itself prove beneficial, I mention it only as an indication that physostigma is affecting the system.

"It might reasonably be expected that the active principle of physostigma—eseria—should be valuable in tetanus, and especially for administration by subcutaneous injection. It is, however, an alkaloid that is very difficult to prepare, and as far as my knowledge of its properties is concerned, it appears to be somewhat unstable. There is, besides, but little advantage in employing a more active remedy than the extract of physostigma.

"In these observations, no distinction has been drawn between the traumatic and idiopathic varieties of tetanus. As far as treatment is concerned, they only differ in this, that the traumatic variety is usually the more severe and acute, and

that it therefore generally demands a very energetic and active employment of the remedy."

Dr. Fraser next makes a few remarks on the influence of this remedy over chorea, but at present there appears to be little evidence on this subject. "The treatment of this disease," he says, "will rarely require to be so active or energetic as that recommended for tetanus. Physostigma should be administered either in the form of powder or of tincture. From three to six grains of powder, three or four times daily, may be given to children, and from ten to twenty grains, as frequently to adults."

Dr. Crichton Browne finds Calabar bean markedly useful in general paralysis of the insane; indeed, he has discharged some of his patients cured of this severe disease. I have known it arrest the progress of this disease, and even slightly improve the mental and physical condition. I have seen it not only arrest progressive muscular wasting, uncomplicated with much mental disorder, but also effect considerable improvement in the muscular power. Moreover, it has appeared to me to effect some good in cases of long standing hemiplegia. I have given the extract of physostigma in one-thirtieth of a grain doses every two hours.

THERAPEUTICS OF BELLADONNA.

CERTAIN animals, like pigeons and rabbits, appear to be almost insusceptible to the influence of belladonna. Dr. Horatio Wood has shown that, locally applied, belladonna does not dilate the pupil of pigeons, which confirms Wharton Jones's observation that neither does it when administered internally. Not only belladonna, but also stramonium and hyoscyamus, have very little action on pigeons, it being almost impossible to kill them with these substances. Two grains of atropia administered hypodermically, are required to kill a pigeon,

and Calmus found that fifteen grains are required to kill a rabbit. It is said that all vegetable feeders are but little affected by belladonna, whilst it is a powerful poison for flesh eaters. Thus, it is asserted that belladonna has very little effect on horses and donkeys.

The preparations of belladonna are of frequent and great use as external applications; no applications are so effective for the relief of pleurodynia and the hyper-sensitiveness of the skin and irritability of the muscles of the chest in phthisis, as the liniment or plaster of belladonna. The liniment, both as the stronger and cleanlier preparation, is preferable to the plaster, and should be rubbed over the tender and painful part several times daily, according to the severity of the pain. Although as a rule the liniment is preferable, yet in certain cases of pleurodynia the constant application of the plaster gives more relief. The liniment of belladonna, or the ointment of its alkaloid, is sometimes used in facial neuralgia.

Myalgia, so admirably described by Dr. Inman, often yields to belladonna, although opium preparations, as the linimentum saponis cum opio, sometimes succeed better.

An attack of lumbago, affecting perhaps the whole loins, often leaves behind it one painful spot, which may distress the patient only when the body is moved in one direction. Remains of a lumbago like this generally resist the usual methods of treatment, and are perhaps, driven from one spot only to reappear at another; but a large belladonna plaster will generally lessen, if it fail, altogether to remove these pains.

Belladonna employed either internally or externally checks or even suppresses the secretion of the glands. This at least is true of the mammary, sudoriparous and salivary glands, and possibly of other glands. It is well known that belladonna applied to the breast will arrest the secretion of milk, and is employed with great advantage when, from any cause, a mother with abundance of milk is yet unable to suckle her child, and the breasts become much swollen, exquisitely painful, and threaten to inflame and suppurate, unless the tension

of the ducts is relieved either by the removal or suppression of the milk. If the milk cannot be drawn off artificially the secretion must be suppressed, which can be easily affected by belladonna. It should be applied early, before inflammation has set in, and then in a few hours the swollen, painful breast gradually diminishes, and soon becomes soft, comfortable, and painless. But should this early stage have passed by, and inflammation have set in, and the breasts become tense, shiny, hard, knotty, red, and exquisitely painful, the continuous application of belladonna for twenty-four or forty-eight hours will, even under these adverse circumstances, often remove the tension and inflammation, and arrest impending abscess. The rapid manner in which it affords relief in these cases will greatly astonish any one unaccustomed to its use; in fact, it is impossible to overstate the usefulness of belladonna. It should be employed in all cases, no matter how far the inflammation has advanced. In many instances it will arrest an abscess otherwise almost certain to maturate. Even when it fails to prevent suppuration, yet the application of belladonna will reduce inflammation, subdue much of the pain, and greatly limit the inevitable abscess.

The liniment, the extract, the ointment, or a drachm of the tincture to an ounce of olive oil, or two drachms of the liniment mixed with an ounce of lard, may be used. The liniment is speedily effectual. These applications should be rubbed especially over the areola around the nipple.

Frequent fomentation with very hot water, unless cooler water should be found more agreeable and soothing, is an excellent adjunct to these applications. The nurse must be cautioned to wipe the skin perfectly dry after fomenting, or the friction with the liniment will irritate the skin, and produce a sore.

Belladonna will arrest not only the secretion of milk, but the secretion of the perspiration. A man forty-five years old had been troubled for many months with very profuse sweating of the right side of the face and neck, breaking out on the slightest exertion, or when near a fire, or if excited, so

that the sweat ran down his face and neck in streams, soaking his collar and the band of his shirt, his face being neither red nor injected. The perspiration produced an abundant crop of miliary vesicles, which were strictly limited to one half his face. The liniment of belladonna applied two or three times a day abated this abundant sweating considerably and reduced it to little more than the natural amount.

The effect of belladonna in this instance led the writer to test its influence over other kinds of sweating. The liniment of belladonna, used twice or three times a day, will completely check the sweating about the head and face of young children often so profuse as to soak their hair and the pillow upon which they have been sleeping. After a few days the application may be discontinued without a return of the perspiration. Again, many adults, even when in health, during all their lives, are troubled with profuse sweating of the hands or feet; sometimes so copious as to run off them in drops, and especially noticeable at the tips of the fingers and the ball of the thumb. The belladonna liniment, rubbed into the hands or feet three or four times a day, will often gradually diminish and sometimes arrest this annoying affection completely, although, no doubt, in some cases the treatment fails. Sometimes the good effects are permanent, or the sweating may not return for a considerable time.

Since the foregoing remarks were published the author has made many fresh observations confirming the efficacy of belladonna to check sweating. Thus, to a patient, who all her life had suffered from profuse sweating of the left side of the body, was ordered a belladonna ointment to be rubbed into the face twice or three times a day with the effect of completely checking the excessive sweating of the whole left side. Again, the author has met with cases of local sweating over a surface a little larger than the hand, over the loins, the perspiration exciting a copious eruption of eczema. In this case belladonna checked the perspiration, and thus cured also the eczema.

Many experiments of the following kind were instituted.

On several occasions a patient, after undergoing a sweating in the hot air bath, was rubbed on one side of the face for a quarter of an hour three times a day for two or three days with belladonna ointment; then the bath was repeated of the same temperature and duration, when it was observed that the sweating both during and subsequent to the bath was very greatly lessened; and that the effect was general, although the ointment was applied only to one side of the face. In some cases the ointment was rubbed into the chest, but then the effects were much less marked than when applied to the face, possibly because less of the ointment was absorbed.

As the local application checked sweating over the whole body it was concluded that it acted by its absorption, and this led to the internal administration of belladonna, but its repressing effect was apparently decidedly less than when locally applied, possibly because less of the drug was given by the mouth than was absorbed by the skin. Still no doubt the internal administration of belladonna does sometimes effectually control sweating, as the author has often witnessed in the case of weakly children perspiring profusely on exertion and whilst sleeping; and in the curious case of a middle-aged man, who after much mental worry suffered from excessive sweating of both cheeks while eating, especially hot meat or vinegar, the sweating ceasing immediately after the meal. This man passed at times a profuse quantity of pale urine. Ten drops of tincture of belladonna, thrice daily, checked completely the sweating.

Employed hypodermically, atropia promptly checks sweating. After repeated experiments, I find that in profuse sweating, produced by the hot chamber of the Turkish bath, one one-hundredth or one two-hundredth of a grain of atropia, will, in a few seconds, completely dry the skin and maintain it dry, notwithstanding the continuance of the bath. These experiments led me to employ belladonna hypodermically in the sweating of phthisis and other exhausting diseases, and I found that one one-hundredth or even one two-hundredth of a grain would generally arrest the sweating, sometimes for

more than one night; and that it also made the patient sleep better, and quieted cough in phthisis. Mr. William Murrell has recently made sixty experiments on phthisical patients, and finds that the drug fails in about from 8 to 10 per cent. It was equally successful with men and women, in febrile and non-febrile cases, in the prostrate and comparatively strong. Sometimes its effects are delayed; thus, if administered at bedtime, it may not check sweating till the following night. The beneficial influence may extend over several nights, then gradually wear off, so that each night the perspiration returns a little earlier. In a few cases it permanently checks the perspiration. This treatment unfortunately produces disagreeable dryness of the throat; but as many phthisical patients suffer in this way, the slight increase of it induced by atropia is scarcely noticeable.

Belladonna checks the secretion of that abundant foul-smelling sweat from the feet. Eau de Cologne may be used instead of simple spirit in making the liniment, thus forming an agreeable-smelling application. It has been experimentally proved, that in the cases just described, the effects are due to the belladonna and not to the spirit.

In checking sweating about the head and face, too much liniment should not be applied at one time, or, becoming absorbed, it will dilate the pupil and obscure the sight.

Belladonna will also arrest the salivary secretion, and thus induce dryness of the mouth. Its influence on the secretion of the sub-maxillary glands has been fully worked out. This gland receives branches from the chorda tympani nerve which is endowed with two sets of fibres, one acting immediately on the cells, the other causing the blood-vessels to dilate, being vaso-inhibitory. Belladonna acts through the nerves distributed to the cells, for after the injection of atropia, if the chorda tympani nerve is irritated, the vessels of the sub-maxillary gland become distended as usual, but the gland does not secrete. The paralysing effect of atropia is antidoted by physostigma, for after the injection of physostigma, irritation of the chorda tympani causes the gland to secrete.

Dr. Cook recently cured salivation from mercury, and scurvy, by the hypodermic injection of atropia.

Remembering that in acne there is over-abundant secretion from the sebaceous follicle, the writer was induced to use belladonna with the hope of checking it, and this treatment appeared to be of some slight service.

While speaking of milk abscesses, it was stated that, apart from its power to arrest the milk secretion, belladonna will, in some measure, subdue inflammation and its accompanying pain. Belladonna too is effectual in other forms of inflammation threatening perhaps to end in abscess. Mr. Christopher Heath has shown that belladonna will prevent the formation of abscesses in the neck and elsewhere, and after the onset of suppuration will check the pain and inflammation. The belladonna treatment of boils and carbuncles often succeeds.

Belladonna preparations are of further use as local applications. Thus, the extract smeared over the painful cracks in the mucous membrane, is employed to relieve the pain of fissure of the anus.*

The extract in conjunction with tannin, in the proportion of one or two grains of extract to six or eight of tannin, is recommended by Trousseau, in leucorrhœa with ulceration of the os uteri, and in neuralgia of the uterus. The belladonna arrests the too abundant secretion from the mucous glands on which leucorrhœa depends, while its action in this respect is assisted by the tannin. In both affections the belladonna is very efficient in relieving pain. The mixture of belladonna and tannin may be wrapped in cotton-wool, or made into a bolus with cocoa-nut fat, and placed in contact with the painful and over-secreting os. Some obstinate forms of leucorrhœa yield completely to this treatment.

When the disease depends on too free a secretion of the mucous glands about the os uteri, and when this condition is accompanied by much pain, the following injection yields

* M. Maisonneuve employs forcible distension of the rectum in these cases with considerable success. By forcing two or more fingers up the rectum he overcomes the spasm and gives permanent relief.

good results :—bicarbonate of soda, a drachm; tr. of belladonna, two ounces; water, a pint. The syringe should be introduced as far as possible, while the patient lies on her back, with her buttocks raised by a pillow; then one or two syringefuls used cold, should be injected into the vagina, and made to reach the mouth of the uterus. This position should be maintained for a few minutes, so as to allow the wash to remain in contact with the os uteri for a few minutes.

Dr. Anstie has recently recommended atropia in hypodermic injection, to relieve local pain and spasm. He vouches for its great efficacy,—"it should be employed in the form of solution of the sulphate, four minims containing one-sixtieth part of a grain, two minims will be the proper commencing dose in adults, unless the pain to be relieved be very severe. It should be cautiously increased to one-sixtieth or one-fiftieth part of a grain, more can seldom be needed." He further states, "it is somewhat less frequently tolerated than morphia, but persons quite unable to bear morphia will often bear atropine, and *vice versa*." He agrees with Hunter that when this drug does succeed its effects are more permanent than those produced by the hypodermic injection of morphia. Dr. Anstie has employed atropia hypodermically, with great benefit in one case of asthma, and in two of glaucoma. The same treatment is sometimes useful in neuralgia and sciatica, although the pain of these affections is generally subdued more easily by morphia.

Dropped into the eye, applied to the skin in its neighbourhood, or taken by the stomach, preparations of belladonna very speedily produce extreme dilatation of the pupil. This is one of the most characteristic effects of belladonna. In iritis and some other eye diseases, solutions of atropia are used to produce dilatation of the pupil, and to prepare the eye for an ophthalmoscopic examination. Belladonna is employed both locally and internally in conjunctivitis and other inflammations of the eye.

The local application of the liniment or ointment of belladonna will often relieve and sometimes cure neuralgia,

especially of the fifth nerve, as of the brow or under the eye, severe pains in the eye-ball, with intolerance of light, and even sciatica.

A full dose of belladonna produces great dryness of the tongue and roof of the mouth, extending down the pharynx and larynx, inducing consequently some difficulty in swallowing, with hoarseness, and even dry cough; and a large dose will sometimes induce dryness of the Schneidarian membrane, and dryness of the conjunctiva, with much injection.

"After about two hours," says Dr. J. Harley, "the dryness of the mouth gives way, to be replaced by a viscid, sticky, acid, and foul-smelling secretion, and the mucous membrane becomes clammy, and the tongue is covered with a white fur." Harley produced ophthalmia in a dog by belladonna. Many of these symptoms indicate the influence of belladonna in arresting secretion.

In several instances Harley has seen belladonna clean and moisten the tongue of typhus-fever patients. This remedy is employed in several inflammatory diseases of the throat, and its good effects are most apparent when the throat and tonsils are acutely inflamed and much swollen. It may be given in combination with aconite, and the influence of aconite on this form of inflamed throat, provided the pulse is full, and the skin hot and dry, is greater than that of belladonna.

The influence of belladonna on digestion is not known.

The tincture may afford relief in some painful affections of the stomach—a very vague statement, but as exact as our present knowledge of the drug will permit. The author has heard it praised in "gout of the stomach." In doses of twenty or thirty minims, administered every three or four hours, the tincture has arrested obstinate forms of the vomiting of pregnancy.

It is not ascertained in what way this medicine affects the intestines; but, bearing in mind its influence on the lining membrane of the mouth, it may be conjectured that belladonna lessens the secretion of the intestinal canal. It has been asserted, but without adequate proof, that belladonna increases the peristaltic movement of this canal.

Trousseau recommended belladonna in obstinate constipation, and no doubt it succeeds admirably in many instances. He advised doses of, from one-sixth to one-fourth of a grain of the extract to be taken once a day, either night or morning, increasing gradually the dose; diminishing or discontinuing the medicine when the constipation is removed. Dr. Nunneley finds this treatment useful in all forms of constipation, especially when co-existing with dyspepsia, characterized by a thinly furred tongue, with prominent red papillæ at the tip, epigastric tenderness, pain after food, and often more or less headache. It ensures a natural evacuation daily. It must be continued a fortnight or three weeks. Mr. Foster of Huntingdon, tells me that a small dose of belladonna prevents the constipating effects of iron. In some of the severest cases of constipation where powerful purgatives had failed, a suppository of one or two grains of the extract has opened the bowels.

Belladonna often relieves colic of the intestines; and is especially serviceable in the colic of children.

That the active principle of belladonna is readily absorbed into the blood, is proved by the symptoms. After a considerable dose of belladonna the face becomes much flushed, the eye bright, dry, and injected, the pupil dilated, the sight dim and hazy, while the power of accommodation in the eye for distance is lost. The mind and senses are peculiarly affected. The ideas, at first rapid and connected, become incoherent and extravagant; there is often decided delirium, with pleasing illusions. Sometimes the patient is possessed with constant restlessness, keeps continually moving, and cannot be quieted. A kind of somnambulism is occasionally observed; thus cases are recorded where, under the influence of belladonna, the patient for a long time performs the movements customary to his occupation; thus, it is narrated of a tailor that he sat for hours moving his hands and arms as if sewing, and his lips as if talking, but without uttering a word.

The delirium may be furious and dangerous, requiring the patient to be restrained; nay, it is recorded of one poisoned

by this drug, that so violent did he become that he was ordered to be confined in a mad-house. Sometimes a very small dose will induce this mental disturbance; so great indeed is the susceptibility of some persons, that even when applied to the skin in the form of plaster or ointment, belladonna affects them in a marked manner.

Belladonna weakens the muscular power, and renders the gait unsteady and staggering, and a patient may lose control over his movements, and, unable to direct his course, may run against objects he sees, yet desires to avoid.

Most observers state that it produces severe pain in the head, generally situated over the forehead and in the eyes; but sometimes these pains affect the top of the head. Singing in the ears, too, occurs, with more or less giddiness. In persons poisoned by this plant, spasmodic contraction of the sphincter of the bladder has been not unfrequently observed, and a scarlet rash has broken out on the skin—a rash said to be like that of scarlet fever, and to be most marked in the neighbourhood of the joints.*

The first effect of belladonna on the pulse is to increase its quickness, fulness, and force to the extent even of fifty to sixty beats in the minute. Moderate doses at the same time increasing the blood pressure. This condition of the circulation continues till the tongue and mouth become moist and clammy, when the pulse diminishes in frequency, and loses in strength (J. Harley). In fatal cases the pulse grows rapid, intermittent, and weak. Dr. J. Harley considers belladonna a powerful heart tonic, adducing in proof the power of this drug to reduce the frequency and to strengthen the beats of the heart when weakened by disease.

Dr. Nunneley asserts that in the frog, belladonna neither increases the frequency of the heart's beats, nor dilates the pupil. These statements, if correct, show that belladonna

* Mr. J. G. Wilson reports a case where the local application of belladonna produced a general red rash with redness of the throat and dilated pupils.

must affect the frog otherwise than man and some other animals, as the dog, the horse, etc.

It is stated by Wharton Jones, Meuriot, J. Harley, and others, but denied by Nunneley, that belladonna, when applied to the web of the frog's foot, contracts the smaller arteries, producing at first acceleration of the circulation, followed after a time by complete stasis, beginning, according to Meuriot, in the veins and capillaries; "and the circulation always continues in the artery for some time after it has completely ceased in the vein." Harley says that contraction of all the arteries follows the administration of a moderate, but dilatation after a large, dose of belladonna; the contraction being due to stimulation, and dilatation to exhaustion of the sympathetic system, resulting from its previous over-stimulation.

Meuriot is of opinion that belladonna paralyzes the peripheral branches of the vagus nerve, and by this means accelerates the heart's action. Against this conclusion J. Harley advances several ingenious arguments, and considers the acceleration of the heart's action to be due to stimulation of the sympathetic. The action of belladonna on the pupil has been variously explained, some averring that it depends on paralysis of the third nerve supplying the iris; some teaching that it is due to excitation of the sympathetic; and others maintaining that this drug, by preventing turgescence of the vessels of the iris, produces the dilatation.

Brown-Séquard considers that the sympathetic nerves of the neck are divided into two sets, one for the pupil, one for the bloodvessels of the face and neck. The congestion of the face and conjunctiva, occurring after belladonna, has been attributed to paralysis of that set supplying the vessels of those parts; but as the pupil is, at the same time dilated, belladonna is considered to act as a stimulant to that part of the sympathetic system supplying the iris. J. Harley considers belladonna a stimulant of the whole sympathetic system; but that if its action is carried to excess, this system becomes exhausted, when dilatation of the vessels ensues and the face and conjunctiva become congested.

Brown-Séquard maintains, that both belladonna and ergot of rye, exert a powerful inflnence on the unstriped muscular fibres of the body, instancing the power of each drug to dilate the pupil, and to produce contraction of the uterus. He has seen the vessels of the pia mater of dogs contract after large doses of belladonna or ergot of rye, and he further states that both possess the property of lessening congestion of the cord; for, after full doses of either medicine, the reflex excitability of this part diminishes. Meuriot, on the other hand, maintains that belladonna intensifies the reflex function. Moreover, Brown-Séquard adds, that one drug acts especially on the involuntary muscles of one part, and the other chiefly on those of another part. Thus, he concludes that belladonna affects, especially, the pupil, bloodvessels of the breast (and so arrests the secretion of milk), muscular fibres of bowels, sphincter of bladder (and so removes nocturnal incontinence of urine [?]); while ergot acts especially on the muscular structure of the womb and bloodvessels of the cord.

Thus, many of the phenomena ascribed by Harley to stimulation of the sympathetic, are attributed by Brown-Séquard to the effect of belladonna on unstriped muscular tissue. These speculations have led Brown-Séquard to use belladonna and ergot in those forms of paralysis depending on chronic inflammation of the cord. By giving ergot internally, and by applying belladonna along the spine in the form of plaster or ointment, he seeks to contract the vessels and to lessen the supply of blood to the cord. Meuriot believes that belladonna depresses at first the function of the ends of a nerve and afterwards its trunk.

The influence of belladonna on the sympathetic, led Dr. R. T. Smith to employ it in two cases of exophthalmic goitre—a disease regarded by some as due to paralysis of the sympathetic of the neck. The effects were striking. Five minims of the tincture hourly, affording great relief in four or five days, though the disease had lasted more than a year. In two months time the exophthalmos had much lessened. Homœopathic doctors have long employed this treatment.

Belladonna is often used to relieve pain. Dr. Anstie considers it the best remedy to mitigate every kind of pain in the pelvic viscera. Some neuralgias, no doubt, yield to this medicine; it appears to possess most efficacy over neuralgia referable to the fifth nerve. Cases are recorded of relief afforded by it in sciatica.

Trousseau recommended the following method of treating neuralgia:—To administer one-fifth part of a grain every hour till giddiness is produced, and then to lessen the dose; but to continue the medicine for several days.

The same authority employed belladonna successfully in epilepsy, according to the following method:—"During the first month of treatment, the patient takes a pill, composed of extract of belladonna and powdered leaves of belladonna, of each one-fifth part of a grain every day, if his attacks occur chiefly in the daytime; or in the evening if they are chiefly nocturnal. One pill is added to the dose every month; and whatever be the dose, it is always taken at the same period of the day. By this means the patient may reach the dose of from five to twenty pills, and even more." The dose is to be regulated by the circumstances of the patient. This treatment, it is said, even when it fails to cure, yields much relief.

Belladonna succeeds often in allaying both the cough and oppressed breathing of asthma. To ensure success, however, it must be employed in considerable doses, as Dr. H. Salter has lately pointed out, and the author has often verified his observations. Ten minims of the tincture every two or three hours, a quantity generally well borne, is often sufficient; but if any of the undesired symptoms of belladonna set in, the dose must be reduced. Sometimes far larger doses are required, where the patient is not very susceptible to the action of the drug. Thus, occasionally, half a drachm of the tincture hourly, is well and advantageously borne. A dose like this need only be taken at the time of the paroxysm; but when this lasts several days, the medicine should be given in the quantity recommended till an impression is made on the

disease. The effect is most often satisfactory, in either averting the attack or rendering it milder.

Belladonna is one of the best remedies for whooping-cough; but, to obtain any good from it, it must be employed in considerable doses, as in asthma. Thus, to children two and three years old, the author often gives as much as ten minims of the tincture every hour, and this quantity usually produces no effect, except on the disease, neither dilating the pupil, nor, so far as one can judge in children so young, making the throat dry; and it certainly does not in children a little older, who are able to express their feelings.

If drowsiness, delirium, or dilatation of the pupil occur, of course the dose must be diminished. The only symptom the author has witnessed from these large doses is dilatation of the pupil. Children, it is well known, bear belladonna much better than adults; and this fact accounts for the slight effect of so large a dose, and for the small influence which a less quantity exerts on whooping-cough—a disease of childhood. Some writers state that children become rapidly accustomed to belladonna. These large doses, however, may be given at first, and though I have employed these ample doses in a very considerable number of cases, I have never had to give less on account of any toxic effects. Under these doses the severity and frequency of the cough is often much reduced, even during the period when it is most violent and convulsive. But, like all other remedies in this disease, belladonna is of little use if the child is exposed to cold and cutting winds. If the weather is cold, the child should be confined to the house in a warm room; if the weather is mild, outdoor exercise is, of course highly beneficial; but cold must be most carefully avoided.

While there can be no reasonable doubt of the great efficacy of belladonna in many cases of whooping cough, it must be admitted that in many instances, without apparent reason, it seems of no avail. Influences at present not understood appear to modify its effect; for in some epidemics it is very successful, while in others it appears to be inoperative.

Belladonna exerts but little effect on whooping-cough, when bronchitis or any irritation exists, as that from teething, worms, etc. If the gums are red, swollen, and painful, they must be freely lanced, and the other sources of irritation removed. Belladonna is considered of especial use at the third week of the attack,—at a time, that is, when the febrile stage has passed away, and the violence of the convulsive attacks is declining.

Belladonna is often useful in other coughs, although with our present knowledge on this subject it is impossible to lay down precise rules for its employment.

It is often useful in certain forms of headache. The indications for its use are when the pain is situated over the brows and in the eyeballs, which seem as if too large for the head, and as if they would be forced out of the skull. These headaches are not due to stomach or uterine derangements; indeed, very often their cause cannot be discovered. Sometimes they seem due to weakness and overwork, being met with especially in young women. Three minims of the tincture should be given every three hours.

It is said that belladonna controls the delirium of fevers—as of typhus fever.

Belladonna is both speedier and more certain than any other remedy in removing that troublesome affection, incontinence of urine of children. It must be given in doses of from ten to twenty drops of the tincture three times a day; for small doses often fail, when large ones at once succeed. It may take a fortnight to succeed. Sometimes the incontinence is not limited to the night, but may trouble children during the day. These severe forms will often yield to belladonna; but while in fitting cases it is thus effectual, still it often fails altogether, although no worms infest the intestines, no irritation exists about the rectum, and no reason seems to exist to account for its failure. Strychnia, cantharides, turpentine, santonine, or galvanism, should then be tried.*

* In nocturnal incontinence the child should drink but little some hours before going to bed, and he should be waked in the middle of the night to pass water.

It sometimes checks the incontinence of urine of the old or paralytic.

Belladonna, used internally or externally, is certainly efficacious in erysipelatous inflammation. It may be given in combination with aconite; but when the skin is hot and pungent, and the pulse firm and resistant, aconite exerts over this inflammation an influence far more potent than that of belladonna.

Belladonna has been recommended as a preventive of scarlet fever, but so much prejudice has been introduced into this question, that it is difficult to ascertain whether it has any prophylactic virtue.

Belladonna has been found of service in the treatment of seminal emissions; a grain and a half of sulphate of zinc with a quarter of a grain of extract of belladonna, three or four times a day, is a successful remedy in most cases of nocturnal emissions.

As belladonna and opium are in some respects reciprocally opposed in their action, as on the eye, etc., it has been assumed that they must be opposed in every particular, and that one may be used as an antidote to the other. Many cases are adduced of opium poisoning, where the symptoms although very serious, were apparently removed by belladonna, and *vice versa*. Dr. Erlenmeyer is of opinion, that, in respect to their action on the brain, these agents are antagonistic, and that no coma will result when they are administered conjointly; but that they exercise no mutual counteractive influence on the sensory nerves, and hence he recommends them in combination to relieve pain. On the other hand, some authorities, among whom may be named Brown-Séquard and J. Harley, dispute this antagonism, on the ground that the cited cases are insufficient to prove it; and it has not been observed in experiments made on man and the lower animals.* The reported cases in favour of this antagonism have been severally criticised by Harley,

* But it must be remembered that these drugs so diversely affect animals and man.

who points out that many were treated by other remedies besides belladonna; in others, a fatal dose is not proved to have been taken; and the patients who recovered did not improve sooner than if no belladonna had been administered. Harley's conclusions, which are in most respects directly opposed to those of Erlenmeyer, are—"1. That in medicinal doses the essential effect of morphia (hypnosis) is both increased and prolonged by the action of atropia, whether induced previously or at any time during the operation of the former. 2. That atropia relieves, and, if given simultaneously or previously, prevents the nausea, vomiting, syncope, and insomnia, which frequently result from the action of opium. 3. That in a sufficient proportion (for most individuals one forty-eighth part of a grain of sulph. atropia to a quarter of a grain of acetate of morphia) atropia neutralizes the contractile effect of opium on the pupils; but in larger doses dilatation takes place, as if no morphia had been given. It is also to be observed that if the quantivalent doses are *successively* introduced, the drug last administered exhibits for a short time a counteracting effect. 4. That all the other effects of atropia are intensified and prolonged by the action of morphia, induced previously or at any time during the operation of the former. If, however, the dose of atropia be small, and the morphia produce considerable deranging effects on the vagus, the rapidity of the pulse is not greater than when the atropia is administered alone." Had Harley given opium in a dose just sufficient to destroy life, and then, if death had ensued after the employment of belladonna, he would have proved that belladonna would not arrest the fatal effect of opium, and *vice versa*. In no reported instance did he use enough of either substance to destroy life; hence his observations are not so convincing as they might have been; but as the coma from opium was intensified by belladonna, his observations are valuable.

On the other hand Dr. Johnston of Shanghai, who during his residence in China, has had striking experience of opium poisoning, having treated in various ways upwards of 300

cases, speaks in the strongest terms of the antagonism between opium and belladonna. It is in the worst cases of poisoning, he says, that atropia displays its wonderful effects; for instance where the immoveable pupils are contracted to a pin's point, the conjunctiva insensible to touch, the face pale, the lips, eyelids, and nails livid, the pulse weak and irregular, the breathing slow and stertorous, the extremities cold; he injects half a grain of atropia, then in ten or twenty minutes the pupils begin slowly to dilate, and in an hour or so the face becomes flushed, the breathing soft without stertor, and the pulse stronger. If within two hours the dose fail to produce these restoring effects, he repeats the injection. Where the coma is less profound he first employs a quarter of a grain of atropia.

Amid all this diversity of opinion, it must be admitted that, on the subject of this antagonism, more proof is needed. But while there is room for doubt concerning the antagonism between opium and belladonna, the interesting experiments of Fraser have demonstrated beyond question that atropia is an antidote to physostigma. He experimented on dogs and rabbits; but, as the action of these substances on man and animals is identical, he concludes that atropia will neutralize the fatal effects of physostigma on human beings. His experiments were conducted in three ways: (1) He administered the atropia before the physostigma; (2) He administered them together; (3) He administered the physostigma, and, after the animal was completely paralyzed, he injected atropia. In each series of experiments atropia averted the fatal effects of physostigma, although physostigma was employed in fatal quantities, as was afterwards proved by administering to the animal the same or a smaller dose by itself, when in every instance the animal speedily died. Fraser concludes that "the lethal effects of doses of physostigma greatly in excess of the minimum fatal, may be prevented by doses of atropia greatly below the minimum fatal." He recommends, "in treating cases of poisoning in man, the sulphate of atropia should be given by subcutaneous injection, in doses of from

one-fiftieth to one-thirtieth part of a grain. The exhibition of the antidote should be persevered with, in repeated doses, until the pupils are fully dilated and the pulse rate increased, and probably also until the hypersecretion of bronchial mucus, which greatly impedes respiration, is completely checked."

He thus summarises the antagonism between these two substances: "That physostigma increases the excitability of the vagi nerves, while atropia diminishes and suspends this excitability; that physostigma diminishes the arterial blood-pressure, while atropia increases it; that physostigma greatly augments the secretion of the salivary, bronchial, intestinal, and lachrymal glands, while atropia diminishes and even completely checks these secretions; and that physostigma contracts the pupils, while atropia, to a much greater relative extent, dilates them. Besides these effects of the action through the blood, various opposed topical effects have been observed, among which is the contraction of the veins by physostigma—the existence of which rests on the high authority of Mr. Wharton Jones—and the contraction of the arteries by atropia."

Dr. Fraser has recently published some further experiments on the antagonism between physostigma and atropia, being led to this investigation by the following considerations. While no doubt the more active and poisonous effects of physostigma are antidoted by atropia, still it seemed possible that physostigma might possess some properties—might affect some part of the body in a manner not opposed by atropia—and both poisons might possibly possess certain properties in common, so that while some of the poisonous properties of each substance being antagonistic, other poisonous properties might not be opposed, nay, might be similar in kind and assist each other. His experiments confirm these conjectures. Thus he found that after a minimum fatal dose of physostigma death could be averted by a dose of atropia varying greatly in quantity; but as he increased the dose of physostigma so the range of antidotal doses of atropia became diminished, and that so far from requiring a larger

maximum antidotal dose, the greater the quantities of physostigma administered the smaller became the maximum antidotal dose of atropia, till at last a point was reached when atropia ceased to avert death. For instance, with a minimum fatal dose of physostigma a dose of atropia varying from nine-thousandth to five grains prevented the rabbit's death; but on increasing the dose of physostigma to one and a half times the minimum fatal dose the antidotal dose of atropia ranged from one-fiftieth of a grain to four grains; and on augmenting the dose of physostigma to two and a half times the minimum fatal dose, the antidotal dose of atropia ranged from one-fortieth to two grains and a half. With three and a half times the minimum fatal dose of physostigma the range of atropia sufficient to avert death was reduced from one tenth of a grain to one-fifth of a grain, and with four times the minimum fatal dose of physostigma, atropia failed to avert death. Here, while atropia prevented the more powerfully fatal effects of physostigma, yet on increasing the dose of this drug a point at last is reached when its properties not antagonized by atropia become fatal. But the fatal issue is due not only to increasing the non-antagonized properties, of physostigma, for the range of an antidotal dose of atropia became lessened as the dose of physostigma was increased, showing that the atropia, assisted the physostigma. This fact is also shown by the experiment of injecting simultaneously one half the minimum fatal dose of each substance, when the animal died.

The foregoing experiments, moreover, make it apparent that atropia is an antidote for only a given quantity of physostigma, and that, if the physostigma is increased, a quantity at last is reached the more active properties of which no doubt are neutralized by atropia, but the other properties in conjunction with similar ones of atropia are sufficient to cause death.

It is a most singular fact that while the minimum fatal dose of extract of physostigma is 1·2, and that of atropia at 22 grains, yet nine-thousandth of a grain of atropia injected five

minutes before a minimum fatal dose of physostigma prevents its fatal effects, in fact a quantity of atropia which produces no perceptible effects can avert many of the serious effects of a fatal dose of physostigma.

Although it is experimentally proved that atropia can avert death from physostigma, it yet remains to be proved that physostigma can prevent death from atropia.

Dr. Fraser conceives that "with regard to the counteracting actions themselves it is to be observed that various of the facts mentioned in the record of experiments (of his paper) tend to make mutual antagonism, probable not only of one, but of several of the actions of physostigma and atropia; and it is legitimate to suppose that with a given dose of physostigma, the counteraction produced by a certain amount of atropia will be more perfect in the case of one or more of the antagonistic actions, than in that of others; and that with certain doses of the two substances such incompleteness of counteraction may exist as would even without the occurrence of *non*-antagonized action suffice for the production of death."

Preyer maintains that atropia, by paralyzing the peripheral branches of the vagus nerve, will prevent the arrest of the heart's contractions by hydrocyanic acid; and is thus an antidote to prussic acid.

That atropia is separated from the body in part by the urine may be proved by putting into the eye some of this secretion voided by one to whom belladonna has been given. J. Harley states that within two hours atropia is separated from the body, as none is to be found in the urine after that time.

Dr. Garrod has shown that caustic fixed alkalies destroy the active principle of belladonna, hyoscyamus, and stramonium, but that carbonates and bicarbonates of potash and soda do not destroy it. Lime-water too is equally destructive; hence it has been recommended as an antidote in poisoning by belladonna. (J. Harley.)

STRAMONIUM.

STRAMONIUM produces symptoms very similar to those induced by belladonna. A stramonium ointment, made by mixing half a pound of fresh stramonium leaves with two pounds of lard, and gently heating till the leaves become friable, then straining through lint, is used spread on lint and applied thrice daily at the Middlesex Hospital to relieve pain. Stramonium, smoked with or without tobacco, is mainly used to reduce spasm in asthma. It is especially useful in pure asthma, that is, when the lungs are structurally free from disease, and is useless when the dyspnœa is owing to heart disease. Twenty grains of the dried leaves, or ten of the powdered dried root, may be smoked, inhaling meanwhile into the lungs; or the fumes puffed into an inverted tumbler until it is filled may be placed over the mouth, and the contents inhaled by a deep inspiration. It excites a good deal of cough. The inhalation may be repeated again and again. It is preferable to smoke the plant unmixed, as few persoms can draw the fumes of tobacco into the lungs without great discomfort. There is no doubt that stramonium is very successful in many cases of asthma; but in others, without apparent reason, it fails; and even when it succeeds, its influence, gradually diminishes by use. Sometimes datura tatula succeeds when datura stramonium has failed. Dr. Salter believed that stramonium often failed, owing to the badness of the preparation, and he advised asthmatics to grow and prepare their own stramonium. Its effect is more manifest when employed at the very commencement of an attack, affording but little relief when the paroxysm is fully developed, cold stramonium smoke can sometimes be inhaled when the hot is intolerable. It has been used in neuralgia.

Like belladonna and hyoscyamus, its active principle, as Dr. Garrod has shown, is destroyed by caustic potash and caustic soda.

HYOSCYAMUS.

In many respects the effects of this drug correspond to those of belladonna and stramonium. Thus it produces dryness of the mouth and throat, dilatation of the pupil, presbyopia, lightness and swimming in the head, delirium and hallucinations, a drunken gait, and often a strong desire to fight. Sometimes there is aphonia, and often sleepiness, with oppressive disagreeable dreams. A red rash has been observed after large doses. The pulse at first is much lessened in frequency, but soon recovers itself, sometimes becoming even quicker than before the medicine was taken.

Hyoscyamus is generally used to produce sleep when opium disagrees. It has also been employed in neuralgia.

Like atropia, its active principle is destroyed by the fixed caustic alkalies, as Dr. Garrod proved.

HYDROCYANIC ACID.
CYANIDE OF POTASSIUM.

These poisonous substances are destructive alike of animal and vegetable life.

When applied to the skin for a long time, solutions of these substances, particularly the cyanide, excite some inflammation, on account of its alkalinity.

Kept in contact with the skin for any length of time, they diminish sensibility; formerly they were employed externally in painful diseases, such as neuralgia and rheumatism; now, however, they are quite superseded by more successful remedies. But in allaying the tormenting itching of urticaria, lichen, eczema, and prurigo, they are undoubtedly very serviceable. The itching skin should be bathed with a lotion

made of a drachm of the cyanide of potassium to a pint of water, or thirty drops of hydrocyanic acid to the ounce of water or glycerine. In respect to the cyanide, the action of the prussic acid is assisted by the potash in combination with it. It need hardly be observed that such a lotion must not be applied to the broken skin, for fear of poisoning by absorption.

Dr. Gee employs sulpho-cyanide of potassium in tinea tonsurans, and recommends the hair to be kept close cut; to wash the scalp twice a day with warm water and soap, and after drying the head, to rub well into the patches a lotion composed of half an ounce of sulpho-cyanide of potassium, 1 ounce of glycerine, and 7 ounces of water, and to cover the scalp night and day with lint soaked in this lotion, superimposing a piece of oiled silk; a stronger solution is apt to excite eczema.

The acid possesses a bitter characteristic taste, and excites a sensation of itching in the mouth. It stimulates the flow of saliva, possibly by its action on the mucous membrane of the mouth.

Taken in moderate doses, the acid in a healthy stomach appears neither to produce nor to undergo change; it is nevertheless much used, frequently with benefit, in painful diseases of this organ, as in chronic ulcer, cancer, chronic gastritis, gastralgia, &c. Not only does it occasionally mitigate the pain of these affections, but it may also check vomiting.

Hydrocyanic acid passes very speedily into the blood, and is as speedily eliminated, probably with the breath; hence, if life can be supported for half an hour after a poisonous dose, the patient is generally safe.

How it destroys life is still a disputed question. Being fatal equally to plants and animals, it is not necessary that it should act on the nervous centres, as, from the rapidity of its action, has been supposed. From his experiments on frogs, Kölliker concludes that it paralyzes first the brain, next the cord, and then the motor nerves, the paralysis extending from

the trunk to the periphery. It paralyzes the heart, its action ceasing in the diastole. The voluntary muscles soon lose their irritability, and become stiff.

Preyer maintains that large doses of hydrocyanic acid paralyze the heart at once; that moderately fatal doses deprive the blood of oxygen; and that as belladonna paralyzes the peripheral branches of the vagus, and at the same time stimulates the nervous centres of respiration, atropia in these cases hypodermically injected will prevent death.

OPIUM AND ITS PREPARATIONS.

Small doses of opium excite tetanus in frogs; on the other hand, birds, namely, ducks, chickens, and pigeons, cannot be poisoned by crude opium, the aqueous extract, nor black drop (acetum opii), given internally; and morphia salts must be given in enormous doses. Morphia employed hypodermically in very large doses never causes sleep nor stupor, but convulsions. Thebaia is a tetanising agent inferior only to strychnia and brucia. Narcotina, almost without effect on man, destroys birds in doses of two to seven grains when used hypodermically. Codeia is a fatal convulsive agent to pigeons. Meconia given internally causes emesis, but is harmless when injected under the skin. Narceia has no perceptible influence except to disturb the respiration slightly. Cryptopia in doses of one-fifth to one-half a grain has no effect. None of these agents cause sleep in pigeons, ducks, nor chickens. (Dr. Weir Mitchell.)

Dogs, cats, and rabbits, require large doses of opium to produce stupor or sleep, which is generally accompanied by convulsions. In the lower animals like frogs, it appears that opium only excites tetanus; but as we ascend in the animal

kingdom the soporific effects become apparent, and are most marked in man. Yet race modifies the effects of opium, for it drives the Javanese and Malays into a temporary madness; and even among Europeans its effects vary considerably in different individuals. In some persons, especially women, it produces much excitement but no sleep, the excitement being sometimes pleasant at other times extremely disagreeable. Whilst in some instances it fails to induce sleep, it soothes, and pleasant ideas occupy the mind; but on the other hand, with other persons it induces restlessness, excitement, and even delirium.

Preparations of opium, applied by means of poultices or friction, are absorbed by the unbroken skin.

Poultices containing laudanum are used to allay the pain of superficial and even of deep-seated inflammations, and enough may be absorbed in this way to produce deep sleep. Friction increases the absorption considerably; thus liniment of opium, well rubbed in, relieves neuralgias, pleurodynia, and myalgia. The abraded skin absorbs still more freely, and preparations of opium or morphia are applied to irritable, cancerous, and simple sores. Morphia dissolved in glycerine and spread on lint, is a useful application to a painful cancerous sore.

The hypodermic injection of morphia, originated by Dr. Alexander Wood, is now extensively employed to relieve pain, produce sleep, prevent spasm, and for other purposes, and is preferable to the administration of the drug by the mouth. Its action is more rapid; its effects are more permanent; and it neither destroys the appetite nor constipates the bowels. Dr. Anstie maintains that "anodynes and hypnotics ought never to be administered by the mouth in acute diseases attended by anexoria." At first not more than a sixth part of a grain should be injected; a larger quantity sometimes produces serious symptoms.

An injection not unfrequently causes a good deal of excitement, giddiness, even intoxication, great nausea, and repeated vomiting, followed by considerable depression. Often,

indeed, the patient is unfitted for work during the rest of the day. These inconveniences, however, can mostly be avoided by keeping the patient recumbent for some hours after the injection. Belladonna seems to obviate these unpleasant symptoms if combined with morphia, in the relative proportion of 20 parts of morphia to 1 part of atropia.

An injection occasionally produces redness of the face, contraction of the jaw, dyspnœa, clonic spasms of the limbs, hammering frequent pulse, which symptoms last about five minutes, followed by violent sweating on their decline. These symptoms are said to occur when the injection directly enters a vein (Nussbaum, Muhe, and Hausman). The system becomes habituated to opium by long persistence in hypodermic injections, so that not only must the quantity be increased, but on discontinuing their use a patient suffers the depressing effects of an opium-eater deprived of his opium. Sometimes so severe are these sufferings, that patients declare that the distress occasioned by the intermission of the injection is worse than the pain itself. The injection may be made in any part of the body; but, for the sake of convenience, it is better to choose a place where the skin is loose. A fold of skin should be pinched up firmly, and then the needle is thrust quickly through it into the subcutaneous tissue. If patients dread the slight pain of the puncture, the sensibility of the skin may be first deadened by the ether spray. Immediately after the injection, a sharp smarting pain is felt; and in many cases, a large flat weal, like that of urticaria, soon arises. If care is taken to make the solution as nearly neutral as possible, the pain is much reduced. It should be remembered that these injections sometimes leave a hard horny cicatrix; hence, it is important to inject some part of the skin covered by the clothes.

Eulenberg states, that the sensibility round the punctured spot is lessened if the injection is made over a superficial sensory nerve; and that the sensibility of the whole skin territory of this nerve is somewhat blunted.

A single injection sometimes cures recent and even long-

standing sciatica, facial and other neuralgias; but it usually gives only temporary relief, and the injection must be repeated from time to time.

Injections continued for days, weeks, or perhaps months, sometimes cure obstinate cases of neuralgia and its allies. Sometimes every second day, or twice a week is sufficient to mitigate the pain, and after a time to cure. A single injection frequently cures lumbago at once; but, as the mere insertion of a needle is often equally efficacious, some of the speedy cures attributed to the injection must be due to the effect of unintended acupuncture. Hypodermic injection relieves the pain of severe pleurodynia, but most cases of pleurodynia yield to milder treatment. It is particularly efficacious in the pain of renal, biliary, and intestinal colic. Although not often required, a mild morphia injection will allay severe toothache. Morphia injections are sometimes needed to relieve the pain of acute inflammations, like pleurisy and pneumonia, but are rarely required unless the suffering is severe or persistent.

Morphia injections are used to produce sleep. Morphia, subcutaneously injected, acts more speedily and in smaller quantities than when swallowed.

Morphia is injected to produce sleep in acute mania, delirium tremens, chorea, etc. In delirium tremens, even when bromide of potassium and chloral have failed, an injection often speedily produces sleep. A morphia injection is useful in chorea, when the movements prevent sleep, and when wakefulness, by weakening the patient, increases the movements. Dr. Clifford Allbutt employs morphia injections in dyspepsia of an irritable kind, when the patient is spare, fretful, keen, hasty or absent in manner, with a tongue too clean, red at tip and edges, small pulse, and broken sleep.

Dr. Allbutt strongly recommends a morphia injection in the dyspnœa of heart disease, and in disease of the large vessels; in the pain of angina pectoris, and of intra-thoracic tumours. By removing dyspnœa, it permits sleep, and recruits the worn-out patient. It strengthens the heart, and so removes

congestion of the lungs and face. Dr. Allbutt considers it less useful in aortic than in mitral disease. The author has long employed these injections in heart disease, and can corroborate Dr. Allbutt's statements.

Dr. Spender employs morphia injections to arrest the severe vomiting of pregnancy, and other obstinate and dangerous forms of vomiting. An injection often arrests persistent hiccup, and sometimes puerperal convulsions; it has likewise been successfully employed in tedious labour, produced by a rigid os utero.

Dr. T. J. Gallaher, of Pittsburg, and more recently Dr. John Patterson, of Constantinople, have witnessed great benefit from the hypodermic injection of morphia in cholera, even in the stage of collapse. The cramps and vomiting cease, the patient falls asleep, the skin gradually becomes warm, and the pulse returns. They employ one-fourth to one-eighth of a grain of morphia, and usually one or two injections suffice. In the early stages the patient falls asleep and wakes almost well. Dr. Patterson has employed this treatment for children.

Dr. Braithwaite has successfully given small doses of morphia hypodermically in hæmoptysis.

Mr. Buxton Shillitoe strongly recommends for carbuncles and boils the local application of an extract of opium, the consistence of treacle. The extract must be thickly smeared three or four times a day over and around the swelling. Applied early, it often causes the boil to abort; or it limits its progress, and eases pain. After the extract, Mr. Shillitoe applies a plaster, composed of equal parts of soap, opium, and mercury, spread on thick leather. Should suppuration set in, he lets out the matter, and applies a poultice over a small hole cut in the plaster.

Dropped into the eye, laudanum and solutions of morphia cause smarting, redness, and slight inflammation of the conjunctiva. They contract the pupil, but less so than if administered in other ways. Opium, however, is never used specifically to contract the pupil, Calabar bean effecting this more

safely, easily, and thoroughly. Opium wine, dropped into the eye, is used to relieve the pain of conjunctivitis, and by slight stimulation to improve the condition of the membrane. The wine of the present Pharmacopœia, containing spices, must not be so employed, as it would aggravate the mischief; but the wine of the Pharmacopœia of 1864 must be used. Mixed with either tannin or creasote, opium is often introduced into the hollow of a painful tooth; and if the pain is produced by inflammation of the exposed pulp, this application often gives relief.

The absorption of a somewhat full dose of opium produces much disagreeable dryness of the mouth and throat. The same annoying symptom follows likewise on the hypodermic injection of morphia.

The preparations of opium are rarely used for their topical effect on the throat, but the author thinks that their good effects are due to local action on this part. For instance, many coughs, as in some cases of phthisis, are really owing to the condition of the throat, where this part is red, inflamed, and even ulcerated,—a condition which excites much irritation, and a frequent hacking cough, troublesome especially at night. This cough is much relieved by the topical application of morphia dissolved in glycerine, honey, or treacle, or some other viscid substance, which causes the mixture to linger some time over the irritable membrane. It is well known that the cough of chronic phthisis is often best treated by directing the patient to retain a weak solution of morphia in glycerine, honey, or mucilage, for some time in the pharynx, so as to blunt the irritability of these parts, and so allay the cough. Hence, too, the excellent effects of morphia lozenges allowed to dissolve slowly in the mouth. Even over coughs entirely dependent on lung disease, opium or morphia, administered so that the medicine clings for some time in contact with the structures just outside the larynx, appear to have a greater influence than when the medicine is conveyed quickly into the stomach. This result is referable probably to the fact, heretofore insisted on, that drugs appear

to possess remedial virtues over the organs of the body even when applied only to the orifice of the passages leading to them.

The following is a good formula to allay coughs: Morphia, one-fortieth part of a grain; spirits of chloroform, three minims, in a drachm of glycerine, syrup of lemons, diluted honey, or treacle, repeated frequently, at times only when the cough is troublesome, till the paroxysm is subdued.

It is often taught that morphia should not be given in catarrh or bronchitis. When the expectoration is abundant, and there is duskiness of the skin showing deficient oxidation, opiates or other narcotics that may produce profound sleep must of course be given very guardedly, otherwise, the expectoration, during sleep, may accumulate in the lungs and give rise to serious results. On the other hand we meet with cases with very free expectoration, with very little rhonchus, and no signs of obstructed oxidation, with very violent and frequent cough. In such cases opiates relieve cough and lessen expectoration, for the secretion of mucus in the bronchial tubes is certainly stimulated by violent coughing, for when this is allayed the expectoration becomes much less abundant. That coughing may excite secretion in the bronchial tubes is shown by the common fact, that if a patient can restrain his cough the expectoration becomes less, without any signs of accumulation in the lungs.

Taken into the stomach, opium lessens both its secretion and its movements, and consequently checks digestion. Its retarding effect on digestion is well exemplified by the well known fact, that the food vomited hours afterwards, when an opiate is given too near a meal, is only very partially digested. Nay, according to Bernard a hypodermic injection may have this effect, for he found the crops of pigeons kept full after a hypodermic dose of morphia. Here we have a sufficient reason why opiates should not be given shortly before or after a meal, unless indeed it is intended to diminish appetite or to hinder the natural movements of this organ.

Opiates not uncommonly excite nausea and vomiting, symptoms very apt to occur in the morning after a night dose.

Opium, or its alkaloid, morphia, is given to quell the pain of many stomach affections, and to check the vomiting which may accompany them. Thus it is useful in cancer and chronic ulcer of this organ, and in chronic gastritis from excessive indulgence in alcoholic drinks. Morphia, in small doses, combined with tonics, taken a short time before meals, is very efficacious in removing the pain, the nausea, and want of appetite so often connected with alcoholism. In the treatment of gastrodynia with heartburn Graves employed morphia in small doses, combined with bismuth.

The effects of opium on the intestines are identical with those on the stomach; that is to say, it checks both secretion and movement, thus constipating the bowels in health, and restraining diarrhœa in disease. Constipation, one of the disagreeable consequences following an opiate, is much less marked when morphia is employed hypodermically.

Opium, or its alkaloid, morphia, is very frequently and very beneficially given in both acute and chronic diarrhœa. It is useful in the acute forms, after the expulsion of the disturbing irritant. It is, moreover, of great use in the chronic diarrhœas of tuberculosis, dysentery, and other organic diseases.

In typhoid fever, opium, in small doses, given at night, may serve a double purpose. In wakefulness, with delirium, whether of the boisterous or muttering kind, opium will often produce sleep, and thus check the delirium, while at the same time it will control or even subdue the diarrhœa.

There is a form of dyspepsia and diarrhœa which yields to small doses of opium. There is probably increased peristaltic action of the stomach and intestines, so that the food, soon after it is swallowed, is forced in a half-digested state through the pylorus into the intestines, where, owing to its crude condition, it acts as an irritant, exciting the vermicular action already acting unduly, so that a diarrhœa of partially digested food occurs soon after a meal. The patient suffers from a sensation of emptiness and hunger, which is relieved for a short time by food; but the meal being imperfectly digested,

and expelled through the anus long before it can be absorbed, the system is imperfectly nourished, and these uncomfortable symptoms soon recur. The characteristic symptoms are—sinking at the stomach, relieved for a short time by taking food, and the occurrence of an evacuation of partially digested food immediately after a meal, nay, sometimes even before it is finished, and generally at no other time. This complaint, perhaps the most common form of chronic dyspepsia in children of six to twelve years of age, is quickly arrested by administering from two to five drops of tincture of opium a few minutes before each meal, which seems to check the excessive muscular action, and so enables the food to tarry a sufficient time to undergo digestion. Still more effective is arsenic in this condition.

Colic of the intestines is well combated by small doses of opium or morphia frequently repeated. As this painful affection is generally accompanied by, and is dependent on, constipation, a purgative should likewise be given. The opium assists the purgative by relaxing that contraction of the intestines which hinders the passage of the intestinal contents.

Opium quiets the intestinal movements in inflammation of the peritoneum and of the intestines, or in wounds of the abdomen.

Opiates are administered by the rectum for a variety of purposes. Laudanum is usually injected, mixed with an ounce of decoction of starch, at a temperature of 100° or thereabouts, and is very effectual in checking acute and chronic diarrhœas; and in those severe forms of diarrhœa which sometimes carry off young children in a few hours, an injection of this kind is often the speediest way of controlling the dangerous flux. When other methods fail, the same injection often checks the purging of typhoid fever, or of tubercular ulceration of the intestines or of dysentery. It is highly useful in pain of the bowels and of the organs in the neighbourhood of the rectum. Thus an opiate injection will generally subdue the pain and frequent micturition of cystitis, and the pain arising from various uterine diseases. Sometimes a suppository of opium

or morphia is introduced into the rectum as far as the finger can conveniently carry it, but the injection of the laudanum and starch is more effectual.

Opium mixed with gall ointment is an excellent application to painful bleeding piles, and to fissures of the anus, which cause excruciating pain with each evacuation. Mild purgatives should be simultaneously employed.

Opium injected into the rectum is absorbed, and affects the distant organs of the body. Sometimes a rectal injection will induce sleep when the ordinary method of administering it by the mouth completely fails. In obstinate forms of dyspeptic sleeplessness, or the wakefulness of convalescents from acute disease, the injection of laudanum by the rectum may be tried, and will often prove successful. Both Dupuytren and Graves state that, in delirium tremens and traumatic delirium, this mode of giving opium is preferable to its administration by the mouth. The dose of laudanum injected into the rectum must depend on the nature of the case. If employed to relieve local pain, a small quantity will generally suffice; but to produce sleep a dose must be given about threefold or fourfold that administered by the stomach—at least, so it is generally taught; but an ordinary medicinal dose, even when given by the rectum if well cleared out previously by a simple enema or a purgative, is often amply sufficient to ensure sleep.

The active principles of opium readily pass unaltered into the blood; for, whether the opium is swallowed or injected under the skin, it induces the same symptoms.

To one unaccustomed to opium a small dose produces "a soothing and luxuriant calm of mind, followed in the course of forty or fifty minutes by a disposition to sleep;" if this does not happen, it gives "general repose of both body and mind, undisturbed by pain." The pulse at first quickens, slightly, in ten to twenty minutes by eight to ten beats; but in half or three quarters of an hour, it again falls; at first it is made stronger and more resistent. The mouth and pharynx are dry, and perspiration often breaks out. Larger doses, as from two to three grains, generally produce at first much ex-

citement, with noises in the ears, and closely contracted pupils. The ideas are confused and extravagant, and decided delirium may occur; the head feels heavy and full, the senses are blunted, and sleep soon follows, which is often heavy, even stertorous, and harassed by disagreeable dreams. The pulse, at first full and frequent, soon becomes slow.

The susceptibility to the action of opium, and the symptoms it produces, vary greatly in different persons. Some are so easily affected by opium, that even a small quantity endangers life; a susceptibility so extreme is, however, not common. In some it produces only agreeable feelings and ideas, in others just the reverse; in some the stimulant effects predominate, in others the narcotic.

The primary stage of excitement is very brief after a poisonous dose, and narcotism rapidly supervenes. Great giddiness and a sensation of oppression comes on, with an irresistible craving for sleep. There may be both nausea and sickness. The sleep soon passes into profound insensibility; the breathing grows slower and slower, more and more shallow, till it ceases. The face is pale, or livid and bloated, and the veins swollen. The pulse, at first full and strong, becomes small, feeble, and thready. The pupils are very greatly contracted. The power of swallowing is gradually lost, the pupils become insensible to light, the muscles relax, and the patient cannot be roused from his state of profound insensibility. Mucus collects in the throat, and at last, the breathing ceasing, death takes place. Patients may die in a state of collapse, and not from asphyxia, though death usually happens from paralysis of the respiratory muscles.

In opium poisoning a variety of other symptoms occasionally occur, as diarrhœa, diuresis, convulsions (most common in children), lock-jaw, dilated pupils, one is dilated while the other is contracted, and itching and dryness of the skin.

In some respects opium poisoning simulates apoplexy, drunkenness and uræmic coma.

Opium poisoning may be generally discriminated from apoplexy by attention to the following points:—history of the

attack, odour of breath and vomited matters, the patient's age, and the state of the pupils, which in apoplexy are very generally dilated, and are often unequal.

Only cases of profound intoxication put on a superficial semblance of opium poisoning. In each case there is great insensibility; but if the drunkard can be roused, he answers questions incoherently; but if poisoned by opium, although he is slow to speak, yet his answers are rational and to the point. The breath and vomited matters will very often tell if alcoholic drinks have been taken; but it must be recollected that suicides by laudanum not uncommonly take it in beer or other drinks, but even then the odour of the laudanum may generally be detected. In opium poisoning the pupils are much contracted; but in profound drunkenness the pupils are widely dilated. Moreover, the early symptoms of the attack are sufficient to enable us to decide between opium and alcoholic poisoning.

Uræmic coma may occur very suddenly, and without any, or scarcely any, dropsy. To distinguish such a case from opium poisoning, the history of the attack should be ascertained. A patient in uræmic coma can generally be roused partially, when some information may be extracted from him. An analysis of the urine, moreover, may throw much light on the case, while the state of the pupils precludes suspicion of poisoning by opium.

Effusion of blood into the pons varolii will produce symptoms almost identical with those of opium poisoning; thus in both cases there is profound insensibility, with closely contracted pupils, and slow stertorous breathing. It may be impossible to discriminate between these two conditions till a *post-mortem* examination reveals the real cause of death.

In poisoning by opium, *use the stomach pump, rouse the patient, and keep him constantly moving to prevent sleep;* give strong coffee, apply *cold affusion to the head,* and, if necessary, adopt artificial respiration.

It is not an uncommon practice to give brandy or wine to a patient recovering from the effects of a poisonous dose of

opium, with the view of over-coming drowsiness; but the author having watched the action of alcohol under these circumstances, always found that it greatly increased the sleepiness, and in fact did harm.

In this country the habit of opium-eating is not so largely indulged in as among Asiatics; but it is practised here in some localities to a startling extent. It is taken for its primary stimulating effect, but after a time increasing doses are needed to produce this result. Though carried to a very great pitch, this practice in some individuals induces neither physical nor mental weakness, while others waste, and grow physically and mentally weak, irritable, fretful, and desponding, especially when the opium is withheld; the memory is much impaired; the skin becomes sallow; but, strange to say, in many cases the bowels are not constipated.

The horrors which opium-eaters suffer when the drug is withheld are well known, and need not be dwelt on here; so great indeed is the suffering, that few have sufficient resolution to relinquish the habit. The amount of opium taken is often enormous. De Quincey took 320 grains daily! The moderate indulgence of the habit is perhaps not more prejudicial to health than tobacco smoking. The Chinese are almost universally addicted to the habit of opium-eating, and yet they are an intelligent and industrious race.

Bernard's experiments lead him to conclude that opium depresses the functional activity of the sympathetic system, and notably that part supplying the submaxillary gland. Gscheidlen considers that opium affects the terminations of the motor nerves; small doses at first heightening, but afterwards depressing their function, whilst large doses depress it from the first. Opium is said to lessen the conductivity of sensory nerves, though this blunted sensibility must be due in some measure to the effect of opium on the grey matter of the brain, depressing the power of perception.

In fevers, whether inflammatory or specific, sleeplessness, quickly wearing out the strength, is often one of the most dangerous symptoms. Want of sleep produces either noisy

and furious delirium, as is frequently seen in typhus fever, or wandering and muttering, with picking of the bed-clothes, twitching of the muscles, and great prostration. In either case, opium, judiciously given, may save an almost hopeless life. In delirium of the furious kind, it is well to combine, the opium with tartar emetic, as this combination calms the excitement, and produces sleep more speedily and effectually than opium given alone. Graves gave three or four drops of laudanum and one-sixth to one-eighth of a grain of tartar-emetic every two hours till tranquility and sleep were insured. In very boisterous delirium he increased the dose of tartar-emetic. Now-a-days, however, morphia hypodermically administered is found to act more certainly and speedily, without deranging the stomach or intestines.

Laudanum may be given alone with signal benefit in muttering delirium, with muscular tremors, dry skin, and prostration. A grain of morphia or a drachm of laudanum is mixed with four ounces of water, and a tea-spoonful is given every five or ten minutes, till three or four doses have been administered. If by that time the patient is not asleep, the medicine should be intermitted for half an hour, then if sleep does not come on, a few more doses should be given in the same way. This method often insures calm, refreshing, invigorating sleep, lasting several hours, out of which the patient wakes free from wandering, refreshed, the tongue moister, the appetite and digestion improved, and the skin comfortably moist. Sometimes, however, it answers better to give a single moderate dose.

Any one who has watched the action of opium on a patient in extreme weakness, with sleeplessness, twitching and tremor of the muscles, quivering dry brown tongue, and parched skin, must have been struck by the fact that the administration of laudanum, by producing refreshing sleep, helps a patient over this critical stage with far less consumption of alcoholic stimulant than would otherwise have been required. It need scarcely be said that in many cases brandy or wine must be freely given with the laudanum.

In delirium tremens, opium does great service by producing sleep, and it answers best when employed hypodermically. If the patient is strong, the delirium boisterous, the pulse full, then tartar-emetic or tincture of aconite may be added to the opium. It is convenient to administer the opiate with porter or spirits, this combination apparently heightening its action, while it is more readily taken by the delirious patient. It has been already mentioned that opium in delirum tremens sometimes acts more efficiently when given by the rectum.

Many cases of acute mania may likewise be treated satisfactorily by opium and tartar-emetic. (See Chloral).

Dr. Graves has well pointed out that when an opiate is given as an hypnotic, attention should be paid to the time of its administration. It should be given at the usual time for sleep, or when the patient feels inclined to doze, so that the medicine may come in aid of nature, herself tending to the same end; smaller doses are then more effectual than if given at a less seasonable time. For example, in chronic wasting disease, accompanied by hectic, the opiate should be given very late at night; for then there is no inclination to sleep till the early morning hours. Opium ordinarily requires about one or two hours to produce its narcotic effects. The chronic sleeplessness independent of any very notable disease should not be treated with opium, if it is possible to avoid it. Dyspepsia and uterine derangements are constant causes of sleeplessness, and chloral and bromide of potassium are much better agents than opium.

Opium will of course relieve or abolish pain; yet in the treatment of chronic cases it is right to exhaust all other methods of easing pain; for the opiate soon loses its influence, and must be given in increasing quantities, until the patient becomes accustomed to it and is unable to discontinue it without great discomfort, even after permanent removal of the pain.

Opium, especially when employed hypodermically, is often of great service in acute rheumatism to relieve pain and to ensure sleep.

Opium is often of signal use as an antispasmodic. Its action in this respect, as well as its narcotic power, is much enhanced if given with a stimulant, as alcohol, ether or chloroform.

Laudanum or morphia is of marked service in the convulsive stage of whooping-cough. A sufficient dose should be given to the child to produce very slight heaviness, which state should be maintained by giving one-fiftieth of a grain of morphia every three or four hours, or a proportionate dose every hour. A quarter of a drop or two drops of laudanum, according to the age of the child, must be given every hour. This treatment often qnickly removes the whoop, and reduces the severity and frequency of the cough; but in the case of any irritation, as of teething or of worms, tuberculosis or much bronchitis, then this remedy, like most others, is of little or no use. (See Belladonna, Lobelia, Bromide of Potassium).

Opium and its preparations are beneficial in renal and biliary colic. Morphia answers best when employed hypodermically. If administered by the mouth, small doses of the opiate chosen, combined with spirits of chloroform, should be administered every five or ten minutes, till the pain gives way.

Opiates are also beneficial in some cases of asthma; yet morphia, with some asthmatics, will induce a paroxysm of dyspnœa.

Opium is very useful in diabetes to control inordinate appetite; the diminution of quantity of ingested food, reduces the kidney excretion, and abates the troublesome thirst. It was at one time thought, that this was the only way opium proved useful in diabetes, but it has been shown lately that large doses frequently repeated, will greatly lessen and indeed remove the sugar from the urine, the diet and the appetite remaining unchanged.

Opiates are also used in spasmodic stricture.

Opium and its preparations are reputed to check the secretion from all the mucous membranes of the body, and on this

account are given in bronchitis to check excessive secretion of mucus and pus.

Opiates are employed as diaphoretics.

It is well known that opium; in a small dose taken at night, will, if resorted to at the commencement of the attack, cut short a cold in the head. Some attribute its efficacy to its influence on the skin, and Dover's powder is very generally employed. Two or three drops of laudanum, taken at bed-time, is often sufficient to abolish at once a threatening attack of cold in the head. A glass of hot grog assists the action of the opium.

Laudanum, especially when mixed with tincture of nux vomica, is very serviceable in some of the distressing symptoms which afflict hysterical women, or nervous, over-worked, anxious men. Both men and women, but chiefly women, about forty or fifty years of age, are apt to complain of a sensation of great weight and heat on the top of the head, with frequent flushings of the face, suffusion of the eyes, hot and cold perspirations, and sometimes shooting pains passing up the back of the head, occasionally centring in one brow, with much heaviness and torpor after meals, and now and then the sensations as of a tight cap on the vertex, or dull aching pain in the same part, with inability to fix the attention, and much depression of spirits. These symptoms may generally be traced to a variety of causes, as dyspepsia, especially the flatulent form, heart-burn, uterine derangements of various kinds, or unhygienic conditions. In any case, however, a drop of laudanum, with two of the tincture of nux vomica, repeated three or four times a day, will generally dissociate the foregoing symptoms from the disease with which they are connected, to the great relief of the patient.

Morphia occasionally produces an eruption, sometimes like that of measles, at other times like that of nettle rash: it may be accompanied by distressing itching, sufficient often to counteract the anodyne properties of the medicine.

Tincture of opium in a large dose (3j) mixed with brandy

is recommended in profuse flooding after parturition, accompanied with much exhaustion of the uterus.

The influence of opiates on the urine of diabetes has been already pointed out.

The preparations of opium diminish the water and urea of healthy urine, probably by lessening the appetite, and hindering digestion. Morphia passes out in part by the urine.

Under the influence of opium, the urine is sometimes retained in the bladder for several days.

It is important to bear in mind that the active principles of opium pass out with the milk, so that a child at the breast, may be dangerously affected by opium given to its mother.

Individual peculiarities, disease, age, and custom, modify the action of opium.

Of individual peculiarity we have already spoken. Mr. J. Browne has shown that there is sometimes hereditary susceptibility to some drugs, as opium and mercury. As is well known, very large doses of opium are tolerated in some diseases, especially in the case of severe pain.

Age influences the action of all medicines, but in an especial degree that of opium.

That medicines in the same dose should act far more powerfully on the young than the old, is only natural, for after their absorption, medicines are mixed and diluted with the blood; and as the mass of blood is far greater in adults, this dilution is, of course, greater in them than in children. Other things being equal, the dose of a medicine must, as a general rule, be proportioned to the weight of the individual, provided there is not an undue development of fat; opium, however, is a notable exception, the relative susceptibility of young children to its action being far greater than in adults. So great is the power of opium over persons of tender years, that great care must be taken in its administration.

The influence of custom on the action of opium has already been mentioned.

Morphia is said to be less stimulating, less constipating, less diaphoretic, and less liable than opium to produce headache and nausea.

Some writers extol the narcotic virtues of codeia, asserting that, unlike opium, it produces calm sleep without disordering digestion, exciting nausea, constipating, or producing headache. Other observers consider it useless as a narcotic.

Narcein has been much recommended as more efficacious than morphia, as a hypnotic and sedative. It is said to produce no headache, to induce less perspiration than morphia, not to constipate, nay, in large doses to purge, rarely exciting vomiting, but often nausea and loss of appetite. One observer computes that narcein is four times weaker than morphia. It is stated this is the only alkaloid of opium which does not produce convulsive movements.

Dr. J. Harley considers narcein a pure hypnotic much feebler than morphia and of very little use in medicine, its insolubility rendering it unfit for subcutaneous injection. On the other hand, Dr. Fronmüller, having tested it by mouth and hypodermically, asserts that narcein possesses no narcotic properties: 20 grains by the stomach produced no sleepiness or any effect on the respiration, pulse, heat of skin, urine or pupils.

Narcotine, in doses of one to three grains, is asserted to possess antiperiodic properties. Some consider it even superior to quinia in ague.

Very conflicting statements are made regarding other properties of narcotine. Eulenberg, Charvet, Fronmüller, and others, assert that small doses increase the frequency and the strength of the pulse, making it irregular after a time; and that it increases the frequency of the respirations and exalts the temperature. Small doses they say are not narcotic. Schroff says, doses of 0·06 to 0·12 grms. produce symptoms like the first stage after a usual dose of opium, but without affecting the pupil or producing nausea. Fronmüller asserts that 15 to 30 grains produce sleep; but, on the other hand, Bailley gave 60 to 120 grains without inducing sleep.

Papaverine is said to possess strong narcotic properties without inducing the previous stages of excitement, and is not followed by headache and giddiness. It contracts the pupil,

and when it causes sleep reduces considerably the frequency of the pulse to the extent even of from 20 to 30 beats. Fronmüller also finds that it is a narcotic, and that it dilates the pupil—the pulse, respiration, and temperature remaining unaltered. Hoffmann, in some experiments on himself, could not obtain these results.

The statements concerning the action of the opium alkaloids is most contradictory, due probably in part to the employment of a mixture of the alkaloids, or to impure preparations, and in part to the fact that the effect of these substances on animals is different to their effect on man. Thus, as regards man, morphia is the most powerful alkaloid; but according to Bernard, it ranks fourth as regards animals. Thebaia is to animals the most poisonous alkaloid; but its effect on man is much less marked. Again, it is said that, with respect to animals, narceine is the most soporific of the alkaloids; but its action on man is far less than morphia.

The investigations of Claude Bernard have led him to arrange the constituents of opium into three classes; namely, the soporific, the convulsant, and the toxic. He thus arranges the constituents in the order of their activity :—

Soporifics.	*Convulsants.*	*Toxics.*
Narcein	Thebaia	Thebaia
Morphia	Papaverine	Codeia
Codeia	Narcotine	Papaverine
	Codeia	Narcein
	Morphia	Morphia
	Narcein	Narcotine.

For further remarks on the action of thebaia, codeia, narcotine, and morphia, see Strychnia.

NUX VOMICA. STRYCHNIA. BRUCIA. THEBAIA.

The three alkaloids, strychnia, brucia, and thebaia, appear to exert a similar action on the spinal cord, so that for convenience sake they are grouped together; but it must be stated that strychnia is more powerful than brucia, and brucia than thebaia. The remarks which follow apply mainly to nux vomica and its alkaloids, as thebaia has not yet been put to any therapeutic application.

It was formerly an occasional custom to blister the skin over paralyzed muscles, and to apply strychnia to the raw surface, with the hope of producing a greater effect on the diseased muscles than when the medicine is swallowed. This method, being superseded by the hypodermic injection, has now fallen into disuse.

Dr. Anstie recommends the hypodermic injection of strychnia in one-hundred and twentieth of a grain-doses to relieve the pain of cardialgia and gastrodynia, knowing, he says, "at present no such remedy for gastralgia as this."

Mr. Charles Hunter advises the injection of strychnia hypodermically, in cerebral, spinal, and other forms of paralysis. About one-eightieth to one-sixtieth of a grain administered twice or three times a week, will, he says, after three or four injections, almost always show if strychnia manifests any effect on that particular form of palsy. The injection produces a general warmth or glow of the skin, lasting a few hours, felt most in the paralysed limbs and down the spine; removes the sensation of heaviness or weight and the muscular twitchings, spasms, or cramps, of the paralysed parts, and may induce sweating, especially of the palsied parts. Most of these results I have myself witnessed.

Mr. Barwell employs strychnia hypodermically, in essential paralysis of children and eccentric paralysis of adults; in loss of motor power from pressure on a nerve; from debility after exhausting diseases, as diphtheria, scarlatina, or low fevers;

also in the latter stages of lead or gout paralysis. In opposition to the experience of Mr. Hunter, he cautions against the use of these injections in cerebral and spinal paralysis. Mr. Barwell injects from one-twentieth to one-twelfth of a grain, and employs a two per cent. solution, believing that of this solution a larger dose may be injected with safety, than a corresponding dose of a weaker solution. I have often injected the same relative dose of the pharmacopœia solution, without inducing any of the toxic effects of the drug. The injection should be made into the muscles every second day, or even daily.

Dr. Julian Chesolm employs hypodermic injections of strychnia in eye and ear diseases. He begins with one-fortieth of a grain, daily increasing the quantity till in fifteen to twenty days one-sixth or one-fifth of a grain is reached, and no benefit may take place till these larger doses are administered. As we meet with idiosyncrasies in respect of strychnia, it is well to begin with a small dose. These injections he employs in muscular asthenopia, amblyopia, tobacco amaurosis, and in progressive nerve atrophy not dependent on intra-cranial disease. Dr. Werner finds strychnia by injection useful in traumatic amaurosis. Perhaps these large doses given by the stomach might prove just as serviceable.

The preparations of nux vomica have an intensely bitter taste, and, like other bitters, augment the flow of saliva.

They produce a sensation of hunger, but there is no evidence that strychnia or any other bitter substance increases the digestive power in a healthy person. Like other bitters, and perhaps more efficaciously, these preparations, by their slight irritant action, obviate departures from health of the gastric mucous membrane, and under such circumstances promote digestion. Their action, and especially that of the tincture of nux vomica, for this purpose far the best and most agreeable, is well shown in certain perverted conditions of the digestive canal. For example, in the course of chronic diseases, as bronchitis or dilated heart, or cirrhosis of the liver, the tongue not unfrequently becomes thickly coated

with a white fur, and the state of the digestion indicates chronic catarrh of the stomach. One or two drops of the tincture of nux vomica in a teaspoonful of water, every two hours or oftener, for twenty-four to forty-eight hours, will often clean the tongue, improve the digestion, and clear the way for the administration of nourishment at a critical time. Again, during early convalescence, when the tongue still continues coated, and the digestion weak, nux vomica will improve the condition of the digestive organs, and prepare the way for stronger tonics and more liberal diet.

This treatment greatly mitigates the annoying flatulence and indigestion occurring in cases of mechanical obstruction of the circulation in the digestive organs, as from cirrhosis and dilated heart; indeed, nux vomica is more or less serviceable in flatulency of any kind. Heartburn, too, frequently yields to small quantities of the tincture given three or four times a day.

Nux vomica is of great service in a group of symptoms, including weight at the pit of the stomach after food, acidity and heartburn, flatulence, accompanied by heat and weight at the top of the head, the last symptom occurring usually in women, especially about middle age. This dyspeptic condition is often benefited by five drops of the tincture of nux vomica taken about a quarter of an hour before food three times a day. The heat and sensation of weight on the top of the head, even when occurring independently of any gastric disturbance often yields to the same treatment.

In acute gastric catarrh, accompanied by "sick headache," the action of tincture of nux vomica is often very conspicuous. This common and troublesome complaint is sometimes traceable to error in diet, or constipation, but it occurs often without any apparent cause. Headache is often the most prominent symptom, the nausea being very slight, amounting only to mere qualmishness. A drop of the tincture in a teaspoonful of water, taken every five or ten minutes, to the extent of eight to ten doses, and then continued at longer intervals, often quickly mitigates this kind of headache, and

in a few hours removes it, when otherwise it would continue severe all the day.

The tincture or extract of nux vomica has long been employed to obviate constipation, habitual or temporary. The extract, variously mixed with other remedies, as rhubarb or colocynth pill, should be taken daily, a little time before dinner, both to aid digestion and the proper unloading of the bowels. Or the same effect is often obtainable by giving one or two drops of the tincture twice or three times a day; this small quantity often proving amply sufficient to ensure daily one comfortable motion. In our lack of knowledge of the exact circumstances indicating its employment in cases of constipation, it seems to be capricious in its action, and it is as well, therefore, not to be too sanguine of its success; for in some cases it answers beyond all expectation, while in other apparently similar cases it fails as completely. If the sluggishness of the bowels has persisted a long time, and is very obstinate, the patient should take occasionally, early in the morning, half a tumblerful of some natural purgative water to assist the nux vomica. Should the tardy action of the bowels be due to insufficient supply of bile, the motions being pale in colour, nux vomica will fail, and other more appropriate medicines are required.

Strychnia, as Mr. Savory has shown, is much more poisonous when injected into the rectum than when swallowed, a curious difference not owing to the digestion and destruction of the alkaloid by the gastric juice, as Mr. Savory has proved that this secretion exerts very little, and probably no effect, upon strychnia.

Strychnia and the other active principles of nux vomica quickly enter the blood, as is shown by the rapidity with which a poisonous dose is followed by characteristic symptoms. Moreover, the alkaloid can be extracted from the blood and urine, a conclusive proof of its absorption.

A large and poisonous dose produces symptoms very closely resembling those of tetanus. The first symptoms are general uneasiness, with restlessness and soreness of the

limbs. Shooting pains like electric shocks occur in various parts of the body, often first in the back, and down the arms and legs. Tetanic and paroxysmal contractions of the muscles soon set in, which rapidly grow worse, make the body rigid while the paroxysm lasts, and completely arrest the respiratory movements, so that the face becomes bloated and livid, the jugular veins stand out in the neck, the eyes are staring and prominent, the jaws firmly clenched, and the pupils dilated. Each spasmodic attack lasts from a few seconds to a minute or more, and then generally ceases altogether for a time. Throughout the paroxysms, the mind is quite unaffected, and the patient's sufferings are agonizing. A breath of air, a slight noise, movement of the bed-clothes, the most trivial cause, will excite tetanic spasms. In a fatal case death is rapid; and if the patient survive two or three hours, sanguine hopes of his recovery may be entertained. A fatal termination may be due either to exhaustion from the repeated convulsions, or to asphyxia from spasms of the muscles of the chest.

Brucia, thebaia, and most of the opium alkaloids affect the body in the same way.

The symptoms of strychnia poisoning differ from those of tetanus in the following particulars:—From the first they are very strongly marked, and rapidly reach their worst, perfect intermissions occur, and death soon takes place, or the symptoms rapidly decline, and the patient recovers.

Treatment of poisoning.—*Stomach pump*, when it is available in time, for after tetanic symptoms have set in, the introduction of the stomach tube would excite a paroxysm. *Animal charcoal.* Tannin solution of iodine. *Chloroform inhalation.* Injection of curare or of methyl and ethyl compound of strychnia, of brucia, or of thebaia. Artificial respiration. Fats.

Leube and Rosenthal find that pulmonary insufflation arrests strychnia tetanus by increasing, as he supposes, the absorption of oxygen. Brown-Séquard confirms these statements concerning insufflation, but contends that the arrest of

convulsions is due to the mechanical effect produced by the air forcibly impinging upon the ramifications of the vagus, of the bronchi, and of the nerves of the diaphragm, and exciting a reflex inhibitory action; for section of the cord above or below the origin of the phrenic nerves and section of the vagi prevent the action of insufflation.

Strychnia excites tetanus, not through the brain; for in poisoning by strychnia the mind, to the last, remains unaffected, and between the paroxysms animals can execute voluntary movements. Nor does it tetanize through the muscles or nerves; for after division of one sciatic nerve, strychnia excites tetanus in every part of the body except in the limb supplied by the divided nerve; yet as the vessels of this limb are undivided, its unconvulsed muscles and nerves are as much poisoned by strychnia as those parts which are convulsed. As strychnia tetanizes neither through the brain muscles nor nerves, it must act through the cord. Since tetanus depresses the functional activity of the motor nerves and muscles of a tetanized limb, the one conveying and the other responding imperfectly to stimuli, it would seem that strychnia paralyzes these parts in some degree; a surmise apparently strengthened by the fact that the tetanized muscles quickly become stiff from rigor mortis. Kölliker, however, has shown that tetanus depresses the functions of the motor nerves and muscles through the excessive activity they have been made to undergo. On division of the sciatic nerve, Kölliker found that the posterior limb was not convulsed, and that the motor nerves of this limb retained perfectly their power to conduct impressions, and the muscles to contract on stimulation. Kölliker is of opinion that the afferent nerves are unaffected by strychnia.

Harley's experiments show that the poison acts on all parts of the spinal cord. Its effect on this organ appears to be twofold. It dilates the vessels, and thus increasing the supply of blood, augments the activity of the functions of the cord. But apart from this property of dilating the vessels, it is supposed that strychnia exerts a direct stimulating influence on

the spinal cord, although, as Harley has shown, it can act only through the blood, and does not, as was formerly supposed, exalt the functions of the cord when divested of all its vessels, and when a solution of strychnia is brought into direct contact with its elements.

It is stated that traumatic and strychnic tetanus produces minute ecchymoses in the cord; but this is not the case with tetanus excited in frogs by strychnia; for these animals may be tetanized for weeks without the production of ecchymoses, —a fact proving that they are the result, and not the cause, of the tetanic spasms.

Kölliker asserts that strychnia affects but little the blood of frogs.

Nux vomica or its alkaloid is commonly employed, often with great benefit, in motor paralysis. It is sometimes administered with the view of exciting slight twitchings in the paralysed muscles, so as to keep a sort of artificial exercise to maintain their nutrition, and prevent their wasting; but if strychnia benefited in this way, surely galvanism would effect this object better. Dr. Brown-Séquard recommends nux vomica or strychnia in those forms of paraplegia dependent on softening and wasting of the cord, as when the supply of blood conveyed to it is diminished through degeneration and partial blocking-up of the vessels. Strychnia is supposed to dilate the vessels, and to increase the supply of blood in the degenerated tissues, and thus avert their further destruction.

Strychnia sooner affects paralyzed than unparalyzed muscles.

Strychnia in medical doses is said to strengthen the beating of the heart. It has been shown that the heart of an animal poisoned with strychnia ceases to contract sooner after death than that of an animal destroyed by mechanical means; and further, that if a frog's heart is placed in a solution of strychnia, it ceases to beat sooner than another placed in simple water. It is not said whether this organ ceases to contract in the systole or diastole. Harley states that if a

solution of strychnine is dropped on a heart, its muscles become tetanic. The same authority says that both strychnia and brucia lessen the absorption of oxygen, and the production of carbonic acid; in other words, they lessen the respiratory function of the blood. Thus, if either of these alkaloids is mixed with blood recently drawn, the amount of oxygen it absorbs, and of carbonic acid it gives off, is less than with simple blood. Is it not probable that any substance capable of altering the physical or chemical condition of the blood will lessen its respiratory function?

Strychnia given to rabbits with young, causes them to abort; whence it has been concluded that it possesses a direct influence on the uterus, but there is no evidence to confirm this conjecture.

Strychnia is useful in prolapsus ani. If the prolapsus is associated with constipation, the nux may be added to a purgative, as tincture of rhubarb. In case of diarrhœa this should be checked, when the prolapsus will probably cease; but if not, strychnia will generally succeed quickly in curing a child of this troublesome complaint.

These preparations, and especially the tincture, are often of much use in the so-called hysteria met with in middle-aged people. It appears in many cases to control the distressing flatulence commonly connected with this state, and to relieve the sensation of heat and weight on the top of the head, and it often removes effectually, although less surely, the flushings of the face and hot and cold perspirations. It is still more effectual when combined with small quantities of laudanum.

Dr. Anstie has noticed that strychnia sometimes produces symptoms closely resembling intoxication, this peculiar effect manifesting itself in unsteadiness of gait, perversion of the intellect, and a meaningless smile. On one occasion the author was able to connect a peculiar wandering delirium at night with the employment of strychnia. In this case there were no tetanic twitchings.

According to Dr. Anstie strychnia promotes capillary cir-

culation; hence he recommends it in troublesome coldness of the hands and feet.

Strychnia sometimes induces persistent erections, which phenomenon has led some medical men to give it in impotency and spermatorrhœa.

Large doses of strychnia, are sometimes useful in spermatorrhœa, especially when associated with impotence.

Strychnia is sometimes employed with much benefit in paralysis of the bladder in old people whose water constantly dribbles away. It may be useful in the incontinence of urine of children.

Strychnia is separated in part, at least, by the kidneys. Its influence, if any, on the urine has not yet been ascertained.

Drs. Crum Brown and Fraser, in a remarkably able paper, have recently published some experiments made with methyl and ethyl compounds of strychnia, brucia, and thebaia, and have arrived at some astonishing results. While retaining most of their chemical properties, giving the ordinary reactions of strychnia, brucia, and thebaia, yet the physiological action of these substances on the body is completely altered. These observers experimented with iodide of methyl-strychnium, sulphate of methyl-strychnium, and with the nitrate and hydrochlorate of the same base; likewise with iodide and sulphate of methyl-brucium, and with iodide and sulphate of methyl-thebaium.

Strychnia, brucia, and thebaia, as we have already stated, affect the cord, and produce, according to the dose, more or less severe tetanic convulsion. But these substances, when converted into the ethyl and methyl compounds, cease to act in this manner, but produce general paralysis of the body, an effect shown by these experimenters to depend on paralysis of the ends of the motor nerves; that, in fact, these new compounds act on the body in the same way as curare.

In their action on the heart and muscles, these new substances were likewise found to differ much from strychnia, brucia, etc.; for, after poisoning by the methyl or ethyl

compounds, the heart continued to contract naturally for a long time, while the muscles for many hours continued flaccid, contractile, and alkaline.

These observers further experimented on codeia, morphia, and nicotia. At the conclusion of their treatise they say—"The change in the character of the physiological action is remarkably illustrated by strychnia, brucia, and thebaia, whose purely spinal stimulant action is converted into a paralyzing action on the periphery (end organs) of motor nerves; it is apparent in codeia and morphia, whose convulsant action is also converted into a paralyzing action on motor nerve-end organs, and whose hypnotic action is apparently altogether destroyed in the case of codeia, and certainly greatly diminished in that of morphia; and it is obvious, though less so than with the others, in the case of nicotia, whose convulsant action is diminished, if not altogether removed. We may conclude from these facts that when a nitrile base possesses a strychnia-like action, the salts of the corresponding ammonium bases have an action identical with that of curare.

"It is well known that curare and strychnia are derived from plants belonging to the same genus, and it is therefore interesting to observe such a relationship. It may not, however, be altogether superfluous to add that strychnia, brucia, and the other spinal stimulant alkaloids examined in this paper, have not been converted by chemical addition into curarina—the active principle of curare. The action of the methyl derivatives of these bases is of precisely the same character as that of curare, and they possess the same peculiarity of slow absorption by the mucous membrane of the digestive system, but the degrees of their activity are very different. If we confine our attention to the salts of the methyl derivatives of strychnia, brucia and thebaia, where the action is uncomplicated, we observe they form a series in which the fatal dose varies for each, while this dose, in the case of the most active of the three, is considerably above that of curare, and greatly above that of curarina. Besides, curarina has a characteristic colour reaction that belongs to

none of these bodies, and the latter further prove this dissimilarity by each of them possessing special colour reactions, by which they may be distinguished from each other."

LOBELIA INFLATA.

This remedy has been both highly extolled and as strongly condemned; for with some it has answered beyond expectation, but to others it has yielded nothing but failure and disappointment. This discrepancy of evidence may be reconciled; for it will be found that the medicine has been given in very different doses by the two differing sets of authorities. Unless given in large doses—doses considered by many, without any foundation, as poisonous—this remedy is inoperative. Many erroneously think that lobelia is a highly poisonous and dangerous drug, to be given with much caution and close watching.

Lobelia is of great service in many cases of asthma, whether dependent or not on visible structural changes in the lung. It is useful in the peptic and especially in the bronchitic form. These two forms are generally more or less mixed, the tightness of breathing in bronchitic asthma being increased by food, and the peptic asthma leading after a time to emphysema and bronchitis. Lobelia is less useful I think where the attacks come on periodically, at intervals varying from about three weeks to a month. It may indeed postpone or partly suppress the paroxysm for several days, but after a time it usually breaks out, the lobelia being apparently unable to prevent the attack. My experience leads me to esteem lobelia higher the more I try it. I frequently hear patients extol it though it must be confessed that in some cases it fails entirely. In the bronchitic form patients often say it "helps them to get up the phlegm." It is hardly necessary to observe that lobelia is not useful in all forms of dyspnœa; for instance,

it is useless when this depends on heart disease, and when the difficulty of breathing comes on only from exertion, or from a bad fit of coughing. This medicine being only remedial, and not curative of the conditions causing the dyspnœa, it should be given only during a paroxysm. On any signs of an oncoming fit the medicine must be taken immediately, in doses of a drachm of the simple tincture every hour, or even every half hour, or ten drops may be taken every ten minutes or quarter of an hour, till the dyspnœa gives way. It is better to adopt the smaller and more frequent dose, as, should sickness or depression occur, the medicine should be discontinued. The great drawback is its uncertain action, some patients being made sick and faint by doses which others take without any such effect. The risk of depression is obviated by small frequent doses, and a patient soon learns the suitable dose and periods necessary in his case. It is well to inform patients of the possible occurrence of sickness and faintness, which may make them feel very ill; but these symptoms soon disappear, and never, so far as the author has seen, become serious or dangerous. Thus he has repeatedly given two drachm doses without any dangerous consequences; but this large dose generally excites a sensation of sinking at the stomach, with nausea, and not unfrequently vomiting. Where the patient complains of more or less constant tightness of the chest with frequent exacerbations during the day, he should take ten minims of the tincture thrice daily, with an additional dose on the occurrence of the exacerbation. In bronchitic asthma where the breathing is a little tight all day but much worse at night, the patient should take ten minims, three times a day with additional doses, according to the state of the breathing at night. It should be given with caution to asthmatics with heart disease, or it may render the pulse irregular and very weak. Lobelia inflata allays the dyspnœa which accompanies capillary bronchitis in emphysema.

In certain epidemics of whooping cough lobelia is very serviceable, whilst in some epidemic forms it seems useless. Lobelia is useful in the spasmodic stage, and generally, in

two or three days, reduces by one half the frequency of the attacks, lessening at the same time their severity. The speedy subsidence and disappearance of the whoop attest the influence of this drug. Like all other remedies for whooping cough, it acts best in uncomplicated cases, and when the weather is warm and mild. If the weather is cold, and the winds cutting and sharp, the child should be confined to a warm room; but under other circumstances the child should live as much as possible in the open air. For a child two years old, the author orders ten minims of the tincture of lobelia every hour, and an additional dose each time the cough is imminent, if it gives sufficient warning. Children bear large doses of the drug; for, in no instance, has the author witnessed nausea, sickness, or faintness, or any ill effects, follow the doses just recommended. He finds, indeed, that adults are much less tolerant of lobelia than children.* Sometimes, it is true, this medicine produces a slight burning sensation in the throat. Whooping cough is well known to be a very obstinate and dangerous affection in children only a few months old, and in such cases lobelia often appears to do less good than in older children. The author gives five minims of the tincture every hour even to very young children.

Lobelia has been praised in bronchitis; the author has tried it in several cases; but while it removed any paroxysmal dyspnœa, it appeared to be powerless over the bronchitis itself. It has been employed in laryngismus stridulus and in croup.

* Mr. Foster of Huntingdon, and Dr. Howard Sargent of Boston, America, recommend clover in whooping cough. Dr. Sargent gives a wineglassful occasionally through the day, of an infusion made with two ounces of carefully dried blossoms of red clover, steeped in a pint of boiling water for four hours.

CANNABIS INDICA.

All persons are not similarly affected by Indian hemp, and race and climate have been supposed to modify its influence. Its effects are most marked on the brain, whose functions it more or less perverts in various ways. It generally produces a pleasurable intoxication, and the dosed person becomes talkative, or sings, or perpetually giggles, and objects often assume to him very grotesque aspects, exciting him to much merriment. He is possessed with a feeling of happiness and contentment, and ideas of a pleasing kind pass with much rapidity through the mind, sometimes unconnected and immediately forgotten; but in other instances remembered on the return to the normal state. After a time sleep sets in, generally accompanied with delightful dreams. There may be pain in the head, and "a sensation as of the brain boiling over, and lifting the cranial arch like the lid of a tea-kettle." Among the early symptoms are a feeling of heaviness of the arms and legs. The head feels hot and heavy. The eyes are bright and shiny, with sometimes giddiness and noises in the ears. General sensibility is also affected, and pricking in the feet, or over the whole body with numbness, often of a pleasurable kind, is an early symptom. Pressure on the skin may excite a sensation of burning. After a time, complete anæsthesia sets in to such an extent, that while standing there may be no consciousness of touching the ground. The muscular sense is even lost, and pain is lessened or removed. Sometimes it produces complete catalepsy. It often occasions a ravenous sensation, not to be appeased by food. In some instances the pulse is said to be at first rather increased in frequency and strength, but neither pulse nor breathing is much altered. The pupils contract to light. Sometimes there is strong sexual desire.

Such is the group of symptoms induced by Indian hemp, but they do not all occur in the same person, but are variously combined; and sometimes it produces sensations anything

but pleasant, as nausea, vomiting, great thirst, frequent, weak, and intermittent pulse, with disagreeable sensations and ideas.

If indulged in for a long time, as is common in the East, it produces loss of appetite and strength, trembling and much mental weakness. It is used to produce sleep, and its effects have been compared to those of opium; but it differs from this drug, it is said, in not producing nausea, constipation, or headache. Fronmüller administered it in 1000 cases, and found that it succeeded in 530; partly succeeded in 215; and produced little or no effect in 255 instances. A large dose is required to induce a hypnotic effect, a quantity as eight grains of the spirituous extract, which sometimes excites headache, vomiting, and giddiness soon after its administration; and the headache may be severe, dull, and throbbing, and accompanied by a coated tongue. Opium is a more certain hypnotic.

Cannabis indica is one of the most valuable remedies for megrim or sick headache. It appears to act on the central nervous affection on which this headache depends. It is found serviceable both in cases where there is little or no nausea, and where the attacks are accompanied by severe vomiting. It is most useful in my experience in preventing the attacks. It is sometimes useful in those severe forms where the headache is continuous for weeks, (see Croton-chloral); but is especially effective, where from fatigue, anxiety, or change of life, the attacks become much more frequent, then the drug gradually, and indeed sometimes quickly lengthens the interval between the attacks, and at last brings them back to their old periodicity, or even extends the intervals between the seizures. It need hardly be said that cannabis will not cure these patients. I have given this drug weeks or months continuously in doses of one third to one-half a grain twice or thrice daily. As anæmia or constipation, favouring and even exciting causes of megraine, often co-exist with it, cannabis indica may be combined in pill with either iron or aloes.

Dr. Clouston recommends cannabis indica combined with bromide of potassium in mania, giving a drachm of bromide of potassium with a drachm of the tincture of cannabis indica.

It has been given in a variety of diseases, but has hardly yielded the good results which were expected of it. It has been found useful in neuralgia, whooping-cough, and asthma. It appears to be useful in some cases of hysteria. Some accord it a high reputation as a diuretic in acute and chronic Bright's disease, and consider it to be specially indicated when there is blood in the urine. It is further said to relieve dysuria and strangury, and to be useful in retention of urine dependent on paralysis from spinal disease. It is used occasionally in gonorrhœa. It is very useful, as Dr. Silver has pointed out, in menorrhagia and dysmenorrhæa.

ERGOT.

Ergot has a disagreeable, bitter taste, and occasions an abundant secretion of saliva. In large doses it produces nausea, vomiting, colic, diarrhœa, giddiness, headache, dilatation of the pupil, great retardation and slight weakness of the pulse.

Absorbed into the blood it causes contraction of the blood vessels, and especially those of the cord, a statement made by Brown-Séquard and noticed in the article treating of belladonna.

Whether administered by the stomach, or hypodermically, ergot causes contraction of the arteries and veins, it is said by its influence on the sympathetic system. Administered in either way, it is most valuable in hæmorrhage; indeed, few, if any, remedies rival its efficacy in this respect. Dr. Currie Ritchie and Dr. Drasche were the first to use it hypodermically, and they report successfully of cases of hæmoptysis, epistaxis, hæmatemesis, intestinal hæmorrhage in typhoid

fever. Many other observers have since confirmed their statements. In severe bleeding, when it is urgently necessary to check it at once, the hypodermic application must be used, in from two to five grain doses. As in several instances I have seen this injection produce a good deal of swelling and pain, which, however, always subsided without suppuration, it is well to warn the patient that this temporary untoward accident may follow. If the bleeding is less urgent, administration by the stomach is very successful, as Dr. Anstie has shown in his published cases, and as I have frequently witnessed. In this way it is very useful in hæmoptysis, and should be given in doses of thirty or forty minims of the liquid extract every three or four hours, or indeed, hourly in severe cases.

Hildebrand advises hypodermic injections of ergot for fibrous tumour of the womb; a curious measure it would seem, but it is endorsed by Drs. Keating and Ashurst, distinguished American physicians, who state that this treatment greatly diminishes the size of fibrous tumours. The plan is to inject at intervals five to six grains of ergotine. In Dr. Keating's case the pulse, respirations, and temperature, fell for a time after each injection, the fall increasing with each injection. Thus, after the fifteenth injection the pulse fell to fifty-six, the respirations to twelve, and the temperature to ninety-six. (?) The ergotine excited much nausea and sickness, due probably to the effect of the ergot on the womb, for the introduction of the finger into the os uteri increased the vomiting. This result, however, is not usual.

Ergot is strongly recommended in purpura.

If taken for a long time, it sometimes produces spasmodic contractions of the muscles, and occasionally gangrene of the extremities, in character generally like senile gangrene. Both these consequences of ergot are fatal.

Its effects are most expressed on the uterus, especially when pregnant. It excites in this organ powerful and continuous contractions. It is used in tedious labours, when the uterus is becoming exhausted, but must not be employed when there

is obstruction to the passage of the child, otherwise it may occasion considerable damage to the delicate structures of the mother. Many suppose that it endangers the life of the child in two ways, namely, by subjecting it to powerful and continuous uterine pressure, and by weakening its heart. This injurious pressure may be avoided, it is said, by administering the medicine in small doses, so as to strengthen the natural contractions of the uterus, but not to make them continuous. It is recommended to watch its action on the fœtal heart, and if the pulsations fall to 110, or the beats become irregular, either the drug should be discontinued or the delivery effected by instruments.

It is extremely useful in post-partum hæmorrhages, arresting the bleeding by producing firm contraction of the uterus, and by its influence on the blood vessels. It is also of great use in the various forms of menorrhagia, even when it depends on uterine tumours. It is perhaps the most valuable medicine known in uterine hæmorrhage, checking the bleeding when other remedies have failed, and when the patient is reduced almost to a hopeless state. In such critical circumstances it must be given in full doses, and be repeated every hour or two. It promptly checks, and in a few hours effectually stays, the bleeding. Dry cupping over the sacrum is useful. Perfect rest should be enjoined.

It is said that ergot will arrest sweating.

Ergot is said to reduce the temperature of the body, but most observers doubt the truth of this assertion. The hypodermic injection is said to reduce the temperature of cats and dogs.

It is stated to be useful in neuralgia and paraplegia, whooping-cough, incontinence of urine, and even in some cases of leucorrhœa; but the form of leucorrhœa is not mentioned. It is also recommended in amenorrhœa with anæmia, after the use of iron.

TEA AND COFFEE.

A STRONG infusion of tea is sometimes used in poisoning by tartar emetic or the alkaloids, for the sake of the tannin which precipitates these substances.

Few substances are more to be avoided in flatulent dyspepsia than tea. It is harmful in two ways; for tea itself in this complaint is found to promote flatulence; and women, the chief sufferers from this disagreeable form of dyspepsia, are apt to drink large quantities of weak tea, and the excess of fluid keeps up the distension.

Coffee is slightly purgative to some persons.

The active principle of tea and coffee is absorbed, and acts as a stimulant to the nervous system. These beverages are especially useful in a fatigued state of the system; indeed, under ordinary circumstances they are preferable in this respect to alcoholic drinks.

"Coffee" says Dr. Parkes, in his work on hygiene, "is a most important article of diet for soldiers, as not only is it invigorating, without producing subsequent collapse, but the hot infusion is almost equally serviceable against both cold and heat; in the one case the warmth of the infusion, in the other the action of the skin, being useful; while in both cases the nervous stimulation is very desirable. Dr. Hooker tells us that in the Antarctic Expedition the men all preferred coffee to spirits, and this was the case in the Schleswig-Holstein war of 1849. The experience of Algeria and India (where coffee is coming more and more into use) proves its use in hot climates." The same authority, speaking of tea, says, "Tea seems to have a very decidely stimulative and restorative action on the nervous system, which is perhaps aided by the warmth of the infusion. No depression follows this. The pulse is a little quickened. The amount of pulmonary carbonic is, according to E. Smith, increased. The action of the skin is increased, that of the bowels lessened.

The kidney excretion is little affected, perhaps the urea is a little lessened, but this is uncertain."

"As an article of diet for soldiers, tea is most useful. The hot infusion, like that of coffee, is potent against both heat and cold, is most useful in great fatigue, especially in hot climates (Ranald Martin), and also has a great purifying effect on water."

Dr. Fothergill finds that caffein strengthens the contractions of frogs' hearts, and M. Jaccoud believes that it acts on the heart and blood vessels like digitalis, strengthening the heart and increasing arterial pressure.

These beverages, are useful in the headache of nervousness and exhaustion, and as an aid in rousing and keeping a patient awake in opium poisoning.

A small cup of very strong coffee is often very useful in the paroxysm of asthma; in fact it gives relief in most cases but in very unequal degree.

Although tea and coffee are very wholesome beverages, yet in some persons one or the other, or both,, will occasion palpitation of the heart, sleeplessness, and mental excitement.

Coffee in certain individuals increases rather considerably the urinary water, and it is said to lessen the formation of urea, and so to check metamorphosis; but Dr. Squarey's careful experiments disprove this conclusion with respect to urea.

CINCHONA AND ITS ALKALOIDS.

Salts of Quinia are protoplasmic poisons, arresting amœboid movements and the allied movements of the white corpuscles. Even weak solutions are highly poisonous to protozoa and infusoria (Binz), more so even than salts of strychnia or morphia. Small quantities of quinia salts destroy septic germs, and arrest putrefraction, more thoroughly than most

antiseptics, including even arsenic and creasote. Quinia, moreover, hinders alcoholic and butyric fermentations more than other bitters, with the exception of strychnia. Cinchona possesses the same properties, but in a weaker degree than quinia.

Powdered bark contains, besides various alkaloids, a considerable quantity of tannin, which should be borne in mind when we administer bark, or any of its preparations.

Finely powdered bark has been applied, apparently with great benefit, to foul, indolent, sloughing, and even gangrenous ulcers. It is to be dusted thickly over the sore, and left to form a kind of poultice. Hospital gangrene has been successfully treated in this way.

Bark has been employed as a dusting powder to check profuse formation of pus, mucus, or the secretion of eczema. Its success probably depends on the tannin it contains, and other and cheaper preparations of tannin might prove equally useful.

Cinchona bark and its preparations are bitter to the taste, and, like all bitter substances, stimulate temporarily the salivary glands. The tannin of the bark precipitates the mucus of the mouth, and acts likewise as an astringent to the mncous membrane itself.

Powdered bark is a frequent constituent of tooth-powders.

The alkaloids, when swallowed in an insoluble form, combine with the acids of the gastric juice, and become soluble, so that, except for convenience, it is unnecessary to administer quinia and cinchonia with acids. A large dose merely suspended in fluid is far less bitter than when dissolved.

The alkaloids of bark probably undergo no other change in the stomach than that just mentioned. Their action in the digestive tract is similar to that of bitters generally, acting as slight irritants to the mucous membrane, and so producing, both in the mouth and stomach, an increase of mucus. It is generally stated that cinchona, increases the amount of the gastric juice for a short time, to a small extent, and further experiments show that cinchona and its alkaloids

check the digestion of food by the gastric juice, and also check fermentations, as that of sugar by yeast. The effects of cinchona, therefore appear to be that it increases for a short time the production of both saliva and gastric juice, and so in a small measure may aid digestion; that it is an irritant to the mucous membrane, and promotes the secretion of mucus of the mouth and stomach; and that it checks the digestive action of the gastric juice and fermentation.

Our theoretical knowledge thus would appear to show that quinia neither increases appetite when the stomach is healthy, nor aids digestion in any great measure, yet experience fails to support these conclusions; for even when the stomach appears to be healthy, quinine certainly seems to sharpen appetite and assist digestion, particularly in the case of inhabitants of large towns, and of elderly people.

These substances are useful to check unhealthy or excessive fermentation in the digestive canal.

If too long employed, these alkaloids disorder the stomach, producing heat and weight at the epigastrium, loss of appetite, nausea, sickness, and even diarrhœa. Poisonous doses excite great thirst, burning pain at the epigastrium, and vomiting.

Quinine appears to exert no influence on the secretion of bile.

These alkaloids affect the intestines in the same manner as the stomach.

They are given with benefit in cases of worms; but as decoction of cinchona appears to have no direct influence on ascarides and tæniæ, the good effects of quinia must be due to the improvement it effects in the mucous membrane, by preventing the production of the abundant mucus which favours the development and growth of these worms.

When quinia is taken in large quantities, some of it is said to pass off with the fæces.

Quinia readily passes into the blood, and probably very little is decomposed in the body, as it can be detected unchanged in the urine, sweat, and secretions of healthy persons

and fever patients. It is almost exclusively eliminated by the urine, most of it being excreted in six hours.

Large doses affect sight and hearing, and excite subjective noises, as of bells ringing in the ears, and occasionally produce deafness. Sometimes, but very rarely, the sense of hearing has been lost for life; but usually, in a short time, it may be in a few days, the noises cease, and the hearing again becomes natural. Large doses often dim the sight, and sometimes cause total temporary blindness. The author has noticed that on some occasions, strange to say, the defect of vision is limited to one eye, or begins first in one eye. The pupil of the affected eye is very generally dilated; sometimes to an extreme extent. Severe frontal headache, generally dull, heavy, and tensive, but sometimes agonizing, is one of the most distressing, as well as constant, symptoms following a large dose of quinia. While these symptoms last, and indeed generally before they appear, the face is flushed, the eyes suffused, and the expression is dull and stupid. Even small doses in some persons very susceptible to the action of this medicine, will produce some of the foregoing symptoms, especially the headache and mental disturbance.

It has become somewhat the practice of late to treat pyæmia, acute rheumatism, typhus fever, etc., with oft-repeated large doses of quinia, even to the enormous extent of several drachms in the day, yet without producing any of these toxic symptoms. Workers in barks sometimes suffer from a scaly papular eruption; sometimes from a vesicular weeping eruption; occasionally with great swelling of the genitals or of the face and eyelids, with redness of the eyes. They sometimes complain of great itching of the whole body, and it is known that quinia sometimes produces urticaria.

The statements concerning the influence of quinia on the pulse are discrepant. It is often said, that large doses reduce, while small doses increase, the number of beats.

Mr. Gill and the author investigated the effect of large doses of quinia on the pulse and temperature. Their experi-

ments were conducted on a boy aged ten, convalescent from rheumatic fever, and a healthy girl of thirteen.

Before experimenting on the girl, her pulse beat from sixty to sixty-four; and the following table shows the effects of a daily dose of quinia :—

Dose.	Rise began.	Reached.
gr. 8	in 35 minutes	94
,, 10	,, 15 ,,	72
,, 12	,, 95 ,,	72
,, 20	immediately	120
,, 20	in 50 minutes	96

In the last observation the pulse for about the first thirty minutes fell in frequency; but this did not occur with the other observations. We shall mention presently the depression in the temperature we obtained in the experiments; here it is only necessary to state that the pulse was at its fastest when the temperature began to be depressed by the quinia. The increase in the frequency continued after—

gr. 10	170 minutes.
,, 20	195 ,,
,, 20	Did not fall much.

On every occasion there was a loss of force with the increase in the frequency. Briquet has shown by the aid of the hæmadynamometer that the lateral pressure of the blood on the arteries is lessened in proportion to the dose of quinine.

The effect on the boy's pulse was different, for his pulse beat 112 to 120 in the minute. The rheumatism from which he had recovered had left a mitral regurgitant murmur, and had probably damaged the heart's substance. Two doses of ten grains each were given him on one day, without altering the frequency of the pulse on either occasion; on each occasion, however, its strength was diminished. On another day, after taking a single dose of ten grains, the pulse fell during fifty minutes from 108 and 112 to 104 and 96, growing at the same time in strength. After this it attained a frequency of

120 in the minute, and again fell in force. On two occasions the girl's pulse, when at its quickest, became irregular both in force and rhythm.

Mr. Gill and the author investigated at the same time the influence of quinia on the temperature of fever-free persons. The following table shows the results of our observations:—

Boy.

Dose.	Effect on Temperature.
gr. 10	None
,, 10	Fell 0·2°
,, 10	None

Girl.

Dose.	Effect on Temperature.
gr. 8	Fell 0·2°
,, 10	None
,, 10	None
,, 20	Fell 1°
,, 20	Fell 0·4°

It appears that quinia will reduce the temperature, but that to effect this in any appreciable degree large doses, to the extent of twenty grains, must be given, and even then the depression is but slight, and may not amount to half a degree Fahrenheit.

It may be said that the fall in the temperature does not represent the whole effect of the quinia, as a rise in the temperature would have taken place at the time the depression occurred, so that if we wish to learn the whole influence of the quinia we must add to the amount of depression the rise which should have happened; but to this the author is able to answer that on this point he made many careful observations, and found that the heat of the body remains always very constant between nine a.m. and four p.m., and the foregoing observations were made between these hours.

This table gives the time the depression occurred after the quinia, and the period it lasted. The occasions when the fal reached only 0·2° are not included, since even when the

greatest care is taken, so slight a depression may easily be produced by accidental causes.

Dose.	Time.	Depression lasted.
gr. 20	in 55 minutes	3 hours 15 minutes.
,, 20	,, 80 ,,	45 ,,

Other observers prove that quinia reduces the body temperature in health.

Piorry has shown that during a fit of ague quinine diminishes at once the size of the spleen. It is said that the drug exerts a similar effect on this organ during other fevers, and even in health.

The influence of cinchona and its alkaloids on the various forms of intermittent fever is well known. It controls this formerly common complaint more effectively than any known drug. How it acts is at present quite unknown. It has been supposed to check the fever by its influence on the spleen; but, granting this assumption, it yet remains to show how the influence of the quinia on the spleen prevents the return of the fever paroxysms.

Quinia generally arrests the disease at once. It is well, however, to bear in mind that this remedy may dissociate the other symptoms from the elevation of the temperature; or, in other words, it may remove the shivering, sweating, quick pulse, while the temperature may remain as great, or nearly as great, as on previous days. Mere rest will occasionally effect the same dissociation. This fact it is necessary to recollect, otherwise it may be concluded that with the removal of the more obvious symptoms the disease itself is cured, and thus the patient may be permitted to return to his usual avocations. Unless the unnatural elevation of temperature has been restrained, the paroxysms will speedily return.

A still more curious circumstance remains to be stated. It appears that quinia may check all the symptoms, even the periodical elevation of the temperature, and yet about the same time of day that the series of symptoms were wont to

take place, an increase in the urea and urinary water may occur as marked as during a severe paroxysm; that is, all the symptoms of the paroxysm are absent except those pertaining to the urine.

Two experiments made by the author render it probable that quinia, given after the fit has begun, is powerless to prevent the elevation of temperature of that attack, although it may effectually prevent it in succeeding paroxysms. It is said that when employed subcutaneously after the paroxysm has begun, quinia will arrest the fit. Some hold that quinia is less efficacious than the powdered bark, even when the cinchonia is allowed for, and it is even held that powdered bark is more tonic than quinia. On the other hand, no doubt powdered bark, by reason of its bulk, and of the tannin it contains frequently upsets the stomach.

There is great variation of practice regarding the administration of quinia. Some give small doses, repeated several times daily; others prefer a single large dose daily; both methods are useful, but under different circumstances. In the mild forms of ague, like those now met with in this country small doses several times daily are sufficient; but in malignant forms of the disease, large doses, given even several times a day, may be required to arrest the disease summarily. Some say the drug should be given at the very commencement of the fit; but this practice is held to be bad and to make the immediate attack more severe.

Trousseau advised that fifteen grains should be taken immediately after the fit, and repeated with an interval, first of one, then of two, three, and four days, and so on. Probably this is a good way to extirpate the latent tendency to the disease, and to ensure a perfect cure; for it must be recollected that, judging by the temperature, a patient may unconsciously undergo even a severe fit, a fact proving the great importance of employing the thermometer while treating this disease. Moreover, Trousseau's plan is judicious; for even when the quinine has removed all symptoms, the patient is liable to a recurrence of the attack from various causes, as

depression of the health, or a sudden shock, as from an accident or operation; indeed, in many instances, this tendency to ague lasts for years.

It is important to recollect that the effect of quinia on the fit bears no relation to its physiological operation, either in time or degree, for a small dose may prevent the occurrence of a fit otherwise due twenty-four hours afterwards, the effects of the dose on the system meanwhile never becoming apparent, or having long ere this passed quite away.

Quinia is of especial use in the malignant forms of ague. The dose should be large, and given in a non-febrile period. In these severe forms of the disease, no circumstances are to be considered as contra-indicating its use. If it cannot be borne by the stomach, it may be given by the rectum or hypodermically. For injection it is recommended to dissolve the quinine in ether as this solution is less irritating than an acid, alcoholic or chloroformic solvent. Salts of quinidine on account of their solubility have been recommended for hypodermic use. Quinidine of commerce is generally very impure.

In remittent fever, large and often-repeated doses should be administered during the remission.

The more recent the attack, the sooner and more certainly will quinia cure.

It is less efficacious in quartan than in other forms of ague, probably because old ague generally assumes the quartan type. In obstinate cases resisting quinia, arsenic often succeeds.

In some cases where this medicine appears powerless the administration of an emetic each morning sometimes brings the disease at once under the control of quinia.

Quinia is used as a preventive of ague, and in the navy it is a very useful sanitary precaution to give sailors sent ashore quinia before and after landing, where this fever prevails. This preventive effect is forcibly illustrated in some observations recorded by Dr. J. B. Hamilton, of the Royal Artillery, who treated his men with quinia, and but few succumbed to

ague, and those were attacked mildly; whilst another doctor, disbelieving in the preventive action of quinia, allowed his men to go unprotected by quinia, and a large number were struck down with fever and several died. Dr. Hamilton believes that cinchonia is superior as a prophylactic to quinia, and quinoidia very inferior to quinia.

The other alkaloids of bark, although inferior to quinia, will check ague. Cinchonia, it is said, must be given in doses one third larger than quinia.

The Medical Committee appointed by the Indian Government to estimate the relative value of the alkaloids cinchonia, quinia, quinidinia, and cinchonidinia, decided in favour of the use of all of them in ague. Naturally, there were individual differences of opinion concerning their exact relative value, but all agreed that they are most efficacious against ague.

The general opinion was that sulphate of quinia and sulphate of quinidia possess equal febrifuge power; that sulphate of cinchonidia is only slightly less efficacious; and that sulphate of cinchonia, though considerably inferior to the other constituents, is a valuable agent in fever.

It is a fact well known that in the case of persons who have encountered ague, even many years beforehand, that disease in them is prone to take on an intermittent type and that quinia here is often of great service.

Again, certain forms of neuralgia not uncommonly depend on malarial poison, and are then apt to assume a type distinctly periodical. Here quinia is highly serviceable in large doses given shortly before the expected attack. Quinia often proves useful too in non-malarial forms of neuralgia, presenting this periodical character. Even when the element of periodicity is quite absent, large doses of quinia often succeed in removing the pain of this distressing malady. Quinia is said to control neuralgia and ordinary face-ache more effectively when the powder is taken in minute quantities every few minutes,—for instance, as much as will adhere to the finger's tip dipped into the powder.

It has long been recognized that quinia has most influence

on neuralgia of the supro-orbital branch of the fifth. This branch is most often affected with malarial neuralgia and non-malarial periodic neuralgia; but even non-periodic neuralgia of this branch is probably more amenable to quinia than neuralgia of the other branches of the fifth or of other nerves.

A short time ago it was the custom to treat pyæmia with large doses of quinia. It was said that the quinia produced great reduction in the temperature; but the author is convinced that the falls were often normal, occurring in the course of the disease, independently of the action of quinia. In pyæmia a sudden and extensive rise of the temperature often occurs twice or three times a-day, to fall again, however, in a few hours to the natural or almost natural standard.

Quinia is recommended in other febrile diseases, as typhoid fever, bronchitis, broncho-pneumonia, pneumonia, and acute phthisis. The observations of Weber, Murchison and Ogle, prove that large doses effect sometimes a temporary reduction of temperature, occasionally a considerable fall, but it appears in other respects to leave the disease unaffected. Hence quinia cannot be considered of much service in these affections, as their symptoms and the dangers incident to them are not chiefly due to the elevation of temperature. Thus we meet with patients suffering from simple fever, and sometimes phthisical patients with a temperature of 104 or higher, who are able notwithstanding to continue their daily work, or at all events are but slightly disabled, their appetite being but little affected; whilst a typhus patient with a corresponding temperature, is unable to eat, and lies prostrate, delirious, with dried baked tongue. The dangerous symptoms, therefore, may be independent of the fever; and a remedy, to be serviceable, must control these, and there is no evidence that quinia has this power.

Quinia in large doses of ten to thirty grains, repeated several times a-day, has been recommenced in acute rheumatism. Some advocate its use at the commencement, others at the termination, of the attack; at the beginning, with the

view of shortening the course of the attack and diminishing the chance of relapsing; and at the termination, with the hope of preventing the profound anæmia which so generally accompanies acute rheumatism. Other authorities are altogether adverse to the use of this drug, maintaining that it favours relapses, and merely disguises the pain, but in no degree shortens the attack. In this controversy, which side is in the right, if either is, remains to be proved.

Quinia is often given with decided advantage, to check the profuse sweating of exhausting chronic diseases, as chronic phthisis. If a small dose fail to check this excretion, a large dose of six or eight grains, administered at once, or in portions, repeated hourly, sometimes succeeds.

A night draught, composed of quinia, sulphate of zinc, and sulphuric acid, is very useful in many cases of profuse sweating.

Quinia is sometimes useful in the vomiting of pregnancy. Many American writers believe that quinia strengthens the contractions of the womb during delivery, and some use it in preference to ergot. Other writers deny to quinia this action, but on the rather inconsequent ground that, when given during pregnancy as for ague, quinia does not cause premature labour.

In diseases of malnutrition, quinine is often employed with much benefit, as in impetigo and ecthyma. It is also of great benefit to the pale and badly fed of large populous towns. It is at present undetermined whether its good effects are dependent on its action on the stomach, or on the tissues after its absorption into the blood. Quinia has been recommended in passive bleeding, in undue suppuration, profuse menstruation, spermatorrhœa, and in excessive secretion of milk.

Quinia appears to be useful in some, but quite useless in other, cases of intermittent hæmaturia.

Quinia is found in the blood, which dissolves more of it than water; in the saliva, bronchial mucus, milk, and in dropsical effusions. It is said to be eliminated slightly with

the sweat; but Briquet, after giving large doses, could detect none in this secretion.

Both quinia and cinchona pass off in part by the urine, but a portion appears to be consumed in the blood, or to be eliminated in some other way. Kerner says that "a respiratory power of 3,000 c. c. can destroy fifteen grains of sulphate of quinia in twenty-four hours; any amount over this will pass into the urine." Quinia appears in the urine of healthy individuals in the course of two to five hours, but more quickly in young than old persons. In some diseases (intermittents, pulmonary emphysema, pneumonia, morbus Brightii) its exit is much delayed, and in three cases in which large doses were given, Dietl detected it in the urine many weeks after the last dose, showing that it is not easily destroyed in the body.

Dr. Ranke has made the important observation, that a scruple of disulphate of quinia lessens by one-half the excretion or the formation of uric acid, the effect continuing about two days after a single large dose, the other constituents of the urine remaining unaffected. It would seem likely that the uric acid is not simply retained in the system; for as in Ranke's cases no subsequent increased excretion took place after the effect of the quinia had gone off, its formation was absolutely lessened, or it must have been converted into some other substance. (Parkes on urine.)

Certain circumstances modify the operation of the salts of quinia. The physiological symptoms appear early in young people who can resist the toxical action of the drug; but on the other hand, the effects of quinia are more marked in old people. Diffusible stimulants, as wine and coffee, are said to counteract the action of quinia.

It has been asserted that quinia given to a healthy person will produce fever.

CALUMBA.

Calumba is used as a tonic to increase appetite and digestion. Like most bitters, it exerts a slight irritant action on the stomach, and owing to this property it is said to obviate slight changes in the mucous coat of the stomach, and in this indirect way to assist appetite and digestion. Being easily tolerated, it is employed when the stomach is weak, as in convalescence from an acute disease, when it is often found that calumba is borne with benefit, while stronger tonics upset this organ.

GENTIAN.

Gentian is used for the same purposes as calumba, but is reputed to be slightly purgative.

Mixed with infusion of senna, it is useful when a tonic and purgative are required.

QUASSIA.

Quassia is poisonous to some of the lower animals, as flies, and other insects.

Like the preceding substances, it is a tonic. It has been used in intermittent fever.

Infusion of quassia is a very useful injection in ascarides. It is efficacious also when administered by the mouth.

CHAMOMILE.

These flowers contain both a volatile oil and a bitter substance, and thus to some extent combine the properties of bitters with those of ethereal oils.

Chamomile is not often used as a tonic, but an infusion is sometimes employed to assist the action of emetics.

In the common summer diarrhœa of children, often occurring during teething, characterized by green, many-coloured, and slimy stools, the infusion in doses of half a drachm or a drachm often proves very useful, especially when given at the commencement of the attack. This medicine is likewise efficient in other kinds of summer diarrhœa. It likewise subdues restlessness and peevishness. A mixture is easily prepared by steeping four to six heads of chamomile flowers in a tea-cupful of boiling water for an hour, and then giving a teaspoonful every hour.

It has been used in intermittent fever, in neuralgia of the fifth nerve, and is a popular remedy for "sick headache."

CHIRETTA.

Chiretta is a tonic. When given to promote appetite, it should be taken, like other bitters, a short time before food, as their effects soon wear off.

CASCARILLA.

Cascarilla has a warm, agreeable, bitter taste, and is a stimulant as well as a tonic. It may be used as the preceding medicine to promote appetite.

It has been used in intermittent fever and in dysentery.

ORANGE-PEEL.

Orange-peel contains both a bitter principle and much volatile oil, thus combining the properties of bitter substances with those of ethereal oils.

ELATERIUM.

This drug has a very bitter taste, and exites a free secretion of saliva.

It is a powerful drastic hydrogogue cathartic. Its activity is due to elaterin, a chemically indifferent substance like the resins, and incapable of forming salts with either acids or bases. It often produces colic, and not unfrequently vomiting.

In large doses it may excite inflammation of the stomach and intestines, and even of the peritoneum. It is given as a purgative especially in dropsies; by carrying off a large quantity of water, it is hoped that the dropsy may be reduced. It is thus used both in ascites, and in the dropsy from kidney or heart disease. It must be borne in mind that free purging is very exhausting, and that elaterium very often disorders the stomach, and spoils the appetite. It is a medicine which must be given with caution.

Dr. Hyde Salter strongly recommends purgatives in dropsy depending on aortic, obstructive, or regurgitant disease. He says that although we cannot alter the heart, we can lessen the quantity of blood it has to propel, and thus diminish the congestions on which the dropsy depends. He employs elaterium, and advises a small dose at first, say one-sixth of a grain, to be given alternate mornings at about five a.m., so that by ten or eleven the purgation has usually ceased. This treatment, he says, quiets the heart, relieves the dyspnœa, lessens the pulmonary congestion, and thus diminishes the hydrothorax.

COLOCYNTH.

This drug has an intensely bitter taste, and occasions an abundant secretion of saliva.

It produces diarrhœa, colic, and sometimes vomiting. The diarrhœa is watery, and, after large doses, serous, mucous,

and bloody. In large doses it may excite gastro-enteritis and peritonitis.

It is chiefly used as a purgative, but almost always in combination with other substances. In obstinate constipation it is a good plan to give a few drops of the Prussian tincture several times a-day.

It has been used as a drastic cathartic in dropsies, and, like most other powerful purgatives, it has been used for worms although it has no direct poisonous influence on them, but merely expels them mechanically. Purgatives, therefore, are not good anthelmintics.

ALOES.

Aloes has been used as a slight stimulant to wounds, and when thus employed it often purges. "Dr. Gerhard, of Philadelphia, found it the medicine best adapted for endermic uses, as its application does not irritate a blistered surface very powerfully. Ten grains of it thus employed produced five or six stools, which were generally accompanied by griping. Infants are purged by the milk of nurses who have taken aloes."—Stillé.

It is reputed to be a tonic, and to increase the secretion of bile.

It is chiefly employed as a purgative. It acts mainly on the large intestine and rectum. Its action is slow, and six, twelve, or even twenty-four hours may elapse before it operates. It produces bulky motions, a little softened, but not watery. It evidently acts but little on the mucous membrane of the intestines, and is merely an evacuant of fæces. It often occasions slight griping, and sometimes tenesmus. As its action is tardy it is injudicious to combine it with more speedy purgatives. It is well suited for cases of chronic constipation; for the habitual use of it does not lessen its activity, and it is even said that the dose may be gradually decreased. Sulphate of iron is said to heighten its action.

When both a tonic and a purgative are required, aloes, like senna, may be usefully mixed with some bitter, as gentian. When combined with tonics, purgatives, it is said, act in smaller quantities.

Aloes in a variety of combinations is in common use as a laxative in habitual dyspepsia, with constipation. The compound decoction of aloes, formerly called baume de vie, is a serviceable after-dinner laxative. The basis of many dinner pills is one grain of watery extract of aloes. A dinner pill containing one grain of watery extract of aloes combined either with extract of nux vomica, extract of gentian, or extract of cinchona, is very useful.

In habitual constipation, aloes is the best and the most commonly employed purgative. Dr. Spender, of Bath, extols the following pill, taken at first three times, then twice, and afterwards once a-day; one grain of watery extract of aloes, and two grains of sulphate of iron. This pill takes some days to act. Aloes has been accused of producing piles, and in full or over-doses will no doubt aggravate this disease; but most authorities are inclined to attribute piles to the constipation aloes is employed to remove, and not to the aloes itself. Indeed, the author is convinced that in many cases moderate doses of aloes, just sufficient to gently relieve the bowels, are highly useful in piles.

By its action on the rectum aloes affects sympathetically the neighbouring pelvic organs, as the uterus; and given at, and just before the menstrual period, is useful in many cases of amenorrhœa and deficient menstruation. We cannot refrain from citing the admirable remarks of Dr. Graves on amenorrhœa and its treatment. "The periodicity of this function," he says, "can still be traced, even in cases where suppression has continued for a great length of time, by means of the menstrual molimina (pains in the loins, thighs, and hypogastric region, flushings, colicky pains of the abdomen, general feeling of *malaise*), which occur at stated intervals; in endeavouring to bring on the discharge, therefore, we must be guided as to the time the attempt should be made,

by an observance of the period at which these molimina occur. For a few days before that time our efforts to produce a determination of blood to the uterus may be judiciously employed; and if they fail, the attempt should be abandoned until a few days before the next menstrual period. Of course, I speak not here of the general constitutional treatment, for this must be constantly persevered in; one of the chief means of bringing back this evacuation being the restoration of health to the natural standard. In some this is to be effected by a tonic, and in others by an opposite mode of treatment.

". . . What I wish to impress on your minds is, that all those remedies, as pediluvia, stuping of the genitals, leeches to the inside of the thighs, near the labia, aloes, and other stimulating purgatives, etc., should be only used at the times already spoken of. To use them at any other period, either after the molimina have disappeared, or during the intervals between them, tends, in most cases, still further to derange nature, by determining to the uterus at an unseasonable time, when there is no natural tendency to that organ. Under such circumstances the very same means will frequently fail, and prove injurious, which, applied so as to concide with the time of the natural effort, would have been successful. To illustrate these principles by an example:—We are consulted in the case of a young woman affected with various hysterical symptoms for several months, and during that period more than usually subject to headache, languor, loss of spirits, diminution of appetite, and irregularity, and usually constipation of bowels; she is pale, and complains of various pains and uneasy sensations, and has not menstruated since the accession of these symptoms. Here it is evident that the constitutional treatment must be strengthening and tonic. The practitioner will therefore recommend regular hours, much gestation in the open air, a nutritious diet, and afterwards cold shower-baths; he will regulate the bowels, and afterwards prescribe a course of tonic medicines, chalybeates, preparations of bark, strychnia, etc.; he will likewise inquire carefully when the last period happened, and when, and how

often since that occurrence, menstrual molimina were observed. He thus ascertains when they should again recur, and contents himself with enforcing the constitutional treatment until about six days before the calculated time. Then he lays aside the other medicines, and has recourse to those means which determine to the uterus. Two leeches are applied to the inside of the thigh, near the labium, every second night, until they have been three times applied.* The bleeding is encouraged by stuping. On the intermediate days the bowels must be actively moved by aloetic pills; and for three nights before and after the molimina, hot pediluvia, rendered stimulating by mustard seed, may be used. During the same time also frictions, with stimulating liniments, should be applied to the feet and legs every morning, and oil of turpentine or tincture of cantharides may be exhibited internally, while the necessity of more active exercise is inculcated. If these means fail, they must for the moment be laid aside, and the constitutional treatment must be again resumed until the same number of days before the next period, when the list of remedies above spoken of must be again tried, and in few cases indeed shall we find them to fail."—Graves' *Clinical Lectures*.

SQUILL.

Squill has a bitter taste. It acts powerfully on the stomach and intestines in full doses, exciting great nausea and vomiting, with frequent watery and even bloody diarrhœa. Similar symptoms are likewise produced when the drug is injected into the cellular tissue or peritoneal cavity.

Squill is never used as an emetic or purgative, but almost exclusively as an expectorant in bronchitis.

Some praise it highly as a diuretic. It is recommended in all forms of dropsy.

* The author has never found it necessary to have recourse to bleeding.

JALAP.
SCAMMONY.

Buchheim asserts that these two substances are rendered purgative only by the addition of the bile; unmixed with this secretion, they are inert. They are easily soluble in the bile, and probably undergo decomposition, and the products are unknown. Taurin and glycocoll exert no influence on their efficacy, but it is otherwise with tauro-cholate and glyco-cholate of soda; hence Buchheim concludes that the activity of these drugs is determined by the soda of the bile. They excite diarrhœa of watery motions, with some colic and occasional vomiting, and their use is often followed by much constipation.

These medicines are used as purgatives in obstinate constipation; and jalap, in combination with other substances, is employed in dropsies. Scammony is frequently used with much advantage to destroy the small thread-worms infesting the rectum.

Bleeding has recently been employed with great success in engorgement of the right side of the heart from emphysema and bronchitis, mitral obstructive or regurgitant disease. Now, for some years the author has employed purgatives in these cases, with considerable benefit, to produce three or four watery motions, and he ventures to say that this treatment, first employed by Dr. Graves, has saved many lives.

Like bleeding, free purging unloads the distended and therefore weakened right heart, and it moreover produces a very favourable change in the character of the expectoration, rendering its expulsion easier. The following case, one among many similarly benefited by free purging, will illustrate the advantages of this plan.

A woman, about 40 years of age, suffering from emphysema, was seized with severe bronchitis. She had been dangerously ill about a fortnight: her skin was of a deep leaden

tint; her eyes were prominent, congested, and suffused; her jugular veins were greatly distended; the surface of her body was covered with a cold, clammy perspiration, profuse on her face; her extremities were deadly cold; her temperature varied between 97° and 98° Fah. She suffered from slight delirium both night and day. Her breathing was hurried, and her chest expanded only slightly; her expectoration was abundant, viscid, airless, and purulent; her pulse large, but very compressible, varied from 96 to 100 beats in the minute. The respiratory sounds were obscured by an abundance of mucous rhonchus, and physical examination showed that the right side of her heart was greatly distended. Her urine contained a trace of albumen; her legs were not œdematous. So dangerously ill she was that her death appeared imminent. In a few hours, after free purgation with jalap and bitartrate of potash, the jugular veins became much less distended, and next day they were natural in size; while the deep leaden tint of her skin had given place to a diffused bright red colour often witnessed in cases treated in this way; this colour being probably due to the capillaries—previously distended by the obstructed circulation, till being weakened they lose their power to contract—becoming filled with arterial instead of venous blood. This bright red colour was most marked over the face and hands; her skin became warm, though she continued to perspire freely, and her hands easily grew cold on exposure. She expressed herself much relieved. In twenty-four hours the expectoration became slightly aërated, this change being much more marked on the following day, when the expectoration was observed to be less purulent, and to contain much mucus. On the third day the expectoration was frothy, and consisted chiefly of mucus; coincidently with this improvement in the sputa, her chest expanded more perfectly and the rhonchus diminished. From this time she steadily improved, and was discharged cured.

The engorgement of the right heart with general venous congestion is no doubt apt to return, when it becomes again necessary to purge; indeed, several purgings may be re-

quired. It will rarely happen, I believe, that the venous congestion cannot be removed temporarily by this treatment.

The change in the expectoration sometimes takes place more slowly than in the foregoing case, a week elapsing before it becomes frothy and composed of mucus. Any tendency of the expectoration to assume its old characters may be prevented by a repetition of the aperient.

Sometimes these patients complain of very severe dull headache, or of dull oppressive pain at the epigastrium; bleeding or purging relieve both symptoms, bleeding giving instant ease.

In persistent tricuspid regurgitation from permanent distension of the right side of the heart, induced by repeated attacks of bronchitis, purgatives will probably be of no use except when an attack of bronchitis, adding to the obstruction to the pulmonary circulation, increases the dilatation.

RHUBARB.

Rhubarb is a purgative, and is said to be likewise a tonic. After purging it constipates the bowels, on which account it is often used in the early stages of diarrhœa, to get rid of any irritating matters from the intestines, and after their expulsion to check the diarrhœa. It is a very useful purgative for children, especially when mixed with two or three times its weight of bicarbonate of soda.

Dr. Stillé, of Philadelphia, on the authority of Dr. S. Jackson, (U. S.), whose testimony he endorses, speaks of rhubarb as a remedy of surprising efficacy in piles, when laxatives are needed. He directs a piece weighing about ten grains to be chewed, or rather slowly dissolved in the mouth nightly, or less frequently, according to the degree of constipation. He estimates that rhubarb taken in this fashion is fivefold more efficacious than the powder. He also recommends it in the

costiveness and the hæmorrhoidal swellings incident to pregnancy. (Stillé's *Therapeutics.*)

Rhubarb generally colours the urine reddish yellow, which, on the addition of ammonia and other alkalies, changes into a purple red. It colours also the sweat, the serum of the blood, and the milk. It makes the milk bitter and purgative.

It may be usefully blended with some tonic.

SENNA.

Senna is an active purgative, increasing both secretion and peristaltic action. It often produces both nausea and griping. It may be usefully combined with a bitter tonic, as in the mistura gentianæ composita of former pharmacopœias. This contains an ounce of compound infusion of gentian to half an ounce of compound infusion of senna, and is a very useful compound in dyspepsia with constipation.

Senna renders a mother's milk purgative, and may produce colic in the child.

SENEGA.

Senega increases the secretion of the bronchial mucous membrane, and probably that of the other mucous membranes. It produces a burning itching sensation in the mouth and throat.

It is used in chronic bronchitis, especially in the case of aged people, in whom this disease is usually complicated with emphysema. Some give it in croup and whooping-cough. It is also reputed to be diuretic, and is used when the deficiency of urine is owing to kidney disease. "Infusion of

senega (four to six drachms infused in six to twelve ounces of water, and taken during the day) produced no effect on the urine in Böcker's experiments, conducted on himself and on a pregnant woman." (Parkes *on Urine*.)

Anthelmintics—

FILIX MAS.	**ARECA NUT.**
KOUSSO.	**BARK OF THE POMEGRANATE ROOT.**
KAMELA.	**POWDERED TIN.**
SANTONIN.	**MUCUNA, etc.**
TURPENTINE.	

The intestines are infested by worms of different kinds. The common kinds are the flat worms (Tænia solium and Bothriocephalus latus), round worms (Ascaris lumbricoides), and thread worms (Ascaris vermicularis). These may be treated in three ways. Drugs, as powdered tin and mucuna, may be employed to kill the worm by their mechanical action, or powerful purgatives may be used simply to expel the worm, as jalap, scammony, etc.; or true vermicides, having very little effect on the tissues of the human body, to poison and kill the worm. With the exception of powdered tin and mucuna, all the medicines comprised in the foregoing group are vermicides. It must, however, be borne in mind that all are not equally efficacious for every kind of worm, but that some are poisonous to one kind, and harmless to another; success will depend, not only on giving the fitting drug, but giving it in the right way. These medicines should reach the worms in as concentrated a state as possible; but if the stomach and intestines are filled with food, the poison being thus diluted, may fail to destroy the worms. It is proper, therefore, to give over-night a purgative, and to direct the patient to take a very light tea and no supper, and on the

following morning, after the purgative action, to give the anthelmintic.

Filix Mas is employed for tape-worm. Kuchenmeister asserts that it is more poisonous to the bothriocephalus than to the tæniæ. The patient should eat a very light tea, no supper, and, just before bedtime, swallow a dose of castor oil, a purgative to be preferred to others on account of its speedy action. On the following morning, at about six or seven o'clock, when the oil will generally have acted, give the liquid extract of male fern, in a dose varying from ten drops to a drachm, according to age. The patient is then to abstain from food till the bowels have been freely relieved, when in most cases the worm will be expelled. Some recommend a brisk purge to follow the anthelmintic; but this is seldom necessary, as the foregoing simple plan rarely fails to dislodge the worm. Too large a dose of the male fern may cause nausea, sickness, and even colic, effects seldom witnessed if only a moderate quantity is employed. The liquid extract of male fern is slightly purgative, and for this reason it is not always necessary to administer a purgative after it. The worm should be carefully examined, in order to ascertain if the head has been expelled; in that case there is no fear of the regrowth of the worm. It has, however, been ascertained, that if only the head and a small piece of the neck are left, the worm will die; so that if the head cannot be discovered, it must not be concluded that the patient is not permanently freed of the worm. If any piece is found which tapers to a fine point, even if the head is not attached, it may reasonably be hoped that the worm is destroyed. A good plan to obtain for examination all the worm which has been expelled, is to shake up the motions, already watery and loose from the purgative, with some water, and to filter the whole through a coarse piece of muslin. By this means, even if the head is separated from the trunk, it may be detected and examined.

The treatment for the flat worm by male fern is generally considered the best.

Kousso is used for tape-worms of all kinds, and appears to be very successful, although not much employed in this country. In Abyssinia, where tape-worm is extremely common, kousso has been in use upwards of two centuries. The dose is half an ounce of the flowers suspended in water, and the patient must have fasted for a short time, as in the previous case. Kuchenmeister asserts that kousso expels the worm slowly and in pieces, and that it rarely expels the head. It may cause slight nausea and even vomiting. Its action on the bowels being very slight, it is customary to follow it by a mild purgative.

The bark of the root of punica granatum is the part used. It is employed chiefly in India for tape-worm. Neligan directs the maceration of two ounces of bruised bark, of fresh root if possible, for twenty-four hours in two pints of water, then boil down to one half, strain, and divide into three doses, which are to be taken at half hour intervals. Vomiting often occurs, which, however, should not prevent the giving of the three doses. This treatment should be occasionally repeated daily for four or five days. Most practitioners find the dried root inert.

Santonin is the active principle of worm seed. It is very efficacious for round and thread worms, but it is inoperative against tape-worms. In the treatment both of round and thread worms, two or four grains, according to age, are to be mixed with a drachm or more of castor oil, and taken early in the morning before breakfast, repeating the dose two or three mornings successively. Such treatment seldom fails to bring away any round or thread worms. Santonin has been used, mixed with castor oil, as an injection into the rectum for thread-worms; and Kuchenmeister found that santonin in castor oil, mixed with albumen, killed ascarides in ten minutes, while without the oil the santonin had no effect. He therefore recommends it to be given in two to five grain doses in an ounce of castor oil. This quantity is of course intended for adults. Santonin may be conveniently given in syrup, lozenge, or gingerbread. In an obstinate case, some

advise the administration of one or two grains twice or three times a day; but, repeated so often, this medicine is very apt to occasion sickness and vomiting, together with great difficulty in holding the water; so that children, if they take much of it, are apt to wet the bed at night, are constrained to pass water very frequently, and are even unable to hold it night or day. It may produce headache and sometimes affects smell and taste.

After taking santonin, objects sometimes appear of a green or yellow colour.

Rose finds that santonin always produces hyperæmia of the retina, and he attributes the perversion of vision to the effect of santonin. Dr. Ogston also believes the colour is owing to its influence either on the retina or brain, for it does not colour the structures of the eye.

Drs. Ogston and Brown assert that santonin produced cataract in the eyes of young kittens, but he was unable to induce this condition in adult cats. Drs. Ogston and Dyce Brown recommend santonin in certain eye diseases, as in inflammatory and atrophic alterations in the retina and optic nerve producing deficient sight.

Santonin colours the urine orange, and, on the addition of solution of ammonia, it changes to a brilliant scarlet. It is curious that this remedy will sometimes stay the nocturnal incontinence of children, and when this affection is not dependent on the presence of worms, succeeds occasionally where other remedies, including even belladonna, have failed.

Kamela is much used in India for tape-worm. It may be given in doses from 60 to 120 grains, in honey, syrup, or glycerine. It purges briskly.

Areca Nut is much used by veterinarians to expel tape-worms from dogs, but may be employed for the same purpose in the human subject. Half or a whole nut is to be powdered, and mixed with some syrup, and swallowed. It sometimes succeeds when other remedies have failed.

Turpentine is praised by Neligan for its poisonous effectiveness over both the tape and round worm, but it is more

deadly to the tape-worm. It is also efficacious as an injection against thread-worms. Kuchenmeister showed that it destroys tape-worm in an hour.

Of all medicines to be swallowed, santonin is, as we have said, most effectual against thread-worms, which are found only in the rectum. Scammony too is effectual against thread-worms. A variety of substances administered by injections will speedily destroy thread-worms. Thus a teaspoonful of common salt, infusion of quassia, or a drachm of sequichloride of iron, in a pint of water, will be found very effectual; so will lime-water, solutions of alum, and, in fact, any substance which will coagulate the albumen of their bodies.

O.S. See p. 599.

In the treatment of worms it must always be remembered that the mucous membrane is generally in an unhealthy state, secreting much tenacious mucus, which forms a favouring nidus for the development of worms; worms will rarely develop in a healthy state of the digestive canal. The foregoing modes of treatment are therefore only temporarily remedial, and after the expulsion of the worms, the morbid condition of the intestinal mucous membrane must be treated. This condition of the intestines is generally seen in unhealthy, anæmic children. Cod-liver oil and iron preparations soon restore the gastro-intestinal canal to a healthy condition.

Oils, as is well known, are reputed to destroy worms. If these remedies fail, other medicines must be employed to remove the catarrhal state of the mucous membrane, as common salt, chloride of ammonium, and antimony salts. Cold-sponging, out door exercise, and a judicious diet aid in improving the general health.

ON POULTICES AND HOT FOMENTATIONS.

These widely used applications afford warmth and moisture to diseased parts.

They are applied to the skin when the surface or the structures beneath it are inflamed. Their warmth and moisture relax the tissues, and in some degree obviate the tension due to inflammation, and by this means ease pain; if applied to inflamed tissues, as to abscesses, inflamed pimples, and the like, at the very beginning of their development, they often summarily check the inflammation and prevent the formation of pus. Fomentations with water as hot as can be borne are also very efficacious in arresting inflammation and checking the formation of matter, and should be generally employed as adjuncts to the poultices. Hot fomentations will often disperse or restrict the development of acne indurata and similar inflamed pimples apt to appear on the face, and herpes labialis.

These applications are of further use when suppuration has set in, and when matter requires to be removed. Poultices greatly facilitate the passage of the matter to the surface and its expulsion, while at the same time they considerably limit the spread of the inflammation in all directions. Here again, very hot fomentations often repeated, and continued for some time, are a useful supplement to poultices.

It is necessary to remember that a great deal depends on the heat of the application. Poultices should be always applied as hot as can be borne, and frequently changed, lest they become cold and hard. Indeed, they can scarcely be changed too often; but in hospital practice it is impossible to do this very frequently; yet even in such institutions, where the supply of nurses is necessarily limited, poultices should be changed every two or at most three hours.

When applied to disperse inflammation or to hasten the maturation of abscesses, the poultice should be large, reach-

ing beyond the limit of the inflamed tissues; but as soon as the abscess or boil has maturated and burst, the poultice should be very little larger than the opening in the skin through which matter is escaping. If a large poultice is applied over-long to the skin, it soddens and irritates it, and is very liable to produce an eruption of eczema, or to develop fresh boils around the one first formed.

In treating boils, it is a good plan, in order to protect the adjacent tissues from the undue action of the poultice, so as to check the production of fresh boils, to cover the boil with a piece of opium plaster with a circular hole, and to apply the poultice only over the plaster. Another good protective plan is to smear the contiguous surface with zinc ointment.

When an abscess has fully developed, and is ready to be opened, it is far better to treat it by Lister's carbolic acid method than by poultices.

In skin diseases, as eczema, etc., when the skin is highly inflamed, painful, red, and swollen, poultices moderate the inflammation and alleviate the pain.

Poultices are not only soothing to inflamed tissues when in direct contact with them, but they appear to act in the same manner on deep-seated parts when placed on the surface over the inflamed or painful organ. They are of great service in pneumonia, pleurisy, bronchitis, pericarditis, peritonitis, etc. In such cases a poultice should cover a considerable extent of surface. Here again, acting by virtue of their warmth and moisture, they should be applied very hot, and removed as soon as they become cool. To avoid exposure of the warm, moist skin, the old poultice should not be removed till the new one is ready to replace it.

These applications are extremely useful to children, who, when attacked with bronchitis, or broncho-pneumonia, or lobular pneumonia, should have the entire chest enveloped in a jacket-poultice. As young children are apt to be restless, and to toss about in bed, the poultice soon becomes rucked up, and converted into a narrow band encircling only a very limited portion of the chest, and the uncovered part of the

chest, and much of the moist bread or meal, is exposed, and becomes cold. The jacket-poultice should be constructed in the following way. To a piece of linen sufficiently large to go quite round the chest, tapes should be sewn in such a manner that they can be tied in front, and over each shoulder. It is as well to have the tapes sufficiently numerous to admit of three fastenings down the front of the chest.

That a poultice may retain its heat, one of two plans may be adopted: either the material should be spread an inch or more thick, or it may be made thinner, and then coated entirely with a layer of cotton-wool. This latter plan is preferable; for, being lighter, it does not hamper the breathing—a matter of importance, especially with children.

In inflammation of other deep-seated organs besides those of the chest, the same methods, modified to suit the part, should be adopted. In peritonitis it is of great importance that the poultice should be spread thin and covered with a layer of cotton-wool; for if heavy it aggravates the pain.

Poulticing is useful in acute rheumatism, lumbago, sciatica, pleurodynia, myalgia, and in those so-called rheumatic pains which often attack limited parts of the body, as one arm, etc.* They are soothing and pleasant to the inflamed joints in rheumatic fever, although cotton-wool is generally sufficient. In acute lumbago, poulticing often brings speedy relief, the severest cases being greatly benefited in a few hours, and generally cured in one or two days. The poultice must be very hot and large enough to cover the whole loins or part affected, and thick enough to remain quite hot for half an hour, when it must be changed. This treatment should be continued for three hours, or longer, if unrelieved; when it is discontinued, the skin must be covered with a piece of

* Galvanism proves highly useful in some forms of these complaints, especially in lumbago. In sciatica it gives at least temporary relief, and in some cases a few applications effect a cure. The sciatica and deep-seated pains about the shafts of the long bones, even the dull aching pain in the joints, which not unfrequently remain after an attack of acute rheumatism, will often yield to galvanism.

flannel, and the flannel covered with oil-silk; this after-treatment, like that of the poultices, promotes free perspiration, upon which mainly depends the efficacy of this plan.

When electricity, the needle, or poultices fail to give more than slight temporary relief, it will often be found that the lumbago is accompanied with high fever, being sometimes the first symptom of an attack of rheumatic fever.

Sciatica may be treated in the same way, but the result is not often so satisfactory. (*Vide* Ether.)

Poultices applied as for lumbago, and followed by the application of lint and oilskin, are often useful in severe forms of pleurodynia and myalgia. Belladonna liniment is usually sufficient, and even preferable, in pleurodynia; and sometimes the ether spray at once and permanently removes the pain of this annoying affection.

As we have said poultices may be constructed of various materials. Those used for the purposes just described may be made of linseed-meal, oatmeal, bread, or starch. Each has its peculiar character, and differs somewhat from the others. Linseed-meal and oatmeal poultices have most properties in common; they make compact and only slightly porous poultices, retaining heat and moisture longer than other kinds, and are consequently often to be preferred to bread or starch. But linseed contains a not inconsiderable quantity of acrid matter which sometimes irritates, especially if the skin is of a fine and delicate texture, or when it is inflamed with some eruption, in which case oatmeal or bread must be substituted. Bread poultices are more porous and blander than those of linseed-meal, but the porosity depends very greatly on the way of making them. Bread poultices cool more quickly, and give less moisture to the skin, than those made of linseed meal. Starch poultices retain their heat for a considerable time, and are very bland, unirritating applications.

It is as well to mention that linseed-meal poultices are more tenacious than those made of bread, and are therefore less liable to break up and fall about the bed and clothes of the patient, rendering him unclean and uncomfortable.

In making a poultice, care should be taken that all the materials, as boiling water, linseed-meal, linen, strappings, bandages or tapes, wool and oil-silk, are close at hand ready for use, and placed before a good fire to warm them thoroughly. To manufacture a linseed poultice, sufficient boiling water is to be poured into a heated bowl, and into the bowl the meal must be quickly sprinkled with one hand, while with the other the mixture is constantly stirred with a knife or spatula, till sufficient meal has been added to make a thin and smooth dough. This should be done as rapidly as possible, otherwise the poultice when it is made will be almost cold. Only an experienced hand can make a model poultice. By adding the meal to the water, with constant stirring, instead of the water to the meal, a thorough blending of the two ingredients is insured, not a knotty, lumpy, uncomfortable mass, too often vexing instead of soothing to the patient. The dough must then be spread quickly and evenly on the warm linen, already cut of proper size and shape, the edges of the linen turned a little way over the meal, to prevent any portion escaping beyond the linen, and soiling the patient's clothes.

There are two methods of making bread poultices. One way is to cut the bread in thickish slices, put it into a basin, pour some boiling water over it, and place the soaking mass by the fire for five minutes; then pour off the water, replacing it with fresh boiling water, and repeat this process; afterwards pour off the excess of water, press the bread, beat up with a fork, and make into a poultice. The other plan is to cut stale bread into thick slices, and pour enough boiling water over it to cover it; place the whole by the fire, and allow it to simmer for a short time, then strain off the excess of water, and prepare the poultice. The first-described plan makes a porous poultice, the other a more compact poultice, sharing the character of one made of linseed meal. Each, as we shall see, has its fitting application.

Bran poultices are useful on account of their lightness.

Starch poultices are entirely unirritating, and retain their

heat for a considerable time. The way to proceed is to add a little cold water to the starch, and to blend the two into a pap; then add sufficient boiling water to make a poultice of the required consistence, which must be spread on linen in the manner already described. Poultices made of this substance are useful as soothing applications to open cancers, and to skin eruptions when there is much inflammation, heat, and pain.

There are several ways of employing charcoal as a poultice. It is used to prevent disagreeable odours from foul sores, and it is thought also to conduce to a healthy condition of the tissues. When employed for this double purpose, the charcoal is mixed with the constituent of the poultice. As a porous poultice is here required, bread is better for this purpose than linseed-meal. A portion of the charcoal should be uniformly mixed with the bread, but the greater part should be sprinkled over the surface of the poultice. Whether a charcoal poultice is greatly superior to one made of simple bread is perhaps doubtful; for the charcoal must soon cease to absorb gases, and thus lose its deodorizing property. It may perhaps promote a healthier condition in the sore. If the object is merely to prevent disagreeable smells and to keep the air of the room pure and sweet, the plan pointed out in the section on charcoal is far preferable.

It is a good practice to sprinkle dry charcoal thickly over foul, sloughing, putrid sores, and to cover the charcoal with a simple poultice. This treatment appears to hasten the separation of the sloughs, and to promote a healthier state of the tissues, and may be applied to a boil when the core is separating, or to a bed sore while the black slough still adheres to the living tissues.

Some maintain that yeast poultices are useful applications to sloughing sores, preventing destruction of the tissues, and promoting the separation of sloughs. Yeast poultices are made in two ways. In one the yeast and water are added to flour till ordinary dough is made, and the dough is applied while fermentation is going on. In this case it is simply an

application of "rising dough." The other way is to smear warmed yeast over the surface of a simple bread poultice.

A carrot poultice is made by boiling carrots till they become quite soft, mashing them with a fork, and spreading the pulp on linen in the ordinary way. This application is supposed to make wounds cleaner and healthier.

Laudanum is sometimes added to poultices to ease pain and when the skin is broken it is especially effectual in this respect.

Solutions of chloride of lime or of soda may be added to poultices to destroy offensive gases given off from unhealthy sores.

In eczema, with much inflammation and sensation of heat, Dr. McCall Anderson recommends a cold potato poultice sprinkled with a small quantity of absorbent powder, containing camphor. The powder is composed of half a drachm of camphor, reduced to powder, with rectified spirit, and three drachms each of powdered talc and oxide of zinc. This is a useful dusting powder without the poultice.

Professor Marshall employs an iodine of starch as an application to clean, sloughing sores. It is made with two ounces of starch mixed with six ounces of boiling water, which forms a jelly, and should be added before it cools to half an ounce of liquor iodi. This poultice is spread on lint, and applied cold.

Fomentations by means of flannel wrung out in boiling water are employed for similar purposes as poultices. They are used for the sake of their moisture, but especially for their warmth, and they differ from poultices in being less weighty, and therefore less likely to increase the pain of very tender parts. The flannel is wrung out by means of a wringer made of stout towelling attached to two rods. The wet flannel is placed in the wringer, which is then twisted round the flannel very strongly, till as much as possible of the water is pressed away. As the flannel when first removed from the boiling water is too hot to be held by the hands, the wringer is very handy and useful. If wrung as dry as pos-

sible, these fomentations may be used very hot, without fear of scalding and blistering the skin.

When the fomentation is placed on the body, it should be covered with a piece of mackintosh, and tied on with bandages. Hot fomentations, being used chiefly for the sake of their heat, and quickly cooling, must be frequently renewed; and when removed, the skin must be carefully wiped dry, and the part covered with a piece of flannel, to prevent the patient taking cold.

Fomentations, and in a less degree poultices, are very useful to relax spasm in the internal organs, as in intestinal, renal, and biliary colic. When the inflammation is very extensive, fomentations are preferable, as a poultice of large dimensions would be heavy and uncomfortable. Thus fomentations are employed when a limb is extensively affected with erysipelas, or when the tissues have been widely contused, and have become inflamed.

Sponging the face with water as hot as can be borne, is a very useful application in acne indurata; it will disperse the spots little advanced, and limit the size and hasten the maturation of the more forward spots, and at the same time greatly lessen for some hours the redness of the existing, as well as the redness of the old vanished spots.

If twenty or thirty drops of turpentine are sprinkled on a hot fomentation of the above description, we obtain a good counter-irritant, useful when we require a stimulating, combined with a warm, soothing, action.

Sometimes it is desired to apply heat to a part of the surface of the body, but at the same time it is important to avoid the relaxation of the tissues which moisture would produce. In such cases dry, strongly heated applications are used. These may be made of various substances. Flannel, strongly heated before the fire or in an oven, is sometimes employed; but it very speedily loses its heat. It is therefore customary to employ substances which retain heat, as sand or chamomile flowers. They are to be strongly heated over the fire on an iron pan, and then to be run into a previously heated linen

bag made for the purpose, of such a shape and construction that the sand or chamomile flowers shall form a thickish and even layer. Each substance possesses its respective advantages; the sand, though heavy, better retains the heat, while the chamomile flowers are light, but sooner lose their warmth. A thin piece of flat tile, heated in the oven, and wrapped in flannel, is lighter than sand, retains its heat for a considerable time, and is very generally to be procured. These applications are of great service in relieving spasms and the accompanying pain.

ON ENEMATA.

Injections are used for a variety of purposes; to procure evacuations of the bowels, to restrain diarrhœa, to ease pain about the region of the pelvis, to destroy worms, to introduce medicines into the general system, and lastly, to introduce nutritive substances, into the rectum in cases where food cannot be taken by the stomach.

In the administration of enemata for each of these purposes, certain points must be attended to.

First, concerning injections used to relieve the bowels. It must be clearly understood that enemata seldom act by merely washing away the fæces from the intestines; for they act efficiently when the fæcal matter is lodged high up the intestines, as the transverse colon or cæcum. They act by stimulating, probably, the whole intestinal tract to more vigorous peristaltic action, by which means the contents are propelled along the canal, and finally expelled. This increased activity of the vermicular action of the intestines is produced, probably, by the injected fluid distending the lower part of the large gut, and so stimulating the intestines far beyond the point to which the injection reaches, causing the expulsion of their contents. The object therefore is to distend

the rectum and the adjoining part of the intestine. Now an enema constantly fails, owing to the introduction of so little fluid, that it excites scarcely any contraction. A large quantity, as two, three, or even four pints, of fluid should be introduced. He, however, who for the first time, attempts without due observance of certain conditions, to introduce a copious injection into the rectum, will be doomed to disappointment.

When a copious injection is to be given, the patient being placed on his left side, the fluid must be slowly pumped into the rectum, when, after a variable, but usually a short time, the patient complains of inability to retain more, and suffers from more or less severe colicky pain in the belly, and an urgent desire to empty the bowels. The pumping must now be intermitted for a while, and the patient directed to prevent the escape of the fluid: but if he is unable to control the sphincter, the administrator must help him. This can be done in several ways, all having for their object the strengthening the contraction of the sphincter. The simplest, but not always the most successful plan, is to support firmly with the hand the perinæum and structures around the anus, either with the bare hand, or with the aid of a folded towel. Should this simple support prove ineffectual, which is often the case after a considerable quantity of fluid has been introduced, further assistance is afforded by passing into the rectum, alongside the nozzle of the enema-pipe, one, two, or even three fingers, as circumstances may require, and to press them with the nozzle strongly upward. Stimulated in this way, the sphincter firmly grasps the fingers, and effectually prevents the escape of the fluid. Indeed, with these precautions, almost any amount of fluid may be pumped into the intestines. From time to time the patient will complain of griping pains in the stomach, and an oppressive desire to go to stool, when the pumping should be stayed awhile, and recommenced as soon as these symptoms pass away. The operation over, the patient must be directed to lie quite quiet on the left side, and, if possible, to retain the fluid for ten minutes or more, so as to ensure a more active and thorough contraction of the bowels.

It need scarcely be mentioned that if the rectum or lower part of the large intestine is the seat of cancer, or is diseased in other ways, copious injections, and the introduction of a long tube, are attended with danger.

Sometimes the rectum and lower part of the gut is blocked to distension with fæces, against which the injected fluid juts, and finding no passage it of necessity flows back through the sphincter as fast as it is pumped in. One or two ways may be adopted to force such a blockade, A hollow tube of some inches in length is passed through the impacted fæces, till its free extremity reaches the sigmoid flexure, or even higher. If it is made to pass through the accumulation in the intestine, the injection can easily be proceeded with. Should this fail, and it is highly urgent to obtain an evacuation, then two or three fingers, according to the yielding of the sphincter, are to be introduced in the rectum, and the fæces withdrawn, which can be easily accomplished if they are hard and firm. Obstinate constipation, such as we are now speaking of, occurs most commonly in diabetes. The hard and almost stone-like fæces can easily be withdrawn by the fingers in the manner described; and much more may be withdrawn than is contained in the rectum, for although the intestines may be unable to force the hardened fæces through the sphincter, they are quite capable of propelling them into the rectum; consequently, as fast as the fæces are withdrawn, fresh supplies are propelled downwards within easy reach of the fingers.

Various fluids are employed as enemata. Sometimes simple warm water or gruel; at other times, to one or other of these, soap, turpentine, or castor oil is added. The soap or gruel are generally employed when castor oil or turpentine is added to the injection, as they help to suspend these substances. It must be recollected that castor oil and turpentine are lighter than water, and will float on its surface. If the oil or turpentine is added to the fluid to be injected, although this may be well stirred, yet, as the injection proceeds, the oil rises to the surface; and as the tube of the syringe lies

at the bottom of the vessel, the lower stratum of the fluid is first injected, while much of the oil or turpentine floats on the surface, or sticks to the sides of the vessel, while the portion which is ultimately injected operates only upon the rectum and the neighbouring intestine. The object should be to make the oil or the turpentine, as the case may be, rise as high up the canal as possible, so as to bathe and influence the mucous lining of the intestines as it ascends. The oil or turpentine well beaten up with three or four ounces of gruel, or soap and water, should be first injected into the rectum, after which the water is to be pumped in, so as to force the oil far up the intestinal canal.

What should be the temperature of an injection? Tepid fluid is generally used, but some consider that an injection acts more energetically on the tissues, and excites the intestines to more vigorous action, when the temperature of the fluid differs widely from that of the body. Thus cold or hot water may be used. Very cold water may be injected without the patient's cognizance of its temperature, or being at all incommoded by it.

It is unadvisable to habitually use warm evacuant enemata, or a torpid condition of the intestines may ensue, which will ultimately render the constipation worse.

Large quantities of water, as we have said, are employed to unload the bowels; but this is not the sole use of a free injection; for, if used comfortably warm, it is very soothing to the intestines and to the neighbouring organs. Thus the pain of cancer, either of the intestines or of the organs near may often be much mitigated by warm injections. And injections often greatly relieve the very distressing straining desire to evacuate, without any riddance of fæces, occurring in intestinal cancer. Warm injections are very soothing in the pain of cystitis, prostatitis, abscess of the prostate, and pelvic and abdominal pains generally. (*Vide* Opium and Belladonna.)

Copious injections appear to prove beneficial in some instances of suppresion of the urine.

Injections are often successful in restraining obstinate or dangerous diarrhœa. It is by no means necessary for the injection to reach that part of the intestines upon which the diarrhœa depends; for it is equally successful whether the mischief is situated in the small or large intestines. The benefit derived is therefore due to a close sympathy between the different parts of the intestines, by means of which an impression made on one part is communicated to another. When employed to restrain diarrhœa, it is well that the injection should be retained as long as possible, in order the more effectually to influence the intestines. Therefore only a small quantity should be injected, otherwise the intestine is stimulated to contract, and expel the enema. An injection of an ounce, or at most two ounces, is sufficient for an adult; and it may be repeated several times a day, according to the urgency of the diarrhœa.

The material used in such enemata is starch, boiled or raw, of the consistence of cream, and at a temperature of 100°. An injection simply composed of starch proves effectual; but its astringent sedative action may be much heightened by the addition of some drops of laudanum, graduated in quantity according to the age and condition of the patient. The addition of some acetate of lead or sulphate of copper renders this injection still more astringent. These injections are invaluable in cases where delay is death. They will save many a life in the choleraic diarrhœa of children, which so rapidly proves fatal unless speedily restrained. The diarrhœa of typhoid fever, which, if excessive, adds extremely to the patient's danger, yields generally to these injections. The diarrhœa of phthisis is also usually amenable to these enemata.

Injections are commonly used to destroy thread-worms, which infest the rectum and the intestines in its immediate neighbourhood, but occur in no other part of the canal. As the object of the injection is to destroy these entozoa, a sufficient quantity of fluid should be employed so as to reach a little higher than the rectum. For an adult, half a pint is

sufficient, and for a child, of course, less must be used. To the water injected, various substances can be added, as common salt, tincture of sesquichloride of iron, lime-water, quassia, and various other similarly acting agents, with the object either of directly poisoning the worms, or of destroying them by coagulating the albuminous structures of their bodies. Injections are always successful in removing worms, and so affording temporary relief; but in the treatment of worms it must always be recollected that the morbid state of the mucous coat of the intestines, favouring the production of worms, must be remedied if a permanent relief is to be obtained.

Solutions too concentrated must not be injected, otherwise inflammation may occur, perhaps severe enough to cause sloughing in the rectum and margins of the anus. A teaspoonful of salt, or a drachm of the tincture of steel, to half a pint of water, is sufficiently strong to effect the destruction of these delicately formed animals.

We have already spoken, in the various sections treating of each remedy, of the administration of medicines by enemata.

Nutritive enemata are employed in stricture of the œsophagus, or when swallowing is rendered impossible by tumours pressing against this tube, in persistent vomiting, and in painful diseases of the stomach, like chronic ulcer. A nutrient enema, in order to be retained, should not exceed three or four ounces, and should consist of bland, unirritating material, otherwise the lining membrane of the rectum becomes irritated and inflamed, a condition adverse to absorption. Mr. Marcus Beck advises the addition of pepsine and dilute hydrochloric acid to the injection. From experiments on dogs, M. Bauer finds that peptones are freely absorbed by the large intestines, but that pure soluble albumen is not absorbed, but is taken up readily on the addition of salt. Acid solutions of albumen, as meat dissolved in weak hydrochloric acid are also freely absorbed. Fats and starches injected into the large intestine failed to support life for any considerable time. It sometimes happens that the rectum will not retain even four ounces, and this inability to retain is more

liable to occur after injections have been continued for some time. Before such enemata are given, it must be ascertained that the rectum is not filled with fæces.

Dr. W. O. Leube employs the pancreas of the ox or pig as a ferment. One part of finely minced pancreas being mixed with three parts of scraped meat rubbed well together with warm water, so that the mixture is easily injected. Fat, not exceeding one sixth part of the meat, may be added. This injection is retained from twelve to thirty-six hours. The fæces after this injection generally possess an ordinary fæcal character. Dr. Leube has proved by experiments on dogs, that by means of this injection a considerable quantity of nitrogen can be taken up into the system.

Astringent and stimulating injections, composed of a pint of water, and containing ten to twenty grains of sulphate of copper, or corresponding quantities of nitrate of silver and sulphate of zinc, prove of great service in restraining the troublesome straining diarrhœa of chronic dysentery. In the earlier stages, too, of dysentery, large emollient enemata prove useful, especially by removing the fœtid discharges, and soothing the inflamed mucous membrane.

DIETARY FOR INVALIDS.

Macaroni Soup.

One ounce and a half of macaroni, a piece of butter the size of a nut, salt to taste, one quart of stock.

Throw the macaroni and butter into boiling water, with a pinch of salt, and simmer half an hour. When tender, drain, and cut into thin rings or lengths, and drop it into the boiling soup. Stew gently fifteen minutes, and serve.

Barley Soup.

One pound of shin of beef, four ounces of pearl barley, one potato, salt and pepper to taste, one quart and a half of water.

Put all the ingredients into a pan, and simmer gently for four hours. Strain, return the barley, and heat up as much as required. A small onion may be added, if not objected to.

Bread Soup.

One pound of bread, two ounces of butter, one quart of stock.

Boil the bread with the butter in stock. Beat the whole with a spoon or fork, and keep it boiling till the bread and stock are thoroughly mixed. Strain, season with salt, and serve.

Tapioca Soup.

Two ounces and a half of tapioca, one quart of stock.

Put the tapioca into *cold* stock, and bring it gradually to the boiling point. Simmer gently till tender, and serve.

Sardinian Soup.

Two eggs, a quarter of a pint of cream, one ounce of fresh butter, salt and pepper to taste, a little flour to thicken.

Beat the eggs, put them into a stewpan, and add the cream, butter and seasoning, stir in as much flour as will bring it to the consistency of dough, make it into balls the size and shape of a nut, fry in butter, and put them into a basin of any sort of soup or broth, to which they make a very nice addition.

Stewed Oysters.

Half a pint of oysters, half an ounce of butter, flour, one-third of a pint of cream, cayenne and salt to taste.

Scald the oysters in their own liquor, take them out, beard them, and strain the liquor. Put the butter into a stewpan, dredge in sufficient flour

to dry it up, add the oyster liquor, and stir it over a sharp fire with a wooden spoon. When it boils, add the cream, oysters, and seasoning, and simmer for one or two minutes, but *not longer*, or the oysters will harden. serve on a hot dish, with croutons or toasted sippets of bread. A quarter of a pint of oysters, the other ingredients being in proportion, make a dish large enough for one person.

Panada.

Take the crumb of a penny roll, and soak it in milk for half an hour, then squeeze the milk from it; have ready an equal quantity of chicken or veal, *scraped* very fine with a knife; pound the bread crumbs and meat together in a mortar. It may be cooked either mixed with veal or chicken broth, or poached like an egg, by taking it up in two tea-spoons, in pieces the shape of an egg, after seasoning it. Serve on mashed potato.

Macaroni.

Two ounces of macaroni, a quarter of a pint of milk, a quarter of a pint of good beef gravy, the yolk of one egg, two table-spoonfuls of cream, half an ounce of butter. Wash the macaroni, and boil it in the gravy and milk till *quite* tender. Drain it, put the macaroni into a very hot dish, and place by the fire. Beat the yolk of the egg with the cream and two table-spoonfuls of the liquor the macaroni was boiled in. Make this sufficiently hot to thicken, *but do not allow it to boil*, or it will be spoiled; pour it over the macaroni, and strew over the whole a little finely grated Parmesan cheese; or the macaroni may be served as an accompaniment to minced beef, without the cheese; or it may be taken alone, with some good gravy in a tureen, served with it.

Stewed Eels.

One eel, half a pint of strong stock, two table-spoonfuls of cream, half a glass of port wine, thickening of flour, a little cayenne.

Wash and skin the eel, cut it in pieces about two inches long; pepper and salt them, lay them in a stewpan, pour over the stock, and add the wine. Stew gently for twenty-five minutes or half an hour, lift the pieces carefully on to a very hot dish, and place it by the fire, strain the gravy, stir into the cream sufficient flour to thicken it, mix with the gravy, boil for two minutes, and add a little cayenne. Pour over the eels and serve. Sometimes the addition of a little lemon-juice is gratifying to the palate.

Minced Fowl and Egg.

Cold roast fowl, a hard-boiled egg, salt, pepper, or cayenne, to taste; three table-spoonfuls of new milk or cream, half an ounce of butter, one table-spoonful of flour, a tea-spoonful of lemon-juice.

Mince the fowl, and remove all skin and bones; put the bones, skin, and trimmings into a stewpan, with one small onion, if agreeable to the patient, and nearly half a pint of water; let this stew for an hour, then strain the liquor, chop the egg small, mix with the fowl, add salt and pepper, put in the gravy and other ingredients, let the whole just boil, and serve with sippets of toasted bread.

Fowl and Rice.

A quarter of a pound of rice, one pint of stock or broth, one ounce and a half of butter, minced fowl, egg, and bread crumbs.

Put the rice into the cold stock or broth, let it boil very gently for half an hour, then add the butter, and simmer it till quite dry and soft. When cold, make it into balls, hollow out the inside and fill them with mince made according to the foregoing receipt, but a little stiffer; cover with rice, dip the balls into egg, sprinkle with bread crumbs, and fry a nice brown; a little cream stirred into the rice before it cools improves it very much.

Chicken and Rice.

Cut up the meat of boiled chicken. Have ready some rice well creed and seasoned with salt put round a small flat dish or vegetable dish, warm up the chicken in a little good gravy, and serve in the middle of the dish with the rice round it.

Macaroni boiled in Milk.

Two ounces of macaroni, three-quarters of a pint of new milk, a little lemon-rind, a little white sugar.

Put the milk into a saucepan with the lemon-rind, bring it to boiling point, and drop in the macaroni. Let it swell gradually over the fire till *quite* tender, but do not allow the pipes to break.

If not enough milk add a little more. The lemon-peel should be taken out before the macaroni is put into the milk. Serve hot with fruit syrup, or cold with custard poured over it.

Rice Cream, 1.

To a pint of new milk add a quarter of a pound of ground rice, a lump of butter the size of a walnut, a little lemon-peel, and a table-spoonful of powdered sugar. Boil them together for five minutes, then add half an ounce of isinglass which has been dissolved, and let the mixture cool. When cool, add half a pint of good cream whisked to a froth, mix altogether, and set it for a time in a very cool place, or on ice; when used, turn it out of the basin into a dish, and pour fruit juice round it, or some stewed apple or pear may be served with it.

Rice Cream, 2.

A quarter of a pound of whole rice, well creed in milk, and put in a sieve to drain and cool, mix with the rice a gill of good cream whisked to a froth, and add a wine-glass of sherry, a little powdered sugar, and a tea-spoonful of lemon-juice.

Light Pudding.

Boil very smoothly in new milk one table-spoonful of ground rice, let it get *quite cold*, then add two eggs, very well beaten up, a lump of white sugar, and, if liked, a dessert-spoonful of brandy. Line a small tart dish (sufficient for one person) with paste, put in the pudding, and bake quickly. Serve the moment it is ready, for it falls directly.

Rice and Apple.

Boil about three table-spoonfuls of rice in a pint and a half of new milk, and simmer, stirring it from time to time, till the rice is *quite* tender. Have ready some apples, peeled, cored, and stewed to a pulp, aud sweetened with a very little loaf sugar. Put the rice round a plate, and the apple in the middle, and serve with a little of the following preparation of milk in a cream jug, if liked.

Milk for Puddings or Stewed Fruit.

Boil a strip of lemon and two cloves in a pint of milk; mix half a tea-spoonful of arrowroot in a little cold milk, and add it to the boiling milk; stir it till about the consistency of cream. Have ready the yolks of three eggs, beaten up well in a little milk. Take the hot milk off the fire, and as it cools add the eggs and a table-spoonful of orange-flower water, stirring it constantly till quite cool. Keep it in a very cool place till required for use.

Cream for Stewed Fruit.

An ounce and a half of isinglass boiled over a slow fire in a pint and a half of water, to half a pint. Strain and sweeten, put in a glass of sherry, and stir in half a pint of good cream; stir till cold.

Baked Custard Pudding.

Warm half a pint of milk, or a little more; whisk two eggs, yolks and whites; pour the milk to them, stirring all the while. Have ready a small tart dish, lined at the edges with paste ready baked. Pour the custard into the dish, grate a little nutmeg over the top, and bake it in a very slow oven for half an hour.

Boiled Custard Pudding.

Prepare the custard as in the foregoing receipt. Butter a small basin that will exactly hold it, put in the custard, and tie a floured cloth over it; plunge it into boiling water, turn it about for a few minutes, boil it slowly for half an hour, turn it out and serve.

Baked Bread Pudding.

Half a pint of new milk, a quarter of a pound of bread crumbs, two eggs, one ounce of butter, sugar to taste.

Boil the milk, and pour it over the bread crumbs, and let them soak for half an hour. Beat the eggs, mix them with the bread crumbs, add the sugar and butter, and stir well till thoroughly mixed. Butter a breakfast cup or small pudding mould, fill it a little more than half full with the mixture, and bake in a moderate oven for about twenty minutes. Serve with the following sauce.

Sago Sauce for Boiled or Baked Pudding.

One dessert-spoonful of sago, not quite half a pint of water, one table-spoonful of sherry, one tea-spoonful of lemon-juice, and a little lemon-rind, sugar to taste.

Wash the sago, then put it into a saucepan with the water and lemon-peel, let it simmer for ten minutes, then take out the lemon-peel, add the other ingredients, boil and serve.

Semolina Pudding.

One ounce of semolina, half a pint of milk, one ounce of butter, two eggs, sugar to taste.

Heat the milk, and mix with it the semolina, sugar, and butter; stir this over the fire for a few minutes; then take it off, and mix with it the eggs, which should be well beaten. Butter a small tart dish, line it with puff paste, put in the pudding, and bake in a slow oven.

Rice Pudding.

Two ounces of whole rice, three-quarters of a pint of milk, one ounce of butter, two eggs, sugar to taste, flavouring of lemon-peel.

Let the rice swell in the milk over a slow fire, put in a few small strips of lemon-peel, stir in the butter, and then let the mixture cool. Well beat the eggs, and mix with the rice. Butter a breakfast cup or small mould, fill it three parts full, and bake. Turn it out on a white d'oyley, and serve with sauce.

Rice Milk.

Three table-spoonfuls of rice, one quart of milk.

Wash the rice, put it into a saucepan with the milk, and simmer gently till the rice is tender, stirring it now and then to prevent the milk burning. Sweeten a little, and serve with a cut lemon, black-currant jam, or apples stewed.

Tapioca Pudding.

One ounce of tapioca, one pint of milk, one ounce of butter, two eggs, sugar to taste.

Wash the tapioca, and let it stew gently in the milk for a quarter of an hour, stirring it now and then. Let it cool. Mix with it the butter, sugar, and eggs, which must be well beaten; put it into a small tart dish, and give it an hour's baking in a moderate oven.

Apple and Rice.

Take three small apples, peel and halve them, take out the cores, put them into a stewpan with about half an ounce of butter, and strew over them a little white sifted sugar. Stew them very gently till tender, taking care not to break them. Boil the rice with the milk and a little sugar till quite soft; and when done, dish it with the apples on the top of it, and a little cream served with it separately.

Milk Blancmange.

Quarter of a pound of loaf sugar, one quart of milk, one ounce and a half of isinglass.

Put all the ingredients into a lined saucepan, and boil gently till the isinglass is dissolved. Keep stirring it over the fire for about ten minutes. Strain it through a fine sieve into a jug, and when nearly cold pour it into an oiled mould. Turn it carefully out when required for use.

Rice Blancmange.

A quarter of a pound of ground rice, two ounces of loaf sugar, one ounce of butter, one quart of milk, flavouring of lemon peel.

Mix the rice to a smooth batter with a little milk, and put the remainder into a saucepan with the butter, sugar and lemon-peel. Bring the milk to boiling point, stir in the rice. Let it boil for ten minutes, or till it comes away from the saucepan. Grease a mould with salad oil, pour in the rice, let it get perfectly cold, and turn out.

Arrowroot Blancmange.

Two table-spoonfuls of arrowroot, three-quarters of a pint of milk, lemon and sugar to taste.

Mix the arrowroot with a little milk to a smooth batter; put the rest of the milk on the fire, and let it boil, sweeten and flavour it, stirring all the time, till it thickens sufficiently to come from the saucepan. Put it into a mould till quite cold.

Vermicelli Pudding.

Two ounces of vermicelli, three-quarters of a pint of milk, quarter of a pint of cream, one ounce and a half of butter, two eggs, one ounce and a half of sugar.

Boil the vermicelli in the milk till it is tender, then stir in the remaining ingredients (omitting the cream if that is not obtainable). Butter a small tart dish, line with puff paste, put in the pudding, and bake.

Fruit Cream.

Apples, gooseberries, rhubarb, or any fresh fruit.

To every pint of pulp add one pint of milk or cream, sugar to taste. Prepare the fruit as for stewing, put it into a jar, with two table-spoonfuls of water, and a little good moist sugar. Set this jar in a saucepan of boiling water, and let it boil till the fruit is soft enough to mash. When done enough, beat it to a pulp, work this pulp through a colander, and to every pint stir in the above proportion of milk or cream. Of course the cream is preferable, if obtainable. Sweeten, and serve in a glass dish.

Bread Jelly.

Take the crumb of a loaf, break it up, pour boiling water over it and leave it to soak for three hours. Then strain off the water, and add fresh; place the mixture on the fire, and let it boil till it is perfectly smooth; take it out, and, after pressing out the water, flavour with anything agreeable; put it into a mould, and turn it out when required for use.

Beef Tea and Cream Enema.

Mix four or five ounces of strong beef tea, one ounce of cream, and half an ounce of brandy or one ounce of port wine.

To keep Milk from turning sour.

Fifteen grains of bicarbonate of soda to a quart of milk hinders its turning sour.

Barley Water.

To a table-spoonful of pearl barley, washed in cold water, add two or three lumps of sugar, the rind of one lemon, and the juice of half a lemon. On these pour a quart of boiling water, and let it stand for seven or eight hours. Strain it. The barley should never be used a second time. Half an ounce of isinglass may be boiled in the water.

Lemonade 1.

Well rub two or three lumps of sugar on the rind of a lemon, squeeze out the juice, and add to it half a pint or a pint of cold or iced water, or better still, one or two bottles of soda-water.

Effervescing Lemonade.

Squeeze two large lemons, and add a pint of spring water to the juice, and three or four lumps of white sugar. When required for use, pour half of it into a tumbler, and add half a small teaspoonful of carbonate of soda; stir, and drink whilst effervescing.

Lemonade 2.

The juice of four lemons, the rinds of two, half a pint of sherry, four eggs, six ounces of loaf sugar, one pint and a half of boiling water.

Pare the lemon-rind thinly, put it into a jug with the sugar, and pour the boiling water on it. Let it cool, and then strain it, and add the wine, lemon-juice, and eggs, previously well beaten and strained. Mix all well together, and it is ready for use.

Lemonade. 3.

Pare the rind of three lemons as thin as possible, add one quart of boiling water and a quarter of an ounce of isinglass. Let them stand till next day covered, then squeeze the juice of eight lemons upon half a pound of lump sugar; when the sugar is dissolved, pour the lemon and water upon it, mix all well together, strain it, and it is ready for use.

Milk, Rum, and Isinglass.

Dissolve in a little hot water over the fire a pinch of the best isinglass; let it cool, and mix a dessert-spoonful of rum with it in a tumbler, and fill up the glass with new milk.

Sherry or Brandy and Milk.

To one table-spoonful of brandy, or one wine-glassful of sherry, in a bowl or cup, add powdered sugar and a very little nutmeg to taste. Warm a breakfast-cupful of new milk, and pour it into a spouted jug; pour the contents from a height over the wine, sngar, etc. *The milk must not boil.*

Mulled Wine.

Boil some spice, cloves, nutmeg, cinnamon, or mace, in a little water, just to flavour the wine; then add a wine-glass of sherry or any other wine, and some sugar, bring it to boiling point, and serve with sippets of toast. If claret is used, it will require a good deal of sugar. The vessel for boiling the wine in should be scrupulously clean.

Egg and Sherry.

Beat up with a fork an egg till it froths, add a lump of sugar and two table-spoonfuls of water; mix well, pour in a wine-glassful of sherry, and serve before it gets flat. Half the quantity of brandy may be used instead of sherry.

Milk, Egg, and Brandy.

Scald some new milk, *but do not let it boil.* It ought to be put into a saucepan of boiling water, in a jug, and scalded very gradually. When the surface looks filmy, it is sufficiently done, and should be put away in a cold place, in the same vessel. When quite cold, beat up a fresh egg with a fork, in a tumbler, with a lump of sugar; beat quite to a froth, add a dessert-spoonful of brandy, and fill up the tumber with scalded milk.

Egg, and Wine.

One egg, one table-spoonful and half a glass of cold water, one glass of sherry, sugar, and a very little grated nutmeg.

Beat the egg to a froth with a table-spoonful of cold water. Make the wine and water hot, *but not boiling;* pour it on the egg, stirring all the time. Add sufficient sugar to sweeten, and a very little nutmeg. Put all into a lined saucepan, set it on a gentle fire, and stir it *one way* till it thickens, *but do not let it boil.* Serve in a glass with crisp biscuits or sippets of toast.

Arrowroot Drink.

Mix two tea-spoonfuls of arrowroot in about three table-spoonfuls of cold water, then pour in about half a pint of boiling water; when well mixed, add by degrees, half a pint of cold water, stirring all the time, so as to make it perfectly smooth. It should be about the consistence of cream; if too thick, a little more water may be added. Then pour in two wine-glassfuls of sherry or one of brandy, add sugar to taste, and give it to the patient in a tumbler. A lump of ice may be added, if allowed.

Nutritious Coffee.

Dissolve a little isinglass in water, then put half an ounce of freshly ground coffee into a saucepan with one pint of new milk, which should be nearly boiling before the coffee is added, boil both together for three minutes; clear it by pouring some of it into a cup and dashing it back again, add the isinglass, and leave it to settle on the hob for a few minutes. Beat up an egg in a breakfast cup, and pour the coffee into it; or, if preferred drink it without the egg.

Milk and Isinglass.

Dissolve a little isinglass in water, mix it well with half a pint of milk, then boil the milk, and serve with or without sugar, as preferred.

Milk and Cinnamon Drink.

Boil in one pint of new milk sufficient cinnamon to flavour it pleasantly, and sweeten with white sugar. This may be taken cold with a tea-spoonful of brandy, and is very good in cases of diarrhœa. Children may take it milk-warm without the brandy.

Demulcent Drink.

Take a pinch of isinglass, and boil it in half a pint of new milk, with half a dozen bruised sweet almonds and three lumps of sugar.

Arrowroot and Black-Currant Drink.

Take two large spoonfuls of black-currant preserve, boil it in a quart of water, cover it, and stew gently for half an hour, then strain it, and set the liquor again on fire; then mix a tea-spoonful of arrowroot in cold water, and pour the boiling liquor upon it, stirring meanwhile; then let it get quite cold.

White Wine Whey.

To half a pint of boiling milk add one or two wine-glassfuls of sherry; strain through a fine sieve, sweeten with sifted sugar, and serve.

Caudle.

Beat up an egg to a froth, add a wine-glassful of sherry, and half a pint of gruel, flavour with lemon-peel and nutmeg, and sweeten to taste.

Another Caudle.

Mix well together one pint of cold gruel with a wine-glassful of good cream, add a wine-glassful of sherry and a table-spoonful of noyeau, and sweeten with sugar-candy.

Egg and Brandy.

Beat up three eggs to a froth in four ounces of cold spring water, add two or three lumps of sugar, and pour in four ounces of brandy, stirring all the time. A portion of this may be given at a time.

A Gruel.

Beat up an egg to a froth, add a wine-glass of sherry, flavour with a lump of sugar, a strip of lemon-peel, and a little grated nutmeg. Have ready some gruel, very smooth and hot, stir in the wine and egg, and serve with sippets of crisp toast. Arrowroot may be made in the same way.

Restorative Beef Essence, 1.

Take one pound of fresh beef, free from fat, chop it up fine, and pour over it eight ounces of soft water, add five or six drops of hydrochloric acid, and fifty or sixty grains of common salt, stir it well, and leave it for three hours in a cool place. Then pass the fluid through a hair sieve, pressing the meat slightly, and adding gradually towards the end of the straining about two more ounces of water. The liquid thus obtained is of a red colour, possessing the taste of soup. It should be taken cold a tea-cupful at a time. If preferred warm, it must not be put on the fire, but heated in a covered vessel placed in hot water.

Should it be undesirable for the patient to take the acid, this soup may be made by merely soaking the minced beef in distilled water.

Another Beef Essence, 2.

Take one pound of gravy beef, free from fat and skin, chop it up very fine, add a little salt, and put it into an earthen jar with a lid, fasten up the edges with a thick paste, such as is used for roasting venison in, and place the jar in the oven for three or four hours. Strain through a coarse sieve, and give the patient two or three tea-spoonfuls at a time.

Beef Essence, 3.

Cut up in small pieces one pound of lean beef from the sirloin or rump, and place it in a covered saucepan, with half a pint of cold water, by the side of the fire for four or five hours, then allow it to simmer gently for two hours. Skim it well, and serve.

Mutton Jelly.

Six shanks of mutton, three pints of water, pepper and salt to taste, half a pound of lean beef, a crust of bread toasted brown.

Soak the shanks in water several hours, and scrub them well. Put the shanks, the beef and other ingredients into a saucepan with the water, and let them simmer very gently for five hours. Strain it, and when cold take off the fat. Warm up as much as is wanted at a time.

Beef Tea with Oatmeal.

Mix two table-spoonfuls of oatmeal very smooth with two spoonfuls of cold water, then add a pint of strong boiling beef tea. Boil together for five or six minutes, stirring it well all the time. Strain it through a sieve, and serve.

Baked Soup.

One pound of lean beef, one ounce of rice, pepper and salt to taste, one pint and a half of water.

Cut up the meat into slices, add the rice and seasoning, place all in a jar with the water, cover it closely, and bake for four hours. Pearl barley may be substituted for rice, if preferred.

Mutton Broth.

One pound of the scrag end of neck of mutton, two pints of water, pepper and salt, half a pound of potatoes, or some pearl barley.

Put the mutton into a stewpan, pour the water over it, pepper and salt. When it boils, skim carefully; cover the pan, and let it simmer gently for an hour. Strain it, let it get cold, and then remove all the fat. When required for use, add some pearl barley or potatoes in the following manner:—Boil the potatoes, mash them very smoothly so that no lumps remain. Put the potatoes into a pan, and gradually add the mutton broth, stirring it till it is well mixed and smooth; let it simmer for five minutes, and serve with fried bread.

Soup.

Take three or four pared potatoes, a thick slice of bread, half a tea-cupful of pearl barley or rice, a little salt and pepper, two quarts of beef tea or mutton broth. Heat the beef tea or broth in a pan, and when quite boiling add the rest of the ingredients, except the pepper and salt, which should be added when nearly done; cover the pan, and let it boil slowly for an hour. Serve with toasted bread.

Rabbit Soup.

Soak a rabbit in warm water, and when quite clean, cut it in pieces, and put it into a stewpan with a tea-cupful of veal stock or broth; simmer slowly till done through, then add a quart of water and boil for an hour. Then take out the rabbit, pick tbe meat from the bones, covering it up to keep it white; put the bones back into the liquor, and simmer for two hours, skim strain, and let it cool. Pound up the meat in a mortar, with the yolks of two hard-boiled eggs, and the crumb of a French roll, previously soaked in milk; rub it through a tammy, and gradually add the strained liquor, and simmer for fifteen minutes. If liked *thick*, mix some arrowroot with half a pint of new milk, bring it to the boil, mix with the soup, and serve. If preferred thin, have ready some pearl barley and vermicelli boiled in milk, and add to the soup instead of the arrowroot. Serve with little squares of toast or fried bread.

Calf's Foot Broth.

One calf's foot, three pints of water, one small lump of sugar, the yolk of one egg.

Stew the foot in water, *very gently*, till the liquor is reduced to half; remove the scum, set it in a basin till quite cold, then take off every particle of fat. Warm up about half a pint, adding the butter and sugar, take it off the fire for a minute or two, then add the beaten yolk of the egg; keep stirring it over the fire till the mixture thickens, *but do not let it boil*, or it will be spoiled.

Veal Soup.

A knuckle of veal, two cow-heels, twelve pepper-corns, a glass of sherry, and two quarts of water.

Stew all the ingredients in an earthen jar six hours. Do not open it till cold. When wanted for use, skim off the fat, and strain it. Heat as much as you require for use. Serve very hot.

Good Stock for Soup.

One pound of shin of beef, one pound of knuckle of veal, four white pepper-corns, a lump of sugar, one quart of water.

Simmer gently for six hours, skim well, and strain.

Nourishing Soup.

Stew two ounces of the best well-washed pearl sago in a pint of water till it is quite tender and very thick, then mix it with half a pint of good boiling cream and the yolks of two fresh eggs. Blend the whole carefully with one quart of essence of beef, made according to number 3. The beef essence must be heated separately, and mixed while both mixtures are hot. A little of this may be warmed up at a time.

Sago Soup, 2.

An ounce and a half of sago, one pint of stock.

Wash the sago in boiling water. Put one pint of stock on the fire, and bring it to the boil; add the sago by degrees, and simmer till it is entirely dissolved. When cold, it will form a jelly.

Rice Soup.

Three ounces of Patna rice, the yolks of two eggs, half a pint of cream or new milk, one quart of stock.

Boil the rice in the stock, and rub half of it through a tammy, put the stock in a stewpan, add the rest of the rice whole, and simmer gently for five minutes. Have ready the cream or milk, boiled. Beat the yolk of the eggs, and mix them gradually with the cream. Take the soup off the fire, add the cream and eggs, stirring them well together as you mix them. Heat it up gradually, but *do not let it boil*, or the eggs will curdle, and the soup be spoilt.

Semolina Soup.

Drop an ounce of semolina into one pint of boiling stock, and stir constantly to prevent burning. Simmer gently for half an hour. Season with salt to taste.

Thirst in fevers can be assuaged by the use of whey, or water acidulated with currant jelly or raspberry vinegar, or a light infusion of cascarilla, acidulated with a small quantity of muriatic acid.

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