Hottot,[1] is a compound of arsenious acid and teriodide of arsenic (*arsenite of teriodide of arsenic*).

Göpel[2] gives the following process for this preparation. Two drachms of iodine and one drachm of finely powdered arsenic fused at as low temperature as possible. When cool, four ounces of alcohol are to be added; the solution poured off from the residual arsenic; its colour reduced to a yellow wine colour by a current of arseniuretted hydrogen, and then evaporated in a temperature not exceeding 122° F. until it crystallises.

Dr. Meurer[3] prepares the iodide of arsenic as follows:—Arseniuretted hydrogen gas, prepared from arseniuretted zinc, is to be passed into a solution of one drachm of iodine in four ounces of spirit of wine. The gas is allowed to pass through the solution of iodine (in a place where the operator can be secure from the effects of the gas, as the outside of a window), until the solution is decolorised. A fresh quantity of iodine is then added, and the operation continued. If afterwards the clear solution becomes turbid, a small addition of iodine will render it clear again. The solution is then to be evaporated, when the iodide of arsenic (AsI^3) separates in crystals, which appear under the microscope as six-sided tables.

PROPERTIES.—Iodide of arsenic combines the effects of arsenious acid and iodine. It is a powerful preparation, and, like arsenious acid, requires caution in its use. It becomes absorbed, and is eliminated by the urine, saliva, and perspiration.[4] Dr. Blake[5] injected solutions of it into the veins, but did not find its effects so powerful as might have been expected. Six grains thrown into the veins of a dog had no appreciable effect: fifteen grains immediately arrested the action of the heart. It has been employed in obstinate skin diseases, as well as in real or simulated cancer. Dr. A. T. Thomson administered it internally with great success in lepra and impetigo [and Dr. Neligan has used it internally in cases of favus]. Biett[6] employed it externally in the form of ointment, in tuberculous and herpetic diseases of the skin. In a case of lupus, the ointment has been employed with good effect. Dr. Thomson employed it in the form of pills, commencing with $\frac{1}{10}$th of a grain, and ending with $\frac{1}{3}$rd of a grain.—Biett's ointment consisted of about $2\frac{1}{2}$ grs. of the iodide to ℥j. of lard. About one drachm of this ointment may be used at once.

"An extemporaneous preparation, which is said to combine the virtues of both arsenic and iodine, is said to have been employed successfully in Philadelphia. It is formed as follows:—℞ Liquor. Iodin. comp. ℥j.; Liquor. Potassæ Arsenitis, ℥iv.: M. When mixed together in these proportions, a change is observed in the appearance of the mixture, which is instantaneously rendered almost colourless. The dose is five drops."[7]

Arsenici Superiodidum.—Wackenroder's solution of *superiodide of arsenic* is an aqueous solution of superiodide of arsenic, each drachm of which contains $\frac{1}{48}$th of a grain of metallic arsenic and about $\frac{1}{10}$th of a grain of iodine, or about the $\frac{1}{5}$th of a grain of superiodide of arsenic. Häser gave it in doses of 20 drops twice a day in scirrhus.[8]

Donovan's solution contains teriodide of arsenic and biniodide of mercury. It will be described hereafter (see *Hydrargyri Biniodidum*).

ORDER XXI. ANTIMONY AND ITS COMPOUNDS.

107. Antimonium.—Antimony.

Symbol Sb. *Equivalent Weight* 129.

Stibium.—This substance, although the basis of several important medicinal preparations, is not now used in medicine in the metallic state. In former times, *everlasting* or *perpetual*

[1] *Journ. de Pharmacie*, t. xiv. p. 46, 1828.
[2] *Pharmaceutical Journal*, 1850–51, p. 560.
[3] *Ibid.* 1848, p. 499.
[4] *Lond. Med. Gaz.* Jan. 19, 1839; *Lancet* for 1838-9, vol. i.
[5] *Edinb. Med. and Surg. Journal*, April 1839.
[6] Magendie, *Formulaire*, p. 244, 8me édit. 1835.
[7] *New Remedies*, by R. Dunglison, M.D. 4th edit. p. 77, Philadelphia, 1843.
[8] Dierbach, *Die neuesten Entdeckungen in der Materia Medica*, Bd. iii. Abt. ii. S. 1043, 1847.

pills (*pilulæ æternæ* seu *perpetuæ*) and *emetic cups* (*pocula emetica; calices vomitorii*) were made with it. The former were used as purgatives; the latter communicated an emetic quality to wine which had been kept in them for a day or two. To distinguish metallic antimony from the sulphuret, it has been termed *regulus antimonii*, or, when the ingot presents a stellated crystalline texture on its surface, *regulus antimonii stellatus*. When the metal is alloyed with iron, tin, or lead, it has been called *regulus antimonii martialis, jovialis, saturninus*.[1]

108. ANTIMONII TEROXYDUM.—TEROXIDE OF ANTIMONY.

Formula SbO^3. *Equivalent Weight* 153.

HISTORY.—Basil Valentine[2] was acquainted with this teroxide, which he called *flowers of antimony* (*flores antimonii*); and he states that it could be procured by various methods.

The compound is known by the various names of *oxide* (*antimonii oxydum*, Ph. Ed.), *protoxide*, and *sesquioxide of antimony*.

NATURAL HISTORY.—It is found native, and is known to mineralogists as *white antimony*. It is found in Bohemia, Saxony, Hungary, &c.

PREPARATION.—There are various methods of preparing this oxide.

1. The *Edinburgh College* directs it to be prepared as follows:—

"Take of Sulphuret of Antimony, in fine powder, ℥iv.; Muriatic Acid (commercial), Oj.; Water, Ov. Dissolve the sulphuret in the acid, with the aid of a gentle heat; boil for half an hour; filter. Pour the fluid into the water; collect the precipitate on a calico filter; wash it well with cold water, then with a weak solution of carbonate of soda, and again with cold water, till the water ceases to affect reddened litmus paper. Dry the powder over the vapour-bath."

By the action of hydrochloric acid on tersulphuret of antimony, there are obtained the terchloride of antimony, which is dissolved in the excess of hydrochloric acid, and hydrosulphuric acid gas, which escapes. $SbS^3+3HCl=SbCl^3+3HS$.

When the solution of terchloride of antimony is diluted with water, a white precipitate of *oxichloride of antimony* ($SbCl^3,5SbO^3$) is produced, which becomes crystalline by standing. $6SbCl^3+15HO=SbCl^3,5SbO^3+15HCl$. This precipitate is called *Algaroth's powder* (*pulvis Algarothi*), after the name of an Italian physician of the 16th century, who recommended its use. It has also been termed the *angelic powder* (*pulvis angelicus*), or *mercury of life* (*mercurius vitæ*). By long-continued washing with hot water, the oxichloride loses all its chlorine in the form of hydrochloric acid, and pure teroxide of antimony alone remains. $SbCl^3,5SbO^3+3HO=6SbO^3+3HCl$. Washing it with a solution of carbonate of soda also converts it into the teroxide. $SbCl^3,5SbO^3+3(NaO,CO^2)=6SbO^3+3NaCl+3CO^2$.

2. The *Dublin Pharmacopœia* of 1850 directs the *oxide of antimony* (*Antimonii oxydum*, Ph. Dub.) to be prepared as follows:—

Take of Solution of Terchloride of Antimony, f℥xvj.; Water, *Cong.* ij.; Solution of

[1] [The crude antimony obtained in Hungary is Government property, and is sold in its stores at Vienna and Trieste in two qualities; the superior, called *Rosenau* (from the locality of the mine), being lighter in weight and far more crystalline than the second quality, called *Lipfau*, which is of a closer appearance and very heavy, and from 6 to 8 per cent. cheaper than the first.—ED.]

[2] *Triumphant Chariot of Antimony*, by Kirkringius, p. 91, Lond. 1678.

Caustic Potash, Oj.; Distilled Water, a sufficient quantity. Pour the antimonial solution into the water, and having stirred the mixture well, set it by until the white precipitate which forms has subsided. Draw off the supernatant liquor by decantation, or the syphon, and, having agitated the sediment with a gallon of distilled water, allow the whole to stand till the oxide has fallen to the bottom. Decant again, and having placed the whole on a calico filter, wash it with distilled water, until the liquid which trickles through reddens blue litmus paper only in a very slight degree. The precipitate is now to be shaken occasionally for half an hour with the solution of caustic potash, and then washed on a filter with boiling distilled water until the washings cease to give a precipitate on being dropped into an acid solution of nitrate of silver. Lastly, let the product be dried at a heat not exceeding 120°.

3. Another method of obtaining teroxide of antimony is by the action of sulphuric acid on either metallic antimony or the black sulphuret of antimony. By boiling powdered metallic antimony in sulphuric acid, sulphurous acid escapes, and the tersulphate of the oxide of antimony is obtained. $Sb + 6SO^3 = SbO^3,3SO^3 + 3SO^2$. By the action of water, this tersulphate of antimony is resolved into an insoluble subsulphate, SbO^3,SO^3, and a soluble supersulphate, of antimony. By the action of carbonate of soda, the subsulphate is converted into the teroxide of antimony. $SbO^3,SO^3 + NaO,CO^2 = SbO^3 + NaO,SO^3 + CO^2$. This method of procuring teroxide of antimony was proposed by Mr. R. Phillips[1] in 1811. The late Dr. Babington[2] suggested the substitution of the black sulphuret of antimony for metallic antimony. For some years past, teroxide of antimony, for the preparation of emetic tartar, has been obtained by some English chemical manufacturers by the action of sulphuric acid on sulphuret of antimony. This process has been publicly recommended by M. Hornung[3] as the most economical one for the preparation of antimony for the manufacture of emetic tartar. As it is probable that it will be generally adopted, I subjoin Hornung's account of it.

Fifteen parts of sulphuret of antimony, in fine powder, were mixed with thirty-six parts of sulphuric acid in an iron vessel, and the mixture exposed to a gentle heat during a night. The mixture had become thick; but, on elevating the temperature and stirring it, it again assumed a liquid condition. After continuing the action for some time, the mass acquired a whitish appearance, a portion of sulphur separated in the fused state, and much sulphurous acid was disengaged. The heat and agitation were continued until in this way the whole of the sulphur was burned out, and sulphurous acid no longer disengaged. When the only vapours evolved were those of sulphuric acid, water was added to wash out the free sulphuric acid; and the residue of subsulphate of antimony was decomposed with carbonate of soda, leaving oxide of antimony in the form of a greenish white powder. Fifteen parts of sulphuret yielded thirteen parts of dry oxide, which, with the exception of a small quantity of impurity, dissolved in solution of tartaric acid.

In commenting on this process, Mr. Phillips[4] observes that "there is no use in gently heating the mixture for a long time: it may be boiled to dryness at once; and the residue is fit for preparing tartarised antimony when merely washed with water, and without using any carbonate of soda."

By the mutual reaction of sulphuret of antimony and sulphuric acid, we obtain tersulphate of oxide of antimony, sulphurous acid, and sulphur. $SbS^3 + 6SO^3 = SbO^3,3SO^3 + 3SO^2 + 3S$. By the heat employed, the sulphur and sulphurous acid are dissipated. By washing, the excess of sulphuric acid

[1] *Experimental Examination of the London Pharmacopœia.*
[2] See *Philosophical Magazine* for July 1848.
[3] *Journal de Pharmacie*, Mai 1848; *Pharmaceutical Journal*, October 1348.
[4] *Phil. Mag.* July 1848.

is removed, and the tersulphate of the oxide of antimony decomposed into the subsulphate, SbO^3,SO^3, and a supersulphate of antimony. The subsulphate is afterwards converted into the teroxide by the carbonate of soda. $SbO^3,SO^3 + NaO,CO^2 = SbO^3 + NaO,SO^3 = CO^2$. By boiling in water, the subsulphate may be deprived of nearly the whole of its sulphuric acid.

Sulphuretted Teroxides of Antimony. *Antimony Ash, Glass of Antimony*, and *Saffron of Antimony*, are sometimes prepared and used on account of the teroxide of antimony which they contain; hence they require a short notice.

1. ANTIMONY ASH; *Cinis Antimonii.*—This substance is obtained by roasting powdered black sulphuret of antimony. The process is carried on by some manufacturers of emetic tartar as a cheap method of obtaining oxide of antimony. As I have seen it performed on the large scale in London, the powdered sulphuret was roasted on an iron plate set over a fire: the fumes escaped into a chimney. In this process the sulphur is for the most part burnt off and converted into sulphurous acid, while the antimony abstracts oxygen from the air. The resulting antimony ash is of a grey colour. It is a mixture of *antimonious acid* (SbO^4) with some *teroxide of antimony* (SbO^3) and some unburnt *tersulphuret of antimony* (SbS^3), as well as any other foreign matters contained in the original sulphuret which have not been destroyed or expelled by the heat.[1] Part of the antimony is volatilised during the operation.

2. GLASS OF ANTIMONY; *Vitrum Antimonii.*—To obtain this compound, the black sulphuret of antimony is first roasted, by which antimony ash is obtained (see *supra*). This is then fused in an earthen crucible. The antimonious acid of the antimony ash is deprived of a part of its oxygen by the sulphur of the tersulphuret, and is converted into sulphurous acid, which escapes. It has been analysed by Soubeiran,[2] who states that it consists of *teroxide of antimony* 91·5, *tersulphuret of antimony* 1·9, *silica* 4·5, and *oxide of iron* 3·2. Mr. R. Phillips[3] says that it consists principally of *teroxide of antimony*, some *tersulphuret*, and about five per cent. of *silica*. It has been used to furnish teroxide of antimony in the preparation of emetic tartar.

3. SAFFRON OF ANTIMONY; *Crocus Antimonii; Crocus Metallorum.*—Obtained by deflagrating a mixture of equal parts of black sulphuret of antimony and nitrate of potash; the resulting fused mass (sometimes called *liver of antimony, hepar antimonii*) is to be separated from the scoriæ, reduced to a fine powder, boiled in water, and repeatedly washed: it then constitutes *washed saffron of antimony* (*crocus antimonii lotus*), which was formerly used in the preparation of emetic tartar.—The fused mass is a mixture of sulphate of potash, teroxide of antimony combined with potash, oxisulphuret of antimony, and tersulphuret of antimony combined with sulphuret of potassium. The water abstracts the sulphate of potash, the caustic potash, and the sulphuret of potassium.

Liver of antimony is also obtained by fusing together black sulphuret of antimony and carbonate of either potash or soda: the product consists of a saline compound of tersulphuret of antimony and alkaline sulphuret, mixed with a compound of teroxide of antimony and potash.

Ruby of antimony (*rubinus antimonii; regulus antimonii medicinalis*) is obtained by fusing together five parts of black sulphuret of antimony and one part of carbonate of potash, and separating the upper layer (sulphoantimonite of potassium) from the lower one, which consists of a fused mass composed of tersulphuret of antimony with a little of the teroxide.

PROPERTIES.—Teroxide of antimony occurs native in tabular and acicular crystals, which belong to the right prismatic system. When prepared in the moist way it is a white powder, which becomes yellow by heat, and fuses at a full red heat into a yellow fluid, which concretes, by cooling, into a crystalline mass. If subjected to heat in the open air, it absorbs oxygen, and becomes antimonious acid (SbO^4).

Characteristics.—Heated in liquid hydrochloric acid, it is completely dissolved: the solution contains terchloride of antimony, which, when mixed

[1] Liebig. *Handwört. d. Chemie.* Bd. i. S. 420.
[2] *Journal de Pharmacie*, t. x. p. 528.
[3] *Translation of the Pharmacopœia of the Royal College of Physicians* for 1824, p. 81.

with water, yields a white precipitate (*oxichloride of antimony*, $SbCl^3,5SbO^3$). Hydrosulphurets form a red precipitate (SbS^3) in the solution of the terchloride. Boiled with tartaric acid, or with a solution of bitartrate of potash, it is dissolved: the latter solution yields, on cooling, crystals of emetic tartar ($KO,SbO^3,\overline{T},2HO$), the characteristics of which will be hereafter given. Teroxide of antimony melts before the blow-pipe, and is volatilised in the form of a white vapour.

COMPOSITION.—Teroxide of antimony has the following composition:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Berzelius.*	*John Davy.*
Antimony	1	129	84·31	84·319	85
Oxygen	3	24	15·69	15·681	15
Teroxide of Antimony	1	153	100·00	100·000	100

PURITY.—The Edinburgh College gives the following characteristics of its purity:—

"Entirely soluble in muriatic acid, and also in a boiling mixture of water and bitartrate of potash; snow-white; fusible at a full-red heat."

PHYSIOLOGICAL EFFECTS AND USES.—Teroxide of antimony possesses similar medicinal properties to emetic tartar, in the preparation of which it is used. It is rarely employed as a medicine. [As obtained by precipitation, it has been used by M. Tessier,[1] of Lyons, in the treatment of pneumonia, upon which disease, in the opinion of that physician, it has a specially resolvent power, more particularly marked towards the fourteenth or fifteenth day of the attack. The observations of M. Tessier have been confirmed by other physicians at Lyons.—ED.] The oxichloride of antimony is uncertain in its operation.

ADMINISTRATION.—The oxichloride of antimony is sometimes given in doses of from one to ten grains.

109. PULVIS ANTIMONII COMPOSITUS.—COMPOUND POWDER OF ANTIMONY.

HISTORY.—Dr. James, who died in 1776, prepared a celebrated patent medicine, long known as the *fever powder of Dr. James* (*pulvis febrifugus Jacobi*), or *Dr. James's powder* (*pulvis Jacobi*). The discovery of it was subsequently claimed for a German of the name of Schwanberg.[2] The specification which Dr. James lodged in the Court of Chancery is so ambiguously worded, that his powder cannot be prepared by it. Hence the present preparation has been introduced into the Pharmacopœia as a substitute for it. In former editions of the London Pharmacopœia, as well as in the present Edinburgh and Dublin Pharmacopœias, the name given to it is *pulvis antimonialis* (*antimonial powder*); but since 1836 this name has been unnecessarily (as I conceive) altered to *pulvis antimonii compositus*.

PREPARATION.—All the British Colleges give directions for its preparation.

The *London College* orders, of Tersulphuret of Antimony, lb. j.; Horn Shavings, lb. ij. Mix, and throw them into a crucible red-hot in the fire, and stir constantly until vapour

[1] *Bulletin Therap. Méd.* t. xxxv. p. 237.
[2] *Affidavits and Proceedings of W. Baker*, Lond. 1754.

no longer arises. Rub the residue to a powder, and put it into a crucible. Then apply fire, and increase it gradually, that it may be red-hot for two hours. Grind the residual powder as finely as possible.

The *Edinburgh College* directs equal weights of Sulphuret of Antimony, in coarse powder, and Hartshorn in shavings, to be used. "Mix them, put them into a red-hot iron pot, and stir constantly till they acquire an ash-grey colour, and vapours no longer arise. Pulverise the product, and put it into a crucible with a perforated cover, and expose this to a gradually increasing heat till a white heat be produced, which is to be maintained for two hours. Reduce the product, when cold, to fine powder.

Manufacturers usually substitute bone sawings for hartshorn shavings.

The process of the *Dublin College* differs from those of the other two Colleges:—Take of Tartarised Antimony; Phosphate of Soda, of each, ℥iv.; Chloride of Calcium, ℥ij.; Solution of Ammonia, f℥iv.; Distilled Water, *Cong.* iss., or a sufficient quantity. Dissolve the Tartarised Antimony in half a gallon, and the phosphate of soda, and chloride of calcium, each, in a quart of the water. Mix the solutions of the tartarised antimony and phosphate of soda when cold, and then pour in the solution of chloride of calcium, having first added to the latter the water of ammonia. Boil now for twenty minutes, and, having collected the precipitate, which will then form, on a calico filter, wash it with hot distilled water until the liquid which passes through ceases to give a precipitate with a dilute solution of nitrate of silver. Finally, dry the product by a steam or water heat, and reduce it to a fine powder.

The following is the *theory* of the process: the gelatinous matter of the horn (or bones) is decomposed and burned off, leaving behind the earthy matter (triphosphate of lime $3CaO,cPO^5$, with a little calcareous carbonate CaO,CO^2). The sulphur (S^3) of the tersulphuret (SbS^3) is expelled in the form of sulphurous acid ($3SO^2$), while the antimony attracts oxygen from the air, forming antimonious acid (SbO^4), and a variable quantity of teroxide of antimony (SbO^3). By the subsequent heating the teroxide is, for the most part, converted into antimonious acid; but one portion is usually left unchanged, while another is volatilised. The carbonate of lime of the horn is decomposed by the united agencies of heat and antimonious acid: carbonic acid is expelled, and a small quantity of antimonite of lime formed. The sides of the crucible in which the second stage of the process has been conducted are found, at the end of the operation, to be lined with a yellow glaze, and frequently with yellow crystals of teroxide.

PROPERTIES.—Antimonial powder is white, gritty, tasteless, and odourless. Boiling water extracts the antimonite (and, according to Dr. Maclagan, superphosphate) of lime: the liquid becomes cloudy on cooling. Hydrochloric acid, digested in the residue, dissolves the triphosphate of lime, all the teroxide of antimony, and that portion of the antimonious acid which was in combination with lime. When examined by the microscope, antimonial powder appears to be an amorphous granular powder.

Characteristics.—The solution obtained by boiling antimonial powder in distilled water occasions white precipitates, soluble in nitric acid, with oxalate of ammonia, nitrate of silver, and acetate of lead. The precipitate with the first of these tests is oxalate of lime (CaO,C^2O^3), with the second phosphate of silver ($2AgO,bPO^5$) and with the third phosphate of lead ($2PbO,bPO^5$). Hydrosulphuric acid gas transmitted through the solution produces an orange-red precipitate. If the portions of antimonial powder not dissolved by distilled water be digested in boiling liquid hydrochloric acid, a solution is obtained, which, on the addition of distilled water, becomes turbid, and deposits a white powder (*oxichloride of antimony*, $SbCl^3,5SbO^3$): at least

I have found this to take place with several samples of antimonial powder which I have examined, and the same is noticed by Dr. Barker;[1] but neither Mr. Phillips[2] nor Dr. Maclagan[3] has observed it. Hydrosulphuric acid gas, transmitted through the hydrochloric solution, causes an orange-red precipitate: if this be separated by filtering, and the solution boiled to expel any traces of hydrosulphuric acid, a white precipitate (*triphosphate of lime*, $3CaO,cPO^5$) is thrown down on the addition of caustic ammonia. That portion of antimonial powder which is not dissolved by hydrochloric acid is antimonious acid: if it be mixed with soda, and heated on charcoal in the interior flame of the blowpipe, it is converted into globules of metallic antimony.

"Distilled water, boiled with it and filtered, gives, with sulphuretted hydrogen, an orange precipitate: muriatic acid digested with the residue, becomes yellow, does not [*sometimes does, according to my experiments*] become turbid by dilution, but gives a copious orange precipitate with sulphuretted hydrogen."—*Ph. Ed.* 2d edit. 1841.

COMPOSITION.—*Dr. James's powder* has been analysed by Dr. Pearson,[4] by Mr. Phillips,[5] by Berzelius,[6] by M. Pully,[7] by Dr. D. Maclagan,[8] and was imperfectly examined by M. Chenevix.[9] *Antimonial powder* has been analysed by Mr. Phillips,[10] and by Dr. D. Maclagan.[11] Their results are, for the most part, shown in the following table:—

	James's Powder.					Antimonial Powder.		
	Pearson	Phillips.	Berzel.	Maclagan.		Phillips.		Maclagan.
		Newbury's		Newbury's	Butler's	1st samp.	2d samp.	
Antimonite of Lime [with some superphosphate, *Maclagan*]	—	—	1	3·40	2·25	—	—	0·8
Teroxide of Antimony	—	—	—	2·89	9·80	—	—	3·98
Antimonious Acid	57	56·0	66	43·47	34·21	35	38	50·09
Triphosphate of Lime	43	42·2	33	50·24	53·21	65	62	45·13
Loss [Teroxide of Antimony and impurity, *Phillips*]	—	1·8	—	—	0·53	—	—	—
	100	100·0	100	100·00	100·0	100	100	100·00

According to the Edinburgh Pharmacopœia (2d ed. 1841), antimonial powder is "a mixture chiefly of *antimonious acid* and *phosphate of lime* with some *sesquioxide* [teroxide] *of antimony* and a little *antimonite of lime*."

Pully found *sulphate of potash* and *hypo-antimonite of potash* in James's powder.

[1] *Observations on the Dublin Pharmacopœia*, 204.
[2] *Ann. Phil.* iv. N. S. 266.
[3] *Edinburgh Medical and Surgical Journal*, No. 135.
[4] *Phil. Trans.* lxxxi. for 1791, p. 317.
[5] *Ann. Phil.* N. S. vi. 187.
[6] *Traité de Chimie*, iv. 481.
[7] *Ann. de Chim.* 1805, lv. 74.
[8] *Op. supra cit.*
[9] *Phil. Trans.* for 1801, p. 57.
[10] *Ann. Phil.* N. S. iv. 266.
[11] *Op. cit.*

Mr. Brande has found as much as 5 per cent. of teroxide of antimony in the antimonial powder of the shops. The *antimonite of lime* is obtained in solution by boiling antimonial powder in distilled water: the greater part of it is deposited as the solution cools. The existence of *superphosphate* was inferred by Dr. Maclagan from the precipitates produced with the salts of lead and nitrate of silver. Mr. Phillips states that it contains but little, if any, *teroxide of antimony*, because the hydrochloric solution did not let fall any precipitate on the addition of water. But a small quantity of teroxide may be dissolved in excess of this acid without our being able to obtain any evidence of it by the action of water. Dr. Maclagan[1] has shown, that if hydrosulphuric acid gas be transmitted through the solution, an orange-red precipitate is obtained, which he supposes to be an indication of the presence of teroxide. But unless the antimonial powder be boiled *repeatedly* in water, to remove completely the antimonite of lime, this test cannot be relied on; for if the least trace of this salt be present, on the addition of hydrochloric acid a solution is obtained, which not only produces an orange-red precipitate with hydrosulphuric acid, but even causes a white precipitate on the addition of water.

PHYSIOLOGICAL EFFECTS.—Antimonial powder is most unequal in its operation,—at one time possessing considerable activity, at another being inert, or nearly so. This depends on the presence or absence of teroxide of antimony, which may be regarded as constituting its active principle, and which, when present, is found in uncertain and inconstant quantity. Moreover, this variation in the composition of antimonial powder cannot be regarded as the fault of the manufacturer, since it depends, as Mr. Brande[2] has justly observed, "upon slight modifications in the process, which can scarcely be controlled." Mr. Hawkins gave ʒj. morning and evening without any obvious effect; and the late Dr. Duncan, jun. administered ℈j. and ʒss. doses, several times a day, without inducing vomiting or purging.[3] Dr. Elliotson[4] found even 120 grains nearly inert; nausea alone being in some of the cases produced. In these instances I presume it contains little or no teroxide.

But, on the ather hand, a considerable number of practitioners have found it to possess activity. Dr. Paris[5] observes, that "it will be difficult for the chemist to persuade the physician that he can never have derived any benefit from the exhibition of antimonial powder." I have above stated that the experiments on which Mr. Phillips founds his assertion that this preparation contains but little if any teroxide, are inconclusive, as Dr. Maclagan has shewn. I am acquainted with one case in which it acted with great activity. A workman employed in the manufacture of this powder in the laboratory of an operative chemist in London, took a dose of it (which, from his account, I estimate at half a teaspoonful), and, to use his own words, "it nearly killed him." It occasioned violent vomiting, purging, and sweating.

Dr. James's powder, which some practitioners consider as more active and certain than our antimonial powder, appears to be equally inconstant in its operation. Dr. D. Munro,[6] who frequently used this powder, and saw Dr. James himself, as well as other practitioners, administer it, observes—"like other active preparations of antimony, it sometimes acts with great violence, even when given in small doses; at other times a large dose produces very little visible effects. I have seen three grains operate briskly both upwards

[1] *Op. cit.*
[2] *Manual of Pharmacy*, 3d edit. p. 292.
[3] *Edinburgh New Dispensatory*, 11th edit.
[4] *Cases illustrative of the Efficacy of the Hydrocyanic Acid*, p. 77.
[5] *Pharmacologia.*
[6] *Treatise on Med. and Pharm. Chem.* i. 367.

and downwards; and I was once called to a patient to whom Dr. James had himself given five grains of it, and it purged and vomited the lady for twenty-four hours, and in that time gave her between twenty and thirty stools; at other times I have seen a scruple produce little or no visible effect." Dr. Cheyne[1] thought highly of it in the apoplectic diathesis: but he used it in conjunction with bleeding, purgatives, and a strict antiphlogistic regimen. The preceding facts seem to me to show the propriety of omitting the use of both antimonial and James's powder, and substituting for them some antimonial of known and uniform activity,—as emetic tartar.

Uses.—Antimonial powder is employed as a sudorific in fevers and rheumatic affections. In the former it is given either alone or in combination with mercurials: in the latter, it is frequently conjoined with opium as well as with calomel. In chronic skin diseases it is sometimes exhibited with alteratives.

Administration.—The usual dose of it is from 3 or 4 to 8 or 10 grains, in the form of powder or bolus.

110. ANTIMONII TERSULPHURETUM.—TERSULPHURET OF ANTIMONY.

Formula SbS^3. *Equivalent Weight* 177.

Two forms of this compound are used in medicine—the one crystalline, the other amorphous.

1. Antimonii Tersulphuretum Crystallisatum.—Crystallised Tersulphuret of Antimony.

History.—Black sulphuret of antimony was known in the most ancient times, being used by the Asiatic and Greek ladies as a pigment for the eyebrows.[2] It was formerly called *stimmi* (στίμμι vel στίμμις), *stibium* (στίβι), *platyophthalmon* (πλατυόφθαλμον), or *larbason*[3] (λάρβασον). It has also been called κόχλος. In the native state it is technically termed *antimony ore*, and when first fused out of its gangue, *crude antimony*, or *sulphuret of antimony*. It is the *antimonii sulphuretum* of the Edinburgh and Dublin Pharmacopœias; the *antimonii tersulphuretum* (*tersulphuret of antimony*) of the London Pharmacopœia.

Natural History.—Tersulphuret of antimony is found native in various parts of the world, especially in Hungary, in the Hartz, in France, in Cornwall, and in Borneo. From the latter place it is imported into this country by way of Singapore, being brought over as ballast in the vessels. In the years 1835-36 and 37, the quantities of ore imported were respectively 645, 825, and 629 tons (*Trade List*, Jan. 10, 1837, and Jan. 9, 1838). In 1840, there were imported 627 tons.

Preparation.—The old method of separating the tersulphuret from its silicious gangue was to melt it in a covered crucible or pot, in the bottom of

[1] *Dubl. Hosp. Rep.* i. 315.
[2] 2 *Kings*, ix. 30; *Ezekiel*, xxiii. 40; Pliny, *Nat. Hist.* xxxiii.
[3] Dioscorides, lib. v. cap. 99.

which there were several holes, through which the fused sulphuret passed into an inferior or receiving pot. According to Gensenne's method, the melting-pots were placed in a circular reverberatory furnace, and were connected by curved earthen tubes with the receiving pots which were on the outside of the furnace. At La Vendée, neither vessels nor tubes are used: the ore is placed on the bed of a reverberatory furnace, in which is an aperture to allow of the passage of the fused tersulphuret, which flows into a receiving vessel placed externally to the furnace.[1]

PROPERTIES.—The fused tersulphuret (called *common* or *crude antimony*) occurs in commerce in roundish masses, called loaves or cakes: these, when broken, present a striated crystalline appearance, a dark steel or lead grey colour, and a metallic brilliancy. The commercial tersulphuret is opaque, tasteless, odourless, brittle, easily pulverisable, and has a sp. gr. of about 4·6. Its powder is black, but that of pure tersulphuret is reddish-black. It is a little less fusible than metallic antimony. It is volatile, but cannot be distilled; and it appears to be partially decomposed by heat, for, when heated in an earthen crucible for an hour, it loses from 10 to 20 per cent. of its weight.[2] By roasting, it is converted into *antimony-ash*. When reduced to a very fine powder by levigation and elutriation, it constitutes the *antimonii sulphuretum præparatum* of the Dublin Pharmacopœia.

Characteristics.—It fuses and is dissipated before the blow-pipe, with a smell of sulphurous acid and the formation of a white smoke (SbO^3). Digested in warm hydrochloric acid, it evolves hydrosulphuric acid, and forms a solution of terchloride of antimony ($SbCl^3$), which produces a white precipitate (*oxichloride of antimony*, $SbCl^3,5SbO^3$) with water, and an orange-red one (SbS^3) with hydrosulphuric acid. If a current of hydrogen gas be passed over heated tersulphuret of antimony, metallic antimony and hydrosulphuric acid gas are obtained: the metal decomposes nitric acid, and yields a white powder: it readily dissolves in nitro-hydrochloric acid ($SbCl^3$).

COMPOSITION.—Tersulphuret of antimony has the following composition:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Berzelius.*	*Thomson.*
Antimony	1	129	72·88	72·8	73·77
Sulphur	3	48	27·12	27·2	26·23
Tersulphuret of Antimony	1	177	100·00	100·0	100·00

IMPURITIES.—The crude antimony of commerce is rarely, if ever, quite pure. It frequently contains the sulphurets of iron, lead, arsenic, and copper, and on this account it is not adapted for medicinal use. When pure, it is completely soluble in hydrochloric acid; but, when mixed with a sulphuret of arsenic, this remains undissolved, and may be detected by reducing it with a mixture of charcoal and carbonate of soda. If the hydrochloric solution be diluted with water (so as to precipitate the greater part of the antimony), the presence of lead, iron, or copper, in the filtered liquor, may be detected by the appropriate tests for these metals, hereafter to be mentioned.

Striated. Soluble in boiling hydrochloric acid.—*Ph. Lond.*
"Entirely soluble in muriatic acid with the aid of heat."—*Ph. Ed.*

[1] Dumas, *Traité de Chimie*, iv. 160.
[2] Berthier, *Traité des Essais*, ii. 490.

PHYSIOLOGICAL EFFECTS. α. *On Animals.*—Rayer[1] introduced half an ounce of it into the cellular tissue of the back of a dog, but no effects resulted from it. Fifteen grains placed in the peritoneal sac caused inflammation, and in twenty-four hours death, but without any peculiar symptoms. Moiroud[2] says that, given to horses in doses of from two to four ounces, it acts as an excitant, causing increased frequency of pulse and respiration, and softer stools.

β. *On Man.*—In most cases it produces no obvious effects, even when taken in very large doses. Rayer[3] gave half an ounce of it in powder for several days without the slightest effect. Cullen,[4] however, has seen it cause nausea and vomiting in one or two instances in which it was largely employed. Rayer says that the decoction of it is much more active than an equal quantity of the same preparation in powder. How are these facts to be explained? He ascribes the activity of the decoction to arsenious acid, formed by boiling sulphuret of arsenic (contained in the ordinary crude antimony) with water; for Guibourt[5] obtained in this way $1\frac{44}{100}$ grs. of arsenic acid by boiling an ounce of crude antimony. But the presence of arsenic is not necessary to explain the greater activity of the decoction, since, by long-continued boiling with water, the tersulphuret of antimony yields hydrosulphuric acid and ter-oxide of antimony.[6] The occasional nausea and vomiting may arise from the decomposition of the sulphuret by the fluids in the alimentary canal.

USES.—As a medicinal agent, it is occasionally employed as a diaphoretic and alterative in some skin diseases, especially lepra and scabies, in scrofula and glandular affections, and in rheumatism and gout.

As a pharmaceutical and chemical agent, it is a most important substance, being the source from which the metal and all its compounds are procured.

ADMINISTRATION.—The usual dose of it, when taken internally, is from ten to thirty grains of the powder; but several drachms of it have been taken without much effect. The *Tisan de Feltz*, which is occasionally used in skin diseases, is prepared by boiling Sarsaparilla, ℥j. and Crude Antimony (tied up in a bag), ʒj. in a pint and a half of Water; then add Isinglass, ʒiv., previously dissolved in water, and reduce the whole (by boiling) to a pint, which is to be taken during the day.[7]

ANTIMONII SULPHURETUM PRÆPARATUM, D.; *Prepared Sulphuret of Antimony.* (Take of Sulphuret of Antimony any convenient quantity. Let this be reduced to powder; and the finer particles having been separated from the coarser by the method explained in the formula for *Creta Præparata*, let them be dried and preserved for use.)—The powder sold in the shops as prepared sulphuret is usually obtained by grinding in mills without elutriation. Its uses are those of the sulphuret before described.

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[1] *Dict. de Méd. et Chir. Pratiq.* iii. 54.
[2] *Pharm. Vétér.* 428.
[3] *Op. cit.*
[4] *Treat. of Mat. Med.* ii. 482.
[5] Rayer, *op. supra cit.*
[6] Geiger, *Hand. d. Pharm.*
[7] Rayer, *Treatise on Diseases of the Skin*, by Dr. Willis, p. 1223.

2. Antimonii Tersulphuretum Amorphum.—Amorphous Tersulphuret of Antimony.

HISTORY.—Red tersulphuret of antimony was known to Basil Valentine,[1] who calls it *sulphur of antimony*. His directions for preparing it are as follows:—Grind antimony to a fine powder, which is to be boiled for two hours, or a little longer, in a sharp lye of beech-wood ashes. Filter the boiled liquor, and pour over it, vinegar: the red sulphur of antimony will then be precipitated.

The discovery of *mineral kermes* (so called on account of its similarity in colour to the insect kermes, *Coccus Ilicis*) is usually ascribed to the celebrated Glauber, one of whose pupils communicated the mode of preparing it to M. de Chastenay, by whom it was communicated to M. de la Ligerie. The latter gave a portion of the medicine to Simon, a Carthusian friar, who effected a remarkable cure with it: hence it obtained the name of *Carthusian powder, poudre des Chartreux*, or *pulvis Carthusianorum*. The secret of its preparation was purchased of M. de la Ligerie by the king of France.[2]

NATURAL HISTORY.—Amorphous tersulphuret of antimony does not occur native. The mineral called *red antimony* is composed of $SbO^3,2SbS^3$.

VARIETIES.—Two varieties of amorphous tersulphuret of antimony are employed in medicine; one is commonly known as mineral kermes, the other is the precipitated sulphuret of antimony.

a. *Kermes Minerale.—Mineral Kermes.*

PREPARATION.—This is prepared both by the humid and by the dry way; and the French Codex gives directions for its preparation by both methods.

α. *By the humid way.*—This is directed to be prepared as follows:—

Take of Crystallised Carbonate of Soda, 128 parts; Water, 1280 parts; Sulphuret of Antimony, 6 parts. Dissolve the carbonate of soda in the water, by the aid of heat, in a cast-iron pan. Add the sulphuret of antimony, reduced to a fine powder, and boil the mixture for an hour, constantly stirring it with a wooden spatula: filter the boiling solution into an earthen pan previously heated, and containing a small quantity of very hot water. Let the solution cool as slowly as possible; collect the red powder which is deposited on a close cloth, and wash on the filter with cold water. Press the washed powder, and dry it on a stove moderately heated.

The *theory* of this process is as follows:—When tersulphuret of antimony is boiled with a solution of carbonate of soda, a portion of the latter is resolved into carbonic acid and soda. The soda reacts on the tersulphuret of antimony, and produces sulphuret of sodium and teroxide of antimony. $3NaO+SbS^3=3NaS+SbO^3$. The sulphuret of sodium dissolves some tersulphuret of

[1] *Basil Valentine, his Triumphant Chariot of Antimony, with Annotations of* Theodore Kirkringius, M.D. p. 131, Lond. 1678.

[2] Lemery, *Sur une Préparation d'Antimoine, appellée communément Poudre des Chartreux, ou Kermes Mineral*, in the *Mémoires de l'Académie Royal*, Année 1720, p. 417, Paris, 1722.

antimony, the quantity of which is greater in proportion as the liquid is hotter and more concentrated. $3NaS + xSbS^3$. The teroxide of antimony combines with soda, $NaO + SbO^3$. As the solution cools, amorphous red tersulphuret of antimony is deposited. This is *kermes minerale*. If the quantity of soda employed be insufficient to hold the whole of the teroxide in solution, a portion of this is also deposited, as the liquid cools, in the form of acuminated six-sided prisms or needles, which, by the microscope, are seen to be mechanically mixed with the red tersulphuret (H. Rose).

The relative proportions of sulphuret of antimony and alkaline carbonate directed to be employed by different authorities are remarkably different. Whatever process be followed, it is essentially requisite, in order to obtain good-coloured kermes of a fine and velvety quality, that the solution be cooled as slowly as possible. This, in fact, is the principal secret in its manufacture. Both Berzelius[1] and Rose[2] state that mineral kermes contains some alkaline sulphuret. According to Rose, it is in combination with pentasulphuret of antimony, the formation of which depends on the absorption of atmospheric oxygen by the solution. $2O + 3(NaS,SbS^3) = 2NaO + NaS,SbS^5 + 2SbS^3$.

β. By the dry way.—The process of the French Codex for *kermes igne paratum* is as follows:—

Take of Sulphuret of Antimony, 500 parts; Carbonate of Potash, 1000 parts; and Sulphur, sublimed and washed, 30 parts. Carefully mix these three substances, and fuse in a Hessian crucible. Pour the mass, while liquid, into an iron mortar, and, when cold, reduce it to powder. Then boil the powder in an iron pan, with 10000 parts of water, filter the boiling liquor, allow it to cool slowly, then decant it, and collect the kermes on a filter; wash it and dry it as already mentioned.

The quantity of kermes obtained by this process is greater, but less fine, than that procured by the preceding process; and it ought to be exclusively reserved for veterinary medicine.

This is Baumé's method of preparing kermes. According to Berzelius, the best proportions of the ingredients are 1 part of pure carbonate of potash, and $2\frac{2}{3}$ parts of tersulphuret of antimony. The changes effected by the fusion are analogous to those before explained. $4(KO,CO^2) + 4SbS^3 = KO, SbO^3 + 3(KS, SbS^3) + 4CO^2$. The *Codex* obviously directs an excess of carbonate of potash to be used. The addition of sulphur augments the quantity, but injures the colour, of the kermes, probably because it promotes the formation of pentasulphuret of antimony, SbS^5.

PROPERTIES.—Mineral kermes is an odourless, tasteless, brownish-red powder, insoluble both in water and in alcohol. Examined by the microscope, it is seen to consist of a reddish or brownish granular mass, which, when the kermes contains teroxide of antimony, is intermixed with acuminated prisms or small acicular crystals of this substance. Dilute mineral or vegetable acids abstract any contained teroxide: concentrated hydrochloric acid decomposes the tersulphuret. $SbS^3 + 3HCl = SbCl^3 + 3HS$. Mineral kermes is completely soluble in hydrosulphuret of ammonia.

COMPOSITION.—The following is the composition of mineral kermes according to H. Rose:—

[1] Schweigger's *Journal*, Bd. xxxiv. S. 58; also, Poggendorff's *Annalen*, Bd. xx. u. xxxvii.
[2] Poggendorff's *Annalen*, Band xlvii. S. 323 (also, *Berl. Jahrb. für die Pharmacie*, Band xlii. 1839).

Kermes prepared by boiling with Carbonate of Soda; but not very carefully dried.		*Kermes prepared by boiling with Potash or its Carbonate.*			
			With Carbonate of Potash.	With Caustic Potash, and slightly washed.	The same, washed for a long time.
Antimony	67·81	Antimony	69·00	61·91	67·08
Sulphur	28·24	Sulphur	28·41	30·26	29·44
Sodium	1·33	Potassium	2·25	5·66	3·48
Water	2·62	Water	—	2·17	—
	100·00		99·66	100·00	100·00

According to Rose, kermes consists of amorphous tersulphuret of antimony, with the sulphantimoniate of either sodium or potassium. The formula for that prepared by boiling crude antimony with caustic potash, and washed for a short time only, consists of $2SbS^3 + KS,SbS^5 + 2Aq$. If the same kermes be washed for a long time, its formula is $9SbS^3 + KS,SbS^5$.

Berzelius and Fuchs, as well as Rose, are of opinion that pure mineral kermes is an amorphous tersulphuret of antimony. But most chemists who have analysed this substance have detected in it teroxide of antimony. Rose considers this an accidental admixture arising from the use of an insufficient quantity of alkali to retain the teroxide in solution. Liebig,[1] on the other hand, regards it as an essential constituent, and gives as the formula for kermes $2SbS^3 + SbO^3$; and its composition, according to this view, may be thus stated:—

	Atoms.	*Eq. Wt.*	*Per Cent.*
Tersulphuret of Antimony	2	354	69·8
Teroxide of Antimony	1	153	30·2
	1	507	100·0

PHYSIOLOGICAL EFFECTS.—The effects of mineral kermes, of the golden sulphuret of antimony, and of the oxysulphuret of antimony of the London Pharmacopœia, are all similar in their character, though varying somewhat in degree. They are more active in proportion as the quantity of teroxide which they may contain is greater. It is probable, however, that kermes mineral, which is entirely devoid of teroxide, is not without some medicinal activity, as it may become soluble in the gastro-intestinal juices, and thereby acquire activity. Kermes mineral is usually stronger than the golden sulphuret of antimony. The effects of kermes mineral are similar to those of other antimonial compounds, and which will be more fully noticed hereafter (see *Antimonii et Potassæ Tartras*). In small doses, it is sudorific and liquefacient; in large doses, emetic and purgative.

USES.—In England, mineral kermes is scarcely employed; but in some parts of Europe, especially Italy and France, it is in frequent use. Like emetic tartar, it has been administered with great benefit as a contra-stimulant or hyposthenic in inflammatory diseases, especially pneumonia.[2] The uncertainty of its operation is, however, a great drawback to its use; and even when

[1] *Handwört. d. Chemie.* Bd. i. S. 427; *Journ. de Pharm.* t. 25, p. 654, 1839.
[2] See Dr. Stack's *Medical Cases*, p. 9, 1784.

it possesses activity, it is doubtful whether it has any advantages over emetic tartar. Some writers, however, assert that it is less irritating to the stomach and bowels: but assuming this to be true, it is probably referable to its inferior activity.

ADMINISTRATION.—Mineral kermes is given, in the form of powder or pill, in doses of from half a grain to two or three grains.

b. *Antimonii Tersulphuretum Præcipitatum.—Precipitated Tersulphuret of Antimony.*

All the British Colleges give directions for the preparation of an amorphous antimonial sulphuret, called by the London College *antimonii oxysulphuretum;* by the Edinburgh College, *antimonii sulphuretum aureum;* and by the Dublin College, *antimonii sulphuretum precipitatum.*

The *London College* orders of Tersulphuret of Antimony, ℥vij.; Solution of Soda, Oiv.; Distilled Water, *Cong.* ij.; Diluted Sulphuric Acid, as much as may be sufficient. Mix the sesquisulphuret of antimony, solution of potash, and water together, and boil with a slow fire for two hours, frequently stirring, distilled water being often added, that it may fill about the same measure. Strain the liquor, and gradually pour into it as much diluted sulphuric acid as may be sufficient to precipitate the oxysulphuret of antimony; then, with water, wash away the sulphate of soda, and dry what remains with a gentle heat.

The *Edinburgh College* orders of Sulphuret of Antimony, in fine powder, ℥j.; Solution of Potash, f℥xvj.; Water, Oij.

The *Dublin College* gives the following directions:—Take of Prepared Sulphuret of Antimony, ℥v.; Carbonate of Potash from Pearlash, first dried by a low red heat, and reduced to powder, ℥iv.; Water, *Cong.* j.; Pure Sulphuric Acid, f℥ij.; Distilled Water, Oij. Mix the sulphuret of antimony and Carbonate of Potash in a mortar, and heat the mixture in a Hessian crucible, first cautiously until effervescences ceases, and then to low redness, so as to produce liquefaction. Pour out the melted mass on a clean flag, and, when it has concreted and cooled, rub it to a fine powder in a porcelain mortar. Add this, in successive portions, to the gallon of water while boiling in an iron vessel, and, having maintained the ebullition for twenty minutes, transfer the whole to a calico filter, and cause the solution which passes through to drop into the distilled water previously mixed with the sulphuric acid. Let the precipitate which forms be collected on a calico filter, and let warm distilled water be repeatedly poured upon it, until the liquid which passes through ceases to give a precipitate when dropped into a solution of nitrate of barytes. Finally, dry the product on porous bricks placed in a warm atmosphere.

The *theory* of the process has been already in part explained. When the common black tersulphuret of antimony is boiled with a solution of caustic potash, sulphuret of potassium and teroxide of antimony are produced, $3KO + SbS^3 = 3KS + SbO^3$: the former combines with and dissolves some tersulphuret of antimony ($3KS + xSbS^3$), while the latter unites with potash ($KO + SbO^3$). Thus the solution contains hyposulphantimonite of potassium and hypantimonite of potash. When sulphuric acid is added to the strained liquor, it decomposes the sulphuret of potassium, precipitates the tersulphuret of antimony, and combines with the potash which retained the teroxide of antimony in solution: the latter is wholly, or in great part, re-converted into tersulphuret of antimony. $4SO^3 + 3(KS,SbS^3) + KO,SbO^3 = 4(KO,SO^3) + 4SbS^3$. From Mr. Phillips's analysis, it would appear that some teroxide of antimony escapes decomposition, and is contained in the precipitated product. It is probable that the precipitate sometimes contains pentasulphuret of antimony, SbS^5. This is formed by the action of atmospheric oxygen on the al-

kaline solution prior to the addition of the sulphuric acid. $2O + 3(KS,SbS^5) = 2KO + KS,SbS^5 + 2SbS^3$.

PROPERTIES.—Oxysulphuret of antimony is a red, odourless, almost tasteless powder. It is insoluble in cold water, and only slightly soluble in liquor ammoniæ. Boiled in nitro-hydrochloric acid, terchloride of antimony is formed in solution, and some sulphur remains undissolved. Heated in the air, it burns, evolves sulphurous acid, and leaves a greyish residuum.

Characteristics.—When heated with concentrated hydrochloric acid, it evolves hydrosulphuric acid, showing it to be a sulphuret. From the other sulphurets or oxysulphurets of antimony it is to be distinguished partly by its colour. Its hydrochloric solution is shown to contain antimony by the tests for this metal. When boiled in a solution of bitartrate of potash, a solution of emetic tartar is obtained, which may be recognised by the characters hereafter to be mentioned for this salt. It may be reduced by hydrogen and heat.

COMPOSITION.—By boiling in a solution of bitartrate of potash, it loses, according to Mr. Phillips, 12 per cent.—the amount of teroxide which it is presumed to contain.[1] Its composition, according to the same authority, is as follows:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*Phillips.*
Teroxide Antimony	1	153	13	12
Tersulphuret Antimony	5	885	75	76·5
Water	16	144	12	11·5
Oxysulphuret Antimony, *Ph. L.*	1	1182	100	100·0

By microscopic examination, I can discover no crystals of teroxide of antimony in samples of this compound made by Mr. R. Phillips and by myself.

From the mode of its preparation, this compound would appear to be a mixture of amorphous tersulphuret of antimony, SbS^3, with some pentasulphuret, SbS^5. In other words, it is probably a mixture of mineral kermes (minus the alkaline sulphuret) and golden sulphuret. According to the Edinburgh College, it is "a mixture or compound of sesquisulphuret of antimony, sesquioxide of antimony, and sulphur."

PURITY.—Recently precipitated oxysulphuret of antimony is readily and completely soluble in liquor potassæ: but the oxysulphuret of the shops leaves a white residuum. Boiled in hydrochloric acid, it is dissolved with the evolution of hydrosulphuric acid gas: the solution is opalescent or slightly milky, but becomes quite transparent on the addition of a small quantity of nitric acid. It should not effervesce with dilute sulphuric acid.

The *London College* states that it is

Of a golden-red colour; soluble in boiling solution of potash, and almost entirely dissolved by hot hydrochloric acid, hydrosulphuric acid being evolved and some sulphur remaining. These solutions are colourless.—*Ph. Lond.*

The *Edinburgh College* states that it is

"Tasteless: twelve times its weight of muriatic acid, aided by heat, will dissolve most of it, forming a colourless solution, and leaving a little sulphur."

The commercial oxysulphuret is of a brighter colour than that obtained

[1] This method of determining the quantity of teroxide of antimony cannot be absolutely relied on (see H. Rose, Poggendorff's *Annalen*, Bd. xlvii.)

according to the process of the Pharmacopœia. A manufacturer of it informs me that it is prepared by boiling sulphur with the black sulphuret of antimony and potash, and precipitating by an acid in the usual way. Mr. Redwood[1] mentions two ways by which a product resembling the usual commercial article may be procured: one is, by boiling together 4 parts of black sulphuret of antimony, 8 parts of lime, and 80 parts of water, and precipitating the strained solution by excess of hydrochloric acid; the other is by fusing together 2 parts of black sulphuret of antimony, 4 parts of carbonate of potash, and 1 part of sulphur, boiling the fused mass when cold in 20 times its weight of water, and precipitating by a large excess of dilute sulphuric acid.

PHYSIOLOGICAL EFFECTS.—The medicinal activity of this preparation is greater in proportion to the quantity of teroxide of antimony which it may contain. The obvious effects are precisely analogous to those of emetic tartar; namely, vomiting, purging, and sweating. In small doses, it is employed as an alterative, expectorant, and diaphoretic; in somewhat larger doses, it causes nausea and sweating, and sometimes vomiting; in still larger quantities, it excites both vomiting and purging.[2]

USE.—It is principally employed as an *alterative* in chronic diseases, particularly cutaneous affections, glandular enlargements, secondary syphilis, rheumatism, and diseases of the liver. In these complaints it is usually associated with mercurials (especially calomel), and sometimes with either guaiacum or narcotics.

ADMINISTRATION.—As an alterative, the dose is from one to three or four grains; as an emetic, from five grains to a scruple. It is a constituent of the *pilulæ hydrargyri chloridi compositæ*, commonly termed *Plummer's pill*.

ANTIDOTES.—Vide *Antimonii et Potassæ Tartras*.

111. Antimonii Pentasulphuretum.—Pentasulphuret of Antimony.

Formula SbS^5. *Equivalent Weight* 209.

Sulphur Antimonii Auratum; Golden Sulphuret of Antimony; Stibium Sulphuratum Aurantiacum.—Obtained by adding a diluted mineral acid (usually sulphuric acid) to the mother liquor from which mineral kermes has been deposited: the precipitate is to be washed and dried. Its formation has been before explained (see *ante*, p. 734). *Schlippe's salt* is the sulphantimoniate of sodium, $3NaS,SbS^5,18HO$. When it is decomposed by sulphuric acid, the golden sulphuret of antimony is precipitated. $3NaS,SbS^5,18HO+3SO^3=3(NaO,SO^3)+SbS^5+3HS+15HO$. Golden sulphuret of antimony is an orange-red, odourless, and tasteless powder. In its medicinal properties and uses it resembles mineral kermes and precipitated sulphuret of antimony. The dose is from half a grain to two or three grains.

[1] Gray's *Supplement to the Pharmacopœia*, 2d edit. 1848.
[2] For some experiments and observations on the action of *Kermes Mineral* and the *Golden Sulphuret*, consult Rayer, in *Dict. de Méd. et Chir. Prat.* iii. 57, *et seq.*

112. ANTIMONII TERCHLORIDUM. TERCHLORIDE OF ANTIMONY.

Formula $SbCl^3$. *Equivalent Weight* 235·5.

HISTORY.—Basil Valentine was acquainted with this preparation, which has had various appellations; such as *oil* or *butter of antimony* (*oleum seu butyrum antimonii*), *muriate* or *hydrochlorate of antimony, sesquichloride of antimony, protochloride of antimony*, &c.

PREPARATION.—There are several methods of obtaining terchloride of antimony, which, in the pure state, is not used in medicine. The liquid sold in the shops and used in medicine under the name of *butter of antimony*, is an impure solution of terchloride of antimony in liquid hydrochloric acid, often containing a large quantity of iron. It is the *liquor stibii chlorati* of the Pharm. Bor., 1846. It is sometimes prepared by dissolving roasted antimony-ash in hydrochloric acid It may also be prepared by dissolving the common crude antimony (SbS^3) in hydrochloric acid. The addition of a little nitric acid facilitates the process. In the Prussian Pharmacopœia it is directed to be prepared by dissolving lb. j. of powdered black sulphuret of antimony in lb. iv. of crude hydrochloric solution. The filtered solution is to be evaporated to lb. iss., and to the cold liquor ℥ix. of hydrochloric acid, and lb. iss. of distilled water, are to be added, or so much that the filtered liquor shall have the sp. gr. of 1·345 to 1·350.

By the action of liquid hydrochloric acid on tersulphuret of antimony, we obtain terchloride of antimony, while sulphuretted hydrogen escapes. $SbS^3 + 3HCl = SbCl^3 + 3HS$. The terchloride of antimony thus obtained is dissolved in excess of liquid hydrochloric acid, forming the *hydrochloric solution of terchloride of antimony* (*liquor hydrochloricus antimonii teroxydi*). If this solution be submitted to distillation, the water and excess of hydrochloric acid are first expelled; afterwards the terchloride is volatilised: this concretes on cooling. If, therefore, our object be to obtain the pure terchloride, it may be procured from the hydrochloric solution by changing the receiver as soon as the distilled product concretes on cooling. In order to deepen the colour of the commercial butter of antimony, pernitrate of iron is usually added to it.

PROPERTIES.—The *butter of antimony* of the shops is a transparent liquid, varying in its colour from pale yellow to deep red. If it be free from iron, it is yellowish: the deep red colour of the article usually found in the shops is due to pernitrate of iron. Its sp. gr. varies from 1·2 to 1·5. The Prussian College fix it at from 1·345 to 1·350. It fumes in the air (especially when ammonia is present), in consequence of containing an excess of hydrochloric acid. It reacts on vegetable colours as a powerful acid.

Characteristics.—Mixed with water, it throws down a whitish powder (*oxichloride of antimony*, $SbCl^3,5SbO^3$), soluble in an excess of tartaric acid. The hydrosulphurets produce a reddish precipitate (SbS^3), usually darkened by sulphuret of iron (FeS). Alkalies and their carbonates occasion a precipitate of the white teroxide of antimony (SbO^3), usually discoloured by sesquioxide of iron, Fe^2O^3. Nitrate of silver occasions a white precipitate (AgCl and SbO^3).

COMPOSITION.—Terchloride of antimony is thus composed :—

	Atoms.	Eq. Wt.	Per Cent.	Göbel.	H. Rose.
Antimony	1	129	54·8	54·98	53·27
Chlorine	3	106·5	45·2	45·02	46·73
Terchloride of Antimony	1	235·5	100·0	100·00	100·00

The butter of antimony of the shops consists of *terchloride of antimony, free hydrochloric acid*, a little *nitrous acid, water*, and *sesquichloride of iron*. It may also contain other impurities derived from the tersulphuret from which it is separated. Serullas says he never found arsenic in it.

PHYSIOLOGICAL EFFECTS.—It acts as an energetic caustic; but I am not acquainted with any cases of poisoning by it. It cannot be much diluted without undergoing decomposition.

USES.—In medicine it is employed only as a caustic. It usually acts without much pain or inflammation, and, after the separation of the eschar, produces a clean healthy surface. It is sometimes used as an application to parts bitten by rabid animals or venomous serpents; its liquidity enabling it to penetrate into and corrode all parts of the wound. It is also applied to ulcers to repress excessive granulations. Richter and Beer have employed it in staphyloma: the mode of applying it is as follows:—Dip a camel's hair pencil, or a point of lint, into the liquid, and apply it to the tumour until a whitish crust is perceived, when the whole is to be immediately washed away by means of a larger pencil dipped first into milk and afterwards into milk and water.

ANTIDOTES.—The treatment of poisoning by this preparation is the same as for the mineral acids. After the use of antacids, vegetable astringents (tea and infusion of nutgalls) should be administered to neutralise the effect of the oxichloride of antimony separated in the stomach.

ANTIMONII TERCHLORIDI LIQUOR, D. (Take of Prepared Sulphuret of Antimony, lb. j.; Muriatic Acid of Commerce, Oiv.:—Upon the sulphuret, placed in a porcelain capsule, pour the acid, and, constantly stirring, apply to the mixture, beneath a flue with a good draught, a gentle heat, which must be gradually augmented as the development of the gas begins to slacken, and finally carried to ebullition, and maintained at this temperature for fifteen minutes. The vessel being now removed from the fire, let its liquid contents be separated by filtration through calico, returning what passes through first, in order that a perfectly clean solution may be obtained. Transfer the liquid to another capsule, and, having boiled it down to the bulk of one quart, allow it to cool, and preserve it in a bottle furnished with a well-ground glass stopper. The specific gravity of this solution is 1470.)

113. ANTIMONII ET POTASSÆ TARTRAS.—TARTRATE OF ANTIMONY AND POTASH.

Formula $KO,SbO^3,C^8H^4O^{10},3HO$; or $KO,SbO^3,\overline{T},3HO$. *Equivalent Weight* 359.

HISTORY.—This salt was first publicly noticed in 1631 by Hadrian de Mynsicht.[1] "But the preparation was in all probability suggested by a treatise, entitled *Methodus in pulverem*, published in Italy in 1620. This

[1] *Thesaurus Medico-Chymicus.*

book, written by Dr. Cornachinus, gives an account of the method of preparing a powder which had been invented by Dudley, Earl of Warwick, and which had acquired celebrity in Italy in consequence of the wonderful cures which it had performed. This powder was composed of scammony, sulphuret of antimony, and tartar, triturated together. The extraordinary effects which it produced would naturally draw the attention of chemists to the combination of antimonial preparations with tartar."[1]

This salt has had various denominations, such as *emetic* or *stibiated tartar* (*tartarus emeticus, antimoniatus,* vel *stibiatus*); *tartarised antimony* (*antimonium tartarisatum,* D.); *potassio-tartrate of antimony* (*antimonii potassio-tartras,* L.); *antimonio-tartrate of potash* (*potassæ antimonio-tartras*); *stibium oxydatum kalico-tartaricum; kali tartaricum stibiatum,* &c.

PREPARATION.—Tartrate of antimony and potash is prepared by boiling water and cream of tartar with teroxide of antimony. $KO,\overline{T}+SbO^3+3HO=KO,SbO^3,\overline{T},3HO$.

Formerly, either saffron of antimony (*crocus antimonii*) or glass of antimony (*vitrum antimonii*) was employed to yield teroxide of antimony in the manfacture of emetic tartar. Antimony ash (*cinis antimonii*) is also sometimes used. But probably the best method is to obtain teroxide of antimony by the use of an alkaline carbonate.

If the teroxide of antimony be quite pure, the atomic proportions of this substance and of cream of tartar required to produce emetic tartar are—one equivalent, or 153 parts, of the teroxide, and one equivalent, or 188 parts, of the crystals of cream of tartar.

The *London Pharmacopœia* of 1851 gives the following directions for the preparation of this salt:—

Take of Tersulphuret of Antimony, rubbed to the finest powder, lb. j.; Sulphuric Acid, f℥xv.; Bitartrate of Potash, ℥x.; Distilled Water, Ov. Mix the tersulphuret with the acid in an iron vessel; to these apply a slow fire beneath a chimney, stirring frequently with an iron spatula; then increase the fire, until the flame of the ignited sulphur being extinguished, nothing remains excepting a whitish pulverulent mass. Wash this when cold with water until no acid can be detected, and dry. Carefully mix nine ounces of this salt with the bitartrate, and boil in the water for half an hour. Strain the solution while still hot, and set aside that crystals may form. The solution being poured off, dry these, and again evaporate the solution that it may be converted into crystals.

The *Edinburgh College* gives the following directions for the preparation of this salt:—

Take of Sulphuret of Antimony, in fine powder, ℥iv.; Muriatic Acid, (commercial) Oj.; Water, Ov. Dissolve the sulphuret in the acid with the aid of a gentle heat; boil for half an hour; filter; pour the liquid into the water; collect the precipitate on a calico filter, wash it with cold water till the water ceases to redden litmus paper; dry the precipitate over the vapour bath. Take of this precipitate, ℥iij.; Bitartrate of Potash, ℥iv. and ʒij.; Water, f℥xxvij. Mix the powders, add the water, boil for an hour, filter, and set the liquid aside to crystallise. The mother liquor, when concentrated, yields more crystals, but not so free of colour, and, therefore, requiring a second crystallisation.

In this process, terchloride of antimony, $SbCl^3$, is first obtained. By water, this is first converted into the oxichloride, $SbCl^3,5SbO^3$, which, by continued washing, is converted almost entirely into teroxide. SbO^3. This combines,

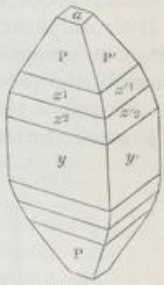
[1] Thomson's *System of Chemistry,* 7th edit. vol. ii. p. 797, 1831.

in the subsequent part of the process, with the bitartrate, and forms emetic tartar. This is an excellent process for the manufacture of emetic tartar. [It differs from that of the London College in the substitution of hydrochloric for sulphuric acid.—ED.]

The *Dublin College* orders Emetic Tartar to be thus prepared:—Take of Oxide of Antimony, ℥v.; White Bitartrate of Potash, ℥vj.; Distilled Water, Oij. Rub the bitartrate to a fine powder, and, having carefully mixed it with the oxide of antimony, add a little water, so as to convert the matter into a thick paste, which should be set by for four-and-twenty hours. Pour on this the remainder of the water, previously raised to the temperature of 212°, and, having boiled for fifteen minutes, with repeated stirring in a glass or porcelain vessel, filter through calico, returning the slightly turbid liquor which passes through, so as to obtain a clear solution. After twelve hours let the liquid be decanted from the crystals which will have formed, and boil to one third, when, upon cooling, an additional product will be obtained. The salt, after being dried upon blotting paper, without the application of heat, should be preserved in a bottle.

PROPERTIES.—Emetic tartar crystallises in white, transparent, inodorous, rhombic octohedrons, whose lateral planes are striated (see fig. 132). By exposure to the air the crystals become opaque, probably by giving out an equivalent of water. Their taste is feebly sweetish, then styptic and metallic. They dissolve in 14 or 15 parts of water at 60° F. ($12\frac{65}{100}$ at 70°, Brandes), and in 2 parts ($2\frac{78}{100}$ parts, Brandes) at 212°. The aqueous solution slightly reddens litmus. Emetic tartar is not soluble in alcohol. When calcined in close vessels, it yields a pyrophoric alloy of antimony and potassium. The crystals decrepitate in the fire.

FIG. 132.

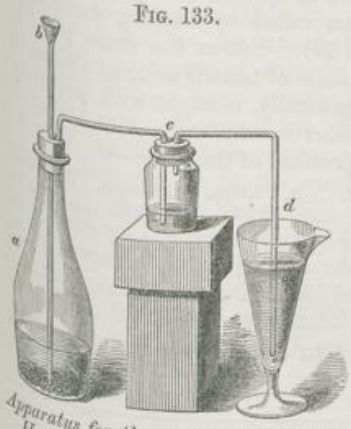


Octohedron of Emetic Tartar.

Characteristics.—Heated in a porcelain or glass capsule, this salt is charred, and evolves the peculiar caramel-like odour of burning tartaric acid. If the charred salt be heated in a glass tube by a blowpipe, globules of antimony are obtained. If the reduction be effected on charcoal, a portion of the metal is reoxidised, and deposited on the charcoal in the form of a white powder or crystalline needles (SbO^3).

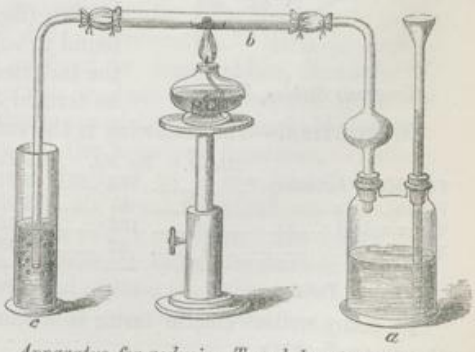
If a stream of hydrosulphuric acid gas, generated in the flask *a*, fig. 133, be

FIG. 133.



Apparatus for the passage of Sulphuretted Hydrogen through a Solution of Emetic Tartar.

FIG. 134.



Apparatus for reducing Tersulphuret of Antimony.

a. Vessel for generating hydrogen.
b. Reduction tube.
c. Vessel containing solution of acetate of lead to detect the hydrosulphuric acid which is formed.

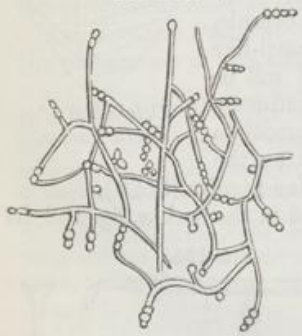
washed, by passing it through water contained in the bottle *c*, and then conveyed into a solution of emetic tartar slightly acidulated by hydrochloric acid, and contained in the glass *d*, an orange-red precipitate of amorphous tersulphuret of antimony (SbS^3) is obtained. This precipitate is soluble both in liquor ammoniæ and hydrochloric acid. If it be collected, dried, introduced into a green glass tube, a current of hydrogen gas transmitted over it, and, when the process has gone on for a few minutes, the heat of a spirit-lamp applied to it, hydrosulphuric acid and metallic antimony are produced. ($SbS^3 + 3H = Sb + 3HS$). A portion of the metal is [spuriously?] sublimed. The metal is known to be antimony by dissolving it in nitro-hydrochloric acid: the solution ($SbCl^3$) forms a white precipitate ($SbCl^3,5SbO^3$) on the addition of water, and an orange-red one (SbS^3) with hydrosulphuric acid gas or hydrosulphate of ammonia. The mode of reducing the tersulphuret will be readily understood by the accompanying woodcut (fig. 134). This process was proposed by the late Dr. E. Turner.

If the solution of emetic tartar, which has been deprived of antimony by sulphuretted hydrogen, be filtered and evaporated, it yields crystals of cream of tartar,[1] $KO,\overline{T},HO$, the characters of which have been already pointed out.

Hydrosulphuret of ammonia ($NH^3,2HS$) occasions, in a solution of emetic tartar, an orange-red precipitate (SbS^3), which is completely soluble in an excess of the precipitant. Infusion of nutgalls occasions an abundant bulky whitish-yellow precipitate of tannate of antimony.

If emetic tartar be dissolved in water, and to the solution sulphuric acid and zinc be added, antimoniuretted hydrogen gas, SbH^3, is evolved. $SbO^3 + 6Zn + 6(HO,SO^3) = 6(ZnO,SO^3) + SbH^3 = 3HO$. The characters of this gas have been already pointed out.

FIG. 135.



Sirocrosis Stibica, Kützing.

A soft, flexible, mucilaginous mass is formed in an aqueous solution of emetic tartar when kept for some time. If this be examined by the microscope, it is seen to consist of articulated filaments with branches which at the apex support a series of spermatia. This algaceous plant has been called by Kützing *Sirocrocis stibica* (fig. 135). But as the same plant is found in solutions of tartaric acid, as well as of the tartrates generally, it might with propriety be termed *Sirocrocis tartarica*.[2]

COMPOSITION.—The following is the composition of this salt:—

	Atoms.	*Eq. Wt.*	*Per Cent.*	*R. Phillips.*	*Thomson.*	*Wallquist.*
Teroxide of Antimony	1	153	42·619	43·35	42·62	42·99
Potash	1	47	13·091	49·25	57·38	13·26
Tartaric Acid	1	132	36·769			38·61
Water	3	27	7·521	7·40		5·14
Emetic Tartar	1	359	100·000	100·00	100·00	100·00

By many writers emetic tartar is assumed to contain only 2 eq. of water. $KO,SbO^3,\overline{T},2HO$.

[1] Thomson's *First Principles of Chemistry*, vol. ii. p. 441, 1825.
[2] *Pharmaceutical Journal*, vol. vii. pp. 343 and 370.

PURITY.—In the crystalline state, the purity of this salt is easily determined. The crystals should be well formed, perfectly colourless, transparent, or opaque, and, when dropped into a solution of hydrosulphuric acid, have an orange-coloured deposit (SbS^3) formed on them. When pure, the powder of this salt is perfectly white. Some ignorant druggists prefer a yellowish white powder; and I am informed by a manufacturer of this salt, that he is obliged to keep two varieties (one white, the other yellowish white) to meet the demands of his customers! The yellow tint is owing to the presence of iron, which is readily detected in the salt by the blue colour immediately produced in its solution by adding first a few drops of dilute sulphuric acid, and then ferrocyanide of potassium. [This test should not precipitate or in any way affect solution of the pure salt.—ED.]

Emetic tartar is sometimes adulterated with bitartrate of potash. According to the late Mr. Hennell,[1] the antimonial salt may contain 10 per cent. of bitartrate, and yet the whole will dissolve in the proper quantity (14 or 15 parts) of water. In order to detect any uncombined bitartrate, he adds a few drops of a solution of carbonate of soda to a boiling solution of the antimonial salt, and if the precipitate formed be not dissolved, he concludes that there is no bitartrate of potash present.

A dilute solution of emetic tartar occasions no precipitate with chloride of barium: it produces a white precipitate (unless the solutions be very dilute) with nitrate of silver, and which is soluble in excess of water.

Colourless, soluble in water. This solution is not altered by ferrocyanide of potassium. Hydrosulphuric acid being added, a reddish-coloured substance is precipitated; neither chloride of barium nor nitrate of silver being added throws down anything but what is again dissolved by the addition of water. That which is thrown down by nitric acid is redissolved by an excess of the same acid. From one hundred grains dissolved in water, hydrosulphuric acid precipitates forty-nine grains of tersulphuret of antimony.—*Ph. L.*

"Entirely soluble in twenty parts of water; solution colourless, and not affected by solution of ferrocyanide of potassium: a solution in forty parts of water is not affected by its own volume of a solution of eight parts of acetate of lead in thirty-two parts of water and fifteen parts of acetic acid."—*Ph. Ed.*

PHYSIOLOGICAL EFFECTS. α. *On Vegetables.*—Emetic tartar acts as a poison to plants.[2] The *Sirocrocis stibica*, however, grows luxuriantly in it (see *ante*, p. 744), and, therefore, forms an exception to this statement.

β. *On Animals.*—An extended examination of the effects of emetic tartar on the different classes of animals is still a desideratum. Hitherto experiments with it have been principally confined to dogs, rabbits, horses, oxen, sheep, and cats. Moiroud[3] has given two drachms to horses, and gradually increased the dose to six ounces, without perceiving any remarkable or permanent derangement in the exercise of the principal functions. Gilbert (quoted by Moiroud) has exhibited ten drachms to a cow, and four to a sheep, without any remarkable effect: but six drachms killed an animal of the latter species. Magendie[4] examined its effects on dogs. He found that from six to ten grains introduced into the stomach killed the animals in from two to three hours, when the gullet was tied: those who were able to get rid of it by vomiting took as much as a drachm without experiencing any bad

[1] Phillips's *Transl. of the Pharm.* 4th edit.
[2] Schübler and Zeller, in *Schweigger's Journ. f. d. Chem.* 1827, B. 50, S. 54-66.
[3] *Pharm. Vétér.* 287.
[4] Orfila, *Toxicol. Gén.*

effects, and in some cases half an ounce caused no ill effects. From his experiments it appears that it operates locally and by absorption, its principal action being on the intestinal canal and lungs; for nausea, vomiting, alvine evacuations, difficulty of respiration, and accelerated respiration, were produced by injecting a solution of the salt into the veins,—by introducing it into the stomach, as well as by applying it in the solid state to the cellular tissue. Traces of pneumonia, gastritis, and enteritis, were found after death. These experiments have been repeated by Rayer and Bonnet[1] on rabbits, but without obtaining the lesion of the lungs mentioned by Magendie: in some cases no appreciable lesion was observed in any organ. Dr. Campbell (quoted by Dr. Christison) found no pulmonary inflammation in a cat killed by this salt. According to Flourens,[2] emetic tartar injected into the veins of ruminants causes efforts to vomit, but not actual vomiting; of the four stomachs possessed by these animals, the *reed* or true stomach is the only one affected by it. Orfila[3] has detected antimony in the viscera of animals to whom emetic tartar had been administered by the stomach. It has also been found in the liver, blood, and urine.

γ. *On Man.* αα. *Local effects.*—Emetic tartar is a powerful local irritant. Its irritant properties may be regarded as a peculiar or specific kind; at least if we are to judge from its well-known effects when applied to the epidermis (as in the form of solution or ointment, or sprinkled over a plaster). It causes an eruption of painful pustules, resembling those of variola or ecthyma. The smaller ones are semi-globular; the larger ones, when at their height, are flattened, are surrounded with an inflammatory border, contain a pseudo-membranous deposit and some purulent serum, and have a central dark point. When they have attained their greatest magnitude, the central brown spots become larger and darker, and, in a few days, desiccation takes place, and the crusts are thrown off. The largest are produced by using the powder sprinkled over a plaster; the smallest are developed by applying the solution. They are usually very painful. I am acquainted with no agent which produces an eruption precisely like that caused by emetic tartar. The facility with which it is produced varies considerably in different individuals, and in the same individual at different times. A pustular eruption has been met with in the mouth, œsophagus, and small intestines, from the internal use of emetic tartar, and white aphthous spots have been observed on the velum and tonsils.[4] But these effects are rare. Severe inflammation of the throat (*angina antimonialis?*) has sometimes followed the employment of antimony.[5]

We have further evidence of the local irritation produced by emetic tartar in its action on the stomach and intestines. When swallowed in full doses, it gives rise to vomiting and purging, and pain in the epigastric region. After death, redness of the gastro-intestinal membrane has been found. However, it would appear from the experiments of Magendie, before referred to, that part of this effect should be referred to the specific influence which this salt

[1] *Dict de Méd. et de Chir. Prat.* iii. 69.
[2] *Mémoires de l'Académie Royale des Sciences*, t. xvi. 1838; also, *Journ. de Chim. Méd.* ix. 21.
[3] *Journ. de Chim. Méd.* t. vi. 11e Série, p. 290. See also the Report of the Commissioners of the French Academy of Sciences, in the *Journ. de Pharm.* xxvii. p. 415.
[4] Lepelletier, *De l'Emploi du Tart. Stibié*, p. 171, Paris, 1835.
[5] *Lond. Med. Gaz.* March 20, 1840, p. 960.

exerts over the stomach, independently of its direct local irritation, since the same symptoms have been induced by its application to wounds, and by its injection into the veins. Occasionally, constitutional effects (nausea, vomiting, and griping pains) have appeared to result from its application to the skin.[1] In one instance death resulted from its employment: the patient was an infant two years of age, and death occurred in forty-eight hours.[2] These effects, if really produced by this salt, occur very rarely. I have applied to the skin emetic tartar (in the form of solution, ointment, and plaster) in a very large number of cases, without having observed any constitutional effect; although I have occasionally fancied that it ameliorated pulmonary affections, even when no eruption or redness was produced, and which might arise from absorption.[3]

ββ. *Remote* or *constitutional effects.*—Taken internally, *in small doses,* emetic tartar increases the secretion and exhalation of the gastro-intestinal membrane, and of the liver and pancreas. Subsequently, it acts powerfully on other emunctories: thus it causes sweating, without any very marked vascular excitement; it renders the mucous membranes (especially the aërian membrane) moister, and, when the skin is kept cool, promotes the secretion of urine. These effects are produced more certainly and speedily by this salt than by any other antimonial preparation.

In somewhat larger doses, it excites nausea, frequently with vomiting, disorders the digestive functions, gives rise to an uneasy sensation in the abdominal region, depresses the nervous functions, relaxes the tissues (especially the muscular fibres), and occasions a feeling of great feebleness and exhaustion. These symptoms are accompanied or followed by increased secretion and exhalation from the different emunctories, but especially from the skin, as above mentioned. Of all emetic substances, this creates the most nausea and depression.

In excessive doses, emetic tartar has, in a few instances, acted as an irritant poison, and even occasioned death. In one case a scruple, in another 27 grains, nearly proved fatal.[4] In a third, 40 grains caused death.[5] The symptoms in the latter case were vomiting, hypercatharsis, convulsions, epigastric pain and tumefaction, and delirium. Death occurred four days after the ingestion of the poison. Were the above cases not well authenticated, we should be disposed to ascribe the dangerous symptoms and death to some other circumstance rather than to the use of the above-mentioned quantities of emetic tartar; for of late years this salt has been extensively employed in enormous and repeated doses with perfect safety. Rasori[6] has given many drachms in twenty-four hours, and many ounces during the course of a disease, without occasioning either vomiting or abundant alvine evacuations. Laennec[7] has confirmed, to a certain extent, the statements of Rasori. He gave a scruple, two scruples, and even a drachm and a half, within twenty-four hours (usually in doses of one, two, or three grains) without ever having

[1] *Journ. de Chimie Méd.* iv. 478.
[2] *Med. Repos.* xvi. 457.
[3] See also some experiments on this subject in *Mem. of the Med. Soc. Lond.* vols. ii. iv. and v.
[4] Orfila, *Toxicol. Générale.*
[5] *Ibid.*
[6] Bayle's *Bibliothèq. de Thérap.* i. 198.
[7] *Treatise on Diseases of the Chest,* by Dr. Forbes, p. 249.

seen any injurious consequences. The usual effects which I have observed from the continued use of one or two grain doses, are nausea, vomiting, and purging, which in most cases are much diminished, or entirely cease, after the use of the medicine for a day or two. Perspiration I have found to be a frequent effect. In all the instances above referred to in which these large doses were administered, the patients were affected with inflammatory diseases. Now it is to this morbid state, or *diathesis*, that, according to Rasori, we ought to ascribe the *tolerance* of, or capability or *aptitude* of bearing, these immense quantities of this powerful medicine (see *ante*, p. 100, *et seq.* for some remarks on the Italian *doctrine of contra-stimulus*). Consequently, if the opinion be worth anything, the susceptibility to its influence should increase as the disease subsides,—a circumstance which Rasori asserts really takes place. But in this the theoretical views of this distinguished Italian have probably led him to overlook the truth. "It is certainly true," observes Laennec, "that after the acute period of the disease [peripneumonia], the tolerance diminishes, or sometimes entirely ceases; but it is more common to find the patient become habituated to the use of the medicine, insomuch that during convalescence, and when he has begun to use food as in health, he will take daily, without knowing it, six, nine, twelve, or even eighteen grains of emetic tartar." Though I have seen this salt extensively employed in both public and private practice, I have never met any satisfactory cases supporting Rasori's assertion of the diminished tolerance when the patient becomes convalescent. Moreover, large doses have been taken by healthy individuals without any remarkable effects. Alibert[1] saw, at the Hôpital St. Louis, a man who took half a drachm of this salt in order to poison himself, but suffered no remarkable inconvenience from it. Lebreton[2] reports the case of a girl who swallowed six drachms at once as a poison: oil was immediately given; vomiting took place, and she soon recovered. Other published cases might be brought forward in proof of the slight effects of large doses, but I must content myself with referring to the memoir of Magendie[3] for a notice of them. I may add, however, that this distinguished physiologist concludes that the comparative slightness of the effects arose from the evacuation of the salt a few moments after its ingestion; though in several, at least, of the cases, this was not proved, and in one it certainly did not happen: it was that of a man who swallowed 27 grains of this salt, and did not vomit.

The action of large doses of emetic tartar on the circulation and respiration is usually that of a sedative. This has been very frequently, though not constantly, observed. In one case of peripneumonia, the daily use of from six to eight grains reduced the pulse, in nine days, from 120 to 34 beats per minute, and diminished the number of inspirations from 50 to 18.[4] In another, the pulse descended, in three days, from 72 to 44 beats per minute.[5]

Modus Operandi.—Emetic tartar, when swallowed, becomes absorbed, and may be detected in the blood and viscera, especially the liver. It is eliminated by the urine, in which secretion it can readily be recognised.

[1] *Nouv. Elém. de Thérap.* 5me édit. i. 259.
[2] Orfila, *Toxicol. Gén.*
[3] *De l'Influence de l'Emétique.*
[4] Bouneau et Constant, quoted by Lepelletier, *De l'Emploi du Tart. Stib.* 84.
[5] Trousseau, quoted by Lepelletier.

Minaret[1] states, that a young woman labouring under pleuritis took emetic tartar, which operated on the child at her breast as well as on herself. It therefore probably existed in the milk. Several parts of the body are influenced by this salt. The specific affection of the *alimentary canal* (especially of the stomach) is shown by the vomiting[2] and purging produced, not only when the medicine is swallowed, but when it is injected into the veins or into the windpipe, or when applied to the serous coats of the intestines, or to the cellular tissue. If it purge, or occasion sweating, it usually causes thirst, but not commonly otherwise. The appetite and digestion are frequently unimpaired. After the use of it for some days, patients sometimes complain of irritation in the mouth and throat, with a metallic taste: this has been considered a sign that the system is saturated with antimony, and that the use of it should be suspended. A pustular eruption has occasionally appeared in the mouth, as I have already stated.

Magendie ascribes to emetic tartar a specific power of causing engorgement or inflammation of the *lungs*; for he found, on opening the bodies of animals killed by it, that the lungs were of an orange-red or violet colour, incapable of crepitating, gorged with blood, and here and there hepatised. Moreover, it has been assumed that the same effects are produced in the human pulmonary organs; and in support of this opinion, a case noticed by Jules Cloquet[3] has been referred to: it is that of a man who died of apoplexy, but who, within five days of his death, had taken forty grains of tartar emetic. "In the lungs were observed very irregular blackish spots, which extended more or less deeply into the parenchyma of this organ." Furthermore, it is argued, that unless we admit a specific influence of antimony over the lungs, we cannot well explain the beneficial effects of this remedy in peripneumonia. In opposition to this view I may remark, that in cases of poisoning by this substance in the human subject, no mention is made of the difficulty of breathing, cough, pain, or other symptom, which could lead to the suspicion that the lungs were suffering; and in the case of poisoning related by Recamier,[4] we are distinctly told that the thorax was sound. Besides, we should expect that if emetic tartar had a tendency to inflame the lungs, or at least to occasion pulmonary engorgement, that large doses of it would not be very beneficial in acute peripneumonia. It would even seem that this substance must have an influence over the human lungs of an opposite kind to that supposed by Magendie; for, as already related, it reduces the frequency of respiration in a considerable number of instances.

The sedative influence of emetic tartar over the *circulatory system* has been already noticed. The great depression of the muscular power, the diminution of the frequency of the pulse, and fainting, the epigastric pain sometimes experienced under circumstances that almost preclude the supposition of gastric inflammation, the cramps and convulsions, the delirium and insensibility, caused by emetic tartar in poisonous doses, are referrible to the influence of this substance on the *nervous system*.

The *absorbent system* is supposed to be stimulated to greater activity by emetic tartar, in consequence of the disappearance of serous and synovial

[1] *Lond. Med. Gaz.* xiii. 496.
[2] For some observations on the mode by which this salt induces vomiting, see p. 245.
[3] Orfila, *Toxicol. Générale.*
[4] Orfila, *op. cit.*

effusions under its use. Moreover, Laennec[1] ascribed the efficacy of it in peripneumonia to the increased activity of the interstitial absorption.[2]

The influence of it over the *secreting organs* has been before referred to.[3] Every one is familiar with its diaphoretic properties. Its diuretic effect is best seen when the skin is kept cool, and when neither vomiting nor purging supervene. Magendie says it augmented the secretion of saliva in dogs; and the same effect has been observed in man by Drs. Griffith and Jackson. The menstrual discharge is not checked by it; but occcsionally has come on under its use.

[Mr. Milton[4] has found tartar emetic the most suitable means of combating inflammation of the cellular tissue, whether in the substance of an internal organ or beneath the integuments of a limb.

Dr. Langevin,[5] of Havre (Seine inferieure), has found this salt of the greatest service in the gastro-intestinal inflammations connected with rheumatism frequently met with among sailors.—ED.]

USES.—As an *emetic*, this salt is usually administered by the stomach, but it is sometimes used as an enema, and occasionally is injected into the veins. When administered by the stomach, it is generally given in doses of one or two grains, frequently in combination with ten or fifteen grains of ipecacuanha. When our object is merely to evacuate the contents of the stomach, and with as little constitutional disorder as possible (as in cases of narcotic poisoning), other emetics (as the sulphates of zinc and copper) are to be preferred, since they occasion less nausea and depression of system, while they excite speedy vomiting. On the other hand, when we use vomiting as a means of making an impression on the system, and thereby of putting a sudden stop to the progress of a disease, emetic tartar is by far our best vomit. It is with this view that it is sometimes employed in the early stages of fever, especially when accompanied by gastric or bilious disorder. Emetic tartar is used as a vomit, with considerable success, in the early stage of inflammatory diseases; especially in croup, tonsillitis, swelled testicle, bubo, and ophthalmia. Here, also, the success of the remedy is in proportion to its early application. In croup it should be given to excite, in the first instance, vomiting, and afterwards prolonged nausea. Under this plan of treatment I have seen two or three slight cases completely recover without the use of any other remedial agent. Dr. Copland[6] also bears testimony to the success of the practice. In most cases it will be found advisable to precede the use of this medicine by blood-letting. Dr. Cheyne[7] advises the employment of emetic tartar in the second stage of croup, for the purpose of moderating vascular action, and of promoting the separation of the adventitious membrane. But I am disposed to rely chiefly on calomel (given so as speedily to occasion ptyalism) and blood-letting. Dr. Cheyne recommends half a grain of emetic tartar to be dissolved in a table-spoonful of water, and given to a child two or three years of age every half hour till sickness and vomiting are produced; and, in two

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[1] Orfila, *op. cit.* p. 203.
[2] I have already made some observations on the mode by which resolvents operate, see p. 175.
[3] See *Liquefacientia*, p. 175, *et seq.*
[4] *Lancet*, 1850, vol. i. p. 353.
[5] *Bulletin Thérap. Médicale*, t. xxxv. p. 199.
[6] *Dict. of Pract. Med.* i. 467.
[7] *Essay on Cynanche Trachealis*, 1801.

hours after the last act of vomiting, the same process is to be recommenced, and so repeated while the strength will admit. Another disease which is relieved by the occasional use of emetics is *hooping-cough*. They should be administered at the commencement of the disease, every, or every other day. They diminish the violence and length of the fits of spasmodic coughing, and promote expectoration. Emetic tartar is particularly valuable in this disease, in consequence of being tasteless, and, therefore, peculiarly adapted for exhibition to children. In derangements of the hepatic functions, indicating the employment of emetics, this salt is usually preferred to other vomiting agents, on account of its supposed influence in promoting the secretion of bile.

Clysters containing emetic tartar have been employed to occasion vomiting, but they are very uncertain in their operation. Rayer has frequently employed from six to twelve grains without producing either nausea or vomiting.

It has been repeatedly *injected into the veins* to excite vomiting. The usual dose is two or three grains dissolved in two ounces of water; but in some cases six grains have been employed. The effects are unequal: when vomiting does occur it is not always immediate; frequently it does not take place at all.[1] In several cases of choking, from the lodgment of pieces of meat in the œsophagus, this remedy has been applied with great success: vomiting was produced, and with it the expulsion of the meat. It has also been tried in epilepsy and trismus; but frequently with dangerous consequences.[2] Meckel employed it to restore animation in asphyxia by drowning.[3] It has also been used in tetanus.[4]

As a *nauseant*, to reduce the force of the circulation and the muscular power, emetic tartar is frequently of considerable service. Thus, in dislocations of the larger joints (the hip and shoulder, for example), blood-letting, and nauseating doses of emetic tartar, are employed to diminish the resistance of the muscles opposing the reduction. Even in strangulated hernia it has been given.[5]

Emetic tartar, in large doses, is a most powerful and valuable remedy in the treatment of inflammation. On this subject I have already offered some remarks (see *ante*, p. 189.) As an emetic, nauseant, or diaphoretic, it has long been in use in peripneumonia; having been employed by Riverius in the 17th century, and subsequently by Stoll, Brendel, Schroeder, and Richter, in Germany; by Pringle, Cullen, and Marryat, in England. But as a remedy for inflammation, independent of its evacuant effects, we are indebted for it to Rasori,[6] who first used it in the years 1799 and 1800, in an epidemic fever which raged at Genoa. Subsequently he exhibited it much more extensively, and in larger doses, in peripneumonia. This mode of treatment was tried and adopted in France, first by Laennec;[7] and in this country by Dr. Balfour.[8] Its value as an antiphlogistic is now almost universally

[1] Dieffenbach, *Transf. d. Blut. u. d. Infus. d. Arzn.*
[2] *Ibid.* p. 49.
[3] *Ibid.*
[4] *Lancet* for 1836-37, vol. i. p. 35.
[5] *Ibid.* p. 876.
[6] See the French translation of his Memoir, in Bayle's *Biblioth. de Thérap.* i. 198.
[7] *Treatise on Diseases of the Chest*, translated by Dr. Forbes.
[8] *Illustrations of the Power of Emetic Tartar*, 2d edit. 1819.

admitted. Practitioners, however, are not quite agreed as to the best method of using it. Rasori,[1] Laennec,[2] Recamier,[3] Broussais,[4] Bouillaud,[5] Dr. Mackintosh,[6] Drs. Graves and Stokes,[7] Dr. Davies,[8] and most practitioners of this country, employ blood-letting in peripneumonia, in conjunction with the use of emetic tartar. But by several continental physicians the abstraction of blood is considered both unnecessary and hurtful. Thus Peschier[9] advises on no account to draw blood; and Trousseau[10] observes, that blood-letting, far from aiding the action of emetic tartar, as Rasori, Laennec, and most practitioners, imagine, is, on the contrary, singularly injurious to the antiphlogistic influence of this medicine. Louis[11] has published some numerical results of the treatment of inflammation of the lungs by blood-letting and by emetic tartar; from which it appears that this substance, given in large doses, where blood-letting appeared to have no effect, had a favourable action, and appeared to diminish the mortality.[12] But he particularly states that blood-letting must not be omitted.

Laennec's mode of using this salt, and which, with some slight modification, I believe to be the best, is the following:—Immediately after bleeding, give one grain of emetic tartar, dissolved in two ounces and a half of some mild fluid [cold weak infusion of orange flowers], sweetened with half an ounce of syrup of marshmallows: this is to be repeated every two hours for six times, and then suspended for seven or eight hours, if the symptoms are not urgent, or if there be any inclination to sleep. But if the disease has already made progress, or if the oppression be great, or the head affected, continue the medicine until amendment takes place; and, in severe cases, increase the dose to two, or two and a half grains. The only modification in this plan, which I would venture to propose, is, to begin with a somewhat smaller dose (say one-third or one-half of a grain), and gradually increase it; for, in consequence of the violent vomiting which one grain has sometimes produced, I have found patients positively refuse to continue the use of the medicine.

From my own experience I should say, that emetic tartar is nearly as serviceable when it causes moderate sickness and slight purging, as when it occasions no evacuation. Laennec observes, that "in general the effect of emetic tartar is never more rapid or more efficient than when it gives rise to no evacuation; sometimes, however, its salutary operation is accompanied by a general perspiration. Although copious vomiting and purging are by no means desirable, on account of the debility and hurtful irritation of the intestinal canal which they may occasion, I have obtained remarkable cures in cases in which such evacuations had been very copious."[13] A few drops

1 *Op. cit.*
2 *Op. cit.*
3 *Gazette Médicale*, 1832, p. 503.
4 *Cours de Pathologie et de Thérapeutique générale*, ii. 521.
5 *Dictionnaire de Médecine et de Chirurgie pratique*, xiii. 495.
6 *Practice of Physic*, i. 426.
7 *Dublin Hospital Reports*, v. p. 48.
8 *Lectures on Diseases of the Lungs and Heart*, 188.
9 Bayle, *Bibliothèque Thérapeutique*, i. 246.
10 *Dictionnaire de Médecine*, 2e édit. iii. 220.
11 *Recherches de la Saignée*, Paris, 1835.
12 *Op. cit.* p. 62.
13 *Op. supra cit.* p. 251.

of tincture of opium may be sometimes conjoined with the antimony, to check its action on the alimentary canal.

The attempts which have been made to explain the *modus medendi* of emetic tartar in pneumonia and other inflammatory diseases are most unsatisfactory. Whilst almost every writer, even Broussais, admits its efficacy in inflammation, scarcely two agree in the view taken of the mode by which its good effects are produced, as the following statement proves:—Rasori explains its operation according to the principles of the theory of contra-stimulus,[1] of which he may be regarded as the founder. He considers emetic tartar endowed with the power of directly diminishing the inflammatory stimulus; of destroying the diathesis, and of being, therefore, a real contra-stimulus. Broussais, Bouillaud, and Barbier, ascribe its curative powers to its revulsive or derivative action on the gastro-intestinal membrane. Laennec thinks that it acts by increasing the activity of interstitial absorption. Fontaneiles supposes that the antiphlogistic effect depends on alterations in the composition of the blood. Eberle[2] refers it to the sedative effects, first, on the nervous system, and consecutively on the heart and arteries. Tealer thinks that, like many other therapeutic agents, it influences the organism by concealed curative properties. Dr. Macartney[3] regards it as a medicine diminishing the force of the circulation, by the nausea which it occasions. These examples are sufficient to show the unsatisfactory condition of our present knowledge as to the mode by which emetic tartar produces its curative effects.[4] But this is no argument against the existence of remedial powers. Shall we deny the efficacy of blood-letting in inflammation, of mercury in syphilis, of cinchona in intermittents, of arsenic in lepra, of sulphur in scabies, of hydrocyanic acid in gastrodynia, and of a host of other remedies, simply because we cannot account for their beneficial effects? The fact is, that in the present state of our knowledge we cannot explain the *modus medendi* of a large number of our best and most certain remedial means.

In *pleurisy*, emetic tartar does not succeed so well as in inflammation of the substance of the lungs. "It, indeed, reduces speedily the inflammatory action," says Laennec,[5] "but when the fever and pain have ceased, the effusion does not always disappear more rapidly under the use of tartar emetic than without it." I have sometimes conjoined opium (always after copious blood-letting) with advantage. In *bronchitis* (both acute and chronic), it may be most usefully employed in conjunction with the usual antiphlogistic agents.[6] In *rheumatism* (especially the kind called *articular*), next to peripneumonia, emetic tartar has been found by some practitioners (especially by Laennec[7]), more efficacious than in any other inflammatory affection: the usual duration of the complaint, when treated by this remedy, was found by Laennec to be seven or eight days.[8] In muscular rheumatism it succeeds less perfectly. Synovial effusions (whether rheumatic or otherwise) have, in some cases, given way rapidly to the use of emetic tartar.[9] In *arachnitis*, Laennec has seen all the symptoms disappear, under the use of emetic tartar, in forty-eight hours. In three instances of acute hydrocephalus, all the symptoms disappeared in the same space of time. In *phlebitis*,[10] in *inflammation of the mammæ* occurring after delivery,[11] in *ophthalmia*, and various

[1] See *ante*, p. 100, *et seq.*
[2] *Materia Medica*, t. 66.
[3] *A Treatise on Inflammation*, 1838.
[4] See p. 179, for some observations on the curative agency of resolvents.
[5] *Op. cit.* p. 259.
[6] *Vide* also Dr. Kemp, *Lond. Med. Gaz.* xix. 300; and Mr. Ellis, *op. cit.* p. 369.
[7] *Op. cit.*
[8] See also Bayle's *Bibl. Thérap.* i. 311; and Lepelletier, *De l'Emploi du Tart. Stib.* p. 220.
[9] Laennec, *op. cit.* p. 263; and Gimelle, *Brit. and For. Med. Rev.* for July 1838, p. 224.
[10] Laennec, *op. cit.*
[11] Dr. E. Kennedy, Mr. Lever, and Dr. Ashwell, *Lond. Med. Gaz.* xx. 761.

other inflammatory affections, emetic tartar has been successfully employed as an antiphlogistic.

In *continued fever*, it is of considerable service. Mild cases are benefited by the use of small doses (as from one-sixteenth to one-fourth of a grain) as a diaphoretic. In the more severe form of this disease, accompanied with much vascular excitement, emetic tartar, in the dose of half a grain or a grain, may be usefully administered as an antiphlogistic; but its use should, in general, be preceded by blood-letting. In the advanced stage of typhus-fever, accompanied with intense cerebral excitement, manifested by loss of sleep, delirium, &c., Dr. Graves[1] has obtained most beneficial results from the use of emetic tartar and opium. The same combination has been employed with great success in delirium tremens, as well as in delirium of erysipelas, scarlatina, and measles, by Dr. Law.[2]

Dr. Billing[3] regards *Asiatic cholera* as being "like ague; not merely as regards its epidemic and miasmatic origin, but almost, if not altogether, an ague of a fresh type;" and he depends much in the treatment of it on tartarised antimony with sulphate of magnesia. In a case of blue cholera he ordered two grains of emetic tartar and half an ounce of sulphate of magnesia in half a pint of water; a tablespoonful to be taken every half hour. The patient recovered.

Emetic tartar is one of our most valuable sudorifics, being oftentimes available when other agents of this class are inadmissible: for example, when we are desirous of producing diaphoresis, in fevers and other diseases which are accompanied with preternatural vascular action about the head, the use of opiate sudorifics (as the compound ipecacuanha powder) is objectionable; whereas emetic tartar may be employed with safety, since it has no tendency to increase disorder of the nervous system, but to reduce cerebral excitement. On the other hand, when much gastric or intestinal irritation is present, the narcotic sudorifics are generally to be preferred to antimony.

As an expectorant, in various pulmonary affections, small doses of this salt are frequently employed with advantage.

In some spasmodic complaints, the use of it has been followed, in the few instances in which it has been tried, with good effects.[4] In *apoplexy*, it has been employed to depress cerebral vascular action, but its tendency to occasion vomiting renders it objectionable. [It has been employed in *tedious labour* with benefit by Mr. Stedman[5] and other practitioners.—ED.]

The internal employment of emetic tartar in syphilis has been recently advocated by Mr. Smee.[6]

As a local irritant, applied to the skin, it may be employed in the form of aqueous solution, ointment, or plaster. It is used in the same cases as vesicatories, over which it has the advantage of not affecting the urino-genital organs. When it is desirable to keep up long-continued irritation, blisters are in some cases preferable. In *chronic diseases of the chest* it is used with the greatest advantage. I have found it much more serviceable than

[1] *Lond. Med. Gaz.* xx. 538.
[2] *Ibid.* xviii. 538 and 694.
[3] *First Principles of Medicine*, p. 240, *et seq.* 4th edit. 1841.
[4] *Vide* Laennec, *op. cit.* p. 260; Jacobi, *Lond. Med. Gaz.* iii. 784; and Mr. Ackerley, *Lond. Med. Gaz.* xxi. 56.
[5] *Medical Times and Gazette*, 1852, vol. ii. p. 640.
[6] *Lond. Med. Gaz.* vol. xxxi. p. 44, Oct. 7, 1842.

blisters. In employing it, one part of the chest may be rubbed until the eruption is produced; and then, after the interval of a day or two, another part: thus keeping up irritation by a succession of applications to different parts of the chest for several months. In this way it is found to be most serviceable in chronic catarrhs, peripneumonias, and pleurisies. Even in lingering phthisis I have seen the cough and pain alleviated by the occasional use of antimonial frictions. The objection to its use is the painful character of the eruptions. In *hooping-cough* it is also serviceable. Autenrieth recommended it as a means of diminishing the frequency of the paroxysms and the violence of the cough. In *laryngitis* it is occasionally of great service; as also in various *affections of the joints*, especially chronic inflammation of the capsular ligament, or of the synovial membrane, hydrops articuli, particularly when connected with inflammation, and tumors of various kinds about the joints. In *tic douloureux*[1] it has also been employed with benefit. In the *paralysis* of children, the region of the spine should be rubbed with the ointment. Its effects are most beneficial, especially where one leg only is affected. It is sometimes necessary to keep an eruption out for many weeks. In *hysteria*,[2] the same application to the spine has been found serviceable.

[Tartar emetic ointment applied to the scalp has been employed in *tubercular meningitis* by Dr. Harn,[3] of Aix-la-Chapelle. Internal remedies are not excluded in the outset of the disease; but it is to the revulsive action of the tartar emetic ointment that Dr. Harn looks as the most powerful means of obtaining absorption of the morbid products. The ointment is gently applied to the shaven scalp every two hours until the eruption appears. Its employment need not interfere with the application of cold to the head. Great pain is often caused, suppuration frequently follows, and it may be many weeks before cicatrisation is complete. The urgency of the case excuses the severity of the treatment, in the opinion of Dr. Harn. When, however, the symptoms yield shortly after the application, it can be withheld, and the progress of pustulation retarded by cold applications.—ED.]

A *stimulating wash*, composed of one scruple of tartar emetic to an ounce of water, was proposed by the late Sir William Blizard, in the year 1787, to cleanse foul ulcers, repress fungous growths and venereal warts, and as a local application in tinea capitis. A weak solution (as half a grain to the ounce of water) has been employed as a stimulant in chronic ophthalmia, and in spots on the cornea.

ADMINISTRATION.—The dose of emetic tartar, *in substance*, is, as a diaphoretic and expectorant, $\frac{1}{12}$ to $\frac{1}{6}$ of a grain; as a nauseant, from $\frac{1}{4}$ to $\frac{1}{2}$ a grain; as an emetic, from 1 to 2 grains; as an antiphlogistic, from $\frac{1}{2}$ a grain to 3 or 4 grains. This salt is, however, rarely employed in substance. Sometimes a grain of it, mixed with ten or fifteen grains of powdered ipecacuanha, is employed as an emetic. A mixture of one grain with sixteen grains of sulphate of potash may be employed, in doses of from two to four grains, as a substitute for antimonial powder, to promote diaphoresis.

In *solution*, it is commonly employed as an expectorant, diaphoretic, nauseant, or emetic, in the form of antimonial wine. When used as an

[1] Hausbrandt, *British and Foreign Medical Review*, Jan. 1837, 230.
[2] Tate, *A Treatise on Hysteria*, Lond. 1830.
[3] *Bulletin Thérapeut.* t. xxxvii. p. 54.

antiphlogistic, an aqueous solution of greater strength may be administered: it should be made with boiling distilled water in a glass vessel (as a Florence flask).

For external use, emetic tartar is employed in the form of *liniment, ointment,* or *plaster.* A saturated solution is a very useful liniment: it is prepared by pouring an ounce and a half of boiling water over a drachm of emetic tartar, and allowing the solution to stand till cold. In many cases it will be found preferable to the ointment, being the mildest, least painful, and cleanest. Another mode of employing emetic tartar externally, is by sprinkling from ten grains to a drachm of the salt, in fine powder, over a Burgundy pitch plaster.

Antidote.—Promote vomiting by tepid bland liquids. The antidote is said to be tannic acid, and vegetable substances which contain it (as yellow bark, tea, nutgalls, &c.) Faure[1] recommends the decoction in preference to other preparations of yellow bark. But though cinchona decomposes emetic tartar, it does not destroy its activity. Some years since, at the General Dispensary, I saw from 1 to 2 grains of this salt, mixed with either powder or decoction of yellow bark, given by Dr. Clutterbuck to nearly 100 patients: and in almost every instance nausea and vomiting occurred. The experience of Laennec,[2] as well as of Rayer,[3] is to the same effect. Opium is a most valuable agent for checking excessive evacuations. Venesection and the warm bath have been used to relieve the gastro-enteritis.

1. VINUM ANTIMONII POTASSIO-TARTRATIS, L.; *Vinum Antimoniale,* E.; *Antimonii Tartarizati Liquor,* D.; *Antimonial Wine.* (Emetic Tartar, ℈ij; Sherry, Oj., *L. E.* Take of Tartarised Antimony, ʒj.; Distilled Water, Oj.; Rectified Spirit, f℥vij. Having dissolved the tartarised antimony in the water, and cleared the solution by passing it through a paper filter, add the spirit, and preserve the product in a well-stoppered bottle, *D.*) —Each fluidounce contains two grains of emetic tartar. It is important that Sherry, and not an inferior kind of wine, be employed; for the latter frequently contains matters which precipitate the teroxide of antimony. If the wine be good, and the salt pure, no precipitate is formed in the solution, unless it be kept for a long period, when decomposition of the salt ensues. The Dublin formula is objectionable on account of its want of colour.

Antimonial wine is used, as a diaphoretic or expectorant, in doses of from ten to thirty drops frequently repeated; as a nauseant, from one to two fluidrachms; as an emetic, about half a fluidounce, or two fluidrachms given at intervals of about ten minutes for four or five times, until the desired effect is produced: as an emetic for children, from thirty drops to a fluidrachm; and as an antiphlogistic in peripneumonia, from two or three fluidrachms to an ounce; but for this latter purpose an extemporaneous but carefully-made aqueous solution is to be preferred.

2. UNGUENTUM ANTIMONII POTASSIO-TARTRATIS, L.; *Unguentum Antimoniale,* E.; *Unguentum Antimonii Tartarizati,* D.; *Tartar Emetic Ointment.* (Emetic Tartar, rubbed to very fine powder, ʒj.; Lard, ℥iv., *L. E.* The *Dublin College* orders ʒj. of the Emetic Tartar to ℥vij. of the

[1] *Lond. Med. Gaz.* xvi. 703.
[2] *Diseases of the Chest,* Forbes's translation, 257.
[3] *Dict. de Méd. et Chir. Prat.* iii. 57.

Ointment of White Wax.)—In the preparation of this ointment it is important that the emetic tartar be in the state of a very fine powder, in order to avoid the irritation produced by rubbing gritty particles on the skin. A portion of ointment, about the size of a small nut, is to be rubbed on the skin night and morning. After the use of it for two or three times, the painful condition of the part thereby induced commonly prevents further employment of friction. It is sometimes applied, spread on linen, without rubbing. By either of these methods a crop of painful pustules is produced: but the facility and rapidity with which they are developed, varies considerably in different individuals. Occasionally, adventitious eruptions have appeared in other parts of the body, which have been ascribed to absorption of antimony into the system.[1] But I believe with Rayer,[2] that they arise from the inadvertent application of the ointment to these parts. This ointment is used as a counter-irritant in various chronic maladies: thus it is applied to the chest in pulmonary affections, and to the joints in chronic diseases (whether rheumatic or otherwise). It should only be applied to sound portions of the skin, and, therefore, leech-bites, the scarifications from cupping, and wounds, are to be carefully avoided; for severe inflammation, and even gangrenous ulceration, may be produced by not attending to this caution. I have before mentioned, that in a very few cases severe and even fatal constitutional disorder has appeared to have resulted from the use of antimonial ointment.

ORDER XXII. BISMUTH AND IT'S COMPOUNDS.

114. BISMUTHUM.—BISMUTH.

Symbol Bi. *Equivalent Weight* 213.

HISTORY.—This metal is first mentioned by Agricola, in 1529. It has been termed *marcasita, tectum argenti*, or, by the Germans, *wismuth*. "The old miners call it wismuth," says Matthesius, "because it blooms like a beautiful meadow (*wiesematte*), on which variegated flowers of all kinds are blooming."[3]

NATURAL HISTORY.—Bismuth occurs only in the mineral kingdom. It is found in Cornwall, Saxony, Bohemia, the United States, and other localities. It is met with in the metallic state nearly pure (*native bismuth*), and in combination with sulphur and with oxygen.

PREPARATION.—It is chiefly obtained from native bismuth by melting the metal out of its gangue.

PROPERTIES.—It is a reddish-white metal, without taste or smell, composed of brilliant broad plates, and readily crystallisable in cubes or regular octohedrons (figs. 136 and 137). It belongs, therefore, to the regular system. The sp. gr. of purified bismuth is, according to Karsten, 9·6542; that of commercial bismuth, according to Herapath, 9·833. It is moderately hard, brittle, pulverisable, fusible at 476° F. When strongly heated in the air, it

[1] *Gaz Méd.* 1832, p. 842.
[2] *Treatise on Diseases of the Skin*, by Dr. Willis, p. 540.
[3] Schwartze, *Pharm. Tabellen.*