
CHAP. XIX.

SALES ET SALINA.—OF SALTS AND SALINE SUBSTANCES.

THE term Salt has long been employed, in chemical language, to denote an extensive order of substances; yet it is difficult to assign to it a precise definition, or to distinguish these by characters at once sufficiently comprehensive and appropriate. It is from a combination of the following properties, however, that the definition has been attempted to be formed.

Salts are said to be bodies eminently sapid, or which excite a strong penetrating taste when applied to the tongue. Many of them have indeed this power, but there are others, particularly among the earthy salts, in which any degree of sapidity is scarcely perceptible, while there are many bodies eminently sapid which are not of a saline nature.

2d, All salts are supposed soluble in water, and this, strictly speaking, is perhaps true; but in many of them, the degree of solubility is so inconsiderable, that it can scarcely be assigned with propriety as a distinctive character of the order. Sulphate of barytes, for example, is not soluble in five thousand times its weight of water, and there are several others nearly equally insoluble.

3d, Salts are said to be capable of assuming a crystalline form. When dissolved in water, many of them, on evaporation of part of the water, concrete into regular crystals. But there are others which, either from being sparingly soluble in that fluid, or from having a strong attraction to it, cannot be made to crystallize; while there are substances crystallizable even from their watery solution, sugar, for example, not saline.

4th, Salts are said to be fusible by the application of heat. But the same character may be assigned to every other fossil substance, the pure earths excepted; and there are besides many salts, which, instead of being fused, are decomposed in a high temperature.

Lastly, Salts have been considered as unflammable; and many of them must be so, as they are formed of substances already saturated with oxygen; but there are many others, as ammonia and the vegetable acids, as well as the compounds of these, which are more or less inflammable; some of them even burn with a bright flame.

It is evident, therefore, that those properties which have been assigned as the characters of the order, are not possessed by every substance which, in chemical arrangements, is regarded as saline, but that, on the contrary, the exceptions are very numerous. Neither are they possessed exclusively by these substances; there being bodies not saline which are sapid, soluble in water, fusible by heat, unflammable, and which have even a tendency to assume the crystalline form.

The characters of this order, therefore, are now drawn

rather from the chemical composition of the substances arranged under it. It is thus understood as comprehending the acids, the alkalis, and the compounds resulting from the combination of acids with alkalis, earths, and metallic oxides. The acids and alkalis are named Simple or Primitive Salts; the others Secondary, or more commonly Neutral Salts, as in general the properties of the acid, and of the alkali, earth, or metal of which they are formed, are neutralized or lost. These are the substances comprized under the present chapter, with a few associated with them for convenience, though not strictly connected with them. They are generally speaking preparations of importance, but differing so widely in chemical constitution and medicinal powers, as to admit of no general observations.

ACIDUM ACETOSUM DESTILLATUM. Distilled Acetous Acid. (*Acid Aceticum, Ph. Lond.*—*Acetum Distillatum, Ph. Dub.*)

“Distil eight pounds of Acetous Acid in glass vessels, with a slow fire. The two pounds that first come over are to be rejected as too watery; the four pounds which follow are the distilled acetous acid. The residuum affords a still stronger acid, but too much burnt.” The London College order the first pound only to be rejected, and the distillation to be continued until seven pounds have distilled over. The proper name of the acid thus obtained is Diluted Acetic Acid.

Vinegar, Acetous Acid as it is named by the College, as it is produced by fermentation, consists of acetic acid, largely diluted with water, and mixed with a number of other substances,—tartaric acid, extractive, mucilaginous, and saccharine matter. From these it is purified by distillation, but it is still largely diluted with water; the distilled liquor is indeed even weaker than the vinegar itself, a larger portion of the acid remaining in the residual liquor; and, in general, it receives from the distillation somewhat of an empyreumatic odour. It is usual, on the large scale, to perform the distillation in a tin still, connected with a tin spiral tube in a refrigerator, and to add portions of boiling water during the distillation, so as to dilute the residual liquor, and bring over the whole of the acid. The process, however, ought to be conducted in glass vessels, as directed in the Pharmacopœia; as, from metallic ones, (tin, which has been employed, being often alloyed with lead), the acid may receive an impregnation that might prove noxious.

Distilled acetous acid is colourless, not very sour to the taste, usually slightly empyreumatic, and of a specific gravity of 1006. It is chiefly employed as a solvent of some vegetable substances, and in making some of the salts. Sometimes it is applied externally, in preference to common vinegar, as a discutient, and as an application to burns. It has the advantage, as a pharmaceutic agent, not only of greater purity, but of not being liable, like undistilled vinegar, to spontaneous decomposition.

ACIDUM ACETOSUM FORTE. Strong Acetous Acid.

“ Take of Dried Sulphate of Iron, one pound; Acetate of Lead, ten ounces. Rub them together. Put them into a retort, and distil from sand with a moderate fire, as long as any acid comes over.”

ACIDUM ACETICUM. Acetic Acid. Pharm. Dub.

“ Take of Acetate of Potash, six ounces; Sulphuric Acid, three ounces. Put the acid into a tubulated retort, and add to it gradually, and in different portions, the acetate of potash, allowing the mixture to cool after every addition; then distil the acid with a moderate heat, until the residuum is dry. The specific gravity of this acid is to that of distilled water as 1070 to 1000.”

These are two processes for obtaining acetic acid in a concentrated state, and others have been likewise employed. One giving perhaps a stronger acid than either of them, has been long in use, and had a place in the former edition of the London Pharmacopœia. It consists in exposing verdigrase, which is a sub-acetate of copper, well dried, to a heat gradually raised, and purifying the acid which distils over by a second distillation; the high temperature in this process merely expelling the acetic acid from the metallic salt. In the process of the Edinburgh Pharmacopœia, the expulsion of the acetic acid from the acetate of lead is favoured by the affinity exerted to the oxide of lead by the sulphuric acid of the sulphate of iron; and as the salts are dried, or contain little water of crystallization, the acid is supposed to be obtained in a concentrated state. In the process given

by the Dublin College, the sulphuric acid combines with the potash of the acetate of potash, and disengages the acetic acid. This distils over, and as the acetate of potash contains little water, and the water of the sulphuric acid must be in part retained by the affinity exerted to it by the sulphate of potash, the acetic acid is obtained in a concentrated form.

Chemists had observed some difference of properties between the acetic acid obtained from the decomposition of verdigrease by heat, radical vinegar as it was named, and the acid of vinegar purified by distillation, and concentrated by freezing, or obtained in a concentrated state by the decomposition of an acetate having an alkaline or earthy base. They were therefore regarded as chemically different; the one, that obtained from the metallic salt, was believed to be more highly oxygenated, in consequence of receiving, it was supposed, oxygen from the metallic oxide, and was named Acetic Acid; while the other, to denote its relation to this, was named Acetous Acid. At a later period, it was supposed that they differed rather in the proportion of carbon existing in their base. But the experiments, first of Adet, and since of Darracq, have proved, that they differ merely in degree of concentration, (that expelled from the metallic salt by heat being strongest), and sometimes in a small quantity of extractive matter adhering to the acid concentrated by freezing. When freed from this, and when brought to the same specific gravity by diluting the stronger, they have the same properties, display the same affinities, and

afford the same products by analysis. There is therefore only one acid, the Acetic, and the name Acetous is not properly applied.

The process of the Edinburgh College affords an acid not so highly concentrated, and therefore not so pungent as that in which it is procured by exposing verdigrease to heat. That procured by the process of the Dublin College is rather stronger; and it has the advantage of not being liable to be contaminated by any metallic impregnation. It is also free from sulphurous acid, with a portion of which the others are sometimes impregnated. A process, which would afford it equally pure, and probably stronger, would be to decompose the solid acetate of lime by sulphuric acid, as the sulphate of lime, by its strong affinity to water, would detain it; or the acid may be brought to the highest state of concentration, by distilling it from dry muriate of lime.

Acetic acid, in its highly concentrated state, has a fragrant, and, at the same time, very sharp penetrating odour; its taste is extremely sour and pungent, and it is so acrid as to inflame the skin. It is highly volatile, evaporating at the common temperature of the atmosphere: it is also inflammable when a burning body is approached to its vapour. It exerts the agencies of a powerful acid, and it has a very peculiar action on several of the proximate principles of vegetables, whence it can be applied to pharmaceutical purposes,—dissolving them, without decomposing them, or materially altering their properties. It thus dissolves resins, gum-resins,

camphor, and essential oils. It is employed medicinally, principally as a stimulating perfume in languor or faintness, or to obviate the unpleasant smell of confined or corrupted air. The combination of it with camphor is principally used for this purpose, as has been noticed under the chapter of medicated vinegar, in which a preparation of this kind has a place.

ACIDUM BENZOICUM. Benzoic Acid.

“Take of Benzoin, twenty-four ounces; of Carbonate of Soda, eight ounces; Water, sixteen pounds. Boil the benzoin, rubbed with the carbonate, in water for an hour, stirring them constantly, and strain. Boil the residual balsam in other six pounds of water, and strain. Mix this when strained with the former liquor, and evaporate until two pounds remain. Strain again, and drop into the liquor, as long as there is any precipitation, diluted sulphuric acid. Dissolve the precipitated benzoic acid in boiling water. Strain the liquor while hot, through linen, and put it aside, that crystals may form. These crystals being collected, and washed with cold water, dry and preserve them.”

The same process nearly is followed by the London College, lime being substituted for carbonate of potash, and muriatic acid for sulphuric acid. A pound and a half of benzoin are boiled with four ounces of recently prepared lime, in a gallon of water, for half an hour, stirring them constantly. This being poured off, the remaining matter is boiled in four pints of water; the two portions are mingled together, and reduced, by evapora-

tion, to one half, and into this, when strained, muriatic acid is dropt in as long as there is any precipitation. The precipitate is dried by a gentle heat, and being put into a proper vessel, the acid is sublimed by a slow fire.

The Dublin College have retained the old process of sublimation for procuring this acid. The benzoin is melted in a wide-necked retort, to which a receiver is adapted without being luted, and it is sublimed with a moderate heat. The sublimed matter condensing in the neck of the retort is removed occasionally, that it may not accumulate in too great quantity. If stained with oil, it is to be pressed, wrapped up in bibulous paper, which will absorb the oil, and is to be again sublimed.

Benzoic acid exists in the various balsams, in benzoin, in largest quantity; and it is procured without difficulty, by sublimation, from the application of a moderate heat. It is this process that has been generally employed; the other methods are introduced as more economical. In the process of the Edinburgh College, the acid of the benzoin combines with the soda of the carbonate of soda, forming a soluble salt; the sulphuric acid when added, combines with the soda, and the benzoic acid, being sparingly soluble in cold water, is precipitated. The process given by the London College is essentially the same; the benzoic acid combining with the lime, and forming a soluble salt: this cannot, however, be decomposed by sulphuric acid, as the sulphate of lime would be precipitated with the acid; muriatic acid, therefore, is added, which combines with the lime; the muriate of

lime remains dissolved, and the benzoic acid is thrown down.

The quantity of benzoic acid obtained by sublimation is greater than can be obtained by the other methods, the product, according to Mr Brande's experiments, amounting to two ounces from a pound of benzoin, while, according to the others, it is equal only to from one ounce five drachms, to one ounce six drachms and a half. But there is a difficulty in conducting the process by sublimation, from a portion of the oily matter of the benzoin being liable to rise with the acid in vapour, and communicating to it a brown tinge. By managing the heat, however, with due precaution, and changing the receiver towards the end of the sublimation, this may be avoided, at least so far as to obtain a pure product, nearly equal in quantity to that from the other methods; and as the sublimed acid is more white and brilliant than the precipitated acid, even when the latter is dissolved and crystallized, this method is still usually followed by the practical chemist. The London College give the precipitated acid the same brilliant appearance by sublimation.

Benzoic acid is in slender needle-like crystals, or in soft flakes, of a white colour and silky lustre; its taste is pungent and acidulous, its odour aromatic, and when it is heated, penetrating: this odour, however, appears to arise from a minute portion of oily matter adhering to it, as by dissolving the acid in alcohol, and precipitating it by water, it is obtained nearly inodorous. It is volatile

and inflammable, is scarcely sensibly soluble in cold water, but is dissolved abundantly by hot water, and is also soluble in alcohol. It has been regarded as a stimulating expectorant, but is totally destitute of medicinal efficacy, and the sole consumption of it is in the composition of the pectoric elixirs of the Pharmacopœias, in which, as it has long been an ingredient, it is still retained.

The London College have given a formula for obtaining another vegetable acid, the Citric.

ACIDUM CITRICUM. Citric Acid.

“Take of Lemon Juice, a pint; Prepared Chalk, an ounce, or as much as may be sufficient to saturate the juice; Diluted Sulphuric Acid, nine fluidounces. Add the chalk to the lemon juice heated, and mix them; then pour off the liquor. Wash the citrate of lime which remains with water, frequently added; then dry it. To the dried powder add the diluted sulphuric acid; boil for ten minutes; express the liquor strongly through linen, and strain through paper. Evaporate the strained liquor so far, that on cooling, crystals shall form. To obtain these crystals pure, dissolve them in water a second and third time; strain the solution each time; evaporate, and put it aside to crystallize.”

The juice of the lemon consists principally of citric acid, from which, however, as has been already remarked, it is difficult to abstract the mucilaginous and extractive matter, so as to render it capable of being preserved.

Hence the process of obtaining the acid in a pure crystallized form, originally proposed by Scheele, has been introduced. The lime of the carbonate of lime, added to the lemon juice, combines with the citric acid, forming an insoluble precipitate, which falls down: this is washed to carry off the adhering vegetable matter, and is submitted to the action of diluted sulphuric acid: the sulphuric acid combines with the lime, and disengages the citric acid; this, dissolved by the water, is pressed out from the sulphate of lime, and by the evaporation of the solution is brought to crystallize. The crystals are at first of a brownish tinge, from the re-action, it has been supposed, of the sulphuric on the citric acid. By a second or third solution and crystallization they are obtained colourless, or rather white. A slight excess of sulphuric acid, Scheele found to be useful; and its operation, as Dize has remarked, consists in decomposing a little mucilage or extractive matter, which adheres to the citric acid, and opposes its crystallization. It remains in the residual liquor without rendering the crystals impure.

Citric acid crystallizes in rhomboidal prisms; it is easily soluble in water, has a taste extremely sour, and reddens deeply the vegetable colours. In its solid state it remains unchanged, and even in solution is not very liable to spontaneous decomposition. It is used, as has already been remarked, as a refrigerant. A grateful lemonade is prepared from it, by dissolving 30 or 40 grains in a pint of water, with the addition of a little sugar, an agreeable flavour being communicated by a little dried

lemon peel having been infused in the water, or a powder formed by rubbing sugar on the fresh lemon being dissolved in it. It is used, too, in forming the common effervescing draught, being mixed with carbonate of soda, and water added. Whether it acts with equal certainty with the recent juice, as a remedy in scurvy, remains to be ascertained.

ACIDUM MURIATICUM. Muriatic Acid.

“ Take of Muriate of Soda, two pounds; Sulphuric Acid, sixteen ounces; Water, one pound. First expose the muriate of soda in a pot to a red heat for a short time; when cold, put it into a retort. Then pour the acid, mixed with the water, and cold, on the muriate of soda. Distil from a sand-bath with a moderate fire, as long as any acid comes over. The specific gravity of the acid is to that of distilled water as 1170 to 1000.”

The process in the other Pharmacopœias is nearly the same, the proportions of the ingredients being different. In the Dublin Pharmacopœia, the same weight of sulphuric acid as of muriate of soda is ordered, and the acid is diluted with an equal weight of water. In the London Pharmacopœia, two pounds of muriate of soda are put into a retort, with a pound and a half of sulphuric acid diluted with a pint and a half of water. It would require comparative experiments to determine the best proportions; but it is not improbable, that in the formula of the Edinburgh College, the proportion of acid is too small, chemists having been formerly led into error in

cases similar to this, by supposing, that in decomposing a compound salt by an acid, there is no advantage in adding more of the decomposing acid than is necessary to neutralize the quantity of base which the portion of salt operated on contains, not knowing the influence of quantity in adding to the force of chemical affinity. We now know, that in every case of this kind the product is increased by employing more of the decomposing agent than is strictly necessary to neutralize the ingredient with which it combines; and that if this excess be not employed, a portion of the compound operated on is not decomposed. I have accordingly observed, in performing the above process, according to the formula of the Edinburgh College, that a portion of undecomposed muriate of soda exists in the residual mass. The cake remaining in the retort is easily dissolved by pouring water on it when the retort is perfectly cold, and its solution is favoured by the excess of acid in its composition.

The London College direct that the sulphuric acid be diluted only with a portion of the water, and that the remaining water be put into the receiver. This is proper, both as abridging the distillation, and assisting the condensation of the acid gas. An apparatus, on the construction of Woolfe's, is sometimes employed, but is unnecessary, as a range of two or three receivers, without tubes immersed in the liquid in each, is sufficient. The advantage of diluting the acid with at least a portion of the water, is, that the rapid effervescence and disengagement of gas produced by the action of the concen-

trated acid on the muriate of soda is prevented, and the process is rendered more manageable. In the large way the distillation is sometimes performed from an iron pot connected by an earthen head and tube with a range of receivers, the fire being directly applied, and then the concentrated sulphuric acid is poured directly on the muriate of soda to lessen the action on the iron. But the acid prepared in this way, even when the precaution is followed, of coating the inner surface of the pot, is always contaminated with this metal. The yellow colour which the acid usually has, is not always, however, owing to the presence of iron, but is derived sometimes from a little extractive matter adhering to the sea salt, and it is to consume this that the salt is ordered, in the Edinburgh Pharmacopœia, to be exposed to a red heat. The yellow colour may be removed, by distilling the acid a second time from a little muriate of soda. To the test of the strength of the acid from its specific gravity, the London College have added, that a fluidounce of it, diluted with water, ought to dissolve, of a pure limestone, half an ounce.

The theory of the process is sufficiently simple. In all cases, where two acids act on one base, this base would be shared between them, in proportions determined by their affinities to it, and their relative quantities. But circumstances may prevent this participation, and cause one of the acids alone to combine with the base, as, for example, the application of a certain temperature, when one of the acids is much more disposed than the other, to assume the elastic form. This happens in the present

case. The sulphuric acid exerts an affinity to the soda of the muriate of soda; this weakens the affinity exerted by the soda to the muriatic acid; its tendency to assume the elastic form prevails, and a portion of it is disengaged, and by the application of heat, aided by the quantity of sulphuric acid employed, the decomposition is rendered complete,—or the sulphuric acid combines with the soda, and the muriatic is disengaged; it is condensed partly by the water which rises with it in vapour, and partly by the water placed in the receivers.

Muriatic acid exists when uncombined in the elastic form, and is incapable of condensation by any cold or pressure hitherto applied to it. But it is rapidly and largely absorbed by water; the water, at a common temperature, and under a mean pressure, condensing 360 times its volume. When of the strength stated in the Pharmacopœias, the specific gravity of 1.170, it is supposed to contain 22 of real acid, and 78 of water; it emits pungent vapours of muriatic acid gas on exposure to the air, reddens deeply the vegetable colours, tastes extremely sour, erodes even immediately vegetable and animal substances, and exerts considerable chemical agencies. The acid, however, not yielding oxygen readily, can oxidate inflammable and metallic substances, only by enabling them, by a resulting affinity, to attract oxygen from the water with which it is combined. The decomposition of this acid has been hitherto only imperfectly effected. Galvanism can scarcely be brought to act on it in the elastic form; and in the liquid state the water only is de-

composed. By heating potassium in the gas, rendered as dry as possible, hydrogen is evolved, and in such quantity as to prove that the acid gas retains a very large quantity of water combined with it; and more lately, Mr Davy has discovered, that when the acid is obtained in combinations, free, or nearly so, from this water, its acidity is suspended, but is immediately restored on the addition of water;—facts which, in the present state of chemical theory, admit of no satisfactory explanation.

Muriatic acid is applied to no medicinal purpose. It has a place in the Pharmacopœias, merely as being employed in various pharmaceutic processes.

ACIDUM MURIATICUM DILUTUM. Diluted Muriatic Acid. Ph. Dub.

“Take of Muriatic Acid, Distilled Water, each one pound. Mix them.”

This is a formula wholly superfluous, as muriatic acid is not employed medicinally, and requires therefore no adjustment to render its exhibition convenient; and for any pharmaceutic process, it is easy to order its dilution to the requisite extent.

ACIDUM OXYMURIATICUM. Oxymuriatic Acid.

When muriatic acid is distilled from substances capable of affording oxygen easily, it is converted into a species of elastic fluid altogether different in its chemical properties, which is considered as a compound of muriatic acid with oxygen, and is therefore named Oxymuriatic Acid.

This has been applied to some medicinal purposes, and a process for preparing it has been introduced into the Dublin Pharmacopœia. The compound salt which is formed when this acid is presented to potash, the Oxymuriate of Potash, has also received a place in the Materia Medica; and the process may be conducted so that it also shall be obtained. The preparations in which the oxymuriatic acid is formed, in the process given by the Dublin College, have been named

AQUA OXYMURIATICA ET AQUA ALKALINA OXYMURIATICA.

“Take of Muriate of Soda dried, two pounds; Manganese in powder, one pound; Water, Sulphuric Acid, each two pounds. Mix the muriate of soda and the manganese; put them into a matrass, and add the water; then by a convenient apparatus add the sulphuric acid gradually, and at intervals; transmit the gas which is disengaged through a solution of four ounces of sub-carbonate of potash, in twenty-nine ounces of water. Toward the end of the operation, apply a moderate heat to the matrass. The specific gravity of this liquid is to the specific gravity of distilled water as 1087 to 1000.”

“The Oxymuriatic Water (or solution of oxymuriatic acid in water) is prepared by transmitting the superfluous gas of the above process, by a proper apparatus, through a pint of distilled water. The specific gravity of this liquor is to that of distilled water as 1003 to 1000.”

When muriate of soda, black oxide of manganese, and

sulphuric acid are mingled together, the sulphuric acid combining with the soda disengages the muriatic acid; and the acid, receiving oxygen from the oxide of manganese, is converted into oxymuriatic acid, which assumes the elastic form. If the sulphuric acid is concentrated, its action is rather too rapid, and gives rise to a disengagement of gas not easily regulated; and if any part of the elastic product is forced from the apparatus, it is extremely disagreeable to the operator, from its highly suffocating odour. It is proper therefore to use the acid diluted somewhat, and after the commencement of the operation, to favour its progress by the application of a moderate heat. The proportions of the ingredients recommended by Vauquelin, are four parts of muriate of soda, one of oxide of manganese, three of sulphuric acid, and two of water. When the combination of the gas, either with water, or with an alkaline solution, is to be effected, it is proper to use the bottles of Woolfe, so as to transmit the gas through the liquid, the first bottle being left empty to collect a little common muriatic acid that distils over, holding oxide of manganese dissolved.

Oxymuriatic acid has been employed to neutralize the agency of contagion, and change the noxious constitution of foul or corrupted air. To Guyton we are indebted for this application of it. It has been successfully applied in fumigating the wards of hospitals, the apartments of a prison, or other situations in which the atmosphere is contaminated by noxious effluvia, and probably is in this respect the most powerful agent we have it in our

power to employ. By its chemical agency, it changes the constitution of the greater number of the compound gases, and more particularly of those having carbon and hydrogen as their elements. Noxious effluvia, derived from the decomposition of vegetable and animal matter, which are the usual sources of a corrupted or contagious atmosphere, may be presumed to be of similar constitution, and therefore to be liable to similar decomposition; and accordingly it has been ascertained, that air highly tainted has its purity, so far as is connected with the removal of such effluvia, restored by the diffusion of the vapours of oxymuriatic acid. The usual materials are mingled together, the sulphuric acid being used in its concentrated state, and are distributed in different vessels placed in the apartment designed to be fumigated. The only disadvantage attending the use of it is, that from its suffocating odour, the atmosphere in which it is diffused cannot be breathed; and in some situations, as in hospitals, where the sick cannot be removed, this renders it necessary to substitute the nitrous acid vapour. But where this does not limit its use, the oxymuriatic acid, as more active, is to be preferred. In its pure state, the oxymuriatic acid is not applied to any other medicinal use, and there is therefore scarcely any necessity for the solution of it in water, which has received a place in the Dublin Pharmacopœia.

The salt obtained by transmitting the oxymuriatic acid gas through a solution of potash, and named the Oxymuriate of Potash, it has already been remarked, has been

received into the *Materia Medica*, and has been employed as an antisyphilitic remedy. This salt is not strictly an oxymuriate, but the compound of an acid containing still more oxygen than the oxymuriatic acid, what has been named the Hyper-oxymuriatic Acid. When the oxymuriatic acid gas is introduced into the alkaline solution sufficiently concentrated, it undergoes a singular decomposition: one portion of it returns to the state of muriatic acid, and combines with part of the alkaline base; the other portion, receiving the oxygen which this had parted with, passes to the state of an acid, having of course a still larger proportion of oxygen in its composition than the oxymuriatic acid, and this combines with another portion of the alkali. The former salt, the muriate of potash, being abundantly soluble, remains dissolved; the other, being more sparingly soluble, is deposited in crystalline plates. These form the salt properly named Hyper-oxymuriate of Potash, (*Hyper-oxymurias Potassæ.*)

These combinations are much influenced by the concentration of the alkaline solution. If it is much diluted, the oxymuriatic acid is absorbed by it, and remains united with the water and the alkali without decomposition; as is evident from the liquor retaining the property of destroying the vegetable colours,—a property belonging to the oxymuriatic acid, but not to the hyper-oxymuriate of potash. It is only when the more powerful action of the alkali on the acid is favoured by concentration, that the decomposition takes place; and Berthollet has supposed,

even, that it is much determined by the operation of crystallization itself. The alkaline solution, therefore, into which the oxymuriatic acid gas is transmitted, ought to be of such a strength, that the hyper-oxymuriate will be formed in it, and crystallize spontaneously. The solution ordered by the Dublin College appears to be too weak, and the liquor obtained by their process probably contains much of the oxymuriatic acid undecomposed. A solution of the proper strength is obtained by dissolving sixteen ounces of sub-carbonate of potash in four pounds of water; and as the disengagement of the carbonic acid, by the action of the oxymuriatic acid, is troublesome, it is better to remove it by previous agitation of the solution with eight ounces of lime. From this solution, when the transmission of the oxymuriatic acid gas is continued for a sufficient length of time, the hyper-oxymuriate crystallizes spontaneously, and the quantity of crystallized salt ought not to be increased by any evaporation of the liquor, as a portion of muriate of potash might crystallize along with it. The crystals are therefore removed, washed with a little cold water, and dried. And when the salt is to be medicinally used, it ought always to be under this crystallized form. The solution ordered in the Dublin Pharmacopœia must be an uncertain preparation.

Hyper-oxymuriate of potash crystallizes in thin quadrangular tables, white, with considerable lustre. Its taste is cool and penetrating. It dissolves in 17 parts of cold water, and in 5 of boiling water; is fused by heat; and

by a higher heat is decomposed, giving out very pure oxygen gas. From the facility with which it parts with oxygen, it acts with much force on inflammable bodies, producing, by mere trituration with them, or percussion, violent deflagrations or detonations.

Its medicinal applications have been already pointed out. When nitric acid was introduced as a remedy in syphilis, the theory which suggested its use led likewise to the employment of hyper-oxymuriate of potash. It was given in a dose of ten grains thrice a day; and from the cases then brought forward, appeared to be superior even to nitric acid in suspending the symptoms of syphilis. It was not however ultimately established in practice, and as no great advantage appears to be derived from it as an auxiliary to mercury, it is now seldom prescribed.

ACIDUM NITROSUM. Nitrous Acid. *Ph. Ed. Dub.*

“ Take of Nitrate of Potash bruised, two pounds; Sulphuric Acid, sixteen ounces. The nitrate of potash being put into a glass retort, pour upon it the sulphuric acid, and distil from a sand-bath with a fire gradually raised, until the iron pot is at an obscure red heat. The specific gravity of this acid is to that of distilled water as 1550 to 1000.” The directions in the Dublin Pharmacopœia are nearly the same.

In this process the sulphuric acid combines with the potash, and disengages the nitric acid. The latter acid, however, principally from the agency of the heat, espe-

cially towards the end of the distillation when it is necessary to raise it pretty high, suffers a partial decomposition; a small portion of it loses a part of its oxygen, and a quantity of nitric oxide gas is formed; this is absorbed by the nitric acid, and forms the nitrous acid, which is of a yellow or red colour, and fuming, more or less so, according as it is more largely impregnated with nitric oxide, and, according, therefore, to the degree of heat employed in the distillation. The residuum is sulphate of potash, with an excess of sulphuric acid, this excess of acid being necessary to render the decomposition of the nitre complete. The specific gravity of the acid is probably stated too high; the coloured, or what is strictly named Nitrous Acid, being not easily procured of a greater specific gravity than 1.52. It sometimes contains a minute quantity of sulphuric acid and muriatic acid; the first is detected by adding muriate of barytes to the acid diluted with two parts of distilled water, sulphate of barytes being formed; the other is detected by nitrate of silver, muriate of silver being precipitated. When not intentionally added, however, these acids are never present in sufficient quantity to render it unfit for medicinal or pharmaceutical use.

Nitrous acid is extensively employed as a pharmaceutic agent: from the facility with which it parts with oxygen, it is one of the most important, particularly in oxidating and dissolving the metals. Its powers as a tonic and antisyphilitic remedy have been already considered; and indeed, when internally administered, it is necessarily gi-

ven in the state of nitric acid, being brought to this state by dilution with water. In the state of vapour, it has been employed under the form of fumigation to destroy contagion; the due proportion of nitre and sulphuric acid being mingled together in small earthen cups, which are put in warm sand, and placed in the apartment designed to be fumigated, and, though inferior to oxymuriatic acid in power, it has the advantage that it can be applied without requiring the removal of the sick.

ACIDUM NITROSUM DILUTUM. Diluted Nitrous Acid.

“Take of Nitrous Acid, Water, equal weights. Mix them, avoiding the noxious vapours.”

In combining nitrous acid with water, the greater part of the nitric oxide gas, if it is highly charged with it, is disengaged with effervescence; if less is present, it is retained and converted into nitric acid by the oxygen held loosely dissolved by the water. The diluted acid is employed in a number of the chemical processes of the Pharmacopœia, and is convenient, in particular, for the solution of metals, being of that strength at which its action upon them is not too rapid.

ACIDUM NITRICUM. Nitric Acid. Ph. Ed.

“Take of Nitrous Acid, any quantity. Put it into a retort, and a receiver being adapted, apply a very gentle heat until the reddest part shall have passed over, and the acid which remains in the retort shall have become nitric

acid." The heat is best applied by the medium of a water-bath.

Another process has been given in the London Pharmacopœia for the preparation of nitric acid.

"Take of nitrate of potash dried, Sulphuric Acid, each two pounds. Mix them in a glass retort; then distil the nitric acid with the heat of a sand-bath, until red vapours are produced. Lastly, having poured the distilled acid on an ounce of dried nitrate of potash, distil it again in a similar manner. The specific gravity of nitric acid is to that of distilled water as 1500 to 1000. If a piece of limestone be put into a fluidounce of it diluted with water, seven drachms ought to be dissolved."

The process given in the Edinburgh Pharmacopœia is that which has been usually followed by chemists to convert nitrous into nitric acid. The nitrous acid is merely the nitric holding dissolved a portion of nitric oxide: when heat is applied, the nitric oxide being more disposed than the acid to assume the elastic form, the affinity by which it is retained in combination with it is weakened, and it is disengaged: this affinity, however, so far continues to operate, that it carries a portion of the acid along with it, and it escapes therefore in the state of very deep coloured nitrous acid vapour. The process is thus so far attended with loss, but this is easily obviated by condensing the nitrous acid vapour, by a portion of water put in the receiver, the diluted acid which will thus be obtained being easily applied to use. The heat ought to be applied by a water-bath, this being sufficiently high

to expel the nitric oxide gas, and being not too high to produce decomposition of the acid.

It is difficult, however, by this method, to render the acid perfectly colourless, the last portion of nitric oxide, communicating a pale straw colour, being retained by such an affinity, and the volatility of the acid in this state approaching so nearly to that of nitric acid, that the whole may be distilled without the oxide being entirely separated. A more perfect process to obtain perfectly colourless nitric acid, is to distil it from a little black oxide of manganese, which yields oxygen to the nitric oxide.

In the process of the London Pharmacopœia, from the large quantity of sulphuric acid employed to decompose the nitre, the acid is obtained by the first distillation nearly in the state of nitric. The operation of this excess of sulphuric acid, in preventing the partial decomposition which would form nitrous acid, probably depends on two circumstances: one, that from the quantity adding to the force of its affinity, less heat is required to promote the decomposition of the nitre, and the greater part of the nitric acid is thus brought over before it is necessary, in continuing the distillation, to raise the temperature so high as to evolve nitric oxide; the other, that the water of this excess of acid will be volatilized, in the progress of the distillation, and contribute to preserve the constitution of the nitric acid. The influence of the latter circumstance is very well shewn by the fact, that the product, instead of being superior in specific gravity to nitrous acid, as concentrated nitric acid is, is inferior, be-

ing, as stated in a report made to the College on the products of this process from different proportions of the materials, 1.50, while the nitrous is stated as having been obtained at 1.53. The weight too of the former, from a given quantity of nitre, amounted to four, that of the latter only to three. The relative value of the two is expressed by the quantity of marble they dissolve, that of the nitrous being stated at twenty-one, that of the nitric twenty-nine, expressing probably, (for they are not stated in a very distinct manner), not the relative strengths of equal weights of the two, but the relative strengths of the entire products, from a given weight of nitre. It thus will follow, that though a larger quantity of acid is obtained from the materials, by the mode of conducting the process in the London Pharmacopœia, the acid itself is not in its concentrated state.

Nitric acid is applied to the same purposes as nitrous acid. Medicinally, they must be the same, as the nitrous, by the dilution necessary for its administration, is converted into the nitric. And in their chemical agencies, and therefore in their pharmaceutic applications, they are precisely alike.

ACIDUM SULPHURICUM DILUTUM. Diluted Sulphuric Acid. *Ph. Ed. Lond. Dub.*

“ Take of Sulphuric Acid, one part; Water, seven parts. Mix them.” The same proportions are given in the Dublin Pharmacopœia. The London College have, without any necessity, altered the proportions both from

those of the other Pharmacopœias, and from those which had formerly been ordered in their own Pharmacopœia: they order a fluidounce and a half of sulphuric acid to be mixed with fourteen fluidounces and a half of distilled water, giving the proportion by weight of one part of acid, to nearly five and a half of water. The reason given for this change is, that "the mixture will be more conveniently made, and its dose more easily apportioned, than that of the former Pharmacopœia." The absurdity of this is obvious. A mixture of sulphuric acid with water is made just as easily in one proportion as in another, and the dose of the diluted acid, whatever may be its strength, is apportioned with equal facility. Nor is it of any importance to have any relation between the dose of the diluted acid and any particular quantity of the concentrated acid, as the acid in the latter state has never been prescribed internally. It is to be regretted, that the strength of a preparation, to which practitioners have long been accustomed, has been thus unnecessarily changed.

The preparation of Sulphuric Acid being carried on on a large scale, for the purposes of commerce, no process is given for it in any of the Pharmacopœias, nor could it be executed in the shops. It is formed by burning sulphur mixed with from one-eighth to one-tenth of nitrate of potash, in large leaden chambers. By the oxygen afforded by the nitre, the sulphur is enabled to burn slowly, though the chamber be closed so as to admit of a very imperfect circulation of air; and the acid formed

is principally the sulphuric, while, from the combustion of sulphur in atmospheric air alone, sulphurous acid chiefly is produced. The acid vapours are absorbed by water placed in the bottom of the chamber. This liquor, when sufficiently acidulated, is concentrated by evaporation, and afterwards by boiling it in glass retorts, and an acid is obtained thick and oily in its appearance, colourless and transparent, having a specific gravity of 1850. Formerly this acid was procured from the decomposition of sulphate of iron, the green vitriol of commerce, by heat; and hence the origin of the name, Vitriolic Acid, by which it has been known.

Sulphuric acid prepared in this manner is never perfectly pure. It contains a quantity of sulphate of potash, (the acid combining with a portion of the potash of the nitre,) and sometimes a small portion of sulphate of lead, derived from the action of the acid on the lead of the chamber. From these it is in a great measure purified by dilution with water, the diluted acid being incapable of holding them dissolved, and hence one advantage of the dilution. The dose of the diluted is also more manageable than that of the concentrated acid. As an astringent it is taken to the extent of from fifteen to thirty drops, usually in a cupful of water.

ACIDUM SULPHURICUM AROMATICUM. Aromatic Sulphuric Acid.

“ Take of Alcohol, two pounds; Sulphuric Acid, six ounces. Drop the acid gradually into the alcohol. Di-

gest the mixture with a very gentle heat in a close vessel for three days, then add of Bark of Cinnamon bruised, one ounce and a half; of Ginger bruised, one ounce. Digest again in a close vessel for six days; then strain through paper placed in a glass funnel."

The dilution of the acid by the alcohol is in the proportions in which they are mixed in this preparation, such, that little chemical action appears to be exerted during the digestion; an odour somewhat peculiar is acquired, but the acidity is little impaired. The aromatics render it more pleasant, and the preparation may be considered therefore as a grateful one for the exhibition of sulphuric acid. Its dose is thirty drops, given in a cupful of water. It is not unfrequently used in dyspepsia, hæmoptysis, and other diseases in which this acid is employed.

ÆTHER SULPHURICUS. Sulphuric Ether.

"Take of Sulphuric Acid, Alcohol, of each thirty-two ounces. Pour the alcohol into a glass retort, capable of bearing a sudden heat. Then pour on the acid in an uninterrupted stream. Mix them gradually by frequent and gentle agitation; then immediately distil from a sand-bath, previously heated for this purpose, into a receiver kept cool with water or snow. Let the heat be regulated in such a manner that the liquor may be made to boil as soon as possible, and continue to boil until sixteen ounces have distilled over; then remove the retort from the sand. To the distilled liquor add two drachms

of potash; then distil again from a high-necked retort, with a very gentle heat, into a receiver kept cool, until ten ounces have passed over. If to the acid remaining in the retort after the first distillation, sixteen ounces of alcohol be added, and the distillation be repeated, ether will again be produced. And this may be often repeated."

The directions in the other Pharmacopœias, for conducting this process, are nearly the same. In the London Pharmacopœia, the acid is ordered to be added gradually to the spirit, agitating the mixture after each addition; but on account of the rise of temperature as the mixture proceeds, this mode is more difficult than that directed by the Edinburgh College, of mixing the whole acid and alcohol at once, and any loss of ethereal vapour from the sudden action produced by the mixture is very trivial. The direction given by the Dublin College, to heat the spirit to 120° , before adding the acid, must render the making the mixture more difficult, and endanger the breaking of the retort from the addition of the dense cold acid.

On mixing equal weights of sulphuric acid and alcohol, a mutual action, marked by an elevation of temperature, and a hissing noise is produced, and a vapour is disengaged, of a pleasant ethereal smell. On raising the temperature by the application of heat, so as to cause the mixed liquid to boil, ether is formed, and distils over. This continues for a considerable time: towards the end of this stage of the process, the liquid in the retort is capable of sustaining a higher temperature, and along

with the ether, there is produced a white vapour, which condenses in streaks having an oily appearance, in the neck of the retort, and this increasing, collects in the form of a dense oily like fluid, named Oil of Wine, or Etherial Oil, which falls to the bottom of the receiver. If the heat be continued beyond this, there is a sudden and copious production of sulphurous acid gas, which, not escaping easily from the heavy liquor in the retort, causes it to swell up, and if not removed from the fire, it will pass over into the receiver. The principal nicety, therefore, in conducting the process, is to continue the distillation, so as to obtain the largest produce of ether, without bringing over the liquor from the retort. The rule given in the Edinburgh Pharmacopœia is to continue it, until the liquid condensed in the receiver is equal to half the quantity of alcohol that had been employed; as when this has been obtained, the formation of ether will have nearly ceased: The London College direct the distillation to be continued until the etherial oil is produced; and if care be taken to guard against the sudden swelling up of the liquor in the retort, this may be done, and rather a larger product obtained. Whenever the neck of the retort becomes obscured with white vapours, the fire should be withdrawn; and if the materials begin to swell, the retort ought to be raised in the sand. The receiver requires to be kept cool by immersion in water, or causing water to trickle over it, in order to promote the condensation of the ether; and care ought to be taken to avoid approaching a burning body to the appara-

tus, as accidents have sometimes happened, when the vessels were not closely luted, from the volatility and inflammability of the ethereal vapour.

There is considerable difficulty in establishing the theory of the formation of ether. As the process proceeds, the liquor in the retort assumes a dark colour, and a quantity of carbonaceous matter, somewhat bituminous, is diffused through it; it is likewise found to be considerably diluted with water, and another portion of water distils over with the ether. These changes, and the formation of the ether, must be referred to changes in the composition of the alkohol; and they were generally supposed to be owing to a portion of oxygen from the acid, being communicated to the hydrogen of the alkohol, and forming water; the balance of affinities being thus broken, part of the carbonaceous matter of the alkohol is likewise separated, and its remaining hydrogen and carbon, with any portion of oxygen it may contain, entering into combination, form the ether. To this theory, however, it was some years ago objected by Fourcroy and Vauquelin, that the decomposition of the sulphuric acid is not essential to the formation of ether: it may take place to a certain extent towards the end of the process, when the temperature is high, and the liquor is loaded with carbonaceous matter; but there are no indications of it, they affirm, in the earlier stage, during which principally ether is formed: there is no evolution of sulphurous acid, and if the process be stopt at this stage, it is affirmed by these chemists, that the whole acid is to be found undecom-

posed, the residual liquid being capable of saturating as much of an alkaline base, as the quantity of sulphuric acid employed would do. They gave, therefore, a different view of the agency of the acid. Instead of communicating oxygen, they suppose it to operate by a disposing, or what would now be named a resulting affinity, causing part of the oxygen and hydrogen of the alcohol to combine and form water; then the equilibrium of affinities being subverted, carbonaceous matter is precipitated from the alcohol, and the new affinities being exerted, ether is the product of the combination of its remaining elements. The subject, however, notwithstanding the researches of these chemists, is obscure. The fact, with regard to the acid not being decomposed, is not altogether certain; for the non-appearance of sulphurous acid, from which it has been inferred, may be owing to the small quantity evolved combining with the ether; and the power of the liquid to saturate as much of an alkaline base, as the sulphuric acid used in the process could do, may, if any portion of the acid be decomposed, be owing to the formation, by a partial oxygenation of the elements of the alcohol, of acetic or oxalic acid, both of which have been said to exist in the residual liquor. The facts, that those acids form ethers most readily from alcohol, which yield oxygen most readily, and that those which cannot communicate it directly form it with difficulty, and only by arrangements by which oxygen is communicated from some other substance, favour the supposition, that a communication of oxygen from the

acid is necessary to the commencement at least of the series of changes.

It is sufficiently proved, however, that the decomposition of the acid is not necessary to any great extent, for the residual liquor is still capable of converting a fresh portion of alcohol into ether, and as this is economical, it is ordered in the Pharmacopœias. And its power of doing so appears to diminish progressively, not so much from exhaustion of the acid, as from its becoming too much diluted with water. This water may have either entirely pre-existed in the alcohol; or only partially, and have been in part formed by combination of portions of oxygen and hydrogen; and we have no certain mode of determining which of these is the case. The carbonaceous matter which is precipitated, is obviously derived from the alcohol; and its separation led to the conclusion, that less of this matter must exist in the composition of ether than in that of alcohol; that hydrogen, therefore, predominates in the composition of the former, and to this its greater volatility and levity were ascribed. Both alcohol and ether in burning afford water and carbonic acid, and from the comparative quantities afforded in the combustion of each, Cruickshank inferred that the proportion of carbon to hydrogen is in ether as 5 to 1 nearly, while in alcohol it is as 8 or 9 to 1. The younger Saussure has more lately endeavoured, from the products of their detonation with oxygen, to discover their composition, and ether, he supposes, to contain more carbon and hydro-

gen than alcohol, but less oxygen. He states its composition at 59 carbon, 22 hydrogen, and 19 oxygen.

Ether obtained by the first distillation is not pure. It is diluted with a considerable proportion of water, sometimes also it contains alcohol, and very generally a portion of sulphurous acid, which had been evolved towards the end of the distillation. To free it from these is the object of the directions for its rectification inserted in the formula of the Pharmacopœia,—the sixteen ounces of liquid first procured being distilled from two drachms of potash, from a high necked retort, with a very gentle heat, until ten ounces are obtained; the potash detaining the sulphurous acid by the affinity it exerts to it, and rendering the water also less volatile. The same directions are given in the other Pharmacopœia, a portion of water only being ordered to be added to the potash and ether in the London Pharmacopœia, which may be useful by attracting the alcohol more effectually. If the ether of the first distillation be much impregnated with sulphurous acid, from the distillation having been continued longer than usual, it will be useful in the process of rectification to add a little black oxide of manganese, which yielding oxygen to the sulphurous acid, converts it into sulphuric, and abstracts it more effectually than is done by the alkali alone. In the London and Dublin Pharmacopœias, both the Unrectified and Rectified Ether have a place, the Ether, as obtained by the first distillation, being named *Æther Sulphuricus* in the London Pharmacopœia, and *Liquor Æthereus Sulphuricus* in the

Dublin; and when rectified, *Æther Rectificatus* in the former, *Æther Sulphuricus* in the latter. The Edinburgh College, with more propriety, admit of no distinction, but name the product when rectified, Sulphuric Ether, and sanction its use only in this state.

Sulphuric Ether in a state of purity has a peculiar odour, strong and diffusive, but not pungent; its taste is warm and penetrating; it is colourless and transparent; its specific gravity is 0.732, and when highly rectified is brought so low as .716; it is therefore one of the lightest known liquids. It is also one of the most volatile; it evaporates rapidly at common temperatures; it boils strongly in vacuo, even below 32, and under the atmospheric pressure at 98°. In evaporating it absorbs much caloric; hence, if dropt on the hand it quickly disappears, producing on the spot a sensation of cold; and this affords a very good test of its purity, the volatility being greater, as it is more highly rectified. It is soluble in alkohol in every proportion; in water only in the limited proportion of one part to ten; and this affords another test of its proper preparation, as if more soluble it is diluted either with water or alkohol.

Its medicinal properties have been already considered. It is employed principally as an antispasmodic, being given in a dose from half a drachm to a drachm. And it is sometimes applied externally as a stimulant, or, from the cold attending its evaporation, as a remedy to burns.

ÆTHER SULPHURICUS cum ALKOHOLE. Sulphuric Ether with Alcohol. (*Spiritus Ætheris Sulphurici, Ph. Lond.*)

“Take of Sulphuric Ether, one part; alcohol, two parts. Mix them together.”

A process had formerly a place in the Pharmacopœias, in which sulphuric acid and alcohol were submitted to distillation, more alcohol being employed than the acid could convert into ether. A portion of it, therefore, distilled over unchanged on the first application of the heat, and served merely to dilute the ether that followed. For this preparation, which had been received into practice under the name of the Sweet Spirit of Vitriol, the present has been substituted, but it has no peculiar advantage, and is seldom prescribed.

ÆTHER SULPHURICUS cum ALKOHOLE AROMATICUS. Aromatic Sulphuric Ether with Alcohol. (*Spiritus Ætheris Aromaticus, Ph. Lond.*)

“This is made from the same aromatics, and in the same manner as the Compound Tincture of Cinnamon, unless that in place of Diluted Alcohol, Sulphuric ether with alcohol is employed.”

The addition of these aromatics to the sulphuric ether in this formula is of so little importance, that the preparation is scarcely ever used.

To the preceding preparations, the London and Dublin Colleges have added another,—the peculiar oily-like

fluid which is produced in the latter stage of the process for forming Ether, the Oil of Wine, as it used to be named.

OLEUM ÆTHEREUM. Æthereal Oil. Ph. Lond.

“ The liquor remaining after the distillation of sulphuric ether, distil with a very gentle heat, until a black froth swells up; then immediately remove the retort from the fire. To the liquor which remains in the retort, add water, so that the oily part may float upon it. Draw this off, and mix with it lime water, as much as may be sufficient to neutralize the acid mixed with it. Lastly, withdraw the ethereal oil after it has separated.”

A different process is given by the Dublin College to obtain a similar product, which they name
LIQUOR ÆTHEREUS OLEOSUS. Oily Etherial Liquor.

“ Take the liquor remaining in the retort after the distillation of sulphuric ether. Distil it with a moderate heat to one half.”

The product obtained by these processes is probably the same, being formed in the first process, but not distilled over; in the second, being obtained insulated by distillation, though to conduct this is attended with considerable difficulty, from the re-action of the carbonaceous matter, which has been separated from the alkohol, on the sulphuric acid. The nature of this oily substance has not been well determined. It has been considered as a compound of ether and sulphurous acid, but no proof is given that by the combination of these it can be formed. Fourcroy and Vauquelin have supposed, that it is

analogous to ether, differing from it in containing a larger proportion of carbon. It can be formed more directly by distilling ether from sulphuric acid. It is thick, unctuous in appearance, less volatile than ether, and soluble both in it and in alcohol. It is applied directly to no medicinal use, but is employed in forming the following preparation,

SPIRITUS ÆTHERIS COMPOSITUS. Compound Spirit of Ether. Ph. Lond.

“Take of Spirit of Sulphuric Ether, a pint; Etherial Oil, two fluidrachms. Mix them.”

A composition had been in use under the name of Hoffman's Anodyne Liquor, which consisted of alcohol, with a portion of ether and etherial oil. This, after having been discarded from the Pharmacopœias, has been restored in the present preparation, on the supposition that it possesses superior powers as an anodyne. It probably differs, however, in nothing from ether with alcohol, at least there is no distinct proof of any peculiarity of operation being communicated by the etherial oil.

ÆTHER NITROSUS. Nitrous Ether. Ph. Dub.

“Take of Nitrate of Potash, dried and in coarse powder, one pound and a half; Sulphuric Acid, one pound; Rectified Spirit, nineteen ounces by measure. Put the nitrate of potash into a tubulated retort, placed in a bath of cold water; and add to it gradually, and in small quantities, the sulphuric acid and alcohol, previous-

ly mixed and allowed to become cold. Without the aid of any external heat, or with only such a slight degree of it as may be communicated by the addition of a little tepid water to the bath, an ethereal liquor will begin to distil. In a short time, the heat of the retort will increase spontaneously, and a considerable ebullition will take place, which must be moderated by adding a portion of cold water to the bath. The receiver ought also to be kept cold with water or snow, and it ought to be furnished with an apparatus adapted to transmit through a pound of rectified spirit, in a phial kept cold, the highly elastic vapour disengaged suddenly, and with great force, from the mixture, when the heat is raised rather too high. The ethereal liquor thus obtained by spontaneous distillation is to be put into a phial closely stopt with a glass stopper; and to neutralize the excess of acid, as much sub-carbonate of potash in dry powder is to be added as is necessary, closing the phial after each addition, and determining the neutralization by the test of litmus. This is generally attained on the addition of about a drachm of the salt, and in a short time the nitrous ether rises to the surface, and may be withdrawn by a funnel. To obtain the ether in its purest state, distil it from a water-bath, heated to about 140 degrees, to one half. Its specific gravity is to that of distilled water as 900 to 1000."

The process for preparing nitrous ether has always been found extremely difficult, from the great susceptibility of decomposition of the acid, and the rapidity with

which it communicates oxygen to the alkohol. Their mutual action, in consequence of this, becomes extremely violent, and it is difficult to add the requisite proportion of nitric acid to convert it into ether, or to do so at least without considerable waste in the dissipation of elastic products. Different arrangements have been contrived to facilitate this, but probably none that can be conducted more easily than that now received into the Dublin Pharmacopœia, originally contrived by Woulfe, and found by Pelletier to succeed better than any other. The addition of the mixture of sulphuric acid and alkohol should be made in small quantities at a time, not exceeding two ounces, and the quantity of product is increased by keeping the first receiver perfectly cool, and connecting with it not merely one bottle, but a range of bottles, containing, according to a method employed by Thenard, a saturated solution of muriate of soda kept cold by ice, through which the elastic product is transmitted; it is condensed, and the liquid floats on the surface.

The theory of the formation of nitric ether remains obscure; the series of changes, however, are obviously altogether different from those which take place in the production of sulphuric ether. The acid is entirely decomposed, or nearly so, scarcely any trace of it having been found by Pelletier in either the distilled or the residual liquor; there is no precipitation of carbonaceous matter from the alkohol, the liquor remaining transparent, and of a light yellow colour; it contains oxalic and

acetic acids, much diluted with water. Thenard, in his researches on this subject, found, that the elastic fluid disengaged during the process, consists of nitrogen, nitric and nitrous oxide, and carbonic acid gases, holding dissolved ether, and a portion of acid partly nitrous, partly acetic. The nitric ether, which is condensed, has also combined with it nitric and acetic acids; and when these are abstracted, so that it has no sensible acidity, it acquires this merely on keeping, a proof that the elements of these acids exist in its composition. From the products obtained from its decomposition by transmitting it through an ignited tube, he infers, that 100 parts of it consist of 16.41 of nitrogen, 39.27 of carbon, 34.73 of oxygen, and 9.59 of hydrogen. In its formation, much of the oxygen of the acid appears to combine with the hydrogen of the alcohol, forming water; a portion of it unites with part of the carbon, forming carbonic acid, and with portions of both producing acetic acid; a considerable part of the nitrogen of the acid is disengaged in its insulated state, or in the form of nitric and nitrous oxides, and the remaining oxygen and nitrogen combine with the remaining carbon and hydrogen, and form the nitric ether.

Nitric ether is light and volatile; its colour is usually yellow, probably, however, from the presence of a portion of free nitric acid surcharged with nitric oxide; its odour is strong and penetrating, though not so fragrant as that of sulphuric ether; when pure and concentrated its volatility is such, that it instantly evaporates when poured

from a phial, and boils at 70° under the common atmospheric pressure; it is highly inflammable: with alcohol it combines in every proportion, but in water it is soluble only in limited quantity, requiring, according to Thenard, when pure, 50 parts for its solution.

This ether has scarcely in its pure form been applied to any medicinal use; though it not improbably is possessed of powers analogous to those of sulphuric ether. Diluted with alcohol with a portion of free acid, it forms the following preparation, which has long had a place in the Pharmacopœias, and is used as a refrigerant and diuretic.

SPIRITUS ÆTHERIS NITROSI. Spirit of Nitrous Ether.
(Spiritus Ætheris Nitrici, *Ph. Lond.*—Spiritus Æthereus Nitrosus, *Ph. Dub.*)

“Take of Alcohol, three pounds; Nitrous Acid, one pound. Pour the alcohol into a large phial placed in a vessel full of cold water, and add the acid gradually, agitating them frequently. Close the phial lightly, and set it aside for seven days in a cool place; then distil the liquor with the heat of boiling water into a receiver kept cold with water or snow, as long as any spirit comes over.” In the Pharmacopœia of the London College, a smaller proportion of acid is added, three ounces only to two pints of rectified spirit, and twenty-six ounces are distilled off immediately by a gentle heat.

A preparation of this kind has long been employed in medicine. It consists probably of nitric ether diluted with alcohol, and containing always a portion of free acid.

It is not difficult to add the nitric acid to the alcohol in the proportion of one to three parts, at least from this quantity of acid added with precaution, no violent action results. If heat were applied to this mixture, however, so as to raise it to 212° , a mutual decomposition, attended with the rapid extrication of elastic products would take place. The heat must therefore be either applied more slowly, or the method ordered by the Edinburgh College must be followed, that of allowing the mixture to stand for some days in a cool place. During this time, a mutual action is exerted between the acid and alcohol; the former is partially decomposed, and the heat required for distillation can be safely applied. That this decomposition takes place is proved by the experiments of Bayen. He digested an ounce of nitrous acid with two ounces of alcohol for five weeks; the liquor then required for its saturation only 134 grains of an alkaline base, while an ounce of the same acid required to saturate it 282 grains of the same base. And when, after digesting the acid and alcohol together, he submitted them to distillation, on mingling the product and the residual liquor, the whole was capable of neutralizing only 32 grains. By this reciprocal action of the acid and alcohol, a portion of nitric ether appears to be formed; this nitric ether distils over with a considerable portion of unchanged alcohol, and a quantity of free acid. The theory of its production, therefore, so far as relates to the formation of the nitric ether, is the same with that which has been already explained. The propriety of the change which has been

made by the London College, in this process, that of diminishing so much the proportion of nitric acid, may be questioned, both as less nitric ether must be formed when the proportion of acid is so small, and as a considerable share of the medicinal efficacy of the preparation probably depends on the free acid.

Spirit of nitric ether has an odour extremely fragrant; its taste is pungent and acidulous; it is volatile and inflammable, soluble readily both in alcohol and in water. It is employed principally as a grateful refrigerant in inflammatory affections, as a diuretic in dropsy, or rather as an auxiliary to promote the operation of more powerful diuretics, and as a stimulant relieving nausea and flatulence. Its dose is 30 or 40 drops taken in a cupful of water.

The Dublin College give a formula for the preparation of a spirit of nitrous ether, which must afford a product considerably different from that obtained by the preceding processes, particularly in containing no free acid. The directions are to "add to what remains after the distillation of nitrous ether the rectified spirit of wine which had been employed in the process to condense the elastic vapour, and distil with the highest heat of a water-bath to dryness. Mix this distilled liquid with the alkaline solution remaining after the separation of the nitrous ether, and add also as much dry sub-carbonate of potash as shall be sufficient to neutralize the free acid, ascertaining this by the test of litmus. Lastly, distil this with the mean heat of a water-bath while any liquid comes over,

The specific gravity of the distilled spirit is to that of distilled water as 880 to 1000."

By this process, the portion of nitric ether in the residuum of the first distillation is obtained, and the alcohol which had been in part also impregnated with it, is farther changed by the free nitric acid of the residual liquor. The product, therefore, is somewhat analogous to that obtained by the preceding processes. But by the action of the alkali, to which it is afterwards submitted, its acidity must be removed, and to a certain extent this must modify its medicinal powers. The product of the process which has been longest in use, that of the Edinburgh Pharmacopœia, and the powers of which are sufficiently ascertained, is probably that which ought to be preferred.

CARBONAS POTASSÆ. Carbonate of Potash. Ph. Ed.
(Sub-Carbonas Potassæ, Ph. Lond. — Sub-Carbonas Kali, Ph. Dub.)

"Let impure Carbonate of Potash be put into a crucible, and exposed to a red heat, that the oily impurities, if any are present, may be burnt out; then having rubbed it with an equal weight of water, mix them thoroughly by agitation. The liquor, after the impurities have subsided, being poured into a clean iron-pot, is to be boiled to dryness, stirring the salt constantly towards the end of the boiling, that it may not adhere to the vessel." The directions given in the other Pharmacopœias are essentially the same, except that in the London Pharmacopœia the liquor is not ordered to be evaporated to dryness, but

until it become thick; it is then removed from the fire, and stirred with an iron rod, until it concrete into crystalline grains.

The Potash of commerce is obtained by the incineration of the wood of land vegetables; the ashes being lixiviated with water, so as to dissolve the saline matter, and this being evaporated to dryness. The dry mass consists principally of sub-carbonate of potash, with smaller quantities of sulphate and muriate of potash, siliceous earth, and metallic matter, principally oxides of manganese and iron. These are in a great measure abstracted by the present process, the sub-carbonate of potash from its greater solubility being dissolved, while the others, and especially the earthy and metallic matter, from the small quantity of water employed, remain undissolved. It is obtained at least sufficiently pure for medicinal or pharmaceutical use.

This saline matter is in the state of sub-carbonate, and is therefore improperly named in the Edinburgh Pharmacopœia. It is deliquescent, acrid, changes the vegetable colours to a green, and has the general alkaline properties. It consists, according to Kirwan, of about 60 of potash, 30 of carbonic acid, and 6 of water, with a few grains of sulphate of potash, siliceous and argillaceous earth. It is rarely applied to any medicinal use, but is employed principally as an agent in Pharmacy. A solution of it is inserted in the Dublin Pharmacopœia, under the name of *AQUA SUB-CARBONATIS KALI*, obtained by exposing the sub-carbonate in a funnel, in the tube of

which is a piece of linen, to a humid atmosphere; the solution formed by the water, slowly imbibed from the atmosphere, being received in a vessel beneath. A similar solution, LIQUOR POTASSÆ SUB-CARBONATIS is obtained, according to a formula in the London Pharmacopœia, by dissolving a pound of sub-carbonate of potash in 12 ounces of water.

CARBONAS POTASSÆ PURISSIMUS, *olim, Sal Tartari.* Pure Carbonate of Potash, *formerly Salt of Tartar.* (Kali e Tartaro, *Ph. Dub.*)

“Take of impure Super-tartrate of Potash, any quantity. Having wrapped it up in moist bibulous paper, or put it into a crucible, burn it into a black mass, by placing it among live coals. Having reduced it to powder, subject it to a moderate heat, in an open crucible, until it become white, or at least of an ash-grey colour, care being taken that it do not melt. Then dissolve it in warm water; strain the liquor through linen, and evaporate it in a clean iron vessel, stirring the matter constantly, towards the end of the evaporation, with an iron spoon, that it may not adhere to the bottom of the vessel. A very white salt will remain, which is to be left a little longer on the fire, until the bottom of the vessel is nearly at a red heat. When cold, it is to be kept in glass vessels, well stopt.” The same directions nearly are given in the Dublin Pharmacopœia, and this salt has also a place in the London Pharmacopœia.

By exposing the super-tartrate of potash to heat, the

tartaric acid is decomposed. Part of its carbon and oxygen unite, and form carbonic acid, which is attracted by the potash; and, by continuing the heat, the remaining carbonaceous matter is burnt out. The super-tartrate of potash of commerce usually contains a little tartrate of lime, which by the heat is converted into carbonate of lime, but by dissolving the saline matter in water, this, and any other earthy substances are separated, and, by evaporation, a salt is obtained, which, like the former, is a sub-carbonate of potash, but more pure. It appears also to contain rather a larger proportion of carbonic acid. The process, however, being more expensive than the preceding one, it is not often to be found in the shops.

CARBONAS POTASSÆ. Carbonate of Potash. Ph. Lond.

“Take of Sub-Carbonate of Potash, prepared from Tartar, a pound; Carbonate of Ammonia, three ounces; Distilled Water, a pint. Add to the potash dissolved in the water, the carbonate of ammonia; then, by a sand-bath, apply a heat of 180 degrees for three hours, or until the ammonia is expelled, and put the liquor aside that crystals may form. Let the residual liquor be reduced by evaporation, in a similar manner, so that when set aside it may again afford crystals.”

The intention of this process is to obtain potash fully saturated with carbonic acid, or in the state of the neutral carbonate, the carbonic acid required for this being abstracted from the ammonia, and the ammonia itself being expelled. The same object is obtained with equal

certainty and facility, by transmitting a current of carbonic acid gas through a solution of one part of sub-carbonate of potash, in three of water; and the crystallized salt is obtained probably more pure, as in the former method it is difficult to expel the ammonia entirely. The carbonate crystallizes in quadrangular prisms, which are not deliquescent: they are soluble in four parts of cold water. The taste of this salt is mild, but somewhat alkaline, and it changes the vegetable colours to a green. It is therefore disposed to crystallize with an excess of base, and is, in strictness of chemical language, a sub-carbonate. According to Pelletier, it consists of 40 of potash, 43 of carbonic acid, and 17 of water. It has been proposed to be used in medicine as a diuretic and antacid, in preference to the sub-carbonate, as being milder; and it answers better for preparing the effervescing draught.

AQUA SUPER-CARBONATIS POTASSÆ. Water of Super-Carbonate of Potash.

“ Take of Water, ten pounds; Pure Carbonate of Potash, one ounce. Dissolve, and expose the solution to the current of Carbonic Acid Gas, which arises from three ounces of Powder of Carbonate of Lime, three ounces of Sulphuric Acid, and three pounds of Water, gradually and cautiously mixed. The chemical apparatus invented by Dr Nooth is well adapted to this preparation. But, if a larger quantity of the solution is required, the apparatus of Woulfe is preferable. The colder the air

is, and the greater the pressure, the better will be the liquor. It ought to be kept in vessels well stopt."

Potash, when used as a lithontriptic, excites so much irritation in the stomach and bladder, that its use cannot well be long continued. But, when super-saturated with carbonic acid, as it is in this preparation, it is rendered more pleasant and less irritating; and, though its lithontriptic or real solvent power is diminished, or perhaps entirely lost, it is capable of acting as a palliative, and of being continued for any length of time; and from the observations already made under the class of lithontriptics, it follows, that no greater advantage is to be expected from the use of alkaline remedies under any form. It is taken to the extent of one, or even two pounds in the day. It affords also a grateful antacid. A solution of this kind has been in use for a considerable time; and to establish uniformity in its strength, it is properly inserted by the Edinburgh College as an officinal preparation. When properly prepared, it is pungent and acidulous, and sparkles when poured into a glass. By employing an apparatus, in which strong mechanical pressure can be applied, the solution may be still more impregnated with carbonic acid: it is thus rendered more grateful, and as an antacid, in particular, is perhaps rendered more effectual, the stimulus of the carbonic acid relieving the uneasy sensations connected with acidity of the stomach, while the alkali neutralizes the acid itself.

AQUA POTASSÆ, *vulgo Lixivium Causticum.* Water of Potash.

“ Take of newly prepared Lime, eight ounces; Carbonate of Potash, six ounces. Put the lime into an iron or earthen vessel, with twenty-eight ounces of warm water. The ebullition being finished, immediately add the salt; and the whole being well mixed, close the vessel until they become cold. Let the cold materials, previously well agitated, be poured into a glass funnel, the tube of which is obstructed with clean linen. Cover the upper orifice of the funnel, while the neck of it is inserted in another glass vessel, that the water of potash may gradually drop through the linen into the lower vessel. When it first ceases to drop, pour into the funnel a few ounces of water, but cautiously, so that it may swim above the matter. The water of potash will again begin to drop. In this manner the affusion of water is to be repeated, until three pounds have filtered, which will be in the space of two or three days. The upper parts of the liquor are to be mixed with the lower by agitation, and it is to be kept in a vessel well stopt.” The directions given in the London and Dublin Pharmacopœias are essentially the same. A test is added to judge of the proper preparation of the solution, that it should be colourless, and scarcely effervesce on the addition of an acid. If on this addition any effervescence should take place, the liquor is to be again digested with a little lime, and filtered in a similar manner.

This process affords a very good example of the action exerted on an acid by two bases having an attraction to it, and of the effect of quantity of matter in influencing the results of chemical affinity. To the carbonic acid combined with the potash, an attraction is exerted by the lime, and by this attraction part of the acid would be withdrawn. A portion of it, however, would still remain united with the potash; and the only mode of counteracting this, and of at least diminishing the quantity, is to increase the proportion of lime acting on the carbonate. From the insolubility of lime, this can scarcely be done in any other mode than that followed in the present process, in which, by the arrangement of putting the entire mixture, with a great excess of lime, into a funnel, the tube of which is nearly obstructed, the alkaline solution must filtrate slowly through the mass of lime. The affinity of the lime to the carbonic acid is thus favoured, and the greater part of the acid is abstracted from the potash. Still, however, from the effect of quantity on the force with which affinity is exerted, a small quantity of acid is retained in combination with the potash, which cannot be abstracted by this process. But if the lime has been in a sufficiently active state, and the directions observed so that the filtration has been performed slowly, the quantity is very inconsiderable, as is apparent from scarcely any sensible effervescence being excited by the addition of an acid, and for any medicinal or pharmaceutical purpose to which the solution is applied may be neglected. The agency of the air must be

excluded during the filtration, especially from the filtered liquid, to prevent absorption of carbonic acid; and for the same reason it must, after it is prepared, be kept in glass vessels well stoppt. Its specific gravity is to that of distilled water as 1220 to 1000. The medicinal applications of the alkali under this form have been already considered.

POTASSA, *olim Causticum Commune Acerrimum*. Potash.
(Potassa Fusa, *Ph. Lond.*—Kali Causticum, *Ph. Dub.*)

“ Take of Water of Potash, any quantity. Evaporate it in a covered clean iron vessel, until, when the ebullition is finished, the saline matter flow smoothly like oil, which will happen before the vessel is at a red heat. Then pour it on a clean iron plate; cut it into small masses before it hardens, and immediately put them into a phial well stoppt.”

By the dissipation of the water, the alkali is obtained in a solid form; it is usually run into moulds, so as to be formed into cylindrical pieces. Under this form it is used as a caustic; it quickly erodes animal matter, and, mixed with soap into a paste, is sometimes used to open an ulcer.

POTASSA CUM CALCE, *olim Causticum Commune Mitius*.
Potash with Lime. (Potassa cum Calce, *Ph. Lond.*—
Kali Causticum cum Calce, *Ph. Dub.*)

“ Take of Water of Potash, any quantity. Evaporate it to one-third in a covered iron vessel; then mix with it

as much newly slacked lime as may be sufficient to give it the consistence of a solid paste, which is to be kept in a stopt vessel."

As a caustic, this is milder than the former preparation, and it has the advantage of being less deliquescent, so that it can be more easily confined to the part to which it is applied. When mixed, however, with the requisite quantity of soap to form a paste, it is scarcely sufficiently active.

ACETIS POTASSÆ. Acetite of Potash. (Potassæ Acetas, *Ph. Lond.*—Acetas Kali, *Ph. Dub.*)

"Take of Pure Carbonate of Potash, one pound. Boil it with a gentle heat in four or five times its weight of Distilled Acetous Acid, and add more acid at different times, until, on the watery part of the former portion being nearly dissipated by evaporation, the acid newly added excite no effervescence: this will happen when about twenty pounds of acid have been consumed. Afterwards evaporate to dryness slowly. Let the remaining impure salt be liquefied with a gentle heat, for a short time; then dissolved in water, and strained through paper. If the liquefaction has been properly done, the strained liquor will be limpid; if not, of a brown colour. Afterwards evaporate with a very gentle heat this liquor, in a shallow glass vessel, stirring the salt while it concretes, that it may more quickly be brought to dryness. Lastly, the acetite of potash ought to be kept in a glass vessel, well closed, that it may not liquefy by the action of the air."

In this process, the acetic acid of the distilled vinegar combines with the potash, disengaging the carbonic acid. The acetate of potash, obtained by the evaporation, is liable to be of a brownish colour, from the presence, probably, of a little extractive matter, derived from the vinegar. It is freed from this, either by boiling the solution with charcoal powder; or, as directed in the Pharmacopœia, by melting the salt; and, by the second solution and evaporation, it is obtained in the form of a white foliated mass; the foliated structure, which is very characteristic of this salt, arising from a species of crystallization it suffers.

Acetate of potash is extremely deliquescent, becoming humid in a very short time from exposure to the air. It does not require more than its weight of water for its solution, at the temperature of 60° : it was at one time celebrated as a diuretic, in a dose of one or two drachms; but it has now nearly fallen into disuse.

SULPHAS POTASSÆ, olim *Tartarum Vitriolatum*. Sulphate of Potash. (Potassæ Sulphas, *Ph. Lond.*—Sulphas Kali, *Ph. Dub.*)

“Take of Sulphuric Acid, diluted with six times its weight of Water, any quantity. Put it into a large glass vessel, and gradually drop into it, of Carbonate of Potash, dissolved in six times its weight of Water, as much as may be necessary to the perfect saturation of the acid. The effervescence being over, strain the liquor through paper; and, after due evaporation, put it aside, that cry-

stals may form. Sulphate of Potash may also be conveniently made, by dissolving the residuum of the distillation of Nitrous Acid in Warm Water, and saturating it by adding Carbonate of Potash."

In the former of these processes, the sulphuric acid unites with the potash of the carbonate of potash, and expels the carbonic acid with effervescence, the sulphate of potash remaining in solution. The second process being more economical, is that which is always followed, and it is it which has a place in the other Pharmacopœias. The salt remaining after the distillation of nitrous acid is sulphate of potash, with a considerable excess of sulphuric acid: this excess of acid is neutralized by the potash of the carbonate of potash. The neutral salt forms only in small crystals, the figure of which is a six-sided prism, acuminated by six planes: by slow evaporation they are obtained of a larger size. They require seventeen parts of cold water for their solution. The taste of the salt is bitter. Its powers are those of a cathartic, in the dose of half an ounce; but it is more usually given in smaller doses as an aperient, and, from its sparing solubility, is given usually in powder.

SULPHAS POTASSÆ CUM SULPHURE, *olim Sal Polychrestus.*

Sulphate of Potash with Sulphur. Ph. Ed.

"Take of Nitrate of Potash in powder, Sublimed Sulphur, equal weights. Throw them well mixed together, in small quantities at a time, into a red-hot crucible.

The deflagration being finished, let the salt cool, and keep it in a glass phial, well stopt."

The nitrate of potash being decomposed at a red heat, affords oxygen to the sulphur, in such proportions as to convert it principally into sulphuric, and partly into sulphurous acid. Both acids are attracted by the potash; and it appears even that from the rapidity of the deflagration, a portion of the sulphur escapes oxygenation, and remains united with a portion of the alkali. This is therefore a mingled product. In its medicinal qualities, it does not appear to differ from the sulphate of potash; and it is soon converted into it, by exposure to the air. Hence it is little used.

POTASSÆ SUPER-SULPHAS. Super-Sulphate of Potash.
Ph. Lond.

"Take of the Salt which remains after the distillation of Nitric Acid, two pounds; Boiling Water, four pints. Mix them, so that the salt may be dissolved, and strain. Then boil the solution until a pellicle appear on its surface, and put it aside that crystals may form. The liquor being withdrawn, dry these on bibulous paper.

By solution in water, the free acid of the residual mass is in part removed, but the salt still crystallizes with an excess of acid. It is much more soluble than the neutral sulphate, but it is not very apparent to what medicinal use it can be applied, with any peculiar advantage.

TARTRIS POTASSÆ, olim *Tartarum Solubile*. Tartrite of Potash. (Potassæ Tartras, *Ph. Lond.*—Tartaras Kali, *Ph. Dub.*)

“Take of Carbonate of Potash, one pound; Super-Tartrite of Potash, three pounds, or as much as may be necessary; Boiling Water, fifteen pounds. To the carbonate of potash dissolved in the water, add, by small quantities, the Super-Tartrite of Potash rubbed to a fine powder, as long as it excites effervescence, which generally ceases before three times the weight of the carbonate of potash have been thrown in. Then strain the liquor, when cold, through paper; and, after due evaporation, put it aside that crystals may form.

The excess of tartaric acid in the super-tartrate of potash, is in this process saturated by the potash of the carbonate of potash, and the proper neutral salt is formed. Though ordered to be crystallized in all the Pharmacopœias, the crystallization of it can scarcely be accomplished by hasty evaporation. In its preparation, therefore, the solution is usually evaporated to dryness, and it is kept in powder in the shops.

This salt has a bitter taste; it is very soluble in water, requiring only four parts of cold water for its solution; and from this greater solubility compared with that of the super-tartrate, it derived its name of Soluble Tartar. Even the weaker acids decompose it partially, and reduce it to the state of super-tartrate. As a purgative, it is given in the dose of one ounce.

SULPHURETUM POTASSÆ, *olim Hepar Sulphuris*. Sulphuret of Potash. (Potassæ Sulphuretum, *Ph. Lond.*—Sulphuretum Kali, *Ph. Dub.*)

“Take of Carbonate of Potash, Sublimed Sulphur, of each eight ounces. Having rubbed them together, put them into a large coated crucible; and a cover being adapted to it, apply the fire to it cautiously, until they melt. The crucible, after it has cooled, being broken, remove the sulphuret, and preserve it in a phial well stopt.” The formula in the Dublin Pharmacopœia is the same; but in the London Pharmacopœia the proportions are very different, one ounce of sulphur being heated in a covered crucible with five ounces of sub-carbonate of potash, until they unite: the advantage supposed to be derived from this large proportion of alkali, is, that the whole sulphur is rendered soluble in water.

During the fusion of the two substances, the sulphur and potash combine, and the carbonic acid is disengaged, only partially, however, and hence the combination is less perfect than when the sulphur is melted with the pure alkali. The compound is easily fusible, and is of a yellowish, green, or brown colour, and inodorous, but becomes foetid when moistened or dissolved in water from partial decomposition, and the production of a compound of sulphur and hydrogen. It has been proposed to be used as an antidote to some of the metallic poisons, from the supposition that the sulphur will combine with the metallic preparation, and render it inert. From a similar theory,

it has been imagined that it might obviate the effects of mercury on the system when these are too violent: but it is very seldom had recourse to with either intention, and it is doubtful if much advantage would be derived from it. The dose in which it has been proposed to be given is from ten to twenty grains, three or four times a day. It is said, in some cases of cancer, to have increased the efficacy of cicuta as a palliative, in doses of five grains.

AQUA SULPHURETI KALI. Water of Sulphuret of Potash.
Ph. Dub.

“Take of Sublimed Sulphur, half an ounce; of Water of Potash, nine ounces. Boil them together for ten minutes, and filter the liquor through paper. Keep it in phials closely stopt. The specific gravity of this liquor is to that of distilled water as 1120 to 1000.”

The alkali in its pure form, and in this state of solution, acts readily on the sulphur and dissolves it, the liquor being of a dark yellow or red colour. It is not merely, however, a solution of sulphuret of potash in water; for whenever sulphur is combined with an alkaline base, it partially decomposes water, and in the state of solution, therefore, a new compound is formed. The nature of their re-action is somewhat complicated. A portion of the sulphur attracts a portion of the oxygen of the water, and the sulphuric acid thus formed is combined with a part of the alkaline base. The hydrogen of the decomposed water enters into union with the remain-

ing sulphur, forming the compound with excess of sulphur, named Super-Sulphuretted Hydrogen, and this remains combined with the rest of the base, forming what some chemists have named a Hydroguretted Sulphuret, —what may be distinguished by the less harsh appellation of a Sulphuretted Hydro-sulphuret. The solution, as prepared by the above formula, is adapted to the same uses as the sulphuret of potash.

CARBONAS SODÆ. Carbonate of Soda. (Carbonas Sodæ, *Ph. Dub.*—Sub-carbonas Sodæ, *Ph. Lond.*)

“ Take of Impure Carbonate of Soda, any quantity. Bruise it, and boil it in water until all the saline matter is dissolved. Strain the solution through paper, and evaporate it in an iron vessel, so that on cooling crystals shall form.”

The barilla of commerce, from which this salt is ordered to be prepared, is the residual matter of the combustion of marine plants. It is a very impure carbonate of soda, containing large quantities of other saline and earthy matter, chiefly sulphate and muriate of soda, lime, magnesia, argil and silex, with charcoal. The sub-carbonate of soda crystallizing readily, the solution on being evaporated affords it nearly pure in the crystals which first form. The residual liquor, containing more of the other salts, ought to be rejected, a direction properly given in the formula of the London Pharmacopœia. From three to five ounces of the crystallized salt are obtained from a pound of barilla.

This crystallized salt, though mild to the taste, is still sensibly alkaline, and it changes the vegetable colours to a green. It is therefore, in the strictness of chemical nomenclature, a sub-carbonate, as the London College have named it. It crystallizes in octohedrons; its crystals are efflorescent; they require not more than twice their weight of cold water for their solution; and by a heat inferior to that of 212° are liquefied by the action of the very large quantity of water of crystallization they contain. Its quantity amounts to 64 parts in 100, with 21.6 of soda, and 14.4 of carbonic acid. The use of this salt as a lithontriptic has been already stated; and for its more convenient exhibition, it is ordered in the London and Dublin Pharmacopœias to be kept dried.

SODÆ SUB-CARBONAS EXSICCATA. Dried Sub-carbonate of Soda, *Ph. Lond.*—(Carbonas Sodæ Siccatum, *Ph. Dub.*)

“Take of Sub-carbonate of Soda, a pound. Submit it to the heat of boiling water in a clean iron vessel until it is perfectly dry, stirring it constantly with an iron spatula. Then rub it into powder.”

Carbonate of soda has been given as a lithontriptic, principally mixed with soap under the form of pill. If the crystallized salt be used, besides the addition to its bulk from the water of crystallization, it effloresces, so that the pill prepared from it soon loses its cohesion. The dried carbonate is therefore preferable; and from the

moderate heat to which it is exposed in the drying, the water merely is expelled.

SODÆ CARBONAS. Carbonate of Soda. Ph. Lond.

“ Take of Sub-carbonate of Soda, a pound ; Sub-carbonate of Ammonia, three ounces ; Distilled Water, a pint. To the sub-carbonate of soda dissolved in the water, add the ammonia ; then by a sand-bath apply a heat of 180° for three hours, or until the ammonia is expelled, and put it aside, that crystals may form. Let the remaining liquor be evaporated in a similar manner, and put aside, that crystals may again be produced.”

The sub-carbonate of soda will in this process receive carbonic acid from the carbonate of ammonia, and be brought to the neutral state, while the ammonia will be expelled by the heat. The same neutralization might be effected more directly and economically, by transmitting a current of carbonic acid gas through the solution of the sub-carbonate. The salt in this state, however, does not appear to possess any particular advantage for medicinal or pharmaceutical use.

AQUA SUPER-CARBONATIS SODÆ. Water of Super-carbonate of Soda. Ph. Ed.

“ This is to be prepared from ten pounds of Water, and two ounces of Carbonate of Soda, in the same manner as the Water of Super-carbonate of Potash.”

The proportion of the carbonate to the water is greater in this preparation than in that of the super-carbonate of

potash water; but this is owing to the carbonate of soda containing so much water of crystallization, that even with the enlarged proportion, there is not more real alkali in the one than in the other. The super-carbonated soda water is used as a lithontriptic in the same dose as the super-carbonated potash water, and is usually preferred, on the supposition of being more pure and mild.

TARTRIS POTASSÆ ET SODÆ, *olim Sal Rupellensis*. Tartrate of Potash and Soda. (Soda Tartarizata, *Ph. Lond.* — Tartaras Sodæ et Kali, *Ph. Dub.*)

“ This is prepared from Carbonate of Soda and Super-Tartrate of Potash, in the same manner as Tartrate of Potash.”

The excess of tartaric acid in the super-tartrate of potash, being saturated in this preparation by the soda of the carbonate of soda, a triple salt is formed, properly named by the Edinburgh College, Tartrate of Potash and Soda. It crystallizes in rhomboidal prisms; is soluble in five parts of water at 60°, and has a bitter saline taste. It consists, as Vauquelin has stated its composition, of 54 parts of tartrate of potash, and 46 of tartrate of soda. It is employed as a cathartic, in the dose of one ounce; and is often preferred, as being less disagreeable than the greater number of the saline cathartics.

PHOSPHAS SODÆ. Phosphate of Soda. (Phosph. Sodæ, *Ph. Dub.*)

“ Take of Bones, burnt to whiteness, and reduced to

powder, ten pounds; Sulphuric Acid, six pounds; Water, nine pounds. Mix the powder in an earthen vessel with the sulphuric acid; then add the water, and again mix them. Keep the vessel in the vapour arising from boiling water for three days; at the end of which, dilute the matter, by adding other nine pounds of Boiling Water, and strain through a strong linen-cloth, pouring over it gradually, boiling water, until the whole acid is washed out. Put aside the strained liquor, that the impurities may subside, from which pour it off, and, by evaporation, reduce it to nine pounds. To this liquor, again poured off from the impurities, and heated in an earthen vessel, add Carbonate of Soda dissolved in warm water, until the effervescence cease. Then strain, and put it aside, that crystals may form. These being removed, add, if necessary, to the liquor, a little Carbonate of Soda, that the phosphoric acid may be exactly saturated; and prepare it, by evaporation, again to form crystals, as long as these can be produced. Lastly, let the crystals be kept in a vessel well stopt."

The white residuum of burnt bones consists chiefly of phosphate of lime. The sulphuric acid partially decomposes it, by combining with the lime; the phosphoric acid which is disengaged, in conformity to the law of chemical attraction, that quantity of matter influences affinity, and that in all cases where two acids act on a base, there is a participation of this base between them, in proportions determined by their respective quantities and affinities, retains a quantity of lime combined with it,

forming a soluble compound. When carbonate of soda is added to the acidulous liquor obtained by washing the materials, the soda combines with the free phosphoric acid, and the lime retaining as much phosphoric acid in combination as forms neutral phosphate of lime, is precipitated; the phosphate of soda crystallizes on evaporation of the strained liquor. Its crystals are rhomboidal prisms, and are obtained of a regular figure only in crystallizing with a slight excess of alkali. Hence the liquor should be slightly alkaline; and from the tendency of the salt to crystallize with an excess of base, it is necessary, though the neutralization may have been perfect, to add, previous to the second crystallization, a little carbonate of soda. The crystals are efflorescent; they are soluble in little more than three parts of cold, and in half that quantity of boiling water. They consist, according to Thenard, of 19 of soda, 15 of acid, and 66 of water. The taste of this salt is purely saline, without any bitterness; its medicinal operation is that of a mild cathartic, and, from being less nauseous to the taste than the other salts, it is entitled to preference. Its dose is one ounce, given generally dissolved in six ounces of tepid water, or soup.

SULPHAS SODÆ, *olim Sal Glauberi*. Sulphate of Soda.
(Sulphas Sodæ, *Ph. Lond. Dub.*)

“ Dissolve the Acidulous Salt, which remains after the distillation of muriatic acid, in Water; and add to it, Carbonate of Lime in powder, to remove the superfluous acid. Put it aside until the impurities have subsided;

then having poured off the liquor, and strained it through paper, reduce it by evaporation, that crystals may be formed." The London College order the excess of sulphuric acid to be neutralized by carbonate of soda, but it is more economical to use carbonate of lime. Slaked lime is preferable to either, as it decomposes a little muriate of iron, which adheres to the salt.

In the decomposition of murfate of soda by sulphuric acid, to prepare muriatic acid, more sulphuric acid is used than is necessary merely to saturate the soda, advantage being gained from its quantity adding to its affinity, as has been already explained; hence the necessity of removing the excess of acid in the residual mass, to obtain the neutral sulphate. This salt is also obtained as a residuum in some other processes, particularly in the preparation on a large scale of muriate of ammonia, the Sal Ammoniac of commerce. It crystallizes in hexhaedral prisms; they are efflorescent and soluble in rather less than three parts of cold water. They consist of 18.48 of soda, 23.52 of acid, and 58 of water. This salt has long been in use as a cathartic: it operates with sufficient power and certainty, but is liable to occasion nausea, from its very bitter taste. Its medium dose is an ounce and a half.

CARBONAS AMMONIÆ, *olim Ammonia Præparata*. Carbonate of Ammonia. (Carbonas Ammonicæ, *Ph. Lond. Dub.*)

“ Take of Muriate of Ammonia, one pound; Car-

bonate of Lime, commonly called Chalk, dried, two pounds. Each being separately reduced to powder, mix them, and sublime from a retort into a receiver kept cold."

In this process the muriatic acid of the muriate of ammonia combines with the lime of the carbonate of lime, and the carbonic acid of the latter unites with the ammonia of the former; the exertion of these new affinities being determined by the heat applied. The carbonate of ammonia which is formed is sublimed, and is obtained in a crystalline cake. When the process is carried on in the large way, the sublimation is generally performed from an iron pot, to which the heat is directly applied, and which is connected with a large earthen or leaden receiver. The Dublin College, in place of carbonate of lime, direct carbonate of soda to be used; with this the application of so high a heat will not be required; but not being sufficiently economical, the direction will not be attended to by the practical chemists.

According to the experiments of Mr Davy, carbonate of ammonia varies in the proportions of its ingredients according to the heat applied in its preparation; they vary so much as from 20 to 50 parts of ammonia in 100, the ammonia being in larger proportion, as the temperature at which the carbonate has been formed is high; that formed at a temperature of 300° containing 50 parts of alkali, while that produced at a temperature of 60° contains only 20 parts. Still in all these proportions the product is a sub-carbonate; its smell is pungent and am-

moniacal, and it changes the vegetable colours to a green : It is very volatile, abundantly soluble in water, and is efflorescent on exposure to the air. Its medicinal uses are as a stimulant applied to the nostrils in fainting, and as a stimulant and diaphoretic, taken internally, in a dose of from five to fifteen grains.

AQUA CARBONATIS AMMONIÆ, *olim Aqua Ammonia*. Water of Carbonate of Ammonia. (Aq. Carbonatis Ammoniaë, *Ph. Dub.*)

“ Take of Muriate of Ammonia, Carbonate of Potash, of each sixteen ounces; Water, two pounds. To the salts, mixed and put into a glass retort, add the water; then distil from a sand-bath with a fire gradually raised, to dryness.” The Dublin College give the same process with the substitution of Carbonate of Soda for carbonate of potash, by which probably a larger quantity of carbonic acid will be combined with the ammonia.

In this preparation of carbonate of ammonia by the humid way, carbonate of lime, from its insolubility, could not be employed to decompose the muriate of ammonia, as it is in the dry way; an alkaline carbonate is therefore employed. The alkali, whether potash or soda, attracts the muriatic acid, while the ammonia combines with the carbonic acid. The carbonate of ammonia is volatilized and dissolved by the watery vapour. The solution is applied to the same medicinal purposes as the concrete ammoniacal carbonate, and is generally preferred for internal use.

A formula is given by the London College for a similar preparation, under the name of *Liquor Carbonatis Ammoniacæ*, obtained by the solution of the solid carbonate in water. Eight ounces of the carbonate of ammonia are dissolved in a pint of distilled water, and the solution is strained through paper.

LIQUOR VOLATILIS CORNU CERVI. Volatile Liquor of Hartshorn. Pharm. Dub.

“Take of Hartshorn any quantity. Put it into a retort, and distil, with a heat gradually raised, a volatile liquor, salt, and oil. Distil the volatile liquor repeatedly until it become limpid as water, separating, after each distillation, the salt and oil by filtration. The liquor will be purified more easily, if, after each distillation except the first, there be added to it a sixth part of its weight of charcoal, previously made red hot, extinguished by being covered with sand, and reduced to powder while hot. If hartshorn cannot be procured in sufficient quantity, the bones of any land animal may be employed in its place.”

This is a process which has long been employed in Pharmacy. The animal matter, principally the gelatin of the bones, at an elevated temperature suffers decomposition, and its principles enter into new combinations, forming chiefly carbonate of ammonia and empyreumatic oil. These are the products of the process; the carbonate of ammonia being partly dissolved by the water which distils over, and obtained partly in a concrete state. It is always contaminated, however, with the empyreu-

matic oil, which renders it nauseous ; and though at one time it was supposed, from this impregnation, to be possessed of some peculiar virtues, this probably had no just foundation, and it is now rejected from practice. If sublimed from charcoal powder, the oily matter is completely removed ; but then it differs in nothing from the carbonate of ammonia obtained by the preceding processes, and the process, with these repeated operations, is not more economical.

AQUA AMMONIÆ, *olim Aqua Ammonia Caustica*. Water of Ammonia. (Liquor Ammonia, *Ph. Lond.*—Aqua Ammonia Caustica, *Ph. Dub.*)

“Take of Muriate of Ammonia, one pound ; Lime, recently prepared, a pound and a half ; Distilled Water, one pound ; Water, nine ounces. Pour the water upon the lime bruised in an iron or earthen vessel, closing the vessel until the lime, having fallen into powder, has become cold ; then mix the muriate, rubbed to very fine powder, with the lime, rubbing them together in a mortar, and then put them into a retort of the coarser glass, (*bottle glass*). Let the retort be placed in a sand-bath, and connect with it properly the apparatus of Woulfe. In the first bottle, of smaller size than the others, furnished with a tube of safety, put two ounces of distilled water ; and in the second vessel what remains of the distilled water. Then apply the fire, increasing gradually until the bottom of the iron pot is at a red heat, and as long as the ammonia is produced. Mix the liquor

from both bottles, and let it be kept in small phials well stoppt." The directions in the London Pharmacopœia for conducting this process are nearly the same, except that the lime, without being previously slaked, is reduced to powder, and mixed with the muriate of ammonia, and to this mixture put into a retort, a pint of water is added; the lime will then be slaked, but it must be with some risk of the retort breaking from the sudden heat, and the ammoniacal gas must also be very rapidly disengaged. In the formula given by the Dublin College, a large quantity of water is mingled with the materials in the retort, and a portion only of this is drawn off by distillation, impregnated with the whole of the ammonia.

In these processes, the lime combines with the muriatic acid of the muriate of ammonia, and the ammonia is disengaged. Being permanently elastic, it is condensed only by combination with the water, and this is effected either by distilling water at the same time from the materials, or by transmitting the ammoniacal gas through water. The Edinburgh and London Colleges have preferred the latter mode, and they obtain a solution in this way, perhaps more strongly impregnated; the other mode is rather more easily conducted, and affords a product sufficiently strong for any medicinal or pharmaceutical purpose. On a large scale, an iron still is employed, into which the materials are put, and to which the fire can be directly applied; the head of the still being connected with a spiral tube placed in a refrigeratory, to the extremity of which, besides the recipient to collect the

condensed product, two or three receivers are adapted, containing water to absorb any ammoniacal gas.

Water, under a common atmospheric pressure, and at a temperature below 50° , absorbs about one-third of its weight of gas; and by this combination its specific gravity is diminished, that of the saturated solution being not more than 9054. It is seldom so completely impregnated. By following the mode directed by the Dublin College, which is that usually followed, the solution is obtained of the specific gravity of 936; and when of this strength, it contains about 16 of ammonia in 100 parts. Its smell is strong and pungent; its taste extremely acrid, and it inflames the skin. Though its odour is pungent, it ought to be free from any foetor. It is employed in medicine as a stimulant and diaphoretic, internally, in a dose from twenty to thirty drops, and sometimes as an emetic in a larger dose diluted with water. Externally it is used as a stimulant applied to the nostrils, and as a rubefacient.

ALCOHOL AMMONIATUM, *olim Spiritus Ammoniae*. Ammoniated Alcohol. (*Spiritus Ammoniae, Ph. Lond. Dub.*)

“ Take of Alcohol, thirty-two ounces; recently Prepared Lime, twelve ounces; Muriate of Ammonia, eight ounces; Water, eight ounces. From these, prepare the Ammoniated Alcohol in the same manner as the water of ammonia, and preserve it in a similar manner.

This compound used formerly to be prepared by de-

composing the muriate of ammonia by sub-carbonate of potash, and this method is still retained in the Dublin Pharmacopœia. The result of it was, that as carbonate of ammonia is not soluble in alkohol, either the alkohol was impregnated with the portion of ammonia only disengaged by the operation of the excess of alkali in the sub-carbonate on the muriate of ammonia, or that the distillation was carried so far, as to bring over with the alkohol a quantity of water sufficient to dissolve the carbonate of ammonia which had been produced. The Edinburgh College having substituted lime, it disengages the ammonia from the muriate of ammonia altogether in its pure form, and the ammoniacal gas is condensed by the alkohol. The London College order it to be prepared merely by mixing two parts of rectified spirit, and one of water of ammonia; but in this way the alkohol is considerably diluted. Ammoniated alkohol has the pungent smell, and retains all the powers of ammonia. It is used principally as the menstruum of some vegetables with which ammonia coincides in medicinal operation.

ALKOHOL AMMONIATUM AROMATICUM, *olim Spiritus Ammonia Aromaticus*. Aromatic Ammoniated Alkohol. (Spiritus Ammonia Aromat. Ph. Lond. Dub.)

“Take of Ammoniated Alkohol, eight ounces; Volatile Oil of Rosemary, one drachm and a half; Volatile Oil of Lemon, one drachm. Mix them so as to dissolve the oils.” In the London Pharmacopœia, oil of cloves is ordered in place of oil of rosemary; and in the Dublin,

half an ounce of nutmeg, with two drachms of oil of lemons, are digested with two pounds of spirit of ammonia, and afterwards a pound and a half distilled off.

By this combination of ammonia with alcohol, and the addition of the aromatic oils, it is rendered more grateful than the water of ammonia. This preparation is therefore frequently used in preference to the other, as a stimulant in languor or faintness, or to relieve flatulence. Its dose is from fifteen to thirty drops.

ALCOHOL AMMONIATUM FOETIDUM, *olim Spiritus Ammoniaë Foetidus*. Fœtid Ammoniated Alcohol. (Spiritus Ammoniaë Fœtidus, *Ph. Lond. Dub.*)

“Take of Ammoniated Alcohol, eight ounces; Assafoetida, half an ounce. Let them digest in a close vessel for twelve hours; then distil eight ounces by the heat of boiling water.”

The impregnation of the ammoniated alcohol with part of the assafoetida in this process, though it may communicate a fœtid smell, can add little to its activity; and accordingly, though it has a place in all the Pharmacopœias, it is not found in the shops. It has been given in hysteria in a dose of thirty drops.

SPIRITUS AMMONIÆ SUCCINATUS. *Pharm. Lond.* Succinated Spirit of Ammonia.

“Take of Mastich, three drachms; Alcohol, nine fluidrachms; Oil of Lavender, fourteen minims; Oil of

Amber, four minims; Water of Ammonia, ten fluid-ounces. Macerate the mastich in the alcohol, so that it may be dissolved, and pour off the clear solution; add to this the other ingredients, and mix them all by agitation."

Spirit of ammonia, impregnated with oil of amber and some other essential oils, had been in use as a stimulating perfume under the name of Eau de Luce. A composition had been introduced into the London Pharmacopœia as a substitute for this, which had not, however, its usual milky appearance. This is given in the present formula by the addition of the mastich, the resinous matter of which is separated by the water, but retained in a state of suspension, probably by the action of the alkali.

AQUA ACETITIS AMMONIÆ, vulgo Spiritus Mindereri. Water of Acetate of Ammonia. (Liquor Ammoniaë Acetatis, *Ph. Lond.*—Aqua Acetatis Ammoniaë, *Ph. Dub.*)

"Take of Carbonate of Ammonia, any quantity. Pour upon it as much distilled acetous acid, as may be sufficient to saturate the ammonia exactly."

The acetic acid of the distilled vinegar combines with the ammonia of the carbonate of ammonia, disengaging the carbonic acid with effervescence; and the acetate of ammonia being a very soluble salt, remains dissolved in the water. As the distilled vinegar is not uniform in strength, the precise proportion necessary to be added cannot be assigned, but in general it will be about thirty parts to one. As much must always be added as to produce neutralization; and as the liquid is sometimes used as an ex-

ternal application in cases where the acrimony of the alkali would be hurtful, it is better that there should be even a slight excess of acid. From the variable quantity of acid in the vinegar, the preparation cannot be of uniform strength, and this cannot be obviated by crystallizing the salt, the heat decomposing it which would be necessary to evaporate the water. Were it of any importance, a uniformity of strength might be obtained by ordering the quantity prepared from a given weight of carbonate of ammonia to be reduced by slow evaporation to a certain measure; but this is not necessary, the solution having no great activity, and being given generally in divided doses. It is employed as a diaphoretic in febrile affections, an ounce of it being given, and repeated twice or thrice at intervals of an hour, and its operation promoted by mild diluents. Externally it is used as a discutient, and likewise as an application in some forms of inflammation.

HYDRO-SULPHURETUM AMMONIÆ. Hydro-Sulphuret of Ammonia: (Hydro-Sulphuretum Ammonia, *Ph. Dub.*)

“Take of Water of Ammonia, four ounces. Expose it in a chemical apparatus to the stream of gas which arises from Sulphuret of Iron, four ounces; Muriatic Acid, eight ounces, previously diluted with two pounds and a half of Water. The sulphuret of iron for this purpose is conveniently prepared from three parts of Purified Iron Filings, and one part of Sublimed Sulphur, mixed toge-

ther, and exposed in a covered crucible to a moderate heat, until they unite."

The sulphuretted hydrogen is produced in this process by the muriatic acid enabling the iron to decompose part of the water by attracting its oxygen. The hydrogen disengaged combines with a portion of the sulphur, and forms sulphuretted hydrogen; and this elastic fluid being transmitted through the water of ammonia unites with it, and forms a liquid of a dark green colour, and a very foetid odour.

The medicinal applications of hydro-sulphuret of ammonia have been already taken notice of. It depresses the action of the stomach and digestive organs, and has been used from this quality in bulimia and in diabetes, in a dose of from five to ten drops twice a day.

AQUA SULPHURETI AMMONIÆ. Water of Sulphuret of Ammonia. Ph. Dub.

"Take of recently Prepared Lime, Muriate of Ammonia in powder, each four ounces; of Sublimed Sulphur, Warm Water, each two ounces. On the lime in an earthen vessel, sprinkle the water, and cover the vessel until the lime fall to powder. This, when cold, mix by trituration with the sulphur and muriate of ammonia, avoiding the acrid vapour which arises. Put the mixture into a retort, and distil with a strong heat suddenly raised. Keep the liquor thus obtained in a phial closely stopt with a glass stopper."

This preparation is similar to one long known to che-

mists by the name of Fuming Liquor of Boyle, and which Berthollet considered as a hydro-sulphuret of ammonia much concentrated, with an excess of ammonia, to which he ascribed its fuming property. As muriatic acid, when added to it, causes not only a disengagement of sulphuretted hydrogen, but likewise a precipitation of sulphur, it is probably rather a sulphuretted hydro-sulphuret. It has not been applied to any medicinal use.

SULPHAS ALUMINÆ EXSICCATUS, *olim* *Alumen Ustum*.
(Alumen Exsiccatum, *Ph. Lond.* — Alumen Ustum, *Ph. Dub.*)

“ Let Alum be liquefied in an earthen or iron vessel, and exposed to heat, until it cease to boil.”

In this process, the alum loses merely its water of crystallization; it is deprived of its hardness, and resolved into a spongy mass, easily reducible to a fine powder; and both from this, and from being rendered more active, it is better adapted to the purposes of an escharotic, to which it is applied.

LIQUOR ALUMINIS COMPOSITUS. Compound Solution of Alum. *Ph. Lond.*

“ Take of Alum, Sulphate of Zinc, each, half an ounce; Boiling Water, two pints. Dissolve the alum and the sulphate of zinc in water; then strain through paper.”

This forms a strong astringent solution, which has been employed to check hæmorrhage or profuse mucous

discharges; and when considerably diluted, has been used as a collyrium.

MURIAS BARYTÆ. Muriate of Barytes.

“ Take of Carbonate of Barytes, Muriatic Acid, each, one part; Water, three parts. To the water and acid mixed together, add the carbonate, bruised into small pieces. The effervescence being finished, digest for an hour, then strain, and after due evaporation put the liquor aside that crystals may form. Repeat the evaporation as long as there is any formation of crystals.

“ If the carbonate of barytes cannot be procured, the muriate may be prepared from the sulphate, in the following manner :

“ Take of Sulphate of Barytes, two pounds; Wood Charcoal in powder, four ounces. Calcine the sulphate, that it may be the more easily reduced to a fine powder, with which is to be mixed the powder of charcoal. Put this into a crucible, and having adapted a cover, urge it with a strong fire for six hours. The matter being well triturated, put it into six pounds of Boiling Water, in a closed glass or earthen vessel, and mix them by agitation, preventing, as much as possible, the access of the air. Let the vessel stand in a vapour bath, until the part not dissolved has subsided; then pour off the liquor. Pour on the residuum four pounds of boiling water, which, after agitation and subsidence, add to the former liquor. While it is yet hot, or, if it has cooled, having again heated it, drop into it Muriatic Acid as long as effervescence

is excited. Then strain it, and evaporate, that it may crystallize."

The first of these processes is the most easy of execution, the muriatic acid combining with the barytes, and disengaging the carbonic acid with effervescence; the muriate of barytes remaining dissolved, and by evaporation being obtained crystallized. But the native carbonate of barytes being not an abundant mineral production, is not always to be procured: the second process, therefore, is inserted, in which the sulphate, which is a more common fossil, is substituted. In this process, the carbonaceous matter with which it is heated attracts the oxygen of the sulphuric acid; the sulphur remains united with the barytes. This sulphuret of barytes is dissolved by the water, and freed from any undecomposed sulphate; but in dissolving, it is at the same time, like other sulphurets with an alkaline or earthy base, partially changed; a portion of its sulphur attracts oxygen from the water, reproducing sulphuric acid, with which a little barytes unites and is precipitated; the hydrogen of the decomposed water unites with another portion of sulphur, forming sulphuretted hydrogen, which enters into combination with the remaining sulphuret of barytes, and prevents its farther decomposition. When the muriatic acid is dropt in, it combines with the barytes, disengages the sulphuretted hydrogen, and precipitates the sulphur. The solution of muriate of barytes, on evaporation, affords the salt crystallized. This process, though a little complicated, is perhaps preferable to any other, as it must afford the barytic

salt free from any metallic impregnation; for, if any metallic matter be mixed with the sulphate, being reduced by the charcoal, it will not be dissolved in any subsequent step of the process.

SOLUTIO MURIATIS BARYTÆ. Solution of Muriate of Barytes.

“Take of Muriate of Barytes, one part. Distilled Water, three parts. Dissolve.”

The muriate of barytes was introduced by Dr Crawford as a remedy in scrofulous affections, as has been already stated under the class of tonics, to which it belongs. This saturated solution is designed to afford a preparation of uniform strength,—a circumstance of importance, as from the activity of the medicine its dose requires to be regulated with some care. Five drops are given twice a day, and gradually increased to twenty or more.

CARBONAS CALCIS PRÆPARATUS, *olim Creta Præparata et Cancrorum Lapilli, vulgo Oculi Cancrorum Præparati.* Prepared Carbonate of Lime, formerly Prepared Chalk, and Prepared Crabs Stones, commonly called Crabs Eyes.

“Carbonate of Lime, whether the softer variety, commonly named Chalk, or the harder, called Crabs Stones and Crabs Eyes, after being rubbed to powder in an iron mortar, and levigated with a little water on a porphyry stone, is to be put into a large vessel. Water is to be poured upon it, and after the vessel has been frequently

agitated, it is to be poured off, loaded with the fine powder. On the water remaining at rest, a subtile powder subsides, which is to be dried. The coarse powder which the water could not suspend, is to be again levigated, and treated in the same manner." The same directions nearly are given for the preparation of chalk, by the London College; the crabs claws and concretions they have rejected, retaining in place of them, as purer than the chalk, Prepared Shells, the process for obtaining which has been already given (page 13.) The directions given by the Dublin College for the preparation of chalk are also similar; and they have likewise admitted Prepared Oyster Shells, and Prepared Egg Shells, (*Ovorum Testæ Præparatæ*, *Ostrearum Testæ Præparatæ*;) these being prepared as chalk.

Chalk is a native carbonate of lime, seldom perfectly pure, but containing often portions of argillaceous and siliceous earths. The crabs stones are concretions found in the stomach of the river craw-fish, (*Cancer Astacus*). They are collected when the animal is in a putrid state, are washed and dried. They have the advantage of being free from any gritty particles, and form therefore a smoother powder. They consist of carbonate and phosphate of lime, with a portion of gelatin; the proportion of carbonate being about seventy, of phosphate ten or twelve. The shells are of similar composition; but for all these, there is generally substituted in the shops merely chalk prepared with more care, and having a little gelatin diffused through it. They are used as antacids.

POTIO CARBONATIS CALCIS, *olim Potio Cretacea*. Potion of Carbonate of Lime.

“Take of Prepared Carbonate of Lime, an ounce; Refined Sugar, half an ounce; Mucilage of Gum Arabic, two ounces. Rub them together, and then add gradually, Water, two pounds and a half; Spirit of Cinnamon, two ounces. Mix them.”

This is similar to the chalk mixture of the other Pharmacopœias, already noticed, and is merely a convenient form for exhibiting carbonate of lime.

CRETA PRÆCIPITATA. Precipitated Chalk. Ph. Dub.

“Take of Solution of Muriate of Lime, any quantity. Add to it, of Carbonate of Soda, dissolved in four times its weight of warm distilled water, as much as may be sufficient to precipitate the chalk. Render the precipitate pure, by allowing it to subside three times, and washing it each time with a sufficient quantity of water. Then collect it, and dry it on a chalk stone or bibulous paper.”

In this process, the muriate of lime is decomposed by double affinity, the muriatic acid being attracted by the soda, and the carbonic acid combining with the lime. It affords a pure carbonate of lime, but is scarcely of sufficient importance to be received as an officinal preparation.

CALX. Lime. Ph. Lond.

“Take of Limestone, a pound. Bruise it into small pieces, and calcine these in a crucible with a very strong

fire for an hour, or until the carbonic acid is entirely expelled, so that acetic acid, when added, shall not disengage any bubbles of air. In the same manner, lime may be prepared from shells, after these have been washed in hot water, and freed from their impurities."

There is little advantage in the introduction of this process; lime prepared on the large scale, for the numerous uses to which it is applied, being sufficiently pure for any medicinal purpose, especially as, when it is internally administered, it must always be given in solution; and in the state in which it is usually met with, it impregnates water just as strongly as lime in its purest state.

AQUA CALCIS. Lime Water. (Liquor Calcis, *Ph. Lond.*
—Aqua Calcis, *Ph. Dub.*)

"Take of Lime recently prepared, half a pound: Put it into an earthen vessel, and sprinkle upon it, four ounces of water, keeping the vessel closed while the lime becomes hot, and falls into powder; then pour on it twelve pounds of water, and mix them by agitation. After the lime has subsided, repeat the agitation; and do so about ten times, keeping the vessel always shut, that the free access of the air may be prevented. Let the water be strained through paper, interposing between the filter and the funnel glass rods, that the water may pass through as quickly as possible. Let it be kept in bottles well stoppt."

Lime is sparingly soluble in water; not more than

$\frac{1}{1000}$ th being dissolved, at 60°. Yet, notwithstanding this small quantity, the water has a strong styptic taste, and changes the vegetable colours to a green. The caution to exclude the air in this process, arises from the supposition that the lime would combine rapidly with the carbonic acid of the atmosphere. After the solution is strained, it is at least necessary that it should be kept in vessels well stopt. Lime water is the form under which lime is always used internally. It is employed as a tonic, astringent, and antacid in dyspepsia, chronic diarrhœa, and leucorrhœa. Its dose is from one to two pounds daily.

AQUA CALCIS COMPOSITA. Compound Lime Water.
Ph. Dub.

“Take of Guaiac Wood in shavings, half a pound; Liquorice Root cut and bruised, an ounce; Bark of Sassafras bruised, half an ounce; Coriander Seeds, three drachms; Lime Water, six pints. Macerate them without heat for two days, and strain.”

The lime water can derive very little additional power from these ingredients, and they, on the other hand, must have their powers very imperfectly extracted. The preparation is one, therefore, which can have little activity.

SOLUTIO MURIATIS CALCIS. Solution of Muriate of Lime. (Aqua Muriatis Calcis, *Ph. Dub.*)

“Take of Pure Carbonate of Lime (namely White Marble), in small pieces, nine ounces; Muriatic Acid,

sixteen ounces; Water, eight ounces. Mix the acid with the water, and add gradually the pieces of carbonate of lime. The effervescence being finished, digest for an hour. Pour off the liquor, and reduce it by evaporation to dryness. Dissolve the residuum in its weight and a half of water, and strain."

The muriatic acid combines with the lime, and disengages the carbonic acid. To remove any superfluous acid, and obtain a solution of uniform strength, the solid salt is obtained by evaporation, and is then dissolved in a fixed proportion of water. The solution of muriate of lime has been recommended as a tonic, similar, and not inferior to the muriate of barytes. The dose is from fifteen to twenty grains of the dried salt, or thirty drops of the solution.

CARBONAS MAGNESIÆ, olim Magnesia Alba. Carbonate of Magnesia.

"Take of Sulphate of Magnesia, Carbonate of Potash, of each equal weights. Let them be dissolved separately in twice their weight of warm water, and either strained or otherwise freed from impurities. Then mix them, and immediately add eight times their weight of boiling water. Boil the liquor for a short time, stirring it, then allow it to remain at rest, until the heat be diminished a little, and strain it through linen, on which the carbonate of magnesia will remain. Wash it with pure water, until it be perfectly tasteless."

In this process there is a mutual decomposition of the

salts, the sulphuric acid of the sulphate of magnesia combining with the potash of the carbonate of potash, and the carbonic acid uniting with the magnesia. The use of adding the boiling water, and boiling the liquor, is, partly to dissolve the sulphate of potash, which is a salt sparingly soluble, and partly to prevent a species of crystallization which the carbonate of magnesia would undergo, rendering it gritty, and thus give it a smoothness which it has not when this precaution is not observed. Carbonate of magnesia, however, is generally prepared on a large scale from the Bittern, or liquor remaining after the crystallization of muriate of soda from sea-water, which is principally a solution of muriate of magnesia. This is decomposed by carbonate of potash, or sometimes by an ammoniacal carbonate, and there are some niceties of manipulation requisite to give it the whiteness, lightness, and smoothness, which are valued as marks of its goodness. Hence it is superior in these qualities to what it would be were it prepared by the above process on a small scale.

Carbonate of magnesia, properly prepared, is nearly insipid; it is extremely light, white, and smooth to the touch; is insoluble in water. It consists of from 45 to 55 of magnesia, from 25 to 48 of carbonic acid, and from 15 to 30 of water. What appears to be the neutral carbonate, obtained in crystals by mixing the saline solutions without applying heat, consists of 25 of magnesia, 50 of acid, and 25 of water. The common preparation is therefore a sub-carbonate. It is given as an ant-

acid in a dose from a scruple to a drachm, and usually produces at the same time a laxative effect.

MAGNESIA, *olim Magnesia Usta.* Magnesia.

“ Let Carbonate of Magnesia be exposed in a crucible to a red heat, for two hours. Then preserve it in glass phials well stopt.”

By the heat thus applied, the carbonic acid of the carbonate, and a considerable portion of its water, are expelled, and the pure magnesia remains. It loses about half its weight. A smaller quantity, therefore, of the pure magnesia, will produce the same effect as a larger of the carbonate. It is preferred to the latter, both from this circumstance, and also, where, from the abundant acidity on the stomach, flatulence is occasioned by the disengagement of carbonic acid when the carbonate is employed.