METALLIC PREPARATIONS.

THE pure metals exert no action on the animal system; for, although iron be given in its metallic state, yet it must be changed by acid in the stomach before it can prove active as a remedy. Tin operates only by mechanical attrition; and mercury, which has also been given internally in the metallic form, on mistaken principles, cannot act otherwise than as a mechanical body: but when metals suffer oxidizement, or are changed by acids to the state of salts, they constitute a class of remedies of great activity and importance. The following are

a. employed as remedies in a metallic state,

TIN, MERCURY?

b. variously combined with oxygen, acids, sulphur, &c.

SILVER,	IRON.	BISMUTH,
MERCURY,	LEAD,	ANTIMONY,
COPPER,	ZINC,	ARSENIC.

The union of oxygen with a metallic base is denominated oxidizement, and the resulting compound an *oxide*. This combination, for medicinal purposes is effected in four ways: 1. By the action of atmospheric air, aided by an increased temperature; 2. By deflagration with nitrate of potash; 3. By the action of water; and, 4. By solution in an acid, the acid being afterwards abstracted by an alkali, or some substance for which it has a greater affinity than it has for the oxide of the metal. In whatever manner the oxidizement is effected, metals in changing to oxides lose their lustre, tenacity, inflammability, and other metallic properties; and are gradually converted into earthy-like substances, the weight of which is greater than that of the portion of metal employed. Different metals combine with different quantities of oxygen, which is even the case with the same metal; and as a striking alteration of properties, particularly of colour, marks the maximum and minimum of oxidizement, this is taken advantage of in naming the oxides: thus *black oxide of iron* is iron in its lowest degree of oxidizement; *red oxide of iron*, the metal in its highest degree of oxidizement. There are intermediate degrees, however, which cannot be correctly expressed in language from the colour alone; and consequently the nomen-

clature of this division of preparations is defective.[1] Some metals are capable of so high a degree of oxidizement as to acquire acid properties, which is so particularly the case with the white oxide of arsenic, that it is regarded as an acid by several chemists. The activity of the oxides of metals on the animal system appears to be regulated, with a few exceptions, by the quantity of oxygen with which they are combined; and therefore, as Dr. Murray has justly observed, "when a process for the preparation of any metallic oxide has once been established, and practitioners have become accustomed to its powers and strength, the process ought not to be varied or changed, from the idea of some trivial improvement; as an alteration of circumstances, apparently of little importance, may give rise to a very important change in the result. And it is nearly demonstrable, that the oxides of a metal formed by different processes, as, for example, by a process conducted in the humid way, or by one with the application of heat, cannot be precisely the same."[2]

Besides the above effects of oxidizement on metals, it renders them capable of uniting with acids, and forming soluble salts. The METALLIC SALTS, therefore, are oxides combined with acids; and this is the case, whether an oxide previously prepared be dissolved in an acid, or whether the salt be the product of the direct solution of a metal in an acid. In the latter case, the metal first gains oxygen either from a part of the acid itself, or from the water, or the air, which it decomposes; and the oxide thus formed is then dissolved by the remainder of the acid. The properties of the metallic salts are much varied by the previous degree of oxidizement of the metals; and this is a point, the fixing of which in pharmaceutical operations is of the first practical importance; for, if in all the indefinite degrees of oxidizement the metallic oxides combine with acids, the resulting salts must vary in as many shades as exist between the maximum and minimum of oxidizement. In the preparation of the metallic salts, therefore, the same strict attention is requisite in following one established and approved process.

No part of chemical and pharmaceutical language is so faulty as the nomenclature of the metallic salts. Thus, although there is no instance of a direct combination of a metal

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[1] Dr. Thomson has endeavoured to remedy this defect by introducing the term *protoxide* to signify the lowest degree of oxidizement; *peroxide* the highest; and *deutoxide*, *tritoxide* &c. the intermediate degrees.

[2] *System of Mat. Med.* ii. 253.

with an acid, yet we have *sulphate of iron*, *nitrate of silver*, *muriate of mercury*, &c.; and to express the combination of the metallic oxides containing a maximum of oxygen, with acids, the syllables *oxy* are prefixed, as *oxysulphate of iron*, *oxynitrate of silver*, *oxymuriate of mercury*, &c. a generic term, which can be properly applied only to denote the compounds of oxymuriatic acid with salifiable bases.

The prefixing the terms *sub* and *super* to denote the quantity of acid below or above the point of perfect neutralization in any salt, is not objectionable in a chemical point of view: but for medicinal purposes this mode of distinguishing salts which have the most marked difference in their active properties, by the alteration or the addition of a syllable only, may be productive of the worst consequences: and therefore it is the more remarkable, that the latter terms are employed in all the British pharmacopœias to denote preparations betwixt which there is very little relationship, and which cannot be converted into each other by any subtraction or addition of acid. The illustration of these observations will be found under the individual Preparations.

Many of the metallic salts are altered by exposure to the atmosphere; some effloresce and attract oxygen; some are altered in their properties by moisture; and others are reduced by the action of light: hence, all of them ought to be kept in well stopped glass bottles; and perhaps these always should be either made of green glass, or otherwise rendered opaque. In compositions which require these salts to be dissolved in water, *distilled* or *filtered rain-water* should always be employed, and much attention is requisite to avoid combining them with incompatible substances, which may either chemically decompose them, or alter their medicinal properties.

Sulphur also combines with the metals and their oxides; but its affinity for the former is greater, and hence there are more *metallic sulphurets* than *sulphuretted metallic oxides*. Metallic sulphurets are also formed, when sulphuretted hydrogen gas is thrown into the acid solutions of those metals which have a weak affinity for oxygen: and, as the metallic solutions differ greatly in the degree of facility with which they are thus decomposed, sulphuretted hydrogen gas may be employed, as Proust has shown, for separating different metals held together in the same solutions. The metallic sulphurets are more used for pharmaceutical purposes than as remedies, their dose not being easily appreciated, and their effects uncertain.

PREPARATIONS OF ANTIMONY.

SULPHURETUM ANTIMONII PRÆPARATUM.

Edin.[1] *Prepared Sulphuret of Antimony.*

"Put sulphuret of antimony, rubbed to powder in an iron mortar, and levigated with a little water, upon a porphyry stone, into a large vessel; then pour water on it, and, after frequently agitating the vessel, pour it off loaded with the fine powder.

"The coarse powder, which the water cannot suspend, is to be again levigated, and treated in the same manner."

Dublin.

"Let it be reduced to powder, and separate for use the very fine particles, in the manner directed for the preparation of chalk."

This mechanical preparation is intended to fit the sulphuret for internal use.

Qualities.—Prepared sulphuret of antimony is an inodorous, insipid, blackish, or deep leaden gray dull powder, which stains the fingers, and is insoluble in water.

Medical properties and uses.—It is inert, unless it meets with acid in the stomach, in which case it usually operates either as a diaphoretic or mild cathartic, but occasionally produces excessive vomiting and purging; and hence it is proper to evacuate the stomach and bowels previous to its use. It has been found efficacious in scrophula, chronic rheumatism, and herpetic eruptions. The dose is from grs. v to ʒj, mixed with honey or any convenient vehicle.

Officinal preparations. *Oxydum Antimonii.* L. D. *Antimonii Sulphuretum præcipitatum.* L. E. D. *Pulvis antimonialis.* L. E. D.

ANTIMO'NII OX'YDUM. Lond. *Oxide of Antimony.*

"Take of tartarized antimony, *one ounce;* subcarbonate of ammonia, *two drachms;* distilled water, *as much as is requisite.* Dissolve the salts separately in the water, then mix the solutions, and boil the mixture until the oxide of antimony is precipitated. Having poured off the water, wash the precipitate with repeated additions of water, and dry it."

In this process, the ammonia of the subcarbonate decomposes the tartrate of antimony, and forms, with its tartaric acid and the tartrate of potash, a ternary salt, which remains in solution in the water employed, while the oxide of antimony is precipitated. This precipitate is a white protoxide of antimony,

[1] Sulphure d'Antimoine (*F.*) Schwazer Schwefelspeiss-glanz (*G.*) Solfuro d'antimonio depurato (*I.*) Kohul (*Arab.*) Surmah (*Hind.*)

the medium oxide of Thenard, containing 0·20 of oxygen in 100 parts.

Use.—This preparation is violent in its action, and thence should be exhibited with caution: but, as a remedy, it is not ever likely to be much employed; and as it is not essential for the composition of any other preparation, it might be dispensed with.

ANTIMO'NII SULPHURE'TUM PRÆCIPITA'TUM.[1] Lond. *Præcipitated Sulphuret of Antimony.*

"Take of sulphuret of antimony in powder, *two pounds*; solution of potash, *four pints*; distilled water, *three pints*. Mix them, and boil the mixture over a gentle fire for three hours, assiduously stirring it, and occasionally adding distilled water, so that the same measure may be kept up. Strain the solution directly through a doubled linen cloth; and, while it is still hot, drop in gradually as much sulphuric acid as may be necessary for precipitating the powder; then wash away the sulphate of potash with hot water, dry the precipitated sulphuret of antimony, and rub it to a fine powder.

SULPHURETUM ANTIMONII PRÆCIPITATUM. Edin.

"Take of solution of potash, *four parts*; water, *three parts*; prepared sulphuret of antimony, *two parts*; diluted sulphuric acid, *a sufficient quantity*. Mix the sulphuret with the solution of potash and the water, then boil them in a covered iron pot over a gentle fire for three hours, frequently stirring with an iron spatula, and adding water as it may be required. Strain the hot liquor through a doubled linen cloth, and add to it when strained as much diluted sulphuric acid as may be necessary for precipitating the sulphuret, which must be well washed with warm water."

SULPHUR ANTIMONIATUM FUSCUM. Dub. *Brown antimoniated Sulphur.*

"Take of subcarbonate of kali, prepared sulphuret of antimony, each *one ounce*. Having mixed them, melt the mixture in a crucible, and when it is cold, reduce it into powder. Put it into a matrass with four pints of water, and boil for a quarter of an hour; then remove the vessel from the fire, and cover it; let it rest a little; and when the liquor becomes limpid, cautiously decant it from the sediment. The antimoniated sulphur will partly separate as the liquor cools; add as much diluted sulphuric acid as will precipitate the whole of it, which takes place

[1] Formerly, *Sulphur Antimonii præcipitatum*, *Sulphur auratum Antimonii*. In strict compliance with the principles of the new nomenclature, the present name should be *Hydrosulphuretum Oxidi Antimonii*.—Murray. Soufre doré d'antimoine (*F.*) Gelber Spiessglanzschwefel (*G.*) Zolfo dorato di antimonio (*I.*)

with an excess of acid: then agitate the mixture, in order that the latter precipitate (which is of an orange colour) may be mixed with the rest; and after allowing it to subside, pour off the liquor from the sediment, which is to be washed with cold water as long as litmus indicates the presence of acid in the effused fluid. Finally, dry it upon bibulous paper."

Although the last of these formulæ differs from the two former, their products are the same,—a sulphuretted hydrosulphuret of oxide of antimony. The following is the theory of its formation. During the boiling, the potash combines with the sulphur of the sulphuret of antimony, and forms sulphuret of potash; which decomposing part of the water, and attracting its disengaged hydrogen, is partly converted into a sulphuretted hydrosulphuret of potash, while its oxygen, aided by the sulphuretted hydrogen, oxidizes the antimony, which is dissolved by the sulphuretted hydrosulphuret of potash. The sulphuric acid, which is now added to the strained solution, combines with the potash, disengaging sulphuretted hydrogen gas, and the oxide of antimony is precipitated combined with the disengaged sulphur and the remaining sulphuretted hydrogen. In the Dublin process, the precipitate thrown down whilst the decanted liquor cools is a powder of a brick-red colour, the well-known *kermes mineral*[1], which is the oxide of antimony in union with such portions of sulphur and sulphuretted hydrogen only as it can attract; while the precipitate, afterwards thrown down by the acid, is the old *Sulphur auratum Antimonii*, or a hydrosulphuret of antimony with an excess of sulphur; and hence, by agitating the mixture, a compound, or intermediate product, is obtained, which is the sulphuretted hydrosulphuret of the oxide, as in the former cases. According to Thenard, the oxide in these two powders is in a different state of oxidizement; an opinion, however, which is at least very problematical. The following are the proportions of their constituents given by him: *Kermes mineral* consists of 72·760 parts of brown oxide of antimony, 20·298 of sulphuretted hydrogen, 4·156 of sulphur, and 2·786 of water and loss: *Golden Sulphur of Antimony* contains 68·30 of orange oxide of antimony, 17·877 of sulphuretted hydrogen, 12·00 of sulphur, and 1·823 of water and loss — in 100 parts.[2] But the real difference appears to consist in the larger portion of sulphur thrown

[1] This powder, although now discarded from the pharmacopœias, was long a celebrated remedy. It was discovered by Glauber, and hence named *Panacea Glauberiana*; and the process kept secret until the French Government published it in 1720, having purchased it from one La Legerie, a surgeon, to whom it had been communicated by a pupil of Glauber.

[2] *Annales de Chimie*, xxxii. 268.

down with the *golden sulphur*; the base being the same in both, as stated by Trommsdorff.[1]

Qualities. — The precipitated sulphuret of antimony, as it is called, is an orange-coloured powder, slightly styptic to the taste, inodorous, and insoluble in water. It readily catches fire, and burns with a blue and greenish flame, exhaling the odour of sulphurous acid, and leaving the metal, after the combustion, in the form of a grayish white oxide.

Medical properties and uses. — This preparation of antimony is diaphoretic and expectorant. It was formerly much employed in asthma, and in catarrhal affections; but it is uncertain in its operation, and is not much employed in modern practice; unless when combined with mercurials, when it forms a useful alterative in herpetic and other eruptions. The dose is from gr. j. to grs. iv. in a pill, twice a day.

Officinal preparation. *Pilulæ Hydrargyri submuriatis comp.* L.

ANTIMONIUM TARTARIZATUM. Lond. *Tartarized Antimony.*[2]

"Take of powdered sulphuret of antimony, *two ounces*; nitrate of potash, *one ounce*; supertartrate of potash, *two ounces*; sulphuric acid (by weight), *two ounces*; distilled water, *one pint and a half.* Mix the acid with the water in a glass vessel, and heat the mixture in a sand-bath. When it is moderately warm, add by degrees the sulphur and the nitre previously mixed together, then strain, and boil until all the moisture is consumed. Wash the residue with distilled water, until it remains tasteless, and while it is yet moist mix with it the supertartrate of potash, and throw the whole into a pint of distilled water; finally boil the solution and set it aside to crystallize."

TARTRAS ANTIMONII; olim, TARTARUS EMETICUS. Edin. *Tartrate of Antimony*, formerly *Tartar Emetic.*

"Take of sulphuret of antimony, and nitrate of potash, each, an *equal weight*; supertartrate of potash, a *sufficient quantity.* Triturate separately the sulphuret and the nitre, and having mixed them well together, throw them into a red-hot crucible. When the deflagration is finished, separate the red matter from the white crust, and rub it into a very fine powder, which must be washed with several effusions of warm water; and afterwards dried.

"This powder is now to be rubbed together with an equal weight of supertartrate of potash, and the mixture boiled in a glass vessel, with four times its weight of distilled water for

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[1] *Annales de Chimie*, xxxiv. 132. The quantity of the sulphuretted hydrosulphuret is much increased, by adding to the sulphuret of antimony a small portion of sulphur.

[2] Tartrate de potasse antimonié (*F.*) Spiessglanz-weinstein (*G.*) Tartaro Antimoniato (*I.*)

an hour; then strained through paper, and the strained solution set aside to deposit crystals by evaporation."

TARTARUM ANTIMONIATUM, sive EMETICUM. Dub. *Antimoniated* or *Emetic Tartar.*

"Take of nitro-muriatic oxide of antimony, *two ounces;* crystals of tartar, rubbed to a very fine powder, *two ounces and a half;* distilled water, *eighteen fluid ounces.* Boil the water in a glass vessel; then gradually throw into it the oxide and the tartar previously mixed together, and boil the mixture for half an hour; then filter the solution through paper, and allow it to crystallize by slow cooling."

By all these methods a little modified crystallized tartar emetic may be prepared. With regard to the formula of the London College, the instructions for conducting the process are such as are likely to mislead any one not much accustomed to think on chemical phenomena. Thus it is not perfectly apparent whether the fluid which passes the filter, or the residue which remains on it, is to be boiled to dryness. The direction as I have stated in another quarter [1] should be "tum cola, et reliquum super chartam bibulam calore exsicca, &c." After repeated trials we have found the following circumstances necessary to be attended to to insure success. In the first place the sulphuret of antimony must be very finely pulverized in an iron mortar, then well mixed with the nitrate of potash, also reduced to a fine powder, and the mixed powders added by degrees to the mixture of the acid, with the whole of the water heated to 180°, and kept in this temperature for some time after all the powder has been added; the supernatant fluid is then to be decanted off, and the residuum washed with distilled water until the fluid comes off tasteless. We have found no advantage from drying the residuum; but while it is yet moist with the last washing, the supertartrate of potash should be added; and after stirring them well together, the whole thrown into a pint of distilled water. The mixture is then to be boiled for half an hour, filtered whilst it is hot, and the fluid set aside in a flat vessel to crystallize. When the solution has been boiled too long, the crystallization is very irregular.

The following is the probable theory of the changes which take place during the process we have described: — The nitrate of potash is decomposed by the sulphuric acid, as is demonstrated by the extrication of nitrous gas; and part of its oxygen being expended upon the oxide of the sulphuret. This is converted into protoxide of antimony; while, perhaps also at the same time, the sulphur is partly converted

[1] *Lond. Med. Repository*, vol. iv. p. 131.

into an acid. Sub-sulphate of antimony is then formed by the action of part of the acid on the protoxide, which has a grayish appearance when washed, and is in a state fit to be acted upon by the tartaric acid of the supertartrate of potash, and form the ternary salt.

The theory of the other two processes is sufficiently obvious. The superabundant acid of the supertartrate of potash combines with the oxide of antimony, forming a triple salt, or a tartrate of antimony and potash; which, on the principles of the reformed nomenclature, should be the pharmaceutical name of this salt.

It must be regretted that all the Colleges have not concurred in adopting the same preparation of antimony for the formation of this important salt.

Qualities. — Tartrate of antimony and potash is procured in small rectangular trihedral crystals, of a white colour, inodorous, nearly insipid, and efflorescent. It should be bought in crystals; and to ascertain its purity, a few of these should be put into a dilute solution of *ammoniæ sulphuretum*, when their goodness may be judged of by the quantity of orange-coloured precipitate that forms. It is soluble in about 15 parts of water at 60°, and in 2 parts at 212°, forming when the salt is good a perfectly clear transparent solution. It is spontaneously decomposed when kept in aqueous solution; and is also decomposed by heat, the strong acids, the alkalies and alkaline carbonates, the earths, hydrosulphurets, some of the metals, and by the decoctions or infusions of many bitter and astringent vegetables, with which therefore it ought never to be conjoined in extemporaneous prescription. According to the analysis of Thenard [1], its constituents are 35·4 of tartaric acid, 39·6 of oxide, 16·7 of potash, and 8·3 of water; but these proportions must necessarily vary with the different modes of preparation.

Medical properties and uses. — This triple salt is emetic, diaphoretic, expectorant, alterative, and rubefacient; and it operates also sometimes as a cathartic. It is certainly the most important of the antimonial preparations, and when the dose is properly apportioned may supersede the use of all the others. It is given as an emetic in the commencement of fevers, in doses of from one to two grains dissolved in distilled water. To obtain its diaphoretic effect, the dose is from $\frac{1}{16}$th to $\frac{1}{4}$th of a grain; and the same or a smaller dose combined with squill, ammoniacum, and camphor, and repeated every three hours, operates as an expectorant. In very minute doses combined with calomel, it is a powerful al-

[1] *Annales de Chimie*, xxxviii. 39.

ternative in many cutaneous diseases; and when ʒiij of it are triturated with ʒj of lard into an ointment, and applied to the skin, it occasions a local pustular eruption, and hence has proved very serviceable in mania, white swellings, and deep-seated inflammations as a counter irritant.

When taken in large doses tartar-emetic acts as a corrosive poison, producing violent vomiting, hiccup, a sensation of burning in the stomach, colic, hypercatharsis, syncope, difficult respiration, convulsions, and death. The treatment, when assistance is demanded in time, consists in carrying the poison out of the stomach by bland, oily liquids freely taken; after which decoction of yellow bark should be freely administered, with opium and local bleedings.

Officinal preparations. *Liquor Antimonii tartarizati.* L. *Vinum Tartritis Antimonii.* E.

LI'QUOR ANTIMO'NII TARTARIZA'TI. Lond. *Solution of Tartarized Antimony.*[1]

"Take of tartarized antimony, *a scruple;* boiling distilled water, *four fluid ounces;* wine, *six fluid ounces.* Dissolve the tartarized antimony in the boiling distilled water; then add the wine."

VINUM TARTRATIS ANTIMONII. Edin. *Wine of Tartrate of Antimony.*

"Take of tartrate of antimony, *twenty-four grains;* Spanish white wine, *one pound.* Mix, so that the tartrate of antimony may be dissolved."

These solutions, when newly made are equal in point of strength, fʒj of each containing grs. ij. of tartarized antimony; but the London preparation soon becomes considerably weaker, the large proportion of water employed facilitating the spontaneous decomposition of the salt, which falls to the bottom of the vessel in which the solution is preserved, in the form of a grayish powder. The same circumstance occurs in a smaller degree in the Edinburgh preparation; and therefore the intention of these processes (the obtaining a solution of a determinate strength to afford a ready mode of administering tartarized antimony in very minutely divided doses) is thus in some respects frustrated. The precipitate appears to be an oxide of antimony, with a portion of supertartrate of potash; arising, perhaps from the potash attracting tartaric acid from the wine, and thus breaking the affinity which retains it as a component of the antimonial salt.

Medical properties and uses. — These solutions are diaphoretic or emetic, according to the extent of the dose. In doses of mx to fʒj in any proper vehicle, repeated every three or

[1] Vinum Antimonii tartarizati. P. L. 1787.

four hours, it usually excites diaphoresis, and is given with this view in the same complaints as the tartarized antimony; but it is principally used as an emetic for infants, a teaspoonful being given every five minutes until vomiting be excited.

PULVIS ANTIMONIA'LIS. Lond. *Antimonial Powder.*

"Take of sulphuret of antimony in powder, *a pound*; hartshorn shavings, *two pounds*. Mix, and throw them into a broad iron pot heated to whiteness, assiduously stirring until the mixture acquire an ash-colour. Take them out, and pulverize them; and then put them into a coated crucible, over which another crucible having a small hole in its bottom is to be inverted and luted. Then place it over the fire, which is to be gradually raised, so that it may continue at a white heat for two hours. Triturate the residue into very fine powder."

OXIDUM ANTIMONII CUM PHOSPHATE CALCIS; olim, PULVIS ANTIMONIALIS. Edin. *Oxide of Antimony with Phosphate of Lime*; formerly *Antimonial Powder.*

"Take of sulphuret of antimony in coarse powder, hartshorn shavings, each *equal parts*. Mix, and throw them into a wide iron pot heated to redness, and stir them assiduously until they are burnt into a matter of a gray colour, which remove from the fire, rub to powder, and put into a coated crucible, over which another crucible having a small hole in its bottom is to be inverted and luted: then apply the fire, which is to be gradually raised to a white heat, and kept at this increased heat for two hours. Finally, reduce the matter when it is cold to a very fine powder."

PULVIS ANTIMONIALIS. Dub. *Antimonial Powder.*

"Take of sulphuret of antimony in coarse powder, hartshorn shavings, each *two pounds*. Boil the hartshorn in a sufficient quantity of water to separate the gluten; then dry it, and mix it with the antimony. Throw the mixture into a wide iron pot heated to redness, assiduously stirring until the sulphurous vapours cease to be extricated, and the matter acquire a gray colour. Rub the mass to powder when it is cold, and put it into a coated crucible; over which invert another crucible having a small hole in its bottom, and lute the two firmly together. Roast the matter with a heat gradually raised to whiteness for the space of two hours; and lastly, when it is cold, grind it to a very fine powder."

In these processes, by the first exposure of the materials to the action of heat, the gelatin and the other principles of the hartshorn, except the phosphate of lime, are decomposed and dissipated; the sulphur of the sulphuret of antimony is at the same time expelled, and the metal is partially oxidized, the

oxidizement being favoured by the shape of the vessel and frequent stirring. By the subsequent application of heat, the oxidizement of the metal is rendered more complete, and the oxide is partially vitrified; but whether the phosphate of lime is merely mechanically mixed with the oxide, or the lime yields up part of the phosphoric acid to it, and a ternary compound of phosphate of lime and antimony be thus produced, is uncertain. From the experiments of Chenevix, however, the former supposition seems to be more probable. In the Dublin formula the boiling of the hartshorn shavings ordered is unnecessary, as the heat effectually decomposes the gelatin, which is the only part of them that can be extracted by the boiling. The change in the proportions of the ingredients, and consequently the strength of the preparation, ordered in the present London Pharmacopœia, is to be regretted. Indeed we cannot discover how the change can render the exhibition of it more manageable[1]; and an active preparation, which has long been used, and found to answer the intentions for which it is prescribed, ought not to be hastily altered for any trivial advantage supposed likely to result from the alteration.

From the uncertainty of uniformity in a preparation by the agency of fire, Mr. Chenevix has proposed the substitution of a powder prepared according to the following formula: Let equal parts of white oxide of antimony and of phosphate of lime be dissolved in the smallest possible quantity of muriatic acid, and pour the solution into a sufficient quantity of distilled water containing pure ammonia in solution. A powder precipitates, which is a mechanical mixture of submuriate of antimony and phosphate of lime.[2] The process by heat, however, is still continued in the pharmacopœias, from a desire of imitating, as closely as possible, the celebrated empirical preparation of Dr. James, "James's Powder," as a substitute for which this preparation was first introduced; and which, according to the analysis of Dr. Pearson, consists of 43 parts of phosphate of lime, and 57 of oxide of antimony, in 100 parts.[3]

Qualities.— The antimonial powder of the pharmacopœias is inodorous and insipid, of a dull white colour, insoluble in water, and only partially soluble in acids; in this particular differing from the powder of Chenevix, which is soluble in every acid that can dissolve either of its components.

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[1] *Powel's Translation of the London Pharmacopœia*, 107. [2] *Phil. Mag.* xi. 110.

[3] *Phil. Trans.* lxxxi. 317. Another analysis of this powder has been published lately by M. Pully, an Italian chemist, who gives the following as its constituents: seven parts of protoxide of antimony, four of phosphate of lime, four and a half of sulphate of potash, and three and a half of potash, holding in solution protoxide of antimony. *Annales de Chimie*, lv. 74. *Thomson's Chemistry*, 4th ed. iii. 315.

Medical properties and uses. — The antimonial powder operates as a diaphoretic, alterative, emetic, or purgative, according to the extent of the dose, and the state or habit of the patient to whom it is administered. It is the preparation of antimony most commonly employed in the commencement of fevers, and in inflammatory affections; being generally given with a view to its diaphoretic effect: and when a copious perspiration is early induced, after having previously evacuated the stomach and bowels, fevers of the most threatening aspect are often cut short by it; but when it fails in producing this effect, the protracted use of it may prove hurtful, particularly if the fever assume the typhoid character. The purging, however, which it is apt to induce in typhus, has been, perhaps, too much dreaded; and we have seen good reasons to subscribe to the opinions published by Dr. Hamilton [1], on the use of purgatives in this kind of fever. Those labouring under inflammatory diseases, who can bear considerable discharges by stool, experience the most benefit from the use of the antimonial powder, particularly when venæsection has been previously employed. In acute rheumatism it is advantageously given, combined with camphor, calomel, and opium; and with calomel and guaiacum in several cutaneous affections. As it is insoluble in water, it is given either in the form of a powder, or made up in pills. The dose is from grs. iij. to grs. viij, repeated every fourth hour, diluting freely in the intervals, until its effects are obtained.

PRÆPARATUM EX ARGENTO.

PREPARATION OF SILVER.

ARGENTI NITRAS. Lond. [2] *Nitrate of Silver.*

"Take of silver, *an ounce;* nitric acid, *one fluid ounce;* distilled water, *two fluid ounces.* Mix together the nitric acid and water, and dissolve the silver in the mixture on a sand-bath. Then gradually increase the heat, that the nitrate of silver may be dried. Melt this in a crucible on a gentle fire, until, the water being evaporated, the ebullition cease: then directly pour it into proper moulds."

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[1] *Observations on the Utility of Purgative Medicines,* p. 14. 23.

[2] Argentum nitratum, P. L. 1787. Nitrate d'Argent (*F.*) Salpetersaures Silber (*G.*) Nitrato di argento (*I.*)

NITRAS ARGENTI. Edin. *Nitrate of Silver.*

"Take of pure silver flatted into plates and cut, *one part*; nitric acid diluted, *two parts*; distilled water, *one part*. Dissolve the silver in the acid and water previously mixed together, in a phial with a gentle heat, and evaporate the solution to dryness. Then put the mass into a large crucible, and place it on the fire, which must be at first gentle, and gradually increased until the mass flows like oil; then pour it into iron pipes previously heated and rubbed with grease. Finally, let the preparation be preserved in a well stopped glass vessel."

Dublin.

"Take of silver flatted into plates and cut; nitrous acid, each *one ounce*; distilled water, *two fluid ounces*. Put the silver in a glass vessel placed in a sand-bath; and pour over it the acid previously diluted. Then dissolve the metal with a gradually raised heat, and evaporate the solution to dryness. Put the mass which remains into a crucible, and dissolve it over a slow fire; finally, let it be poured into proper moulds, and preserve it in a well stopped glass vessel."

In this process the acid is partly decomposed by the silver which is oxidized, and the oxide dissolved as it forms, in the remaining acid. The effervescence is very violent, owing to the extrication of the nitrous gas of the decomposing acid, which flies off in orange-coloured fumes, part of them, however, is retained in the solution, and gives it a blue greenish colour, which goes off as it cools. In this stage of the process, the silver held in solution is in the state of an oxynitrate, which, by due evaporation, may be obtained in brilliant, irregular, thin, six-sided plates, having an intensely bitter taste: and although by the subsequent melting a part of the acid is expelled, yet it is probable that the product is not reduced to the state of a subnitrate.

The difference in the quantity of acid ordered in the different formulæ does not alter the nature of the product; but it is of some consequence, in an œconomical point of view, to know, that even in the Dublin formula, which orders equal parts of silver and acid, the quantity of acid is too great, ten fluid drachms being amply sufficient for the solution of two ounces of silver. Several minute particulars are necessary to be attended to in conducting the process. The silver must be perfectly free from any alloy of copper, which renders the salt always more or less deliquescent. Its presence is indicated when the solution remains of a permanently greenish blue colour: in which case it may be purified by repeated solutions

and crystallizations, as long as tabular crystals are produced, the nitrate of copper being left in the mother-water. The acid employed must also be pure; for, if muriatic or sulphuric acids be present, the solution is rendered turbid by the formation of a precipitate of sulphate and muriate of silver; which however, when only in small quantity, does not impede the process, and is easily separated by simple subsidence, after the nitric acid is fully saturated. For the same reasons the water must be pure; and therefore distilled water, or filtered rain water, should be employed. The granular form of the silver is preferable to the laminated form ordered by the Colleges. For the subsequent evaporation and melting, a porcelain crucible should be used, as the fused silver is apt to sink into the substance of the common crucibles: and it should be of ample size to allow of the swelling and ebullition. The heat must not be continued after the fusion is complete; for by continuing the application of heat, the nitric acid is expelled, and the silver partially reduced; but it should be directly run into the moulds, which may be made of iron; or, in a mass of well-tempered pipe-clay, holes of the size required may be perforated by means of a greased quill, and the fused nitrate run into them. When cold, each piece must be cleaned from the grease, and separately rolled up in clean white paper.

Qualities.—Fused nitrate of silver is in small solid cylinders of a dark gray colour, and presenting, when broken across, a crystallized structure. It is inodorous, has an intensely bitter, metallic, caustic taste, and tinges the skin and hair black wherever it touches, owing to the reduction of the nitrate by the extension of it on the cuticle. It is not deliquescent. It is soluble in an equal weight of water at 60°, and is also soluble in alcohol. It is blackened and reduced by exposure to light or a strong heat, by phosphorus, hydrogen gas, and the hydrosulphurets; is precipitated from its aqueous solution by mercury, copper, and some other metals; and is decomposed by the alkalies, with the exception of ammonia, the alkaline earths, sulphuretted hydrogen, the hydro-sulphurets, the sulphuric, muriatic, and arsenious acids, the majority of the neutral salts, and by astringent vegetable solutions. The constituents of 100 parts are, 64 of silver, 6 of oxygen, and 30 of nitric acid.

Medical properties and uses. — Nitrate of silver is tonic, antispasmodic, and escharotic. It was introduced as an internal remedy by Angelus Sala, in the commencement of the 17th century. It is said to prove efficacious in epilepsy, and its utility in angina pectoris, and chorea, is well known. In these cases it is given in doses of $\frac{1}{8}$th of a grain, gradually increased to grs. iv.

or more, three times a day; but little advantage is gained, unless its use be preceded, by a course of purgatives. The best form of administering it is that of pill made with crumb of bread. But the chief use of nitrate of silver is as an external application to destroy strictures of the urethra, warts, fungous excrescencies, and incipient chancres. In solution, in the proportion of gr. ij to f℥j of distilled water, it forms a good injection in fistulous sores; and a lotion in that disease of the gums generally denominated scurvy, in which the gum becomes spongy, and its edges hang loosely about the necks of the teeth. When this latter disease, however, rises to a great height, the sore edges of the gum should be touched with a hair pencil dipped in a much stronger solution, in the proportion of ℥j of the nitrate of silver to f℥j of distilled water.[1] A solution of one part of the nitrate in 1000 parts of water is recommended by Hahnemann[2] as an application to old sores, and for healing the ulcers of the mouth produced by the use of mercurials.

When given in too large doses, it acts as a poison on the system, producing symptoms resembling those induced by the other corrosive poisons. M. Orfila regards common salt as the antidote of this poison, when given sufficiently early to prevent the specific action of the nitrate on the coats of the stomach[3]: but at the same time, local and general bleeding, tepid baths, and emollient fomentations and glysters must be employed, if any symptom of abdominal inflammation be perceived.

PRÆPARATA EX ARSENICO.

PREPARATIONS OF ARSENIC.

ARSENICI OXYDUM SUBLIMATUM. Lond.[4] *Prepared Oxide of Arsenic.*

"Reduce oxide of arsenic to powder; then put it into a crucible, and, applying heat, sublime it into another crucible inverted over the first."

The greater part of the oxide of arsenic found in the shops, is in the form of semivitreous cakes, which are the product of a second sublimation of the oxide, after it is obtained from

1 *Fox on the Natural History and Treatment of Diseases of the Teeth.*
2 *Annales de Chimie*, iii. 308.
3 *Traité des Poisons*, &c. tom. i. p. 49.
4 Oxide d'arsenique pure (*F.*) Weisses Arsenick (*G.*) Arsenico blanco (*I.*)

roasting ores of cobalt. Although prepared on a great scale, yet it is as pure as sublimation can make it, and therefore this process is superfluous; and as it is also not devoid of risk to the operator, it should be altogether rejected.

LIQUOR ARSENICALIS.[1] Lond. *Arsenical Solution.*

"Take of prepared oxide of arsenic rubbed to a very fine powder, subcarbonate of potash from tartar, each *sixty-four grains*; distilled water, *a pint*. Boil them together in a glass vessel until the arsenic be entirely dissolved. Add to the solution when it is cold compound spirit of lavender, *four fluid drachms*; and then as much distilled water as will make the whole up to a pint."

SOLUTIO ARSENICALIS. Edin. *Solution of Arsenic.*

"Take of oxide of arsenic rubbed to very fine powder, very pure subcarbonate of potash, of each *sixty-four grains*; distilled water *fourteen ounces*. Boil them together in a glass vessel until all the oxide be dissolved. Add to the solution, when it is cold, *half an ounce* of compound spirit of lavender, and as much distilled water as will make the whole up to sixteen ounces."

The white oxide of arsenic possesses properties in some respect similar to those of an acid. It combines with alkalies, is soluble in water, and the solution reddens tincture of litmus: but it also combines with and neutralizes the acids; so that, while some[2] regard it as an acid, others[3] consider it only as a highly oxidized oxide. In the above process, by combination with the potash, its solubility is much increased, and a solution obtained of an uniform strength, by which very minute doses can be correctly and easily apportioned. It was introduced by Dr. Fowler of Stafford, whose formula the London College has adopted, altering only the proportions of the water and the spirit of lavender, to make up the pint of the solution.

Qualities. — This solution, one fluid drachm of which contains half a grain of oxide of arsenic, has the odour, taste, and colour of the compound spirit of lavender. It is decomposed by lime-water and hydrosulphuret of potash, and instantly forms a copious precipitate when dropped into infusion or decoction of cinchona bark; with which, therefore, it ought not to be conjoined in extemporaneous prescriptions.

Medical properties and uses. — The arsenical solution, as it is termed, is a powerful tonic, useful in all the cases in which

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[1] This appellation is certainly very objectionable, as it conveys an erroneous idea of the preparation, even admitting that the term *arsenic* may be used to designate the *white oxide*: it should have been *Liquor Arsenialis Potassæ*, or perhaps more properly, *Liquor alcalinus Oxidi Arsenici*.

[2] Fourcroy. [3] Berthollet.

the white oxide can be employed. (See *Arsenici Oxydum*, Part ii.) It was introduced by Dr. Fowler as a substitute for the celebrated empirical remedy known under the name of "the ague drop," which owes its efficacy to the oxide of arsenic. In addition to the account we have already given of the medicinal use of the oxide, we have to add that we have given this solution with decided advantage after cupping and purging, in threatened apoplexy when the strength was little and the complexion pale. The dose is ♏iv gradually increased to ♏xx, given twice a day.

ARSENIAS KALI. Dub. *Arseniate of Kali.*

"Take of white oxide of arsenic, nitrate of kali, each *an ounce*. Reduce them separately to powder; then having mixed them, put them into a glass retort, and place it in a sand-bath exposed to a gradually raised heat, until the bottom of the retort becomes obscurely red. The vapours arising from the retort should be transmitted through distilled water, by means of a proper apparatus, in order that the nitrous acid extricated by the heat may be disengaged. Dissolve the residue in four pounds of boiling distilled water, and after due evaporation set it apart, that crystals may form."

In this process the nitrate of potash is decomposed by the heat; part of the oxygen of the nitric acid with the whole of its nitrogen escape in the form of nitrous gas, while the remainder of the oxygen is attracted by the oxide of arsenic, which is thus converted into arsenic acid, and combines with the disengaged potash of the nitrate, forming a superarseniate of potash: this remains in the retort in the form of a white saline mass, and is afterwards dissolved and crystallized. The nitrous acid is not worth condensing, as the process is not likely to be performed on a great scale.

Qualities. — Arseniate, or rather superarseniate[1], of potash crystallizes in beautiful, transparent, tetraëdral prisms, having an excess of acid. They are soluble in water; and the solution reddens the vegetable blues.

Medical properties and uses. — This salt may be used exactly in the same manner, and in the same cases as the white oxide. It was discovered by Macquer, and long known under the name of "the arsenical neutral salt of Macquer." The dose is from one-sixteenth to one-eighth of a grain, formed into a pill with crumb of bread.

[1] The arseniate is uncrystallizable and deliquescent, and altogether a different salt; the Dublin College therefore has improperly named it *Arsenias Kali*.

PREPARATA E CUPRO.

PREPARATIONS OF COPPER.

ÆRUGO PRÆPARATA. Dub.[1] *Prepared Verdegris.*

"Let the verdegris be reduced to powder, and the more subtile parts be separated in the manner directed for the preparation of chalk."

By this process the subacetate of copper is obtained in a state of very minute mechanical division, better fitted for internal use, in the cases for which it is sometimes prescribed. (See *Ærugo*, Part ii.)

CUPRUM AMMONIATUM. Lond. *Ammoniated Copper.*[2]

"Take of sulphate of copper, *half an ounce*; subcarbonate of ammonia, *six drachms*. Rub them together in a glass mortar until the effervescence cease; then wrap up the ammoniated copper in bibulous paper, and dry it with a gentle heat."

AMMONIARETUM CUPRI. Edin. *Ammoniuret of Copper.*

"Take of pure sulphate of copper, *two parts*; subcarbonate of ammonia, *three parts*. Rub them thoroughly together in a glass mortar, until all effervescence is finished, and they unite in a violet-coloured mass, which wrap up in bibulous paper, and dry, first on a chalk stone, and afterwards with a gentle heat. Let it be preserved in a well stopped glass phial."

CUPRUM AMMONIATUM. Dub. *Ammoniated Copper.*

"Take of sulphate of copper, *an ounce*; carbonate of ammonia, *an ounce and a half*. Rub them in an earthenware mortar, until all effervescence having ceased, they unite into a mass, which is to be dried, wrapped up in bibulous paper, and preserved in a phial closed with a glass stopper."

The product of these processes is either a triple salt, a subsulphate of oxide of copper and ammonia, or a mixture only of subsulphate of copper, and subsulphate of ammonia[3]; but the former is the more probable state of the compound, from the difference of capacity which it has for water being so great as to render the resulting mass extremely moist. During the trituration, the sulphate of copper is partially decomposed, and part of its acid yielded up to the ammonia, which is con-

[1] Vert-de-gris (*F.*) Grünspan (*G.*) Acetato di Rame (*I.*) Cardenillo (*S.*)
[2] Schwefelsaures Kupfer mit Ammonium (*G.*) Ammoniuro di Rame (*I.*)
[3] It is certainly not an ammoniuret, although so designated in the Edinburgh Pharmacopœia.

sequently freed from the carbonic acid, the effervescence being the effect of the dissipation of this disengaged acid in the gaseous form. The action of the affinities, which produce these changes, is perhaps aided by the water of crystallization of the ingredients becoming fluid. In drying the product it must be very carefully excluded from the air.

Qualities. — This preparation has the odour of ammonia, a hot, styptic, metalline taste, and a rich blue colour. By exposure to the air the blue colour is lost, and the salt acquires a greenish hue.

Medical properties and uses.— Ammoniated copper is tonic and antispasmodic. It has been principally employed in epilepsy, as a remedy for which it was first proposed by Dr. Cullen; and has since his time been frequently employed with evident advantage — although we must confess, that in our trials of it the event has not been such as to encourage us to place much dependence on its powers for relieving this severe disease. It is less apt to excite nausea than the other preparations of copper. Cullen, however, recommends its use not to be continued for more than a month at a time; and adds, that after the first interval, if the disease continues, the most benefit will be derived from giving the medicine "only for some days *before an expected accession.*"[1] *It has been given with* advantage in chorea, after a course of purgatives, combined with digitalis and myrrh.

The dose is gr. ¼th gradually increased to grs. v. given twice a day, either simply made into pills with crumb of bread, or combined with valerian.

LIQUOR CUPRI AMMONIATI. Lond. *Solution of Ammoniated Copper.*

"Take of ammoniated copper, *a drachm*; distilled water, *a pint*. Dissolve the ammoniated copper in the water, and filter the solution through paper."

AQUA CUPRI AMMONIATI. Dub. *Water of ammoniated Copper.*

"Take of lime-water, *eight fluid ounces*; muriate of ammonia, *two scruples*; prepared verdegris, *four grains*. Let them be mixed together, and digested for twenty-four hours; then pour off the clear liquor."

As nearly the same result follows whichever of these processes is adopted; that of the London pharmacopœia, from its simplicity, is undoubtedly to be preferred, although too much water is ordered. In the Dublin process, the lime decomposes the muriate of ammonia, and combines with its mu-

[1] *Mat. Med.* ii. 25.

riatic acid, forming a muriate of lime, while the disengaged ammonia unites with the oxide of copper of the verdegris, and forms a soluble compound. It differs from the simple solution of ammoniated copper, in holding also the muriate of lime in solution; and is a stronger preparation, for nearly one-half of the oxide of the ammoniated copper is precipitated by the excess of water.

Medical properties and uses. — This solution is detergent, and mildly escharotic. It forms an useful local stimulant for cleaning foul indolent ulcers, and disposing them to heal; and is also employed, still more largely diluted, for removing specks from the cornea.

SOLUTIO SULPHATIS CUPRI COMPOSITA. Edin. *Compound Solution of Sulphate of Copper.*

"Take of sulphate of copper, sulphate of alumina, each *three ounces;* water, *two pounds;* sulphuric acid, *one ounce and a half.* Boil the sulphates in the water, to dissolve them; and then to the liquor filtered through paper add the acid."

This preparation is a simple solution of the sulphates. It is sometimes used as a styptic for stopping hæmorrhages; and largely diluted as a lotion in ophthalmia tarsi, and the purulent ophthalmia of infants.

As has been already noticed (Part ii.) the best antidote for the salts of copper, when taken as poisons, is sugar.

PRÆPARATA E FERRO.

PREPARATIONS OF IRON.

LIMATURA FERRI PURIFICATA. Edin.[1] *Purified Filings of Iron.*

"Having placed a sieve over the filings, apply a magnet, so that it may draw the filings upwards through the sieve."

The iron filings obtained from the workshops are always mixed with many impurities, and often with filings of copper and other metals. It requires some address to purify them by this process; at least the sieve must not be placed too close upon the filings, but as distant as the sphere of attraction of the magnet will admit of, so that the iron only may be raised.

OXIDUM FERRI NIGRUM PURIFICATUM. Edin.[2] *Purified Black Oxide of Iron.*

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1 Limaille de Mars (*F.*) Gepülvertes Eisen (*G.*) Limatura di Ferro (*I.*) Eerumboo Podia (*Tam.*)

2 L'oxide noir de Fer (*F.*) Schwarzes gesäuertes Eisin (*G.*) Ossido nero di Ferro (*I.*)

"Let the scales of the black oxide of iron, found at the anvil of the blacksmith, be purified by the application of the magnet; for the magnet attracts the thinner and purer scales only, leaving the larger and less pure."

OXYDUM FERRI NIGRUM. Dub. *Black Oxide of Iron.*

"Let the scales of iron, found at the blacksmith's anvil, be purified by the application of the magnet. Then reduce them to a powder, the finest parts of which are to be separated in the manner ordered for the preparation of chalk."

The scales struck off from red-hot iron by the hammer of the blacksmith are imperfectly oxidized, but still retain their magnetic quality in a sufficient degree to admit of being purified in the above manner.

Medical properties and uses. — This imperfect oxide is tonic, deobstruent, and anthelmintic. It is efficaciously administered in general debility, dyspepsia, chlorosis, and worm cases. Its utility is determined by its meeting with acid in the stomach, which is known to be the case by the disagreeable eructations it produces, and the black colour of the alvine evacuations. The dose is from grs. v to ʒj, combined with any aromatic powder, or formed into an electuary with honey, and taken twice a day.

FER'RUM AMMONIATUM. Lond. *Ammoniated Iron.*[1]

"Take of subcarbonate of iron, muriate of ammonia, each *a pound.* Mix them accurately together, and instantly sublime, by the application of a strong heat; finally, reduce them to powder."

MURIAS AMMONIÆ ET FERRI. Edin. *Muriate of Ammonia and Iron.*

"Take of the red oxide of iron washed and again dried, muriate of ammonia, each *equal parts by weight.* Mix them well together, and sublime by a quick fire. Reduce the sublimation to powder and preserve it in a well stopped phial."

MURIAS AMMONIÆ ET FERRI. Dub. *Muriate of Ammonia and Iron.*

"Take of red oxide of iron, muriate of ammonia, each *equal parts by weight.* Having mixed them well together, sublime them with a sudden and sufficiently strong heat."

Of these processes, those of the Edinburgh and Dublin Colleges are to be preferred, for the reasons below stated. The theory of the operation is obvious: the sudden application of an intense heat enables the oxide of iron to decompose the muriate of ammonia, and to unite with part of its muriatic acid,

[1] Ferrum ammoniacale, P. L. 1787. Fleurs de Mars ammoniacales (*F.*) Eisenhaliges Salzsaures Ammonium (*G.*)

and at the same time it probably enters into that degree of combination with the ammonia, which exists in triple salts, the product being either a muriate of iron and ammonia, or a mixed mass of submuriate of ammonia, and submuriate of iron: some difference, however, takes place when the carbonate of iron, ordered by the London College, is employed; for, a portion of subcarbonate of ammonia being formed, which does not combine with the iron, the formation of *ferrum ammoniatum* is limited: and the sublimed product, instead of being wholly composed of this salt, is only a mixture of it with subcarbonate of ammonia. The strength of the preparation depends very much on the degree of heat employed, and the quickness of the sublimation.

Qualities. — Muriate of ammonia and iron has an odour, resembling, in some degree, that of saffron, and a styptic taste. It is in crystalline grains of an orange colour; soluble in alcohol, and deliquescent; on which account this salt requires to be preserved in very well stopped phials."

Medical properties and uses. — This preparation of iron is tonic, emmenagogue, and aperient. It was formerly much used in epilepsy, hysteria, chlorosis, scrophula, and rickets; but on account of the uncertainty of the preparation it is now seldom prescribed. The dose is from grs. iij. to grs. xv. given twice or thrice a day.

Officinal preparation. *Tinctura Ferri ammoniati.* L.

SUBCARBONAS FERRI PRÆPARATUS. Edin. *Prepared Carbonate of Iron.*[1]

"Let purified filings of iron be frequently moistened with water, till they fall into rust, which is to be rubbed to powder."

FERRI RUBIGO. Dub. *Rust of iron.*

"Take of iron wire, *any quantity.* Cut it into small pieces, which are to be exposed to the air, and frequently moistened with water, until they be converted into rust; let this be rubbed in an iron mortar, and by pouring water on it, wash over the finest part of the powder, which is to be dried."

In these processes the iron is oxidized at the expense of the water which is decomposed, while at the same time carbonic acid is attracted from the atmosphere, and combined with the oxide. The product is a subcarbonate of oxide of iron, for the quantity of acid is not equivalent to the neutralization of the oxide.

According to my experiments, it consists of 85 parts of oxide of iron, and 15 of carbonic acid; but these proportions must

[1] Carbure de Fer (*F.*) Rost (*G.*) Ossido carbonato di Ferro (*I.*) Sudud ul hidud (*Arab.*) Eerumbo tuppoo (*Tam.*)

necessarily vary from variations in the conduct of the process.

Qualities.—It is inodorous, has a styptic taste, and a reddish-brown colour; dissolves in acids with effervescence; and is decomposed by heat.

Medical properties and uses.—The rust of iron is tonic and emmenagogue. Next to the black oxide it is the least active of the preparations of this metal. It has lately been recommended with much confidence, both as an internal remedy, and an external application in cancer.[1] In large doses it often occasions uneasiness at the stomach; yet Cullen says, "We have always found the simple rust as effectual as any other preparation; and the stomach bears it better than any [2]other." It is given in the form of pills, combined with aromatics and bitter extracts. The dose is from grs. iv. to ℈j. given twice a day.

Officinal preparation. *Tinctura Muriatis Ferri.* D.

FERRI SUBCARBONAS. Lond. *Subcarbonate of* [3]*Iron.*

"Take of sulphate of iron, *eight ounces;* subcarbonate of soda, *six ounces;* boiling water, *a gallon.* Dissolve separately the sulphate of iron and the subcarbonate of soda in eight pints of water; then mix together the solutions, and set the mixture aside, that the powder may subside; then pour off the supernatant fluid, wash the sub-carbonate of iron in hot water, and dry it, wrapped up in bibulous paper, with a gentle heat."

CARBONAS FERRI PRÆCIPITATUS. Edin. *Precipitated Carbonate of Iron.* CARBONAS FERRI. Dub. *Carbonate of Iron.*

"Take of sulphate of iron, *four ounces;* subcarbonate of soda, *five ounces;* water, *ten pounds.* Dissolve the sulphate in the water: then add the subcarbonate previously dissolved in the water, and mix them together. Let the carbonate of iron, which is precipitated, be washed with tepid water, and afterwards dried."

This preparation is also a subcarbonate of iron. By mixing the solutions together, a double decomposition is effected; the sulphuric acid of the sulphate of iron combines with the soda, while the iron attracts the disengaged carbonic acid of the subcarbonate of soda; and hence the products are an insoluble subcarbonate of iron, and a soluble sulphate of soda, which are easily separated by washing and filtration. When first precipitated, the subcarbonate of iron has a deep green colour, and

[1] *Carmichael on the Use of Carbonate of Iron in Cancer.*

[2] It is the carbonate of iron which is contained in chalybeate waters, held in solution by the excess of carbonic acid. By exposing these waters to the air, the carbonic acid flies off, oxygen is attracted, and the carbonate falls down in the form of a yellowish sediment.

[3] Chalybs præparatus è aceto, et sine aceto, P. L. 1720. Chalybis rubigo præparata, P. L. 1745. Ferri rubigo, P. L. 1787.

is at a minimum of oxidizement; but while drying, it attracts oxygen rapidly from the atmosphere, and is converted into the red oxide, or a peroxide, containing, according to Proust, 48 per cent. of oxygen. I have found that the precipitate combines with the largest proportion of carbonic acid, when the solutions are mixed at a temperature of 150° of Fahrenheit; and filtration is necessary for separating it, the decantation of the clear fluid being very difficult, owing to the lightness of the precipitate. The great solubility of the sulphate of soda renders much subsequent washing unnecessary; and the precipitate, after being washed, should be dried in the paper on which it is filtered, by a heat not exceeding 200°.

Qualities. — Precipitated subcarbonate of iron is inodorous, has a slightly styptic taste; and when properly prepared is of a chocolate-brown colour. It is insoluble in water, but acids dissolve it with effervescence, disengaging the carbonic acid in the gaseous form. It is decomposed by heat, and converted into the black oxide of the metal. In my experiments, ten grains of the dried subcarbonate, prepared with effloresced subcarbonate of soda, lost 2·3 grains, when dissolved in muriatic acid; and the same quantity, prepared with the crystallized alkali, and dried with great care, lost 1·4; so that prepared in the former method, it contained 23 per cent. of carbonic acid, and in the latter 14 per cent.

Medical properties and uses. — This preparation differs little from the former preparation in its effects, except that it sits easier on the stomach. The dose is from grs. iv. to grs. xxx.; given three times a day, combined with myrrh, or aromatics.

Officinal preparations. *Ferrum ammoniatum.* L. *Tartarum Ferri.* D. *Tinctura Ferri Muriatis.* L.

FERRI SULPHAS. Lond. *Sulphate of Iron.*[1]

"Take of iron, sulphuric acid, each *eight ounces*; water, *four pints*. Mix the sulphuric acid with the water in a glass vessel, and to these add the iron; then, when the effervescence is over, filter the solution through paper, and evaporate it over the fire, so that crystals may form as it cools. Pour off the water, and dry the crystals upon bibulous paper."

SULPHAS FERRI. Edin. *Sulphate of Iron.*

"Take of purified filings of iron, *six ounces*; sulphuric acid, *eight ounces*; water, *two pounds and a half*. Mix, and when the effervescence is over, digest the mixture for some time upon hot sand; then filter the solution through paper, and after due evaporation set it apart, that crystals may form."

[1] Old names of this salt: — *misy*, *sory*, *calchantum*; (Pliny) *sal martis*, *sal chalybis vitriolum ferri*, *vitriolum martis*. *Syn.* Sulfate de Fer (*F.*) Schwefelsäures Eisen (*G.*) Solfato di Ferro (*I.*) Una Baydie (*Tam.*) Casis (*Hind.*)

SULPHAS FERRI. Dub. *Sulphate of Iron.*

"Take of iron wire, *two ounces;* sulphuric acid, *three ounces and a half;* water, *one pint.* Mix gradually the acid with the water; then add the wire cut into pieces, and digest the mixture that the metal be dissolved, after which filter the solution through paper; finally, after due evaporation, set it apart, that crystals may form by slow cooling."

In these processes part of the water is decomposed, the iron is oxidized by combining with its oxygen, while its hydrogen is dissipated in the gaseous form; and the oxide thus produced unites with the acid and forms sulphate of iron, or rather sulphate of oxide of iron; which is dissolved in the undecomposed portion of the water. Concentrated sulphuric acid, nevertheless, scarcely exerts any action on iron at a low temperature, and water alone is very slowly decomposed by it, so that the rapid decomposition of the diluted acid by the iron must be ascribed to the sum of the affinities of the base of the acid for oxygen, and of the iron for oxygen being superior to that of the oxygen to the hydrogen of the water, which is therefore decomposed. The solution is of a pale green colour, and when evaporated directly, yields crystals of sulphate of iron[1]; but if it be exposed for some time to the atmosphere it attracts oxygen, becomes turbid, a subsulphate is precipitated, and the salt obtained is an oxysulphate.

Qualities. — Sulphate of iron has a strong styptic taste: it crystallizes in transparent rhomboidal prisms, of a fine green colour, which redden the vegetable blues; are soluble in two parts of water at 60° and ¾ths of their weight of boiling water, and are insoluble in alcohol. When exposed to the air, the crystals become opaque, and are covered with a yellow powder, owing to the attraction of the oxygen of the atmosphere by the salt, during its efflorescence. Exposed to heat sulphate of iron undergoes the watery fusion; and in an increased heat the acid is driven off, and the base remains in the state of a red oxide, the colcothar of vitriol of commerce. According to Dr. Thomson[2], 100 parts of the green sulphate consist of 26·7 of sulphuric acid, 28·3 oxide of iron, and 45·0 of water.[3] The following substances decompose sulphate of iron: the earths, the alkalies and their carbonates; borate of

1 This salt, which is known in commerce by the name of *green vitriol*, is prepared on the great scale from native sulphurets of iron, by exposing them to the air and moistening them, till a crust of sulphate of iron is formed on their surface, which is afterwards obtained in crystals by solution and evaporation.

2 *System of Chemistry*, 4th ed. iii. 225.

3 Of this quantity of water, 8 parts are water of composition, the oxide being in the state of a *hydrate*.

soda, phosphate of soda, muriate of barytes, nitrate of silver, acetate and superacetate of lead, and almost every salt, the base of which forms an insoluble compound with sulphuric acid: hence these are incompatible in formulæ with this salt.

Medical properties and uses. — Sulphate of iron is tonic, emmenagogue, and anthelmintic.[1] It is a useful remedy when exhibited with due caution, in all cases in which preparations of iron are indicated; but in improper doses it occasions pain of the bowels, nausea, and vomiting, and often proves hurtful by being too long continued. It has been given with advantage in diabetes, in the latter stage of phthisis, and in amenorrhœa, depending on a weakened action of the blood-vessels. The dose is from gr. j. to v. combined with ammoniacum, rhubarb, myrrh, or bitter extracts. It has lately been used dissolved in water as a lotion to cancerous and phagedenic ulcers.[2]

Officinal preparation. *Tinctura Ferri Muriatis.* D.

SULPHAS FERRI EXSICCATUS. Edin. *Dried Sulphate of Iron.*

"Take of sulphate of iron, *any quantity.* Let it be heated in an unglazed earthen vessel, on a moderate fire, until it become white, and perfectly dry."

SULPHAS FERRI EXSICCATUM. Dub. *Dried Sulphate of Iron.*

"Take of sulphate of iron *any quantity.* Let it whiten by exposing it in an unglazed earthen vessel, to a high temperature."

In these processes the degree of heat should not exceed 212° of Fahrenheit. The salt is merely deprived of its water of crystallization, without undergoing any chemical change.

Officinal preparation. *Oxydum Ferri rubrum.* E. D.

OXIDUM FERRI RUBRUM. Edin.[3] *Red Oxide of Iron.*

"Let dried sulphate of iron be exposed to a violent heat, until it is converted into a red-coloured substance."

OXYDUM FERRI RUBRUM. Dub. *Red Oxide of Iron.*

"Let dried sulphate of iron be roasted in a strong fire until it is converted into a red substance; then let this be washed till the water poured from it does not indicate, by the test of litmus, the presence of any acid; and lastly, dry it upon bibulous paper."

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1 It was used as an anthelmintic in the time of Pliny, who says, "Sumitur ad depellenda ventris animalia drachmæ pondere cum melle." *Nat. Hist.* lib. xxxiv. cap. 12.

2 *Edinburgh Med. and Surg. Journal*, ii. 373.

3 Oxide de fer rouge (*F.*) Eisenoxyd (*G.*) Perossido rosso di Ferro (*I.*)

By the degree of heat employed, the sulphuric acid of the sulphate is partly driven off in a highly concentrated state, and partly decomposed, sulphurous acid being disengaged, and the oxide, which is the base of the sulphate, becomes more highly oxidized.

The residue is the red oxide of iron, combined with a portion of the red sulphate, which renders it deliquescent; and which should therefore be separated by washing, as directed by the Dublin College.

According to Proust, the red oxide at the highest degree of oxidizement consists of 48 parts of oxygen and 52 of iron.

Medical properties and uses. — This preparation is possessed of the same medicinal properties as the other preparations: but it is very rarely used, except as a pharmaceutical agent.

Officinal preparation. *Murias Ammoniæ et Ferri.* E. D.

FERRUM TARTARIZATUM. Lond. *Tartarized Iron.*

"Take of iron, *a pound;* supertartrate of potash, in powder, *two pounds;* water, *a pint.* Rub them together, and expose the mixture in an open glass vessel to the action of the air for eight days; then dry it in a sand-bath, and reduce it to a very fine powder. To this powder add a pint of water, and put it aside for eight days; then dry it, and reduce it to powder."

TARTRAS POTASSÆ ET FERRI. Edin.[1] *Tartrate of Potash and Iron.*

"Take of purified filings of iron, *one part;* supertartrate of potash powdered, *two parts;* water, *one part.* Rub them together and expose them to the air in a shallow earthen vessel for fifteen days, stirring the mass daily with a spatula, and keeping it moist by frequent additions of water. Then boil the whole for a short time in four times its weight of water, and pour off the solution from the other fæces. Evaporate the solution to dryness in a water bath, and having rubbed the mass into powder, preserve it in a well-stopped bottle."

TARTARUM FERRI.[2] Dub. *Tartar of Iron.*

"Take of carbonate of iron, *half an ounce;* crystals of tartar in very fine powder, *an ounce;* distilled water, *a pint.* Let them be put into a glass vessel, then boiled for an hour over a slow fire, and the liquor filtered through paper; when this is cold, filter it again, and evaporate it until a pellicle appears on the surface: the liquor, as it cools, will concrete

[1] Tartrate de Fer et de Potasse (*F.*) Eissenweinstein (*I.*) Tartrato di Potassa e di Ossido di Ferro (*G.*)

[2] It is remarkable that both the London and Dublin Colleges should err in giving a name to this triple salt so dissonant to the principles of the reformed nomenclature of their pharmacopœias.

into a saline mass, which is to be reduced to powder, and preserved in closely stopped phials."

Of these three processes, those of the Edinburgh and the Dublin Colleges are to be preferred, as they afford a perfect triple salt; whereas much of the iron employed in the London process remains unaltered, or is at least only in the form of a simple oxide. In the London process, the iron is first oxidized by the partial decomposition of the water, aided by the action of the air, and the oxide thus formed unites with the superabundant acid of the supertartrate of potash: hence the dried mass consists of tartrate of potash and iron, mixed with oxide of iron, and some metallic iron. The subsequent addition of water, and re-exposure to the air, are intended to render the oxidizement complete, and convert the whole to the state of the triple salt; but as this is not effected, it is probable that the proportion of supertartrate of potash ordered, is insufficient for the large quantity of the metal directed to be used. In the Edinburgh and Dublin processes, the superabundant acid of the supertartrate of potash dissolves as much of the oxide of the carbonate of iron as it can take up; and a clear solution is obtained, which, by evaporation, yields a true tartrate of potash and iron. As it is almost impossible to procure this salt in crystals, the solution may be evaporated to dryness.

Qualities.— Tartrate of potash and iron is inodorous, has a slightly styptic taste, and is of a brownish green colour. It is very soluble in water, and deliquesces, in some degree, when exposed to the air, so as to require to be kept in closely stopped phials. The cold solution of the alkalies and their subcarbonates do not decompose this salt; but it is instantly decomposed when boiled with any of them except ammonia and its subcarbonate, which in neither state affect it. The hydrosulphuret of potash and infusions of astringent vegetables decompose it, and are therefore incompatible in formulæ with it.

Medical properties and uses. — This salt possesses the same medicinal powers as the other preparations of iron; but from its mildness, slight taste, and ready solubility, it is a more convenient form for the administration of this metal to children, and in many cases in which the other saline preparations of it prove nauseating, and sit uneasy on the stomach. It is advantageously given in all the cases in which chalybeates prove useful: and is also extolled as a remedy in dropsy, in which it is supposed to exert both a diuretic and a tonic power. The dose is from grs. x. to ʒfs, given either in a state of solution, or in the form of powder or bolus, combined with an aromatic, or bitter.

LIQUOR FERRI ALKALINI. Lond.[1] *Solution of Alcaline Iron.*[2]

"Take of iron, *two drachms and an half*; nitric acid, *two fluid ounces*; distilled water, *six fluid ounces*; solution of subcarbonate of potash, *six fluid ounces*. Mix together the acid and the water, pour the mixture over the iron, and when the effervescence has ceased pour off the acid solution. Add this gradually, and at intervals, to the solution of subcarbonate of potash, frequently agitating until it become of a brownish red colour, and no more effervescence is excited. Finally, set it aside for six hours, and pour off the liquor."

Although this composition has been long known, yet it is not well understood. The diluted acid[3] acts violently upon the iron and oxidizes it, while heat is evolved, and red fumes are extricated, consisting of nitrous gas and nitrous oxide. If this action be moderated by the iron being in a lump, and putting the vessel in which it is dissolving into cold water, the solution is of a pale green colour, and the iron is at the minimum of oxidizement; but if heat be applied, or the effervescence be allowed to proceed with violence, the solution is of a reddish brown colour, and contains oxynitrate of iron; a great excess of acid being present in both cases. On each addition of the solution of the subcarbonate of potash to either of these solutions, effervescence is excited by the disengagement of carbonic acid, and a red precipitate is instantly produced, which is however kept suspended by agitation, and ultimately redissolved by the excess of alkali. By allowing the mixture to stand for six hours as directed, particularly if the weather be cold, the whole becomes involved in a spongy mass of acicular crystals of nitrate of potash, from which the alkaline metallic solution is to be poured off: it is clear, and of a deep brownish red colour, if the acid solution contain the metal at the minimum of oxidizement: but if at the maximum, it is turbid and of a redder hue. The first of these is the preparation of the London College.

Qualities. — This preparation has an alkaline, slightly styptic taste, and excites the sensation of coldness in the mouth produced by nitrate of potash, but in an inferior degree. The metallic part is precipitated by water[4]; and the clear superna-

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1 Teinture martiale alkaline de Stahl (*F.*) Tintura di marte alkalina de Stahl (*I.*)

2 This name has been justly criticised, as implying an unknown substance, "*alkaline iron*;" it should have been, Liquor alkalinus ferri oxidi.

3 The concentrated acid scarcely acts on iron.

4 This precipitate, when the iron has been rapidly dissolved in the acid and heat employed, is a combination of peroxide of iron and carbonic acid. It effervesces strongly with muriatic acid, and gives off carbonic acid during the solution.

tant fluid, when evaporated, yields crystals of nitrate of potash, proving that the solution contains this salt mixed with the alkaline oxide of iron, if not a nitrate of potash and iron. On the addition of alcohol to this solution the whole of the solid ingredients are thrown down in a concreted mass; it is also decomposed by the strong acids, and the pure alkalies; and after being kept for some time, if not very well excluded from the air, it becomes gradually turbid, perhaps owing to the abstraction of oxygen from the atmosphere more completely oxidizing the metal, and much of the oxide is deposited.

Medical properties and uses. — This solution very probably agrees with the other preparations of iron in its medicinal properties; but, setting aside the difficulty of procuring it always of an uniform strength, and the many circumstances in conducting the process, that may alter altogether the nature of the product, we do not know in what mode it can be given; as water, and consequently all infusions and decoctions decompose it, and precipitate the metal. It is therefore difficult to conceive for what purpose it has been introduced into the London Pharmacopœia.

TINCTURA FERRI AMMONIATI. Lond. *Tincture of ammoniated iron.*

"Take of ammoniated iron, *four ounces;* proof spirit, *a pint.* Digest and filter." This being merely a spirituous solution of ammoniated iron, it seems to be unnecessarily introduced into the pharmacopœia by the London College.

TINCTURA FERRI MURIATIS.[1] Lond. *Tincture of Muriate of Iron.*

"Take of carbonate of iron, *half a pound;* muriatic acid, *a pint;* rectified spirit, *three pints.* Pour the acid over the carbonate of iron, in a glass vessel, and shake them occasionally for three days. Set apart the liquor, that the fæces, if there be any, may subside; then pour off the solution, and add the spirit to it."

Edinburgh.

"Take of black oxide of iron, purified and reduced to powder, *three ounces;* muriatic acid, about *ten ounces,* or as much as may be sufficient to dissolve the powder. Digest with a gentle heat, and the powder being dissolved, add as much alcohol as will make the whole liquor amount to two pounds and a half."

Dublin.

"Take of rust of iron, *half a pound;* muriatic acid, *three pounds;* rectified spirits of wine, *three pints.* Put the rust

[1] Koch salzaure Eisentinktur (*G.*) Tinctura di muriato di Ferro (*I.*)

into a glass vessel, pour on the acid, and agitate it occasionally; then set it aside that the fæces may subside, and pour off the liquor: evaporate this slowly, to *one pint*, and when it is cold, add the spirit."

TINCTURA MURIATIS FERRI CUM OXIDO RUBRO. Dub. *Tincture of Muriate of Iron, with the Red Oxide.*

"Take of red oxide of iron, *an ounce*; muriatic acid, *four fluid ounces*; rectified spirit of wine, *a sufficient quantity*. Digest the oxide with the acid for twenty-four hours; then boil the solution for half an hour; evaporate the filtered solution to the thickness of honey, and when it is cold, add rectified spirits of wine, with frequent agitation, until the specific gravity of the tincture be, to that of distilled water, as 1050 to 1000."

Of the formulæ given for the preparation of this tincture, those of the London and the Dublin pharmacopœias are to be preferred. The metal, as ordered in them, is in a higher state of oxidizement, and forms at once, by its combination with the acid, an uniform compound soluble in alcohol; whereas, by following the Edinburgh process, the solution is a mixture of the above muriate, and of the less soluble or green muriate[r], the black oxide not being all completely oxidized; and it is not till after the exposure to air, and by attracting oxygen, that it is converted altogether into the more soluble muriate. Hence the Edinburgh preparation cannot be always of an uniform and fixed strength, which, for an active medicine, is a matter of much importance. The introduction of the last preparation by the Dublin College is superfluous.

Qualities. — The alcoholic solution of muriate of iron is of a brownish yellow colour, has a peculiar odour and a very styptic taste. It contains the iron in a state of oxymuriate; and when it is distilled, this acid comes over, and leaves a black oxide of iron in the retort. With the alkalies and their carbonates it gives a red precipitate; strikes a black colour with infusions of astringent vegetables; and forms with mucilage of acacia gum, an orange-coloured jelly. Hence these substances cannot enter into compositions with this tincture.

Medical properties and uses. — This is an active and elegant preparation of iron, well adapted for all the diseases in which chalybeates prove serviceable. It is also recommended in dysury depending on spasmodic stricture of the urethra, in which case it is given in doses of five or six drops, repeated every ten or fifteen minutes, until nausea be induced. It is also used externally, as a styptic in cancerous and loose fun-

[r] When iron filings are dissolved in muriatic acid, and completely excluded from the air, a muriate is formed insoluble in spirit of wine. *Davy's Researches*, p. 180.

gous sores. The usual dose is from ♏ x. to ♏ xxx. in a glass of water: but it may be gradually increased to ♏ cxx.

ACETAS FERRI. Dub.[1] *Acetate of Iron.*

"Take of carbonate of iron, *half an ounce*; acetic acid, *three fluid ounces*. Digest for three days, and filter."

This preparation is a mild and efficacious chalybeate; but if the variety of forms in which iron is ordered to be prepared for medicinal purposes be considered, it will obviously appear to be superfluous.

TINCTURA ACETATIS FERRI.[2] Dub. *Tincture of Acetate of Iron.*

"Take of acetate of kali, *two ounces*; sulphate of iron, *one ounce*; rectified spirit of wine, *two pints*. Rub together the acetate of kali and the sulphate of iron, in a stone-ware mortar, until they unite into a soft mass; dry this with a moderate heat, and triturate it with the spirit; then put the mixture into a phial; cork it closely, and digest for *seven days*, frequently shaking it: finally, pour the clear tincture from off the fæces."

TINCTURA ACETATIS FERRI CUM ALCOHOLE. Dub. *Tincture of Acetate of Iron with Alcohol.*

"Take of sulphate of iron, acetate of kali, each *an ounce*; alcohol, *two pints*. Rub together the acetate of kali and the sulphate of iron in a stone-ware mortar, until they unite into a soft mass; then dry this with a moderate heat, and when it is cold, triturate it with the alcohol. Put the mixture into a phial, cork it closely, and digest for *twenty-four hours*, frequently shaking it; finally, pour the clear tincture from off the fæces."

These two preparations differ in scarcely any thing except strength; the theory of the formation of the acetate of iron being the same in both cases. During the process a double decomposition takes place; the sulphuric acid of the sulphate of iron leaves the iron and unites with the potash of the acetate of potash, while the disengaged acetic acid of the latter salt combines with the iron, forming acetate of iron, which is soluble in the alcohol. It is also probable that the oxide of iron absorbs oxygen during the trituration, and being thus more completely oxidized, the mass must contain, instead of an acetate, an oxyacetate of iron, which is more readily dissolved in the alcohol. The sulphate of potash remains undissolved in both processes, with a small portion of uncombined oxide of iron, in the form of a brownish precipitate.

Qualities.—These tinctures have a peculiar odour, a warm

[1] Acetate de Fer (*F.*) Acetato di Ferro (*I.*)

[2] Teinture de l'acetate de Fer (*F.*) Tinturo di marte astringente (*I.*)

styptic taste, and a reddish-brown colour. They are decomposed by the alkalies and their carbonates, and the strong acids, and by infusions of astringent vegetables, which are therefore incompatible in formulæ with them.

Medical properties and uses.—These spirituous solutions of acetate of iron possess the same properties as the other preparations of this metal; but if the introduction of the simple acetate be superfluous, the double form of its spirituous solution is still more objectionable. Indeed, every advantage that can be expected from any of these forms of the acetate can be equally obtained from the tartrate of iron and potash (*ferrum tartarizatum*). And we cannot conceive that any particular benefit can result to practice from loading the list of remedies with all the multifarious states of combination of which the same substance is susceptible. The dose of either of these tinctures may be from ♏ x. to f℥j. given in a sufficient quantity of water, or any other proper vehicle.

VI'NUM FER'RI. Lond. *Wine of Iron.*[1]

"Take of filings of iron, *two ounces*; wine, *two pints*. Mix them, and set the mixture aside for a month, occasionally shaking it; then filter it through paper."

Dublin.

"Take of iron wire cut in pieces, *four ounces*; white Rhenish wine, *four pints*. Sprinkle a little of the wine over the iron filings, and expose them to the air, until they be covered with rust, then add the remainder of the wine; digest for seven days, frequently agitating; and, lastly, filter."

As the iron is oxidized and dissolved in the wine by the tartaric acid of the supertartrate of potash it contains, the Rhenish wine ordered by the Dublin Pharmacopœia will be found to answer better for this preparation than the sherry directed by the London College. It is therefore a vinous solution of tartrate of iron and potash; and when prepared in the mode ordered by the London College, each pint contains about grs. xxij. of oxide of iron. The strength, however, must altogether depend upon the state of the wine: and it is to be regretted that the College did not follow the same plan it adopted for the solution of ammoniated copper, and employ a given portion of *ferrum tartarizatum*, which readily dissolves in wine, and forms a permanent solution.

Medical properties and uses.—This is the least unpleasant of the preparations of iron. It is chiefly employed in chlorosis, and the relaxed habits of young females. The dose is from f℥j. to f℥vj. given twice or three times a day.

[1] Vinum chalybeatum, P. L. 1745. Eissenwein (*G.*)

PRÆPARATA EX HYDRARGYRO.

PREPARATIONS OF MERCURY.

HYDRAR'GYRI NITRICO-OX'YDUM. Lond. *Nitric Oxide of Mercury.*[1]

"Take of purified mercury, *three pounds*; nitric acid (by weight) *a pound and a half*; distilled water, *two pints*. Mix them in a glass vessel, and boil until the mercury be dissolved, and a white mass remains after the evaporation of the water. Rub this into powder, and put it into another vessel very shallow; then expose it to a gentle heat, and gradually raise the fire until it cease to emit red vapours.

OXYDUM HYDRARGYRI RUBRUM PER ACIDUM NITRICUM. Edin. *Red Oxide of Mercury by nitric Acid.*

"Take of purified mercury, *three parts*; diluted nitrous acid, *four parts*. Dissolve the mercury, and evaporate the solution over a gentle fire to a white dry mass, which being rubbed to a powder, is to be put into a glass cucurbite, and covered with a thick plate of glass. Then adapt a capital to the vessel, and having placed it in a sand-bath, let the contained matter be roasted with a fire gradually raised until it pass into small very red scales."

OXYDUM HYDRARGYRI NITRICUM. Dub. *Nitric Oxide of Mercury.*

"Take of purified mercury, *ten ounces*; diluted nitrous acid, *ten fluid ounces*. Let them be mixed in a glass, and the mercury dissolved with a gradually raised heat; then increase the fire until the residuary matter in the bottom of the vessel be converted into red scales."

In this process the mercury is first oxidized at the expense of part of the acid employed, and the oxide, which is in a high state of oxidizement, combines with the undecomposed acid, so as to form a nitrate of mercury. By augmenting the heat, this nitrate is decomposed, the acid and water are nearly altogether expelled, and the oxide is left of a bright red colour, or rather the subnitrate, for it is combined with a small portion of acid. However simple the process may appear to be, yet it has been always found difficult to produce the bright red scaly

[1] Hydrargyrus nitratus ruber, P. L. 1787. Oxide mercure rouge par l'acide nitrique (*F.*) Rother prăcipitat. (*G.*) Mercurio Precipitato Rosso (*I.*)

appearance, which the product should have when it is properly prepared. Much of the success of the process appears to depend on the purity of the acid; the proper regulation of the heat, which, at the utmost, should not be 600°[1]; and the scale on which it is formed, the heat being more steadily maintained, and acting with more uniformity, on a large than on a small quantity of materials. Hence the red precipitate prepared in Holland, where it is manufactured largely, has always been considered better than any prepared in this country. The proportions used by the Dutch chemists are 50 pounds of pure mercury, and 70 of pure nitrous acid of a specific gravity 1·3. The decomposition is conducted in very large flat vessels, the fire being raised when the gaseous nitrous acid ceases to be sensibly disengaged; and the test of its perfection is the inflammation of a match which has been just blown out, by introducing it into the vapour arising from the decomposing oxide.[2]

Qualities.— When properly prepared, this subnitrate of mercury is in small scales of a bright red colour, very acrid and corrosive; insoluble in water, but totally soluble in nitric acid without effervescence. It is completely volatilized in a red heat, and at the same time decomposed. We have found the observation of Dr. Murray correct, that "if the preparation be boiled for a short time with five or six times its weight of water, the liquor, when filtered, has the styptic metallic taste, and gives a white precipitate with water of ammonia or carbonate of potash; a plain proof that it holds dissolved nitrate of mercury."[3] According to Payssè, 100 parts contain 82 of mercury, and 18 of oxygen. It is sometimes adulterated with red oxide of lead, which may be detected by dissolving one part of the oxide in four of acetic acid; if lead be present, the solution has a sweetish taste; and when sulphureted water is dropped into it, a dirty dark precipitate is thrown down.

Medical properties and uses.— Nitric oxide of mercury is stimulant and escharotic. It is an external application only, being used, when rubbed into a fine powder, as a stimulant to old sores, and for destroying fungus. As a powder, in the proportion of gr. ss to grs. iv. of sugar, it is blown into the eye to remove specks on the cornea; and formed into an ointment with lard, it is an useful application to ulcerations of the eyelids, and to chancres.

Officinal preparation. *Unguentum Hydrargyri Nitrico-oxidi.* L. E. D.

[1] Higgins, *Essays*, i. 133.
M. Payssè, *Annales de Chimie*, li. 202.
[2] *System of Materia Medica*, ii. 329. Dr. Murray suggests, that it should have been named *Submitras Hydrargyri ruber*.

ACETAS HYDRARGYRI. Edin.[1] *Acetate of Mercury.*

"Take of purified mercury, *three ounces*; diluted nitrous acid, *four ounces and a half, or a little more than may be required for dissolving the mercury*; acetate of potash, *three ounces*; boiling water, *eight pounds*. Mix the mercury with the acid; and, towards the cessation of the effervescence, digest, if necessary, until the mercury be completely dissolved. Then dissolve the acetate of potash in the boiling water; and immediately to this solution, still hot, add the former, and mix them together by agitation. Set the mixture aside to crystallize; then wash the crystals placed in a funnel with cold distilled water; and finally dry them with a very gentle heat.

"In preparing acetate of mercury, it is necessary that all the vessels, and the funnel, which are used, be of glass."

ACETAS HYDRARGYRI. Dub. *Acetate of Mercury.*

"Take of purified mercury, *three ounces*; diluted nitrous acid, *three fluid ounces*; acetate of kali, *three ounces*; boiling distilled water, *eight pints*. Add the acid to the mercury, and when the effervescence is over, digest upon hot sand, that the metal may be dissolved; mix this solution immediately with the boiling water in which the acetate of kali has been previously dissolved, and then let the mixture be passed as quickly as possible through a double linen cloth. Cool it, that crystals may form; wash these with cold distilled water, and dry them upon paper with a very gentle heat.

"In the whole of this process glass vessels must be used."

Acetic acid scarcely acts on mercury, but by either of the above processes the acetate may be formed. Nitrate of mercury is first obtained by the action of the nitric acid on the mercury; and this is decomposed by the acetate of potash, the alkali of which unites with the acid of the metallic salt, and forms nitrate of potash, which remains in solution; while the disengaged acetic acid combines with the oxide of mercury, and forms the acetate of mercury, which readily crystallizes, and is thus easily separated. By preparing the solution of the nitrate of mercury with a gentle heat, when there is an excess of acid, the portion of mild acetate of mercury produced is considerable; but if the quantity of acid be sufficient for the saturation only of the oxide, a sudden decomposition of the solution is effected by the hot water which contains the acetate of potash in solution, independent of the action of the acetate, and a subnitrate of mercury of a yellow colour is precipitated. Hence the propriety of the direction of the Edinburgh College to use more acid "than is required for dissolving the mercury." It is of much importance also that the degree of heat be low;

[1] Acetate de Mercure (*F.*) Essigsaures Quecksilber (*G.*) Acetato di Mercurio (*I.*)

for if a high temperature be employed, the metal is oxidized to a maximum, and the product of the subsequent part of the process is an oxyacetate, which is very acrid and soluble, instead of the salt intended to be produced. For the success of the process, which often fails, the solution of the acetate of potash should not be used immediately after it is made, but should be scarcely more than tepid when it is mixed with the solution of nitrate of mercury; and to the water employed for washing the salt, should be added about f℥j. of distilled vinegar for every Oſs of water; which prevents the partial decomposition of the acetate, and the consequent yellow colour of the crystals, that sometimes occur in the washing.

Qualities. — This salt, when properly prepared, is in small flat crystals, of a silvery whiteness, acrid to the taste, soluble in hot water, but scarcely soluble in cold water; and having an acrid taste. It is insoluble in alcohol. The alkalies decompose it, and it is readily decomposed by heat. Light also has this effect, blackening the salt. The proportion of its constituents has not yet been ascertained.

Medical properties and uses. — Acetate of mercury is antisyphilitic and alterative; but it is scarcely ever used, unless as the active ingredient of Keyser's pills. As an external application, a solution of it, in the proportion of grs. ij. in f℥ij. of rose water, is used in some cutaneous affections. The internal dose is gr. j, night and morning.

HYDRARGYRI OXYDUM CINEREUM. [1] Lond. *Grey Oxide of Mercury.*

"Take of submuriate of mercury, *an ounce*; lime-water, *a gallon*. Boil the submuriate of mercury in the lime-water, stirring it assiduously, until the grey oxide of mercury subside. Wash this with distilled water, and then dry it."

OXIDUM HYDRARGYRI CINEREUM. Edin. *Grey Oxide of Mercury.*

"Take of submuriate of mercury, *half an ounce*; lime-water *five pounds*. Boil the submuriate in the solution, for a quarter of an hour in a slightly covered vessel. Pour off the supernatant fluid, then wash the oxide with distilled water; and dry it."

PULVIS HYDRARGYRI CINEREUS. Dub. *Grey Powder of Mercury.*

"Take of mercury, *two ounces*; diluted nitrous acid, *two fluid ounces*; dissolve the mercury in a slow heat, and dilute the solution with *eight fluid ounces* of cold water; then drop into it *one ounce and a half* of the water of carbonate of ammonia, or as much as may be sufficient for precipitating the

[1] Oxide gris de Mercure (*F.*) Schwarzes gesauertes Quecksilber (*G.*) Protossido cinereo di Mercurio (*I.*)

whole of the metal, which is to be washed with boiling distilled water, until the poured off fluid yield no sediment when water of sulphuret of ammonia is dropped into it. Finally, let the precipitate be dried."

The appellations given to these preparations would lead to the supposition that they were essentially the same, although the Dublin process differs from the other two; and scarcely any difference, indeed, exists between the products of the three processes, when they are properly conducted. In the London and Edinburgh processes, the lime-water decomposes the mercurial salt, its lime unites with the acid of the mild muriate, and the insoluble oxide, which is at a low state of oxidizement, remains of a greyish colour, while the muriate of lime which is formed, being soluble, is easily separated by washing. In the Dublin process it is intended, first, to produce a nitrate of mercury with the metal, at a low state of oxidizement; so that by the addition of the carbonate of ammonia a decomposition may be effected, and grey oxide of mercury, and muriate of ammonia formed, which are to be separated by the subsequent washings. But if the nitrate of mercury be formed, with the assistance of heat, as ordered by the Dublin College; or even if the solution be quickly made without heat, the metal becomes too highly oxidized, and the result is not the grey oxide, which the College intends should be produced, but is a mixture of the grey oxide, and a triple compound of oxide, mercury, ammonia, and nitric acid.[1] The directions of this formula are not sufficiently distinct to produce the effect intended; and, therefore, the following directions given by Hahneman for this preparation are absolutely necessary to be followed for obtaining the grey oxide in a purer form. Dilute the acid with two parts of water, and add the mercury in small quantities at a time, placing the vessel in cold water to moderate the rise of temperature during the solution, which thus proceeds very slowly. When the acid has taken up as much of the metal as will saturate it, dilute the solution with twenty parts of distilled water, and drop in solution of ammonia as long as any precipitate is produced. Wash the precipitate immediately in water, and dry it on bibulous paper before the fire.[2] The same effect is produced if subcarbonates of ammonia be used, the carbonic acid being disengaged.

Qualities.—Grey oxide of mercury, properly prepared, is in the form of an impalpable blackish grey-coloured powder, which becomes paler if exposed to air and light. It is inodorous, insipid, and insoluble in water. In the state in which it is usually found in the shops, it is of a light grey colour, almost

[1] *Green's Chemistry*, (translation.) ii. 230.
[2] *Murray's Chemistry*, 2d edit. iii. 178.

approaching to a white, in which state it contains the triple salt above mentioned. When prepared according to the London formula, it has been supposed [1], that the lime not being able to abstract the whole of the acid, the product is strictly a submuriate of mercury. We find, from experiment, that this is actually the case, and it is not improbable that a minute portion of the lime may also be precipitated in the state of carbonate. The constituents of the grey oxide are supposed to be 96 parts of mercury, and 4 of oxygen, in 100 parts. [2]

Medical properties and uses. — The grey oxide of mercury, when well prepared, may be used as a substitute for the oxide prepared by trituration; and as it is more likely to be always of an uniform strength, it may of course be more depended on than that preparation. It has been, however, objected to for forming ointment for the purposes of mercurial frictions; (see *Ung. Oxydi Hydrargyri cinerei*) — but perhaps the objections have originated from that form of the preparation having been used which contains the triple salt. We have seen it used with advantage for fumigation, both locally applied to assist the healing of venereal ulcers; and, generally, to bring the habit under the influence of mercury, when it could not be introduced by the ordinary mode. The dose of this oxide is from gr. i. to grs. iij. given in the form of pill twice a day.

Officinal preparation. *Unguentum Oxidi Hydrargyri cinerei.* E.

HYDRARGYRI OXYDUM RUBRUM. Lond. [3] *Red Oxide of Mercury.*

"Take of purified mercury, *a pound.* Put the mercury into a glass vessel with a narrow mouth and broad at the bottom. Expose this vessel open to a heat of 600°, until the mercury be converted into red scales; then rub these to a fine powder."

OXYDUM HYDRARGYRI. Dub. *Oxide of Mercury.*

"Take of purified mercury, *any quantity.* Put it into an open glass vessel with a narrow mouth and a broader bottom, and expose it to a heat of about 600°, until it be converted into red scales."

In this process the mercury is brought nearly to the boiling point [4], so as to be volatilized, in which state it decomposes atmospherical air attracting its oxygen, and is converted into a red oxide. A small quantity of mercury requires several weeks to be thus oxidized; and therefore as much only is introduced into the vessel as can cover the bottom of it; and

[1] *Murray's System of Materia Medica*, ii. 326. [2] Fourcroy.

[3] Hydrargyrus calcinatus, P. L. 1787. Oxide de Mercure rouge par le feu (*F.*) Rothes Quecksilberoxyd (*G.*) Perossido rosso di Mercurio (*I.*)

[4] Irvine makes the boiling point of mercury to be 672°; Crichton, 655°; and Dalton, 660°.

both on this account, and in order to prevent the dissipation of the volatilized metal, the shape of the vessel is of some importance. It should have a wide bottom and a long neck, the extremity of which is extended almost to a point; and it should be heated in a sand-bath, the sand not rising higher round the vessel than the mercury stands within it. By keeping up a steady heat, a constant circulation of the mercurial vapour is kept up in the upper part of the matrass, and as it combines with oxygen, a dull film first forms on the surface of the mercury, which is next converted into a black powder, and then into red shining scales. A part of the mercury is always lost; and as the process requires much attention, and so long a time for its completion, the preparation is necessarily expensive.

Qualities.—*Red oxide of mercury* is obtained in the form of minute, crystalline, very brilliant, sparkling, deep red scales, inodorous, but acrid and caustic, although less so than the former preparation. It is soluble in several of the acids without decomposition. It is soluble in water also, and the solution changes to green the syrup of violets. When rubbed with running mercury, both are changed into black oxide; and when heated to ignition in a glass retort, it is decomposed; very pure oxygen being obtained, and the metal again returns to the state of running mercury. According to Lavoisier, 100 parts of this oxide contain 7 of oxygen; Fourcroy makes the proportion of oxygen 8; and Chenevix, 15 parts. The light partially decomposes the red oxide, hence it should be kept in opaque bottles.

Medical properties and uses.—This is a very active preparation of mercury, and has been employed by some very celebrated practitioners[1] as an internal remedy in syphilis. It is, however, very apt to vomit, purge, and otherwise violently affect the stomach and bowels; consequently it is now scarcely ever exhibited internally, or employed as an antisyphilitic. The dose may be gr. j. combined with gr. ss. of opium, in the form of pill, night and morning. It is chiefly used as an external stimulant, and escharotic in the same cases as the nitric oxide; being previously rubbed to a fine powder, and either sprinkled over the ulcers; or united with lard, and applied as an ointment.

HYDRARGYRI OXYMURIAS. Lond.[2] *Oxymuriate of Mercury.*

"Take of purified mercury, *two pounds*; sulphuric acid, *thirty ounces* (by weight); dried muriate of soda, *four pounds*. Boil the mercury with the sulphuric acid in a glass vessel, until the sulphate of mercury becomes dry: rub this, when it is cold,

[1] John Hunter. [2] *Syn.* Muriate de Mercure corrosif (*F.*) Azzendes alzsaures Quecksilber (*G.*) Mercurio sublimato corrosivo (*I.*)

with the muriate of soda in an earthen-ware mortar; then sublime it in a glass cucurbit with a gradually raised heat."

MURIAS HYDRARGYRI CORROSIVUS. Edin. *Corrosive Muriate of Mercury.*

"Take of purified mercury, *two pounds;* sulphuric acid, *two pounds and a half;* dried muriate of soda, *four pounds.* Boil the mercury with the sulphuric acid in a glass vessel placed in a sand-bath, until the matter becomes dry. Mix this, when it is cold, in a glass vessel, with the muriate of soda; then sublime in a glass cucurbit with a gradually raised heat. Separate the sublimed matter from the scoriæ."

MURIAS HYDRARGYRI CORROSIVUM. Dub. *Corrosive Muriate of Mercury.*

"Take of purified mercury *two pounds*; sulphuric acid, *three pounds*; dried muriate of soda, *two pounds and a half.* Dissolve the mercury in the acid, and gradually increase the heat until the matter become almost dry; let this, when it is cold, be rubbed with the muriate of soda in an earthen-ware mortar; and then sublime it in a proper vessel with a gradually raised heat."

Sulphuric acid does not act upon mercury at a low temperature; but when three parts of this acid are boiled upon two of mercury, the metal decomposes the acid, and is oxidized, sulphurous gas being emitted with effervescence; and there remains a dry mass of a fine white colour, which is an oxysulphate of mercury combined with an excess of acid. By triturating this salt with dried muriate of soda, and exposing the mixture to heat, a double decomposition is effected; the muriatic acid leaves the soda, and combines with the oxide of mercury of the oxysulphate, while the sulphuric acid unites with the soda, thus forming muriate of mercury and sulphate of soda, the former of which, being easily volatilized, is separated from the latter by sublimation. This process was first proposed by Kunkel, but no salt has been prepared by a greater variety of methods; and as it is now generally manufactured on the large scale, the proportions of the ingredients ordered by the Colleges are perhaps but seldom adopted. Of the three formulæ of the British Colleges, however, that of the Dublin College is to be preferred, as by the larger proportion of sulphuric acid, and the smaller of muriate of soda, a more complete decomposition of the muriate of soda is effected; and consequently a greater quantity of muriatic acid being evolved, a larger proportion of the oxide of mercury must necessarily be converted into muriate. Sixteen ounces of mercury should yield about ℥xx. of corrosive muriate. The most simple pro-

cess, and perhaps the best, is the direct solution of the red oxide of mercury in muriatic acid, by which the salt is obtained by spontaneous crystallization[1]; but it is too expensive for general purposes.

Qualities.—Corrosive muriate of mercury[2] is obtained by the above processes in the form of a white, shining, semi-transparent, easily pulverized mass, made up of small acicular crystals. When the process is very carefully and slowly conducted, the crystals are separate, regular, tetrahedrous, compressed and pointed. On exposure to the air the mass effloresces on the surface. Its specific gravity is 5·1398. It is inodorous, and has a very acrid, disagreeable metallic taste; changes to green several of the vegetable colours; is soluble in 11 parts of water at 60°, two parts at 212°, and in 4 parts of alcohol at 60°. It is soluble also in the sulphuric, nitric, and muriatic acids, and may be again obtained unaltered by evaporating the solutions. The fixed alkalies and alkaline earths decompose it, precipitating it from its solution of an orange-yellow colour, which becomes brick-red. It is also partially decomposed by exposure to light, and by some metals; and changed into calomel.[3] The carbonates of the fixed alkalies precipitate it of a fixed yellow hue, and ammonia forms with it a white triple insoluble compound, containing muriate of ammonia and oxide of mercury. When triturated with olive oil, the oil is whitened; and when boiled with it, a small portion of calomel is thrown down; and the same is the case when it is boiled with sugar. The volatile oils reduce it. It is also decomposed by solutions of tartrate of potash and antimony; nitrate of silver and superacetate of lead; and forms precipitates in infusions and decoctions of the following vegetable substances; chamomile flowers, horse-radish root, columba root, catechu, cinchona bark, rhubarb root, senna leaves, simaruba bark, oak bark, tea, and in the almond mixture: consequently, it is incompatible in extemporaneous formulæ with these substances. Mr. Chenevix made the first correct analysis of this salt: according to him, 100 grains of it consist of 18 parts of muriatic acid, and 82 of an oxide of mercury composed of 12·3 of oxygen and 69·7 of mercury[4]; but a more

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[1] *Annales de Chimie*, xxviii. 12.

[2] This appellation, which is that of the Edinburgh and Dublin Colleges, is certainly preferable to that of the London College. But as the name *oxymuriate* is improper in a strictly chemical sense, perhaps the name *deuto muriate of mercury*, which most justly designates its chemical character, would be less exceptionable than any other. The old names were, *Hydrargyrus muriatus*, *Mercurius sublimatus corrosivus*.

[3] Mr. Chenevix found, "that if a bit of copper be put into a solution of corrosive sublimate, a white powder shortly falls to the bottom, and that powder is calomel. When washed, it does not contain an atom of copper, nor of corrosive sublimate."

[4] *Phil. Trans.* 1802, part i. 157.

recent analysis of Zaboada makes the proportions 19·5 of acid, and 80·5 of oxide consisting of 8·5 of oxygen and 71·5 of mercury.[1] It should be preserved in opaque bottles.

Medical properties and uses. — This salt has been long known to chemists.[2] It is a powerful stimulant and alterative; and in large doses is one of the most violent of the metallic poisons. As an antisyphilitic it was early much extolled, and is the active ingredient of many a celebrated empirical nostrum; but modern practice has fixed its real merits much lower than they were formerly placed. When taken in over-doses, either by mistake, or designedly as a poison, the best antidote is white of egg *diluted* with water, and given in large frequently repeated doses. The albumen decomposes the corrosive muriate, reducing it to the state of the mild muriate, while the compound which it forms with it exerts no deleterious effect on the stomach.[3] The presence of corrosive sublimate in any solution suspected to contain it may be detected by putting into the fluid a small piece of clean polished copper, which, if the poison be present, will be covered with a white coating, or white streaks that acquire a metallic lustre when rubbed. It sometimes succeeds in curing the primary symptoms of syphilis, but as often fails; and although it checks the progress of the secondary symptoms, relieving venereal pains, and healing ulcers of the throat, "yet even in these cases," says Mr. Pearson, "it never confers permanent benefit; for new symptoms will appear during the use of it; and on many occasions it will fail of affording the least advantage to the patient from first to last."[4] It is given with more advantage in some other affections, as old ulcers, chronic rheumatism, and in cutaneous diseases, particularly lepra, in which Willan says it is the only useful preparation of mercury, "its operation being promoted by giving at the same time an antimonial[5]," and the decoction of the woods. Its sensible operation is by urine; but sometimes it occasions the most violent nausea, griping, and purging, in which cases it should be combined with opium; and it is always necessary to take, during its use, some mucilaginous fluid, to moderate the irritation it is apt to induce. It is also used as an external application. (See the following article.) The dose is from gr. $\frac{1}{8}$th to gr. $\frac{1}{4}$th, twice a day, made into a pill with crumb of bread or extract of poppies.

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[1] *Journal de Physique*, lx. 383.

[2] The preparation is said to have been long known to the Chinese, and it is mentioned by Rhazis and Avicenna Bergman, iv. 281.

[3] Orfila. *Traité des Poisons*, t. i. part i. p. 101.

[4] *Pearson on Remedies for Lues Venerea, &c.* 116.

[5] *Willan on Cutaneous Diseases*, 140.

Officinal preparations. *Liquor Hydrargyri Oxymuriatis.* L. *Hydrargyri Submurias.* L. E. D. *Hydrargyri Precipitatus albus.* L.

HYDRARGYRI SUBMURIAS.[1] Lond. *Submuriate of Mercury.*

Take of oxymuriate of mercury, *a pound*; purified mercury, *nine ounces.* Rub them together until the globules disappear; then sublime; afterwards take out the sublimed matter, reduce it to powder, and again sublime it twice. Finally, reduce it to a very subtile powder, in the same manner which has been directed for the preparation of chalk."

SUBMURIAS HYDRARGYRI MITIS, sive CALOMELAS. Edin. *Mild Submuriate of Mercury*, or *Calomel.*

" Take of muriate of mercury, *four parts*; purified mercury, *three parts.* Rub the muriate in a glass mortar with a little water, in order to prevent the acrid powder from rising, then add the mercury, and again triturate until it be extinguished; put the dried mass into an oblong phial, one-third of which only it shall fill, and sublime it in a sand-bath. Again triturate the sublimate powder, and sublime it, then reduce it to a fine powder, which is lastly, to be well washed with boiling distilled water."

SUBMURIAS HYDRARGYRI SUBLIMATUM, sive CALOMELAS. Dub. *Sublimed Submuriate of Mercury*, or *Calomel.*

" Take of corrosive muriate of mercury, *a pound*; purified mercury, *nine ounces.* Rub them together until the globules disappear, and sublime with a sufficient degree of heat. Let the sublimed matter be rubbed to powder, and again sublimed. Pulverize it, and wash it with frequent affusions of distilled water, until the poured off solution no longer lets any sediment fall on the addition of a few drops of carbonate of kali. Finally, dry it."

This very important preparation is a muriate of mercury, with the metal at a minimum of oxidizement.[2] By triturating the metallic mercury with the corrosive muriate, it is oxidized at the expence of the oxide of this salt, and the whole mass assumes a grey colour. The sublimations render the combi-

[1] Old names, *Aquila alba, Aquila mitigata, Manna Metallorum, Panchymagogum minerale, Panchymagogus quercetanus, Sublimatum dulce, Mercurius dulcis sublimatus, Calomelas. Syn.* Muriate de Mercure doux (*F.*) Mildes Salzsaures Quecksilber (*G.*) Mercurio dolce sublimato (*I.*)

[2] It is very remarkable that all the Colleges have erred in naming this preparation, which in no point of view can be regarded as a *submuriate*, but is as much a *muriate* as the corrosive sublimate; the sole difference depending on the degree of oxidizement of the metal, which in this preparation is at a minimum. In a medical point of view, we are of opinion that the name *calomel*, however absurd, ought to have been retained, as the syllables *oxy* and *sub* are scarcely sufficient to distinguish the two salts to blundering assistants and apprentices, by whom the most dangerous mistakes may be committed.

nation of the new oxide with the acid complete; but this is not the case in the first sublimation; for both metallic mercury and corrosive muriate are found unchanged in the sublimed mass; and hence the necessity of the second trituration and the subsequent sublimations. By repeating, however, the sublimations too often the product is injured, as corrosive muriate is formed in each sublimation, owing to the attraction of oxygen from the air of the apparatus. The final trituration and levigation are intended to separate any corrosive muriate that may have been formed, and the test of the Dublin Pharmacopœia ought always to be had recourse to for ascertaining this point. In performing the process, the addition of a little water during the trituration of the ingredients, in the first instance, is very necessary; as otherwise, the operator is apt to suffer extremely from the acrid powder of the corrosive muriate which is elevated. Mr. Howard has lately proposed the following improvement in the mode of conducting the sublimation, by which the difficulty which attends the grinding and levigation of the mass sublimed in the usual mode is altogether avoided. Instead of subliming so as to obtain the calomel in a concrete form, the vapour, as it rises, is thrown into a vessel containing water, where it instantly condenses in the form of a fine white impalpable powder. It is not, however, certain that the preparation does not suffer some change of composition, as it is lighter than the levigated calomel in the proportion of 3 to 5. It is undoubtedly more free from any combination of corrosive muriate.

Qualities. — Calomel is obtained by the above processes in the form of a dull semitransparent mass, composed, when the sublimation has been slowly conducted, of short prismatic crystals, the specific gravity of which is 7·1758.[1] It is inodorous, insipid, and has a light yellow or ivory colour, which deepens by long exposure to the light. It is regarded as insoluble, one part requiring 1152 of water at 212° for its solution.[2] Nitric acid converts it into corrosive muriate, much nitrous gas being evolved; and the same change is effected by oxymuriatic acid. Lime-water and the alkalies, when triturated with it, instantly render it black, a circumstance which supplies us with a test of its purity, for if it contain any corrosive muriate, a yellow tint is mingled with the black on the addition of lime water. According to Chenevix, 100 parts of it contain, 11·5 of muriatic acid, and 88·5 oxide of mercury,

[1] *Annales de Chimie*, xxviii. 12.

[2] Rouelle.

consisting of 79 of mercury and 9·5 of oxygen[1] : but according to Zaboada, the proportions are, 10·6 of acid, and 89·4 of oxide, consisting of 85 of mercury and 4·4 of oxygen.[2]

Medical properties and uses. — This is the most useful of the preparations of mercury, and is more generally employed than almost any other remedy in the whole range of the materia medica. It is antisyphilitic, antispasmodic, alterative, deobstruent, purgative, and errhine. As a remedy in syphilis, it can be fully confided in, when its disposition to run off by the bowels is counteracted by opium; and in the same state of combination it is also found efficacious in several convulsive affections, as epilepsy, trismus, and tetanus: and in that species of spasmodic stricture which occurs in virulent gonorrhœa. As an alterative and deobstruent, it is employed with advantage in cutaneous eruptions, as lepra, and scabies, in which cases it is combined with antimonials and guaiacum; and in hepatitis, and glandular obstructions: in dropsies it assists the action of squill and fox-glove; and as a purgative it may be employed with safety in almost every form of disease not attended with visceral inflammation, or where there is not great irritability and delicacy of habit. Calomel, however, does not act with certainty as a purgative even in large doses, and hence it is generally combined with scammony, jalap, or some other active cathartic. The usual dose to affect the habit and produce ptyalism is from gr. j. to grs. ij. in a pill with opium, given night and morning; and from grs. iij. to grs. viij. act in general as a purgative: but in some complaints, as yellow fever and croup for example, in which it is supposed to exert a specific effect, this dose has been repeated every two or three hours, until upwards of 100 grains have been taken in a very short space of time.

On account of its insolubility and great specific gravity, it can be given only in the form of pills.

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[1] Comparative Table of the components of Calomel and Corrosive Sublimate.

CALOMEL.		CORROSIVE SUBLIMATE.	
The oxide of mercury in calomel is composed of		The oxide of mercury in corrosive sublimate is composed of	
Mercury	89·3	Mercury	85
Oxygen	10·7	Oxygen	15
	100·0		100
And calomel is composed of		And corrosive sublimate is composed	
Mercury 79 / Oxygen 9.5 — Oxide of mercury	88·5	Mercury 69·7 / Oxygen 12·3 — Oxide of mercury	82
Muriatic acid	11·5	Muriatic acid	18
	100·0		100

Chenevix, *Phil. Trans.* 1802, 157.

[2] *Journal de Physique.*

SUBMURIAS HYDRARGYRI PRÆCIPITATUS.

Edin. *Precipitated Submuriate of Mercury.*

" Take of diluted nitrous acid, purified mercury, each *eight ounces;* muriate of soda, *four ounces and a half;* boiling water, *eight pounds.* Mix the mercury with the diluted nitrous acid, and towards the termination of the effervescence digest with a gentle heat, frequently shaking the vessel. It is requisite, however, that more mercury be mixed with the acid than it can dissolve, so that a completely saturated solution be obtained.

" Dissolve at the same time the muriate of soda in the boiling water; then to this add the other solution while it is yet warm, and mix them very quickly together. After the precipitate has subsided, pour off the saline fluid, and wash the submuriate of mercury by frequent affusions of warm water, which are to be poured off each time after the precipitate subsides, until the water comes off tasteless."

SUBMURIAS HYDRARGYRI PRÆCIPITATUM. Dub. *Precipitated Submuriate of Mercury.*

" Take of purified mercury, *seven ounces;* diluted nitrous acid, *five fluid ounces.* Pour the acid upon the mercury in a glass vessel, and when the effervescence has ceased, digest with a gentle heat for six hours, with frequent agitation. Then raise the heat, that the solution may boil a little, which is to be poured off from the residual mercury, and quickly mixed with *ten pounds* of boiling water, in which *four ounces* of muriate of soda have been previously dissolved; wash the powder that subsides with warm distilled water, as long as the fluid poured off from it yields a precipitate on the addition of a few drops of the solution of (*sub*) carbonate of kali; lastly, let it be dried."

These processes are framed on the process originally suggested by Scheele, and the error into which he was led by reasoning from a false analogy has not been corrected by the Colleges; the product of the above process being a mild muriate of mercury mixed with subnitrate of mercury which modifies its powers, a smaller proportion also of mild muriate being obtained than should follow from the quantity of mercury employed. The cause of this effect is, that by dissolving mercury in nitric acid with the assistance of heat, the metal contained in the acid solution is oxidized to a maximum, and when water is added to it, a subnitrate is precipitated, while a supernitrate remains in solution. Hence, on the addition of the watery solution of muriate of soda, the water occasions the subnitrate to be precipitated, before the decomposition which takes place is effected, at the same time part of the oxide com-

bines with the acid of the muriate of soda, and forms a portion of corrosive muriate which is held in solution with the newly formed nitrate of soda, while the mild muriate is precipitated in combination with insoluble subnitrate of mercury.

To obtain, therefore, the greatest proportion of pure mild muriate of mercury by precipitation, the nitrate must be prepared slowly, and without the aid of heat, which should not be employed in any part of the process. Dr. Murray ascertained, that "the quantity of mild muriate obtained from a solution of ℥j. of mercury in diluted nitric acid in the cold, is a little more than ℥j.; while from the same quantity dissolved with the application of heat, the precipitate did not exceed ℥ſs, while the liquor held dissolved much more corrosive muriate than the other.[1]

Qualities. — Precipitated mild muriate of mercury, when properly prepared, is inodorous and insipid. It is whiter, smoother, and lighter, than the sublimed preparation, but otherwise agrees with it, both in its chemical qualities, and medicinal effects. As prepared, however, according to the directions of the pharmacopœias, subnitrate of mercury, which it contains, may have some effect in altering its powers in a small degree.

Medical properties and uses. — It is said to be more liable to run off by the bowels than common calomel; but as its properties are essentially the same, it may be regarded as a superfluous preparation.

HYDRARGYRI SULPHURETUM NIGRUM.[2] *Lond.* *Black Sulphuret of Mercury.*

"Take of purified mercury, *one pound*; sublimed sulphur, *a pound*. Triturate them together until the globules disappear."

SULPHURETUM HYDRARGYRI NIGRUM. Edin. Dub. *Black Sulphuret of Mercury.*

"Take of purified mercury, sublimed sulphur, of each *equal weights*. Rub them together in a glass mortar with a glass pestle, until the globules of mercury altogether disappear. It may be made with double the quantity also of mercury."

During the trituration of the mercury with the sulphur, Fourcroy supposes that the metal is imperfectly oxidized by attracting oxygen from the atmosphere; but this opinion has been disproved by the experiments of Proust[3]; and although a chemical combination be effected between the mercury and the sulphur, yet the real nature of the preparation is not understood.

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[1] *System of Materia Medica*, &c. ii. 319.

[2] Hydrargyrus e Sulphure, P. L. 1787. Sulphure de Mercure noir (*F.*) Schwarzes Schwefelquecksilber (*G.*) Solfuro di Mercurio nero (*I.*)

[3] *Journal de Physique*, liii. 92.

Qualities. — Black sulphuret of mercury is in the form of a very black, impalpable, inodorous, insipid powder. When heated in an open vessel it emits sulphurous acid gas; becomes first of a deep violet hue, and afterwards sublimes of a brilliant red colour. It is insoluble in nitric acrid, but is totally dissolved by a solution of pure potash, from which the acids precipitate it unchanged. It is often ill prepared, which may be known by rubbing a portion of it on gold; to which, if it be good, no whiteness will be communicated. It is, also, sometimes adulterated with ivory-black, which may be detected in it by throwing a little of the suspected sulphuret on a red-hot iron; if ivory-black be present, some ashes will be left after the volatilization, which will not be the case, when it is good, the pure sulphuret being completely dissipated.

Medical properties and uses. — This mercurial preparation is alterative and anthelmintic. It is chiefly employed against scrophulous swellings, and in cutaneous affections; and has been found useful in ascarides. But it is on the whole a very uncertain preparation, and requires to be long used to produce any sensible effects. The dose is from grs. v. to ʒfs, given twice or three times a day.

HYDRAR'GYRI SULPHURE'TUM [1]RU'BRUM. Lond. *Red Sulphuret of Mercury.*

"Take of purified mercury, *forty ounces*; sublimed sulphur, *eight ounces*. Having melted the sulphur over the fire, mix in the mercury, and, immediately the mass swells, remove the vessel from the fire, and cover it with force to prevent it from catching fire; then rub it into powder and sublime."

SULPHURATUM HYDRARGYRI RUBRUM. Dub. *Red Sulphuret of Mercury.*

"Take of purified mercury, *forty ounces*; sublimed sulphur, *eight ounces*. Mix the mercury with the melted sulphur; and if the mixture take fire, extinguish it by covering the vessel; then rub the mass to powder, and sublime it."

By these processes the mercury and sulphur are more intimately combined, and a more complete sulphuret produced than in the former preparation. The inflammation which is apt to happen after the mixture of the mercury with the melted sulphur, when the mass swells and explodes, as frequently occurs, is similar to the combustion during the union of sulphur by heat with some other metals, independent of the presence of air: hence, covering the vessel, without removing it from the fire, does not check the combustion,

[1] Cinnabaris factitia, P. L. 1745. Hydrargyrus sulphuratus ruber, P. L. 1787. Sulphure de Mercure rouge (*F.*) Zinnober (*G.*) Solfuro di Mercurio rosso (*I.*) Shengerf (*H.*)

although, by excluding the air, a real inflammation of the materials may be prevented. In the second part of the process great caution is necessary to prevent the neck of the vessel in which it is sublimed from being choaked up by the sublimed sulphuret; as by the occurrence of such an accident the vessel would be burst by the confined vapours. To avoid this, a wide-necked vessel should be used.

The cinnabar of commerce, which is chiefly used as a pigment, is manufactured in Holland, on a very extensive scale [1]; and the following method has been proposed by Mr. Kirchoff, for obtaining it in the humid way. First, form ethiops mineral, by triturating, in a porcelain cup with a glass pestle, 300 grains of mercury, and 68 of sulphur, moistened with a few drops of solution of potash, and then add to it 160 grains of potash, dissolved in an equal weight of water. Heat the vessel with the ingredients over the flame of a candle, continuing the trituration, and adding, as the fluid evaporates, pure water from time to time, so as to keep the ingredients covered to the depth of an inch. At the end of two hours, if the trituration has been continued, the colour of the mixture changes from black to brown, and then to red; after which no more water should be added, but the trituration must be uninterruptedly continued until the mass have acquired the consistence of a jelly, and the red colour attained considerable brightness and beauty: the heat must be then immediately withdrawn, otherwise the red soon changes to a dirty brown. [2]

Qualities. — Red sulphuret of mercury sublimes in the form of a vivid red crystalline cake, and yields, by trituration, a powder of a very bright red colour, which is indorous, insipid, and insoluble in water, alcohol, and the acids. It is decomposed, however, by nitro-muriatic acid, which combines with the mercury, and disengages the sulphur; but is not altered by solutions of the alkalies, even when boiled with them; although potash, soda, and most of the metals decompose it when melted with it. Vauquelin supposed that it contains the metal in a state of high oxidizement; a supposition which the experiments of Proust and Seguin have completely disproved. According to Proust, 100 parts of the sulphuret consist of 85 of unoxidized mercury, and 15 of sulphur; but according to the latter experiments of Guibourt [3], the proportions are 86·1803 of mercury and 13·8197 of sulphur. This preparation is sometimes adulterated with red-lead, dragon's blood, and chalk; the first is discovered by the same process

[1] See a description of the method, *Annales de Chimie*, li. 196.
[2] *Nicholson's Journal*, 4to. ii. 1.
[3] *Journ. de Pharmacie*, Aout. 1816. p. 371.

as was described for discovering it in the red oxide; spirit of wine detects the second by extracting the colouring matter; and the last is discovered by an effervescence being excited by muriatic acid; and the production of sulphate of lime on adding sulphuric acid.

Medical properties and uses. — Red sulphuret of mercury is alterative and deobstruent. It was formerly much used in cutaneous diseases, gouty and rheumatic affections, and in worms. It is now, however, scarcely ever prescribed. It has been recommended for fumigations in syphilis; but on account of the sulphurous vapours it is less fit for this purpose than the grey oxide. The dose for internal use is from grs. x. to ʒs. made into an electuary or bolus.

SUB-SULPHAS HYDRARGYRI FLAVUS.[1] Edin. *Yellow Sub-Sulphate of Mercury.*

"Take of purified mercury, *two parts;* sulphuric acid, *three parts.* Put them into a glass cucurbit, placed in a sand-bath, and boil them to dryness. Pulverize the white mass which is left at the bottom of the vessel, and throw it into boiling water. It will immediately be converted into a yellow powder, which is to be washed with frequent affusions of warm water."

OXYDUM HYDRARGYRI SULPHURICUM. Dub. *Sulphuric Oxide of Mercury.*

"Take of purified mercury, *a pound;* sulphuric acid, *a pound and a half.* Dissolve in a glass vessel, with a sufficiently strong heat, and gradually raise the fire until the mass be completely dried. This, by the affusion of a large quantity of hot water, will immediately become yellow and fall into powder, which is to be well triturated with the water in an earthen-ware mortar.

"After pouring off the supernatant fluid, let the powder be washed with repeated affusions of hot distilled water, as long as any precipitate is produced in the decanted liquor on the addition of a few drops of water of subcarbonate of kali; and, lastly, dry it."

Sulphuric acid scarcely acts on mercury unless aided by a high temperature. When it is boiled on it, as directed in these processes, the acid is partially decomposed by the metal which is oxidized, while sulphurous gas is evolved; and the oxide thus formed uniting with the remaining acid, the whole becomes a supersulphate of mercury. By continuing the application of heat, at a higher temperature, a consider-

[1] *Hydrargyrus vitriolatus*, P. L. 1787. Subsulphate de Mercure (*F.*) Gelbes Schwefelsaures Quecksilberoxyd (*G.*) Turpeto Minerale Mercuriale (*I.*)

able portion of the acid is expelled, and partly decomposed, by which the metal is still more highly oxidized, and the resulting dry mass is a subsulphate of mercury. When boiling water is poured on this salt, the fluid, acting by its powerful affinity for sulphuric acid, decomposes it, abstracts the acid, and precipitates the oxide; but as the acid still holds combined with it a small portion of oxide, and the precipitated oxide retains some acid, the result of this part of the process is a supersulphate of mercury held in solution by the water, and a sub-sulphate precipitated in the form of a yellow powder. To obtain this effect completely, the saline mass must be made entirely dry before pouring over it the hot water; for if the vessel be sooner taken from the fire, the precipitation is partial only, the greater part of the salt being dissolved without being decomposed. Perhaps the best mode is to continue the exsiccation until a little of the white mass dissolved in cold water does not redden litmus paper. The proportions for obtaining the largest quantity of product are two parts of acid, and one of mercury: hence, while the quantity ordered by the Dublin College is rather too small, the proportions of the Edinburgh formula are productive of a very unnecessary waste of acid.

Qualities. — Subsulphate of mercury is inodorous, and acrid to the taste. It is obtained in the form of a beautiful bright yellow powder, of a specific gravity of 6·444, and nearly insoluble in water, requiring 2000 parts at 60°, and 600 at 212°, for its solution, which is colourless. By trituration with mercury it is changed into the black oxide; and at a red heat is decomposed, the oxygen being given out and the metal reduced. According to the analysis of Braumcamp and Segueira, its constituents are 84·7 parts of oxide of mercury, 15 of sulphuric acid, and three of water[1]; while Fourcroy makes them 87 of oxide, 10 of acid, and three of water.

Medical properties and uses.—This preparation is emetic, discutient, alterative, and errhine; but from the violence of its action it is seldom administered as an internal remedy. As an errhine, however, it has been found extremely useful in chronic ophthalmia, and diseases of the head; but even for this purpose its acrimony requires to be sheathed with some bland powder, as starch, or liquorice root powder, in the proportion of grs. v. to gr. j. of the subsulphate. In doses of gr. v. it operates as a very powerful emetic.

HYDRARGYRUM CUM CRETA. Lond. *Mercury with Chalk.*[2]

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[1] *Annales de Chimie*, liv. 123.

[2] Mercurius alkalizatus, P. L. 1745.

"Take of purified mercury, *three ounces*; prepared chalk, *five ounces*. Rub them together until the globules disappear."

HYDRARGYRUM CUM CRETA. Dub. *Mercury with Chalk.*

"It is prepared in the same manner as the mercury with magnesia, only instead of magnesia employing precipitated chalk."

In these processes the mercury is slightly oxidized during the trituration, and is in the state of the black oxide, 100 parts of which, according to Fourcroy, contain, when well prepared, about 4 of oxygen.

Medical properties and uses. — It is alterative, and is occasionally prescribed in tinea capitis, and other cutaneous affections; but it merits attention as a mild alterative for children. The dose may be from grs. v. to ʒs. given twice a day, mixed in any viscid substance.

HYDRARGYRUM CUM MAGNESIA. Dub. *Mercury with Magnesia.*

"Take of mercury, manna, of each *an ounce*; magnesia, *half an ounce*. Triturate the mercury with the manna in an earthen mortar, adding as many drops of water as will give to the mixture the thickness of syrup, and continue the rubbing until the metallic globules completely disappear; then add, still triturating, *a drachm* of magnesia; and after the whole is well mixed together, add *a pint* of hot water, and agitate the mixture. Allow the mixture to remain for some time at rest, in order that the sediment may subside, from which the fluid is to be decanted. Repeat the washing a second and a third time, that the whole of the manna may be removed; and add the remainder of the magnesia to the sediment while it is still moist. Finally, dry the powder upon bibulous paper."

The addition of the manna in this process, and in the former preparation with chalk of the Dublin College, is intended only to facilitate the oxidizement of the mercury; and therefore it is afterwards removed by the subsequent washings, so that the product remains a grey or black oxide of mercury, mixed with magnesia. It is a preparation which might well be rejected.

HYDRARGYRUM PRÆCIPITATUM[1] ALBUM. Lond. *White Precipitated Mercury.*[2]

"Take of oxymuriate of mercury, *half a pound*; muriate of ammonia, *four ounces*; solution of subcarbonate of potash, *half a pint*; distilled water, *four pints*. Dissolve first the muriate

[1] This name is completely at variance with the principles on which the reformed nomenclature is founded; and the reasons which might have excused the adoption of *calomel*, and some other equally barbarous terms, cannot be advanced in justification in this instance.

[2] Mercurius præcipitatus albus, P. L. 1745. Calx hydrargyri alba, P. L. 1787. Muriate de mercure precipité (*F.*) Salzsaures Quecksilber präzipitat (*G.*) Precipitato bianco di mercurio (*I.*)

of ammonia, then the oxymuriate of mercury, in the distilled water, and add to the mixed solution the solution of subcarbonate of potash. Wash the precipitated powder until it become tasteless, and then dry it."

SUBMURIAS HYDRARGYRI AMMONIATUM. Dub. *Ammoniated Submuriate of Mercury.*

"Add to the fluid which has been poured off from the precipitated submuriate of mercury a quantity of water of caustic ammonia sufficient to precipitate the whole of the metallic salt. Wash the precipitate with cold distilled water, and dry it upon bibulous paper."

As the products of these two processes are precisely the same, that of the Dublin College is to be preferred, both on account of its œconomy, and its greater simplicity. The fluid it orders to be used, is that which is decanted from the precipitated mild muriate of mercury, prepared by heat; and which, as we have already observed, holds the corrosive muriate in solution; so that the oxide of this salt is precipitated by the ammonia, combined with a portion of acid and also of ammonia, forming a ternary compound, or a submuriate of mercury and ammonia. In the London process, the muriate of ammonia, and the oxymuriate of mercury, when dissolved in the water, combine together, and form a solution of a ternary compound of muriatic acid, ammonia, and oxide of mercury, or a soluble supermuriate of mercury and ammonia. By the addition of the subcarbonate of potash, a great part of the acid, both of the muriate of ammonia, and of the mercurial salt, is abstracted, and the same triple insoluble compound is precipitated as in the former process; and the fluid retains in solution muriate of potash, the carbonic acid having been dissipated in the gaseous form. It is to be regretted, that the quantity ordered is inadequate to the effect intended.

Qualities. — This muriate of mercury and ammonia is inodorous and insipid; of a snowy whiteness, smooth, and insoluble in water, and does not become black when triturated with lime water. It is decomposed by the sulphuric and nitric acids, the former of which converts it into oxymuriate of mercury and sulphate of mercury and ammonia, and the latter into the oxymuriate also, and nitrate of ammonia and mercury. Muriatic acid restores it to the state of soluble supermuriate, the *sal alembroth* of the old chemists. According to Fourcroy's analysis, its constituents are, 81 parts of oxide of mercury, 16 of muriatic acid, and 3 of ammonia. It is sometimes adulterated with white lead; to discover which, digest one part of it in four parts of acetic acid, and add to the solution a small quantity of sulphuret of ammonia; a black precipitate insoluble

in sulphuric acid indicates the presence of lead. Chalk and starch are also sometimes mixed with it; and may be detected by heating the preparation in an iron spoon: if pure, it is completely volatilized; but if adulterated with starch, a black coal is left; or, if with chalk, a white powder, at the bottom of the spoon.

Medical properties and uses. — This preparation is only used, in combination with lard, as an ointment for the cure of itch, and some other cutaneous eruptions.

Officinal preparation. *Unguentum Hydrargyri præcipitati albi.* L. D.

HYDRARGYRUM PURIFICATUM. Lond. *Purified Mercury.*[1]

"Take of mercury, *six pounds*; filings of iron, *a pound*. Rub them together, and distil the mercury from an iron retort."

HYDRARGYRUS PURIFICATUS. *Purified Mercury.*

Edinburgh.

"Take of mercury, *six parts*; filings of iron, *one part*. Rub them together, and distil from an iron retort."

HYDRARGYRUM PURIFICATUM. Dub. *Purified Mercury.*

"Take of mercury, *six pounds*. Distil off slowly four pounds."

By this mode of treating mercury it is certainly obtained more bright and mobile; but although it is generally supposed that the iron operates by exerting a superior affinity for the foreign metals with which the mercury of commerce is supposed to be alloyed, yet this is altogether hypothetical, and the necessity of the process may be well questioned.

LIQUOR HYDRARGYRI OXYMURIATIS. Lond. *Solution of Oxymuriate of Mercury.*

"Take of oxymuriate of mercury, *eight grains*; distilled water, *fifteen fluid ounces*; rectified spirit, *a fluid ounce*. Dissolve the oxymuriate of mercury in the water, and add to it the spirit."

This solution is intended to facilitate the administration of minute doses of oxymuriate of mercury, each fluid ounce of the solution containing half a grain of the salt. It ought not to be long kept or exposed to a clear light, as the oxymuriate is gradually decomposed, and calomel precipitated. It is, however, the most safe and convenient form of administering this active salt; and may be given as an antisyphilitic in doses of from f℥ss. to f℥ij. in f℥ij. of linseed infusion, or water and syrup, and in more minute doses when its alterative effects

[1] Argentum vivum purificatum, P. L. 1745. Mercure (*F.*) Quecksilber (*G.*) Mercurio (*I.*) Azogogue (*S.*)

only are required. As a local application, this solution, diluted with two parts of water forms a useful gargle in venereal sore throat; and without dilution we have found it serviceable as a gargle for breaking the abscess in cynanche tonsillaris, when suppuration takes place. Diluted with an equal quantity of water, it is employed as a wash against tetters and scabies; and very largely diluted, it may be used as an injection in gonorrhœa: or given in the form of enema, when the stomach will not receive it.

In concluding the account of the preparations of mercury, it may not be improper to observe that the exhibition of any of them in certain states of the habit, and at the time under exposure to cold, is apt to excite an erythematic eruption of the skin, accompanied with much fever. This disease does not at all depend on the use of any particular preparation of the remedy; but, as far as I have been able to observe, it is liable to show itself in such an irritable state of the habit as produces hysteria in females, when the body is very suddenly exposed to a current of cold air, or to a cold moist atmosphere, while under the influence of mercury. When it occurs, the mercurials must be immediately discontinued, bark, opium, and purgatives internally administered, and the affected surface sprinkled with dry flour, or covered with the *linimentum aquæ calcis* of the Edinburgh and Dublin pharmacopœias; while at the same time the warm bath is to be used at least twice a day. Under this treatment the disease generally disappears, and the use of the mercurial may be renewed; but sometimes the morbid symptoms increase under every mode of treatment, and a fatal termination of the disease ensues.

PRÆPARATA E STANNO.

PREPARATIONS OF TIN.

PULVIS STANNI. Dub.[1] *Powder of Tin.*

"Take of tin, *any quantity*. Melt it over the fire in an iron mortar, and stir it while it is cooling, until it becomes a powder, which, when cold, is to be passed through a sieve."

[1] Poudre d' Etain (*F.*) Zinn (*G.*) Stagno in polvere (*I.*)

By this process tin is reduced to the form of a fine granular powder, and, perhaps, by the constant stirring, it is also very slightly oxidized, for the powder has less brilliancy than the entire metal.

Medical properties and uses. — Powder of tin is a mechanical anthelmintic. It has been chiefly given in tænia; and is supposed to operate by the grittiness of its particles irritating the worm, and dislodging it from the mucus in which it is imbeded. It is given in doses of ʒj. or ʒij. mixed in treacle, for two or three successive mornings, and a brisk cathartic afterwards exhibited. But it is likely to be, henceforth, seldom used, oil of turpentine being a much superior remedy for the expulsion of tænia.

PRÆPARATA E PLUMBO.

PREPARATIONS OF LEAD.

LI'QUOR PLUM'BI SUBACETA'TIS. Lond. *Solution of Subacetate of Lead.*[1]

"Take of semi-vitrified oxide of lead, *two pounds*; acetic acid (distilled vinegar), *a gallon*. Mix them, and boil down to six pints, assiduously stirring; then set the solution aside, that the impurities may subside, and strain it."

LIQUOR SUBACETATIS LITHARGYRI. *Dub. Solution of Subacetate of Lead.*

"Take of litharge, *a pound*; distilled vinegar, *eight pints*. Put them into a glass vessel, and boil to six pints, assiduously stirring; then set the solution aside, and strain it after the fæces have subsided."

In these processes, the acetic acid, which the distilled vinegar contains in a highly diluted state, attracts a portion of the oxide of lead, and forms an acetate, which remains dissolved in the water. The two Colleges err in naming it a subacetate. The proportion of litharge ordered in both formulæ is too large, a gallon of distilled vinegar of the specific gravity 1·007 being capable of dissolving ten ounces only of the oxide.

Qualities. — This solution of acetate of lead, when properly prepared with pure distilled vinegar, is of a greenish straw-colour, has a slight acetous odour, and an austere somewhat sweetish taste. It is partially decomposed when largely di-

[1] Aqua lithargyri acetati, P. L. 1787. Acetate de Plomb liquide (*F.*) Blaiwasser (*G.*) Aceto di Saturno (*I.*)

luted with distilled water; and with pump water, a heavy precipitate instantly takes place: it is also precipitated in the form of a white sub-salt by the alkalies and their carbonates; and a black precipitate is produced by the alkaline sulphurets. This solution is also incompatible with solutions of mucilage, the gum of which it coagulates; and, indeed, it is the most delicate test for mucilage with which we are acquainted. According to the experiments of Dr. Bostock [1], the constituents of 100 parts of the saturated solution are 23·1 of oxide of lead, 5 of acetic acid, and 71·9 of water, which agree with the statement of Thenard [2], who found that the salt, when crystallized, consists of 17 parts of acid, 78 of oxide of lead, and 5 of water, in 100 parts. [3]

Medical properties and uses. — This solution is used only externally, and when diluted with water forms a very useful cooling, discutient application to phlegmonous inflammations and burns. It was introduced into practice by M. Goulard, a surgeon of Montpelier; and hence was long distinguished by the appellation of Goulard's Extract.

LI'QUOR PLUM'BI SUBACETA'TIS DILU'TUS. Lond. *Diluted Solution of Subacetate of Lead.*[4]

"Take solution of subacetate of lead, *a fluid drachm;* distilled water, *a pint;* proof spirit, *a fluid drachm.* Mix."

LIQUOR SUBACETATIS LITHARGYRI COMPOSITUS. Dub. *Compound Solution of Subacetate of Litharge.*

The same as the London formula, with double the quantity of each of the ingredients.

This preparation, as an article in the pharmacopœia, is superfluous, every surgeon being in the habit of ordering lotions with different proportions of the solution of acetate of lead, according to the circumstances of the case.

PLUM'BI SUPERACE'TAS. Lond. *Superacetate of Lead.*[5]

"Take of carbonate of lead, *a pound;* acetic acid (distilled vinegar), *a gallon and a half.* Boil the carbonate of lead with the acid until this is saturated; then filter the solution through paper, and, having evaporated it until a pellicle appears on its

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[1] *Nicholson's Journal*, xi. 75. [2] Ibid. vi. 223.

[3] The nature of the salt in this solution was first pointed out by Scheele, who changed a solution of the superacetate of lead into Goulard's extract, by keeping it in a plate of lead for the space of a day; but this experiment was over-looked until Dr. Bostock's analysis of the preparation. An excellent mode of preparing it is employed in the French Hospitals. Three parts of superacetate of lead is dissolved in a sufficient quantity of hot distilled water, and to the solution one part of semi-vitreous oxide of lead is added, in fine powder. The whole is then evaporated until it marks 28° of Beaumè's areometer; and when cold filtered. Vide *Journ. de Pharm. Dec.* 1876. p. 565.

[4] Aqua lithargyri acetati composita, P. L. 1787.

[5] Saccharum saturni, P. L. 1720—45. Cerussa acetata, P. L. 1787. Acetate de Plomb cristallisé (*F.*) Essigsaures Blei (*G.*) Zucchero di Saturno (*I.*)

surface, set it apart that crystals may form. Pour off the fluid, and dry the crystals upon bibulous paper."

ACETAS PLUMBI. Edin. *Acetate of Lead.*

"Take of white oxide of lead, *any quantity*; weaker acetic acid, *a sufficient quantity*. Put the oxide into a cucurbit, and pour over it ten times its weight of the acid. Let the mixture stand upon a warm sand-bath until the acid becomes sweet; then let this be poured off, and add fresh portions of acid successively, until no more sweetness is communicated. Evaporate all the fluid, freed from impurities, in a glass vessel to the consistence of thin honey, and set it aside in a cold place that crystals may form, which are to be dried in the shade. Evaporate again the residuary liquor, that new crystals may be obtained; and repeat the evaporation until no more are formed."

ACETAS PLUMBI. Dub. *Acetate of Lead.*

"Take of subacetate of lead, called CERUSSA, *any quantity*, distilled vinegar, *ten times its weight*. Digest them in a glass vessel until the vinegar becomes sweet; and having poured this off, add more, until it ceases to become sweet. Filter the solution, and crystallize by alternate slow evaporation and cooling. Dry the crystals in the shade."

In these processes the acetic acid of the distilled vinegar unites with the oxide of lead of the carbonate; and by the subsequent evaporations the salt crystallizes in the form of an acetate. But on account of the smallness of the quantity of product, the trouble and expence of the process, and the difficulty of obtaining the white lead perfectly free from whitening (carbonate of lime), with which it is generally adulterated, the preparation of this salt is seldom undertaken by the apothecary; so that the superacetate usually found in the shops is the salt which is manufactured on a large scale, for the use of the calico-printers, purified. It is chiefly prepared in Holland, in the following manner: Sheets of lead, coiled up, are put into pots, in which they are half immersed in distilled vinegar, and digested a sufficient time. Before long the upper half, or that which is not immersed, is covered with an efflorescence of cerusse, after which it is immersed in the vinegar, and the part which was before immersed is now brought up to be converted into cerusse as before, when the plate is again turned; and this is repeated two or three times a day, until the vinegar becomes milky. This solution is next boiled in tinned vessels down to about one-third of the original quantity, then strained, and the salt crystallized by slow cooling. The crystals obtained by a second evaporation

of the mother-water are browner, and deliquescent[1]: and as these are generally mixed with the others, the whole requires to be again dissolved in rain or distilled water, and re-crystallized, before they are fit for medicinal purposes.

Qualities.—This salt, when pure, is inodorous, has a sweet, astringent taste, and crystallizes in white glossy, acicular, flat, four-sided prisms, terminated by dihedral summits, which are generally aggregated into irregular masses that have the appearance of lumps of sugar. Its specific gravity is 2·35.[2] Acetate of lead slightly effloresces, is soluble in 25 parts of distilled water either hot or cold; but after standing for some time a slight decomposition takes place, and a small portion of white powder is deposited, which is an insoluble carbonate. It is also soluble in alcohol. In pump or hard water it is instantly decomposed, forming a milky solution, and a copious precipitate falls. It is decomposed by the alkalies and their carbonates, most of the acids, and neutral salts, lime, and magnesia; but it does not affect a solution of gum. According to the analysis of Thenard, the constituents of 100 parts are 58 of oxide of lead, 26 of acid, and 16 of water.[3]

Medical properties and uses.—Taken internally, superacetate of lead is a very powerful astringent, and sedative. It requires to be exhibited, however, with caution, and is admissible only in cases of very urgent danger, as in violent pulmonary and intestinal hæmorrhages, in restraining which it has a very powerful influence. Combining it with opium prevents the deleterious effects which salts of lead are apt to produce when taken into the stomach; but, even when so combined, the smallest dose, in certain habits, is productive of very serious mischief. Some years ago, Dr. Hildebrand of Lemberg tried this salt in combination with opium with seeming advantage in phthisis; and it has been since occasionally used in this country; but from the effects of it in that disease, as far as I have observed, it is not likely to be generally employed by British practitioners. Dissolved in a large proportion of water, it forms an excellent collyrium in ophthalmia; and somewhat less diluted, its solution is in common use as an external application in superficial inflammation. Objections have, nevertheless, been raised to the long-continued external use of the preparations of lead; but the daily extensive employment of them in this form, without any bad effects, is a sufficient proof that, if they occasionally have produced mis-

[1] *Aikin's Dictionary of Chemistry*, ii. 26. [2] Hassenfratz.
[3] *Nicholson's Journal*, vi. 220.

chief, it is rather to be attributed to some peculiar idiosyncracy, than to the nature of the remedy.

The dose of superacetate of lead, when internally exhibited, should not exceed gr. ss. given every six or eight hours. It may be made into a pill with crumb of bread, and a proportion of opium, according to the circumstances of the case. As a collyrium or lotion, the proportions may be from gr. x. to ℈j. of the salt in f℥viij of distilled water. The addition of a small quantity of distilled vinegar is necessary to prevent decomposition, when distilled water is not employed.

Officinal preparation. *Ceratum Plumbi Superacetatis.* L. E. D.

PRÆPARATA E ZINCO.

PREPARATIONS OF ZINC.

CALAMINA PRÆPARATA. Lond.[1] *Prepared Calamine.*

"Burn the calamine, and beat it to powder; then bring it into the state of a very fine powder, in the manner directed for the preparation of chalk."

CARBONAS ZINCI IMPURUS PRÆPARATUS. E. *Prepared impure Carbonate of Zinc.*

"Impure carbonate of zinc, roasted by those who make brass, being rubbed to powder in an iron mortar, and levigated with a little water in a porphyry, is to be put into a large vessel, and water poured over it, which after frequently agitating the vessel, is to be poured off loaded with the powder. The fine powder which subsides after the water has remained at rest, is then to be dried. The coarse, which the water cannot suspend, is to be again levigated, and treated as before."

LAPIS CALAMINARIS PRÆPARATUS. Dub. *Prepared Calamine Stone.*

"Reduce calcined calamine stone to powder, and separate the very fine parts in manner directed for the preparation of chalk."

The nature of this ore of zinc has been already stated. (*Part* ii.) As it is frequently used in the form of a dry powder to excoriations, ichorous ulcers, and superficial inflamma-

[1] Calamine preparé (*F.*) Galmei (*G.*) Calamina (*I.*)

tions, dusted on the part, it requires to be rendered extremely fine.

Officinal preparations. *Ceratum Calaminæ.* L. E. *Unguentum Calaminaris.* D.

OXIDUM ZINCI IMPURUM PRÆPARATUM. Edin. *Prepared impure Oxide of Zinc.*

"It is prepared in the same manner as the impure carbonate of zinc."

This substance, the nature of which has been already stated, (*Part* ii.) is used for the same purposes as the former article.

ZINCI OXYDUM. Lond. *Oxide of Zinc.*[1]

"Throw, gradually, small pieces of zinc into a large deep crucible, heated to whiteness, and inclined to one side, with another crucible placed over it in such a manner that the zinc may be exposed to the action of the air, and frequently stirred with an iron rod. Remove, from time to time, the oxide as it forms, and pass the white and lighter part of it through a sieve. Lastly, pour water upon this, so that an impalpable powder may be formed in the same manner as ordered for the preparation of chalk."

OXIDUM ZINCI. Edin. *Oxide of Zinc.*

"Let a large crucible be placed in a furnace filled with burning coals, in such a manner as to be somewhat inclined to its mouth, and when the bottom of it is heated to a moderate degree of redness, throw into it a piece of zinc about the weight of one drachm. The zinc is soon inflamed, and converted into white flocculi, which are occasionally to be removed from the surface of the metal by means of an iron spatula, that the combustion may be more complete; and when the inflammation is over, remove the oxide of zinc from the crucible. Throw in then another piece, and let the operation be repeated as often as is necessary. Finally, let the oxide of zinc be prepared in the same manner as the impure carbonate of zinc."

Dublin.

"Take of zinc broken into small pieces, *any quantity.* Throw these, at intervals, into a sufficiently large crucible heated to whiteness, and placed with its mouth inclined towards the mouth of the furnace. After each piece of zinc is thrown in, invert over the crucible another crucible, but loosely so as not to exclude the air. Preserve the light, very white, sublimed powder for use."

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1 The ancients, who were acquainted with it, called it pompholyx; and by the early chemists it was named *Nihil album*, *Lana philosophica*, and *Flores zinci*. Zincum calcinatum, P. L. 1787. Oxide de Zinc (*F.*) Weisser Zinkoxyd (*G.*) Per Ossido di Zinco; fiori di Zinco (*I.*)

In these processes, the crucible must be heated above 700° of Fahrenheit, which is the point of ignition of zinc. At this temperature the metal inflames, burning with a dazzling white and green flame; and by attracting the oxygen of the air is converted into a white oxide, which is partly volatilized in the form of very light flocculi. The elevation of these flocculi, however, is owing to the current of air excited by the force of the combustion; for the oxide itself is not volatile, but accumulates in the crucible so rapidly, that it must be withdrawn to allow the access of the air for keeping up the combustion. If the crucible be sufficiently capacious, there is no necessity for covering it with another, by which the operation is always impeded. The subsequent levigation is intended to remove any particles of metallic zinc, which are generally involved in the oxide.[1]

Qualities. — Oxide of zinc thus prepared is inodorous, insipid, of a pure white colour, infusible in the fire, insoluble in water and alcohol, but entirely soluble in acids, and is not altered by exposure to the air. According to Proust, 100 parts of it consist of 80 of zinc, and 20 of oxygen; or 100 zinc + 25 oxygen. It often contains small portions of carbonic acid.[2] It is often adulterated with chalk, and sometimes contains white lead. By pouring sulphuric acid on the specimen, the first is discovered by the effervescence that is excited, the second by an insoluble sulphate of lead being formed.

Medical properties and uses. — Oxide of zinc is tonic and antispasmodic; and has been advantageously used in chorea, epilepsy[3], and some other spasmodic affections. It has been employed in hooping-cough on the continent; and Lœffler recommends it to be used externally as well as internally in that disease. He employs a liniment composed of linseed oil, and oxide of zinc. It is chiefly used as an external application. (See *Ung. Zinci.*)

The dose, as an internal remedy, may be from gr. j. to grs. vj. given twice a day.

Officinal preparation. *Unguentum Zinci.* L. E. D.

ZINCI SULPHAS.[4] Lond. *Sulphate of Zinc.*

"Take of zinc broken into small pieces, *three ounces*; sul-

[1] This oxide may also be readily prepared by dissolving zinc in diluted sulphuric or nitric acid, and precipitating by potash, a process proposed by Marabelli, Professor of Pharmacy at Pavia, in 1798. The washed precipitate is oxide of zinc, containing, according to Vauquelin, 0·21 of oxygen.

[2] *Annales de Chimie*, xxxv. 51. The more recent experiments of Dr. Thomson make the proportions to be metal 100 + 24·16 oxygen; those of Berzelius, metal 100 + 24·4 oxygen.

[3] *Duncan's Med. Comment.* iii. 216.

[4] Zincum vitriolatum, P. L. 1787. Sulphate de Zinc (*F.*) Schwefelsaurer Zink (*G.*) Solfato di Zinco (*I.*) Vitriolo bianco (*S.*)

phuric acid, *five ounces*; water, *four pints*. Mix them in a glass vessel, and the effervescence being over, filter the solution through paper; then boil it until a pellicle begins to form on the surface, and set it aside to crystallize."

Edinburgh.

"Take of zinc cut into small pieces, *three parts*; sulphuric acid, *five parts*; water, *twenty parts*. Mix them, and the effervescence being finished, digest for a short time on hot sand. Then filter the decanted solution through paper, and after due evaporation, set it apart that crystals may be formed."

Dublin.

"Take of zinc reduced to powder in the same manner as tin, *three ounces*; sulphuric acid, *five ounces*: water, *a pint*. Pour the acid previously diluted with the water upon the zinc, put into a glass vessel; digest for a short time after the effervescence ceases; then evaporate to a proper point the strained solution, and set it aside to crystallize."

The directions of the Dublin College for granulating the zinc are to be adopted in preference to those of the other Colleges for dividing it. In these processes, the acid enables the zinc to decompose the water, and the metal is oxidized by attracting its oxygen, while its hydrogen is disengaged with effervescence. The oxide thus formed combines with the acid, forming sulphate of zinc, which is obtained in crystals by the subsequent evaporation. The greater part, however, of the sulphate of zinc of the shops is prepared on a large scale, and purified in the manner that shall be immediately noticed. It is denominated *white vitriol* in the language of commerce, and is manufactured largely both in Germany[1] and England. In Germany it is prepared by exposing roasted blende to the air and humidity; by which means the metal is gradually oxidized, and combined with the sulphuric acid also formed from the sulphur contained in the blende. The sulphate thus produced is separated from the earthy parts of the blende by lixiviation, and after being boiled down is crystallized, or rather concreted, into hard granular masses resembling loaf sugar, which generally contain sulphate of iron, of lead, and sometimes of copper. In England it is prepared generally by the direct combination of its constituents; but although purer than the foreign salt, yet the English white vitriol, almost always, contains iron. Both kinds are purified by solution in water, and then allowing the solution to evaporate very slowly in an open vessel containing some granulated zinc; the sulphate of lead will subside, and

[1] Beckman, in his History of Inventions, says, it was first made at Ramelsberg, in Germany, about the middle of the 16th century; and ascribes the invention to Julius, duke of Brunswick.

the other foreign salts be decomposed by the metallic zinc. The purified sulphate of zinc may be then crystallized by lixiviation and evaporation.[1]

Qualities. — Pure sulphate of zinc, or rather *supersulphate*, for it contains an excess of acid and reddens the vegetable blues, is inodorous, and has a slightly acidulous, styptic, metallic taste. It crystallizes in transparent, colourless, flattish, tetrahedral prisms, terminated by quadrangular pyramids; effloresces slightly in the air; is soluble in 2·5 times its weight of water at 60°, and in less than its own weight of boiling water. It is decomposed by the alkalies, earth, and hydrosulphurets; and throws down a dirty-looking precipitate from astringent vegetable infusion, with which, therefore, it is incompatible in prescriptions. According to the analysis of Dr. Wollaston, the constituents of 100 parts of the pure crystallized salt are 28·4 of oxide of zinc, 27·3 of acid, and 44·3 of water.

Medical properties and uses. — Sulphate of zinc is tonic and astringent, and in large doses emetic. As a tonic, it is less heating and stimulant than sulphate of iron, and hence is preferable in phthisis and other diseases attended with great irritability and general weakness. It is also useful in dyspepsia, fluor albus, and some convulsive affections, as pertussis, chorea, and epilepsy; in which diseases it is generally combined with myrrh, bitter extracts, opium, extract of hemlock, or digitalis, according to the circumstances of the case. As an emetic it operates almost instantaneously, and therefore is often employed to empty the stomach at the commencement of the paroxysm of intermittent fever, and in other cases in which quick vomiting is required. As an external application this salt dissolved in rose-water, in the proportion of grs. ifs. to f℥j. of rose-water, forms an excellent collyrium in the latter stage of ophthalmia, after the inflammatory action has subsided; it is a good injection in a similar stage of gonorrhœa; and a lotion in some kinds of superficial inflammations. In double the strength, this solution is the best application that can be used to scrophulous tumours, after they have suppurated, and the abscess has been discharged.

The dose to produce vomiting is from grs. x. to ʒfs. and as a tonic from gr. j. to grs. ij. may be given twice a day.

Officinal preparations. *Solutio Sulphatis Zinci.* E. *Liquor Aluminis compositus.* L. *Solutio Acetatis Zinci.* E. D.

SOLUTIO SULPHATIS ZINCI. Edin. *Solution of Sulphate of Zinc.*

"Take of sulphate of zinc, *sixteen grains*; water, *eight ounces*; diluted sulphuric acid, *sixteen drops*. Dissolve the

[1] *Aikin's Dictionary of Chemistry.*

sulphate of zinc in the water, and having added the acid, filter the solution through paper."

This formula is given under the idea of the common sulphate of zinc, (which often contains some excess of oxide, and some oxide of iron,) being employed. The superabundant oxide, if present, is dissolved by the acid, so that a solution of an uniform strength is always obtained. It is rather too strong for the purposes of a collyrium in chronic ophthalmia; and the addition of the acid renders it less fit to be used as an injection in gonorrhœa.

SOLUTIO ACETATIS ZINCI. Edin.[1] *Solution of Acetate of Zinc.*

"Take of sulphate of zinc, *one drachm*; acetate (*superacetate*) of lead, *four scruples*; distilled water, *twenty ounces*. Dissolve. Mix the salts separately in ten ounces of the water; then mix the solutions, and after the precipitate subsides, filter."

In this process a double decomposition takes place: the sulphuric acid of the sulphate of zinc, unites with the oxide of lead of the superacetate of lead, whilst its acid combines with the disengaged oxide of zinc. The former salt being insoluble, is precipitated in the form of a heavy white powder, but the acetate of zinc remains dissolved; and thus its solution, which is colourless and limpid, is easily separated by filtration.

Medical properties and uses. — This solution is astringent; and was long employed before it was introduced into the pharmacopœia, and even before its nature was clearly understood. It is an useful collyrium in chronic ophthalmia, and in the acute variety of this disease after the inflamed vessels are unloaded, and the inflammatory action subdued. It is also an useful injection in the advanced state of gonorrhœa.

TINCTURA ACETATIS ZINCI. Dub. *Tincture of Acetate of Zinc.*

"Take of sulphate of zinc, acetate of kali, of each, *an ounce*. Rub them together, and add of rectified spirit of wine, *one pint*. Macerate for a week with occasional agitation, and filter through paper."

In this process, a double decomposition also takes place, acetate of zinc, and sulphate of potash being produced; the former of which is dissolved in the spirit, while the latter remains undissolved, and therefore is easily separated. It is a tedious process, and possesses no advantages over the former to recommend it.

Medical properties and uses. — This tincture is astringent; but requires to be diluted with water, before it can be used either as a collyrium or injection. It might be advantageously employed as an internal remedy in dyspepsia, and other debilities of the stomach.

[1] Dissolution d'Acetate de Zinc (*F.*) Liquore de l'Acetato di Zinco (*I.*)