THIRD DIVISION.—OF CHEMICAL REMEDIES.

UNDER this division are comprised those few classes of medicines, the operation of which either depends entirely on the chemical changes they produce, or is materially modified by these changes. I have placed under it the classes of Refrigerants, Antacids, Lithontriptics, and Escharotics.

CHAP. XVI.

OF REFRIGERANTS.

THE substances arranged by authors on the Materia Medica under the appellation of Refrigerants, have been usually defined, Such medicines as directly diminish the force of the circulation, and reduce the heat of the body without occasioning any diminution of sensibility or nervous energy. The theory delivered of the operation of these medicines is unsatisfactory and obscure; nor are even the facts adduced to establish the existence of such a class of remedies altogether precise. It is acknow-

ledged by Dr Cullen, that " in many trials made on purpose, it did not appear that the supposed refrigerants diminished that temperature of the body, which is the ordinary temperature of it in health." He concludes, therefore, that the definition should apply only to the reduction of the temperature when it has been morbidly increased, and even in this case the effect of these medicines is allowed by practical writers not to be considerable.

It is not necessary to review the opinions that have been advanced on the mode of operation of these substances, since they are in general absurd and unintelligible. Dr Cullen, in particular, gives an explanation on this subject, founded on the most obscure and hypothetical ideas, and which, indeed, it is scarcely possible to understand. Its basis, he remarks, is a doctrine delivered by Needham, " that there is every where in nature an expansive force and a resisting power; and that, particularly under a certain degree of heat, the expansive power appears in all the parts of organized bodies, in consequence of which they shew a singular vegetating power; while, at the same time, in other bodies there is a power resisting and preventing the action of this vegetating power, and at least of diminishing its force." This power, it is added, is found in those saline substances commonly supposed to be refrigerants; and, " as an increase of heat is no other than an increase of the expansive force in the heated parts, it may be understood, how resisting powers may

diminish any preternatural expansive force and heat in our bodies."

The discoveries of Modern Chemistry furnish some facts, which may perhaps be applied to this subject; and indeed it is only to those discoveries which establish the source of animal temperature, that we are to look for an explanation of the changes to which it is subject.

It is established by numerous experiments and observations, that the consumption of oxygen in the lungs is materially influenced by the nature of the ingesta received into the stomach. When the food and drink are composed of substances which contain a small proportion of oxygen, it is known that the consumption of oxygen in the lungs is increased, and this even in a short time after the aliment has been received. Thus Mr Spalding, the celebrated diver, observed, that whenever he used a diet of animal food, or drunk spiritous liquors, he consumed in a much shorter time the oxygen of the atmospheric air in his diving bell; and therefore he had learned from experience to confine himself to a vegetable diet, and water for drink, when following his profession. During digestion too, it was established by the experiments of Lavoisier and Seguin, that a larger proportion of oxygen than usual is consumed.

But it is known that the animal temperature is derived from the consumption of oxygen gas by respiration; and that an increase in that consumption will occasion a greater evolution of caloric in the system, and consequently an increase of temperature in the body, while a

diminution in the consumption of oxygen will have an opposite effect.

If, then, when the temperature of the body is morbidly increased, we introduce into the stomach substances containing a large proportion of oxygen, especially in a loose state of combination, we may succeed in reducing the general temperature. This we accomplish in part by a vegetable diet, but still more effectually by the free use of *acids*. The vegetable acids in particular, which by experience are found to be the best refrigerants, are readily acted on by the digestive powers, and assimilated with the food. And as the large quantity of oxygen they contain is already in a concrete state, little sensible heat can be produced by the combination of that element with the other principles of the food. The nutritious matter which is received into the blood, containing thus a larger proportion of oxygen than usual, will be disposed to abstract less of it from the air in the lungs, and consequently less caloric will be evolved. The temperature of the body will be reduced, and this again operating as a reduction of stimulus, will lessen the number and force of the contractions of the heart.

It might be supposed, however, that any effect of this kind must be very trivial; and it actually is so; for we find in practice that refrigerants produce no sudden or great change. They operate slowly, and have little other effect than moderating the morbidly increased temperature. The whole of their effects, as Dr Cullen remarks, are so slowly produced, as not to be very evident

to our senses, nor easily subjected to experiment, being found only in consequence of frequent repetition.

This is probably the action of acids. The other refrigerants, the neutral salts, perhaps act in a similar manner; the acid they contain may yield oxygen; but they are still less effectual than acids, and their refrigerant power is even problematical, except in so far as they operate on a principle different from that which has been pointed out,—the power they have of producing in the stomach a sensation of cold. If a draught of cold water be swallowed, the sensation of cold it produces in the stomach is equivalent to a partial abstraction of stimulus, which being extended by sympathy to the heart, occasions a transient reduction in the force of the circulation, and by this, or by a similar sympathetic affection, causes a sensation of cold over the body. Nitre is an example perhaps of a refrigerant acting in this manner. It excites a sensation of cold in the stomach, even when taken dissolved, and still more in the solid state; and this is quickly followed by a reduction in the number and force of the pulsations. Hence nitre acts more suddenly than any of the other refrigerants, and is more transient in its operation. It may also, however, operate in some degree more permanently, in the same manner as the vegetable acids; as it appears that nitre, from the florid colour which it gives to blood, parts with oxygen readily.

It is evident that the indication to be fulfilled in the treatment of disease by the use of refrigerants, is the reduction of the morbidly increased temperature. Hence the

propriety of their administration in synocha and other pure inflammatory diseases, and in typhus fever; in both of which the temperature of the body is increased, though from different causes. In inflammatory diseases, the circulation being so much more rapid than usual, a greater quantity of blood is sent both through the whole body and through the lungs in a given time; and the usual alterations of the blood going on, the evolution of caloric, which is the consequence of these alterations, must be increased, and the temperature raised. In such cases, the use of acids, by lessening the disposition of the blood to consume oxygen in the lungs, may be useful in reducing the temperature; and nitre may be of advantage, as it diminishes the force of the contractions of the heart; but these means, it is evident, can have only a trivial effect, compared with those direct evacuations by which the force of the circulation is lessened.

The increased temperature in typhus fever cannot be ascribed to the same cause, but seems rather owing to the absorption of the animal solids constantly going on, and which, containing comparatively little oxygen, cause the blood to consume more of it in the lungs. The introduction of acids into the system, by affording this element in a concrete state to that matter, will lessen the consumption of it in the lungs, and will of course moderate the morbidly increased temperature. In either of these forms of disease, therefore, refrigerants may be useful, and accordingly we find them very generally

used in all the species of febrile affection; though they are still to be regarded as medicines of weak power.

REFRIGERANTS.

CITRUS MEDICA.
CITRUS AURANTIUM.
TAMARINDUS INDICA.
ACETUM.
SUPER-TARTRAS POTASSÆ.
NITRAS POTASSÆ.
BORAS SODÆ.

ALL acids are supposed to be Refrigerants; but the vegetable acids are allowed to possess this power in a more eminent degree,—a superiority which, according to the preceding view, must be founded on their being more easy of assimilation, and of being acted on by the chemical processes of the living system.

The native vegetable acids are found chiefly in the fruits of vegetables. The sour juice of these fruits consists of the Citric or Malic Acid, or more frequently of a mixture of both, sometimes with the addition of tartaric acid. The citric acid is that which is most largely employed, as it forms chiefly the acid juice of the orange and lemon, the two acid fruits in common medicinal use.

CITRUS MEDICA. Lemonum. Lemon. (Page 260.)
Succus fructus. Acidum Concretum.

THE juice of the fruit of the lemon consists almost entirely of citric acid, diluted with a portion of saccharine and mucilaginous or gelatinous matter. As the fruit cannot always be procured, various methods have been employed to preserve the juice. The most effectual is to add to the expressed juice a portion of alkohol, and to put it aside until the mucilaginous matter is deposited, then by a moderate heat to evaporate the alkohol, and preserve the acid juice in bottles carefully closed. Even as prepared in this method, however, the juice is liable to chemical change.

By a different process, the citric acid can be procured pure and in a crystallized state. To the expressed lemon juice gently heated, carbonate of lime is added so as to neutralize it; citrate of lime is formed, and being insoluble is precipitated; it is washed with water to carry off the extractive and mucilaginous matter, and is then submitted to the action of sulphuric acid; which, when digested or

boiled on it for a short time, combines with the lime, and disengages the citric acid; and by evaporation and cooling, this is obtained in a crystallized form. This process was originally given by Scheele, and it has been received into the London Pharmacopœia.

Lemon juice may be regarded as the principal refrigerant, being adapted to cool and quench thirst, and used for these purposes in febrile affections. A grateful beverage is formed from it, diluted largely with water, and sweetened a little with sugar: or the fruit sliced down is added to any mild diluent. A preparation form it, which is used as a refrigerant in fever, is what is named the Saline Mixture, formed by neutralizing lemon juice by the addition of a sufficient quantity of carbonate of potash, adding to this, water with a little sugar and a small portion of any distilled water. Of this mixture, a table-spoonful is taken occasionally; it is grateful, but cannot be considered as possessed of any power, any refrigerant quality which may belong to the acid being probably lost by its neutralization.

Another form under which lemon juice is used in fever, principally with the view of relieving nausea or checking vomiting, is that of the Effervescing Draught, as it has been named. A solution of carbonate of potash, and diluted lemon juice are mingled together, and while in the act of effervescence, the mixture is swallowed. The efficacy of it is probably dependent on the pungency and stimulant operation of the carbonic acid, but it

affords a grateful form under which this can be administered.

The juice of the lemon, and indeed the citric acid, as it exists in any vegetable fruit, has been long known as nearly an infallible remedy in scurvy: a theory of its operation in removing this disease has been given, founded on its chemical agency, and particularly on the supposition that it imparts oxygen to the system, but which cannot be regarded as established.

Lemon juice was employed as a remedy in syphilis, at the time nitric acid received a trial, and cases were given in which it proved successful. These, however, are doubtful, and it has never been established in practice.

The crystallized citric acid may be supposed to have the same power as the native lemon juice. This, however, is somewhat uncertain, especially with regard to the treatment of scurvy, the disease in which the medicinal agency of this acid is most important. It is also deprived of the agreeable flavour of the lemon juice, and is hence even a less grateful refrigerant in fever, though this may be communicated to it, to a certain extent, by infusing a little of the rhind of the lemon in the water in which it is dissolved. It is used medicinally, principally in forming the effervescing draught, its solution being added to the solution of carbonate of potash. One ounce of it, dissolved in a pint of water, is said, by Dr Powell, to be equal in strength to one pint of common lemon juice.

CITRUS AURANTIUM. The Orange. *Succus fructus.* (Page 259.)

THE juice of the orange has a certain degree of sourness, accompanied in the variety named the China Orange, when ripe, with a sweetness; in that named the Seville Orange, with slight bitterness. The former is used as a refrigerant in febrile affections, more grateful, but less powerful than the fruit of the lemon. It is also used as a remedy in scurvy.

TAMARINDUS INDICA. Tamarind. (Page 347.)

THE fruit of the tamarind contains an acid pulp, which is preserved by the addition of a quantity of unrefined sugar, this forming the Tamarinds of the shops. The acid is principally the citric, sixteen ounces of the prepared pulp containing, according to Vauquelin's analysis, an ounce and a-half of citric acid, half an ounce of super-tartrate of potash, two drachms of tartaric acid, and half-a drachm of malic acid. This pulp forms a grateful refrigerant beverage, a little of it being infused in tepid water, which is often taken in febrile affections.

ACETUM. Vinegar. Acidum Aceticum Dilutum.

VINEGAR is a weak acid, formed by that species of fermentation which succeeds to the vinous fermentation, when the fermented liquor is exposed to the air with a due degree of temperature. During this exposure, its spiritous flavour and pungency, and its intoxicating quality, are lost, and it becomes more or less sour. While this state of fermentation, denominated the Acetous, pro-

ceeds, the oxygen of the air is absorbed; according to the experiments of Saussure, carbonic acid is also formed; and the formation of the acid appears therefore to be owing to these changes of composition, in the principles peculiar to the vinous fermented liquor. The product differs according to the kind of fermented liquor from which it has been obtained. In general it is more acid as this has been more spiritous. Vinegar, from wine, therefore, is strongest, and its odour too is more grateful. It is obtained of inferior quality from fermented malt liquors, or from a solution of sugar.

Vinegar when fully fermented is limpid, of a yellowish colour, has an odour which is agreeable and somewhat pungent, and a sour taste. The acid existing in it is very largely diluted with water, and there are also present portions of gluten, mucilage and extractive matter, and frequently malic and tartaric acids.

It is freed from these latter substances by distillation; the process for which has a place in the pharmacopœias. The distilled vinegar is colourless, but its odour is less grateful than that of common vinegar. It is however purer, and is not liable to decomposition, or to become mouldy; hence it is preferable for the preparation of medicated vinegars, and for other purposes in pharmacy.

The acid which is the basis of vinegar, can be obtained in a concentrated state by various methods, principally by the decomposition of its saline combinations; and processes of this kind are now received into the pharmacopœias. As obtained from the metallic acetates by heat, it is in particular extremely strong and pungent; and at

one time, the acid thus procured was supposed to differ in composition from that obtained by other methods, and was distinguished by the appellation of acetic acid, while the other was named acetous. It has been established, however, that they differ only in the degree of concentration, and the name acetic is applied to the acid in all its states. When concentrated it is highly odorous and pungent, and is used principally as a stimulating perfume.

Common vinegar is sometimes employed as a refrigerant in febrile affections. It is also much celebrated as an antidote to the vegetable narcotics. Externally, it is used as an application to burns, and as a discutient. In pharmacy, distilled vinegar is employed as the solvent of the active matter of several vegetable substances.

Offic. Prep.—Acid. Acet. Dist. Acid. Acet. Arom. Acid. Acet. Camph. Syr. Acid. Acet. *Ed.*

SUPER-TARTRAS POTASSÆ. Super-Tartrate of Potash. (Page 363.)

FROM the excess of acid which this salt contains, it possesses the virtues of a refrigerant. A solution of it in a large quantity of water, sweetened with sugar, and receiving flavour from the infusion of a small quantity of the rhind of lemon, forms a cooling beverage, used in febrile affections, and recommended, especially in hospital practice, by its cheapness. Its only disadvantage is its being liable to prove purgative.

NITRAS POTASSÆ. Nitrate of Potash. Nitre. (Page 382.)

THIS salt impresses a sense of coolness in the mouth,

and when taken in small doses frequently repeated, appears to have the effect of reducing the force of the circulation. It is hence not unfrequently used as a refrigerant in acute inflammatory diseases. It is given in a dose of from 5 to 15 grains repeated every four or five hours. When given in larger doses, it occasions nausea, and pain of the stomach. It is often also used as a refrigerant, under the form of gargle, in the different species of cynanche, one drachm being dissolved in six or eight ounces of water: or the nitre troches are allowed to dissolve slowly in the mouth.

Offic. Prep.—Troch. Nitr. Pot. *Ph. Ed.*

SUB-BORAS SODÆ. Sub-Borate of Soda. Borax.

THIS salt, consisting of boracic acid, united with soda, the soda being slightly in excess, is brought from Thibet, where it is found in a native state. It is purified in Europe by crystallization, and is usually in the form of crystalline masses of no regular figure; its taste is cool; it is soluble in eighteen parts of cold, and six of hot water.

Borax is not used internally in modern practice, nor does it appear to possess any activity. Its solution is in common use as a cooling gargle; and mixed with an equal part of sugar, it is used in the form of powder to remove the aphthous crust from the tongue in children. Mixed with honey, it forms an officinal preparation in the London Pharmacopœia, applied to the same purpose.

Offic. Prep.—Mel. Boracis. *Ph. Lond.*

CHAP. XVII.

OF ANTACIDS.

These are remedies which obviate acidity in the stomach, by combining with the acid and neutralizing it. The substances most powerful in exerting this kind of action, and which can be employed, are the alkalis, and among the earths magnesia and lime. They can be regarded only as palliatives, the production of the acid being to be prevented by the administration of remedies capable of restoring the tone of the stomach. They are employed in dyspepsia, and in diarrhœa arising from acidity.

ANTACIDS.

Potassa.
Soda.
Ammonia.
Calx.
Magnesia.

Potassa. Potash.

This alkali is obtained from the incineration of the woody parts of vegetables. The ashes are lixiviated, and by evaporation the saline matter, consisting chiefly of sub-carbonate of potash, is procured. This forms the potash of commerce; it is purified by a second solution in water and evaporation; and to procure the alkali, lime is added to the solution of this sub-carbonate; the whole is put upon a filtre, so that the alkaline solution may pass slowly through the mass of lime; the carbonic acid is thus more effectually abstracted by the lime, and the potash passes through in solution, sufficiently pure for any medicinal application. This solution (Aq. Potassæ) is sometimes employed to relieve the symptoms from acidity, where the generation of acid is constant and abundant, being given in a dose of 15 drops diluted in water. Its acrimony renders it, however, an unpleasant remedy. The sub-carbonate, or the neutral carbonate, is likewise occasionally employed in solution. But the most common form under which the alkali is used as an antacid, is the super-carbonate. For the preparation of this, a formula is introduced into the Edinburgh Pharmacopœia, an ounce of sub-carbonate of potash being dissolved in ten pounds of water, and this being combined by a moderate degree of pressure, with an excess of carbonic acid. By this impregnation, the acrid alkaline taste is concealed, and

an agreeable pungency communicated. The liquor is taken as an antacid, in the dose of half-a-pound occasionally.

SODA. Soda.

THIS alkali is obtained in the state of carbonate, from the saline matter, formed in the combustion of marine vegetables, the barilla of commerce. In its pure state it is not employed in medicine; the carbonate or sub-carbonate is used as a lithontriptic, rarely as an antacid; but the super-carbonate is frequently taken. It is prepared in the same manner as the super-carbonate of potash, the proportions being so adjusted that the strength of each solution is nearly the same. It is therefore taken in the same dose, and is usually preferred, as being supposed to be more mild, to the super-carbonate of potash water.

AMMONIA. Ammonia.

THE solution of ammonia in water (Aq. Ammoniæ) is sometimes used as an antacid, and it has been recommended by Dr Sims as superior even to the other alkalis in relieving cardialgia, and other symptoms from acidity: so much so, that he has been led to suppose that these symptoms frequently arise, not merely from the liquid contents of the stomach being acid, but from the elastic fluid with which it is more or less distended having a degree of acidity, on which the ammonia from its volatility more readily acts. From 20 to 30 drops of the solution are given in a cupful of water. The solution of

the carbonate of ammonia is also used in a dose of half-a-drachm; and the aromatic ammoniated alkohol forms a still more grateful antacid and stimulant.

Calx. Lime. (Page 236.)

Lime, under the form of lime water, is occasionally used as an antacid, in a dose of four or six ounces. It operates, not only chemically, neutralizing the acid, but by its astringent and tonic power contributes to restore the tone of the stomach. It is also employed under the form of carbonate of lime, of which there are two varieties in use, Creta Alba, and Lapilli Cancrorum: the former named by the Edinburgh College Carbonas Calcis Mollior, and the latter, Carbonas Calcis Durior.

Carbonas calcis mollior. Creta Alba. White Chalk.

This is a carbonate of lime, found abundantly in nature, nearly pure, or containing only minute quantities of other earths. From the grosser impurities with which it is mixed, it is freed by levigation and washing. It is then named Prepared Chalk, (Creta Præparata.) This is an antacid in very common use. As the compound it forms with the acid in the stomach has no purgative quality, but appears to be quite inert, it is the antacid commonly employed to check diarrhœa proceeding from acidity. It is given in a dose of 1 or 2 drachms, with the addition of a small quantity of any aromatic. The chalk mixture of the Edinburgh Pharmacopœia affords a very good form for administering it.

Offic. Prep.—Pulv. Carb. Calc. Comp. Mist. Carb. Calc. *Ph. Ed. Lond.*—Pulv. Cret. C. et Opio. *Ph. Lond.*—Troch. Carb. Calc. *Ed.*

CARBONAS CALCIS DURIOR. Cancrorum Lapilli et Chelæ. Crabs' Stones, Crabs' Claws. Cancer Astacus. Cancer Pagurus.

IN the head and stomach of the river craw-fish, are found certain concretions, consisting principally of carbonate of lime, with a little phosphate of lime and animal gelatin. They are prepared by levigation, and washing with water, and are named Lapilli Cancrorum præparati, formerly Oculi Cancrorum præparati. The tips of the claws of the common sea-crab are similar in composition, and are prepared in the same manner. They are named Chelæ Cancrorum præparatæ. Both are employed as carbonates of lime, and being prepared with more care are in general smoother, and more easily diffused in water than the common prepared chalk, though there is reason to believe, that as met with in the shops, they are merely chalk with a little gelatin.

MAGNESIA. Magnesia. (Page 350.)

MAGNESIA is a primary earth, usually obtained in the state of carbonate by decomposing its sulphate or its muriate by an alkaline carbonate, and in its pure state, by expelling from this the carbonic acid by the application of heat. In either state it is used as an antacid: the carbonate has the inconvenience, where large quantities of it require to be taken, of occasioning flatu-

lence from the disengagement of its carbonic acid, and this leads to the preference of the pure magnesia. It is given in a dose of a scruple or half-a-drachm. The salt which magnesia forms with the acid in the stomach proves slightly purgative; and this is the only reason for distinction in practice between this earth and the carbonate of lime, the one being used where diarrhœa accompanies acidity; the other where a laxative effect is wished to be obtained.

CHAP. XVIII.

OF LITHONTRIPTICS.

LITHONTRIPTICS are medicines supposed to have the power of dissolving urinary calculi: their operation, it is obvious, must be purely chemical.

The alkalis, it has been long known, relieve the painful symptoms arising from these calculi; and it was found by experiment that they are capable of dissolving these concretions out of the body; hence it was concluded, not unjustly, that their efficacy depends on their solvent power.

The discoveries of Modern Chemistry have thrown farther light on this subject: it has been proved that these urinary concretions consist frequently of a peculiar animal acid, the lithic or uric acid, either nearly pure, or sometimes combined with ammonia, and animal matter apparently albumen. With this acid, the alkalis, in their pure state, are capable of combining, forming a compound soluble in water.

It has been ascertained, that from the internal administration of the fixed alkalis, either potash or soda, the urine becomes impregnated with them, so as to be sensibly alkaline. Experiments too have proved that either of

these alkalis may be given to such an extent, as to enable the urine applied to a calculus out of the body to dissolve part of it; and it appears therefore to follow, that the same solvent power will be exerted on a concretion in the bladder or kidney. Unfortunately, however, the use of the alkalis to this extent cannot long be persisted in, from the irritation they occasion in the stomach and the bladder; and we have scarcely, perhaps, any decisive proof of a urinary calculus of any considerable size being actually dissolved. The use of these agents in a moderate quantity, however, may prevent its increase; and, as it is often at length covered by matter deposited from the urine, by which its surface is rendered more smooth, this practice frequently alleviates the symptoms.

When the alkalis are used in this manner merely as palliatives, they are generally employed in the form of carbonate, or super-carbonate, as in that state they are more mild and pleasant. Their solvent power is however thus impaired. Still the alkalis in this mild form retain the power of preventing the increase of the urinary concretion. The deposition of uric acid, to which that increase is owing, depends in a great measure on the generation of acidity in the primæ viæ. The acid which is there formed passes of by the kidneys, and causes the precipitation of the uric acid; the use of the mild alkalis, by correcting this acidity, prevents this deposition, and of course prevents the increase of the urinary concretion, and lessens the irritating quality of the urine. It has accordingly been found, that under a course of alkaline

remedies, the deposition of uric acid, so frequently abundant from the urine of those who are liable to calculus, diminishes rapidly.

The administration, then, of these substances is different, according to the object of the practitioner. If he attempt the solution of the calculus, the pure alkali must be given in as large doses, and for as long a time as the patient can bear it: if he seek merely to palliate the symptoms, the continued use of moderate doses of the alkali saturated, or super-saturated with carbonic acid is sufficient, and is even preferable, as less hurtful to the stomach or general system. In both cases, it is proper that diluents should be freely used; and the pure alkali, when employed, ought always to be mixed with some mucilaginous or gelatinous fluid.

These were the views generally given of the operation of lithontriptic medicines, after the discoveries of Scheele and Bergman had made known the properties of uric acid. More recent investigations have still farther extended our knowledge of this subject, and unfortunately preclude still more the hope of lithontriptics being employed with advantage as actual solvents.

It had always been known, that urinary calculi are not of uniform appearance and qualities. Dr Wollaston's researches have proved, that they are of very different chemical constitution, and his experiments have been confirmed by those of Fourcroy and Vauquelin.

Besides the uric acid calculus, which is generally of a brown or yellowish colour, of a compact or radiated struc-

ture, smooth on the surface, and perfectly soluble in alkaline solutions, another had been observed, composed principally of a matter frequently disposed in layers, white, of a lamellated structure, soft and smooth to the touch, and giving a light powder of a brilliant whiteness. This calculus is not soluble in alkaline solutions, but dissolves very easily in diluted acids: it melts before the blowpipe into an enamel; the substance composing it is phosphate of magnesia and ammonia, and though it seldom forms an entire calculus in its pure state, it is often intermixed with the other usual ingredients, or disposed with these in alternate layers.

Phosphate of lime forms another variety of calculus, sometimes alone, but more generally mixed with uric acid, or with phosphate of magnesia and ammonia. Calculi of this kind have usually no great induration, feel dry and rough, and without any lamellated or spathose structure; they are not dissolved by the alkalis, but are soluble more or less in diluted acids.

Lastly, a calculus had been known to surgeons, under the name of Mulberry Calculus, derived from its purplish colour, and its rough irregular surface. This is composed principally of oxalate of lime, with portions of uric acid, phosphate of lime, and animal matter. It is harder and heavier than any of the others; and is less affected by the usual solvents, alkaline solutions having no effect upon it, and acids dissolving it with great difficulty; the alkaline carbonates slowly decompose it.

Now, from these diversities, in chemical constitution,

among urinary concretions, it is obvious, that we cannot expect uniform advantage from the use of any active solvent as a lithontriptic, since what dissolves one calculus will have no effect upon another; and cases have accordingly occurred, where, instead of relief being obtained, as it frequently is from the use of alkalis, it was obtained from weak acids. There is also a peculiar source of difficulty, which has been pointed out by Mr Brande, attending the attempt to exhibit lithontriptics as solvents, which must probably render it impracticable. The phosphates of lime and magnesia, which exist in the urine, are retained in solution principally by its excess of acid: if, therefore, with the view of dissolving a uric acid calculus, or preventing its increase, alkalis be given so as to neutralize this acid, the deposition of these phosphates may be favoured, and a layer of them form on the existing calculus. And there is reason to believe, that the softness and sponginess which have been observed not unfrequently on the surface of calculi, in patients who have continued for a long period the use of alkalis, and which have been regarded as proofs of at least partial solution, have arisen from a deposition of this kind. If, on the other hand, from the state of the urine, or from the information afforded by a small calculus being discharged, there were reason to believe that a calculus in the bladder consisted chiefly of phosphate of ammonia and magnesia, if we attempted the solution of this, by the administration of weak acids, we run the hazard of causing the deposition of uric acid. Nor can we hope, by an alternate use of acids

and alkalis, so to adjust them as to obtain to any extent their solvent effects, without these counteracting results.

There is another mode, in which it has been supposed that lithontriptics may exert a solvent power. In all urinary calculi, there exists a quantity of animal matter, supposed to be of the nature of albumen, and which has also been regarded as the cementing ingredient, giving induration to the calculus. On this it has been conceived solvents may act, so as to destroy the cohesion of the aggregate. The experiments of Dr Egan confirm this, he having found that lime water is more effectual in destroying the cohesion of a urinary calculus, than an alkaline solution,—a result which, on repeating his experiments, I have likewise obtained. Now this superiority cannot be ascribed to any action of the lime on the saline ingredients of the calculus, but must arise rather from its chemical action on the albumen or animal mucus, of which it is known to be the solvent; and it may therefore be supposed that lime water, from this operation, might be used with advantage as a lithontriptic. It would of course require to be given in combination with alkalis, the latter neutralizing the excess of acid in the urine, which would otherwise combine with the lime, and render it inert. But it may be doubted, if this could be managed, so as to obtain any important effect; or that lime could be secreted in its pure form by the kidneys.

From these observations, the advantages to be expected from lithontriptics, it is obvious, must be very limited. They probably cannot be given with greater benefit than

simply to correct the excess of acidity in the urine, so frequent in those who labour under calculus, and thus render it less irritating, and prevent the increase in the size of a concretion. Or, it is possible, in cases of the mulberry calculus, which produces much pain from its rough and pointed surface, that pushing the use of them a little farther might prove useful, even by giving rise to the formation of a layer of the phosphate of ammonia and magnesia, which would at least render the surface of the calculus soft and smooth. In their administration, it may be of advantage to attend to the state of the urine, so far as regards its chemical constitution, and to suspend or vary the remedies as this may change. And in all cases the continuance of the remedies, and the length to which they are carried, ought to be regulated principally by the relief from pain which the patient receives.

LITHONTRIPTICS.

Potassa.
Soda.
Sapo albus.
Calx.

Potassa. Potash. (Page 466.)

This alkali is used as a lithontriptic, either pure or combined with carbonic acid. The pure alkali in the state of solution (Aq. Potassæ) has been given in a dose of 15 or 20 drops, morning and evening, increasing this gradually as far as the stomach can bear it, until the urine is rendered alkaline; and at the same time diminishing the irritation it is liable to produce, by the free use of diluents, and of any mucilaginous or gelatinous liquid. The action of the pure alkali being more powerful than that of the carbonate on uric acid calculi, it is under this form that it has been employed when the actual solution of the calculus has been attempted. Independent, however, of the difficulties which attend this, from the circumstances pointed out under the general observations on the action of lithontriptics, it is scarcely possible to continue the use of the pure alkali to the requisite extent, from the irritation it occasions both in the stomach and bladder; and when it is to be used as a palliative, it is better to employ it under the form of the super-carbonate.

The super-carbonated potash water, already noticed, (page 466.), affords the most effectual palliative in cases of urinary calculi; the relief obtained from it appears to arise from its neutralizing the free acid in the urine, and thus rendering it less irritable. From half-a-pound to a pound is taken in the course of the day; and it has the important advantage, that, from its mildness, it can be continued for any length of time without reluctance.

SODA. Soda. (Page 467.)

SODA, like potash, is used as a lithontriptic, seldom, however, in its pure form. The carbonate, or rather sub-carbonate, is obtained from the barilla of commerce by solution in water and crystallization. The crystals contain half their weight of water of crystallization, and are soluble in two parts of cold, and in an equal part of boiling water. This crystallized salt affords a very excellent form under which it may be administered, so as to give at least the advantages of a palliative, and which is less expensive than any other. It is what has been named the Soda Pill. The crystals are exposed to a very gentle heat, until they lose their water of crystallization, and the dry powder is made into pills with soap. Of these, half a drachm or a drachm are taken in the course of the day.

Soda is likewise employed under the form of the super-carbonated soda water, the powers of which are similar to those of the super-carbonated potash water, and which is taken in the same manner.

SAPO ALBUS.—Soap is a form under which the fixed alkalies have been administered in calculous affections. It is a chemical combination of expressed oil with potash, or soda. Potash forms only a soft soap, soda gives one that becomes hard; and to form the purer soap it is combined with the mildest vegetable expressed oil. The soap is white, but sometimes is designedly coloured by the addition to it, while soft, of a solution of sulphate of iron.

The acrimony of the alkali is much diminished by its combination with the oil, and on this account soap has been preferred as a lithontriptic, one or two ounces being taken in the course of the day. From the oil it contains, however, it is nauseous, and in such large doses generally offensive to the stomach, and the super-saturation with carbonic acid affords a much better method of rendering the alkali mild.

CALX. Lime. (Page 236.)

LIME, in the form of lime-water, has been used in calculus, in the quantity of a quart or more daily: it may prove useful by correcting acidity; but in the small quantity in which it can be taken, it can scarcely be supposed that any of it will be secreted by the kidneys, so as to change the composition of the urine. Were it secreted, indeed, it would be rendered insoluble by the free phosphoric and uric acids. The only method in which it could be brought to act on a calculus, would be by conjoining its administration with that of the alkalis, so that the urine should be rendered alkaline. This combination constituted the celebrated remedies of Stephens; but even with every precaution it may be doubted if the lime could be made to exert any real lithontriptic power.

BITTERS and astringents have been found of service in calculous cases, evidently by restoring the tone of the stomach, and thus preventing the generation of acid. But they cannot be considered as Lithontriptics.

CHAP. XIX.

OF ESCHAROTICS.

Escharotics are substances which erode or dissolve the animal solids. They produce erosion or ulceration, either by directly combining with the animal matter, and forming a soft pulp, or a species of eschar: Or they sometimes appear to act by a resulting affinity, causing the elements of the soft solids to enter into new combinations, whence their cohesion is subverted, and their composition changed. In both cases the life of the part is destroyed. They are employed principally to remove excrescences, to establish an ulcer, or to change the surface of an ulcerated part, converting it into a simple sore. The action of all of them is purely chemical.

ESCHAROTICS.

Acida mineralia.
Super-sulphas aluminæ et potassæ.
potassa.
Nitras argenti.
Murias antimonii.
Sulphas cupri.
Acetas cupri.
Murias hydrargyri.
Sub-nitras hydrargyri.
Oxidum arsenici album.
Juniperus sabina.

The Mineral Acids act rapidly as escharotics, especially the sulphuric and nitric acid; but from their fluidity they can seldom be conveniently applied.

Super-sulphas aluminæ et potassæ. Alumen. Alum.

Alum, from its excess of acid, has a degree of escharotic power; and under the form of dried alum, in which its water of crystallization is expelled, is sometimes used in fine powder to check the growth of fungous excrescences from ulcers. This powder, rubbed with a

little sugar, is, from the same property, applied to remove opaque specks from the cornea.

Potassa. Potash. (Page. 478.)

Pure potash, in its solid state, forms a powerful escharotic, which has long been in use under the name of Causticum Commune Acerrimum. When its solution, before being evaporated entirely to dryness, is mixed with a portion of lime, its operation is rendered rather weaker: this preparation is named Causticum Commune Mitius. Either of them is made into a paste with soap, and applied to the part. This application is frequently employed to establish an ulcer, and sometimes in preference to incision to open a tumor: it is attended with a considerable degree of pain, and a sense of burning heat; after it is removed, a cataplasm is applied, by which this is relieved, and suppuration established. Mr Simmons has recommended potash in preference to other escharotics, to prevent the effects from the bite of a rabid animal; it is applied freely to the bitten part; and the preventive operation of excision, he has supposed, may be rendered more certain by touching the surface with potash.

Nitras argenti. Nitrate of Silver. Causticum Lunare. Lunar Caustic.

This preparation is obtained by dissolving silver in nitric acid, evaporating the solution to dryness, melting the mass by a gentle heat, and while liquid running it into cylindrical moulds, in which, as it cools, it becomes con-

crete. It is the caustic which is in most common use for checking the growth of fungous excrescences, or changing the diseased surface of an ulcer, a little of it being dissolved in as small a portion of water as is sufficient, and applied by a pencil to the part.

Murias antimonii. Muriate of Antimony. (Page 326).

This preparation of antimony has been used as an escharotic, but being liquid it is not easily confined to the part on which it is designed to act, and it has no particular advantage to recommend it.

Sulphas cupri. Sulphate of Copper. Vitriolum Cœruleum. Blue Vitriol.

This salt is a mild escharotic, and from this mildness of its operation is adapted to particular cases. Its solution in water is sometimes employed to change the diseased surface of sores, especially of venereal sores, and either in solution, or in powder mixed with any mild vegetable powder, it is applied to remove specks on the cornea.

Sub-acetas cupri. Sub-acetate of Copper. Ærugo Æris. Verdigrease.

This preparation is formed by stratifying plates of copper with the husks of the grape. These suffer a slow fermentation, whence vinegar is formed; and this acting on the copper, forms a green oxide, with which a portion of the acid likewise combines, so as to form a sub-acetate. It is in frequent use as an escharotic, principally to

change the surface of foul ulcers, being applied under the form of ointment mixed with lard. In the same form, it is applied as a stimulant in some kinds of ophthalmia.

Offic. Prep.—Ungt. Sub-acet. Cupr. *Ph. Ed. Dub.*—Oxymel Æruginis. *Dub. Lond.*

MURIAS HYDRARGYRI CORROSIVUS. Corrosive Muriate of Mercury.

THIS preparation of mercury is occasionally employed as an escharotic. Its solution in water, in the proportion of one grain to the ounce, is in particular applied to venereal ulcers. And still more dilute, it is sometimes used as a lotion to herpetic eruptions.

SUB-NITRAS HYDRARGYRI. Sub-nitrate of Mercury.

THIS is in common use as an escharotic, and as a stimulant application to foul and languid ulcers. Reduced to fine powder, it is sprinkled on the part, or it is applied mixed with lard in the form of ointment; for the preparation of which, a formula is given in the Pharmacopœias.

Offic. Prep.—Ung. Sub-nitr. Hydrargyr. *Ph. Dub. Lond. Ed.*

OXIDUM ARSENICI ALBUM. Oxide of Arsenic. (P. 231.)

WHITE oxide of arsenic has been frequently employed as an external application to cancer, and though it has been regarded as in some measure specific, its immediate action is that of an escharotic. It was first introduced as an empirical remedy, and was applied, mixed with several vegetable powders, and made into a paste with the

yolk of an egg: this, in a few hours, formed an eschar, by which the diseased surface was changed; and by exciting suppuration by the application of cataplasms, this was thrown off. It has since been used under the form of ointment or solution. The latter has been supposed the least painful form, though perhaps it is not the most effectual. Ten grains are dissolved in one ounce of water, and this solution is applied by a pencil to the sore. It not unfrequently amends the discharge, causes the sore to contract in size, and cases have even been related of its having effected a cure. Violent lancinating pain is sometimes produced by its application; and in some cases, from its continuance, the general system appears to be affected; a symptomatic cough being induced, which cannot be relieved but by suspending the application, and when this does come on, the use of the arsenic ought to be stopt. It requires, therefore, to be used with caution.

JUNIPERUS SABINA. Savine. (See p. 373.)

THE leaves of savine possess an acrid power, whence they are employed as escharotic. The powder sprinkled on warts or excrescences removes them; or made into an ointment with lard, is used as an application to old ulcers, and to some obstinate cutaneous affections: it has also been recommended as superior to any other stimulating application in exciting that degree of suppuration, necessary to keep up a discharge from an issue.

Offic. Prep.—Cerat. Sabinæ, *Ph. Lond. Dub.*—Ol. Sabinæ, *Ph. Ed. Dub.*