enteritis is marked, our principal reliance must be on the usual antiphlogistic measures, particularly blood-letting, both general and local, and blisters to the abdomen. One drawback to the success of this treatment is the great depression of the vascular system, so that the patient cannot support large evacuations of blood. Opium is a very valuable agent. Indeed Jäger seems to regard it in the light of a counterpoison. However, on this point he has probably taken a too exaggerated view of its efficacy; but it is undeniable that on many occasions it is of great service. If the stomach reject it, we may employ it in the form of clysters. If constipation and tenesmus be troublesome, mild laxatives, especially castor oil, should be exhibited.

Arsen'ici Io'didum.—I'odide of Arsen'icum.

This compound is prepared by gently heating, in a tubulated retort placed in a sand-bath, a mixture of one part finely pulverized metallic arsenicum and three parts of iodine: the iodide is afterwards to be sublimed, to separate the excess of arsenicum. The compound thus obtained is an orange-red solid, volatile, and soluble in water. If the solution be rapidly evaporated to dryness, we reprocure the iodide; but if we concentrate, and then place the solution aside, white pearly plates are obtained, which by Plisson are regarded as a periodide of arsenicum, but by Serullas as a compound of oxide and iodide of arsenicum (Souberain, *Nouv. Traité de Pharm.* ii. 613; and Serullas, *Journ. de Chim. Méd.* iii. 601). Iodide of arsenicum is probably composed of $1\frac{1}{2}$ eq. iodine = 187·5, and 1 eq. arsenicum = 38. It has been employed by Biett in the form of ointment (composed of iodide of arsenicum, gr. iij.; lard, ℥j.) as an application to corroding tubercular skin diseases (Magendie, *Formulaire*).

Order 17. Compounds of Antimony.

Antimo'nii Sesquisulphure'tum.—Sesquisul'phuret of An'timony.

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 *Kings*, ix. 30; *Ezekiel*, xxiii. 40; Pliny, *Hist. Nat.* xxxiii.) It was formerly called *stimmi* (στίμμι vel στίμμις, *stibium* (στίβι), or *platyophthalmon* (πλατυόφθαλμον), Dioscorides, v. 99.) In the native state it is technically termed *antimony ore*, and when fused out of its gangue, *crude antimony*, or *sulphuret of antimony*.

Natural History.—Sesquisulphuret 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 to the vessels. In the years 1835-36, and 37, the quantities of ore imported were respectively 645, 825, and 659 tons (*Trade List*, Jan. 10, 1837, and Jan. 9, 1838).

Preparation.—The old method of separating the sesquisulphuret from its siliceous gangue was to melt it in a covered crucible or pot, in the bottom of which there are several holes, through which the fused sulphuret passes into an inferior or receiving pot. According to Gensenne's method, the melting pots are placed in a circular reverberatory furnace,

and are connected by curved earthen tubes with the receiving pots which are 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 sesquisulphuret which flows into a receiving vessel placed externally to the furnace. (Dumas, *Traité de Chimie*, iv. 160.)

Properties.—The fused sesquisulphuret (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 sesquisulphuret is opaque, tasteless, odourless, brittle, easily pulverizable, and has a sp. gr. of about 4·6. Its powder is black, but that of pure sesquisulphuret 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 (Berthier, *Traité des Essais*, ii. 490). By roasting it is converted into *antimony-ash* or *cinis antimonii* (a mixture of antimonious acid and sesquioxide of antimony, with more or less unburned sesquisulphuret: Liebig, *Handwörterb. de Chemie*, i. 419) and sulphurous acid, the latter of which escapes. When reduced to a very fine powder by levigation and elutriation it constitutes the *antimonii sulphuretum præparatum* of the Edinburgh, Dublin, and United States Pharmacopœias.

Characteristics.—It fuses and is dissipated before the blow-pipe with the smell of sulphurous acid and the formation of a white smoke. Digested in hydrochloric acid it evolves hydrosulphuric acid, and forms a solution of sesquichloride of antimony, which produces a whitish precipitate (*powder of Algaroth*, or oxychloruret of antimony) with water, and an orange red one with hydrosulphuric acid. If a current of hydrogen gas be passed over heated sesquisulphuret 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.

Composition.—Sesquisulphuret of antimony has the following composition:—

	Eq.	Eq. Wt.	Per Cent.	Berzelius.	Thomson.
Antimony	1	65	73	72·8	73·77
Sulphur	1½	24	27	27·2	26·23
Sesquisulphuret of Antimony	1	89	100	100·0	100·00

Impurities.—The crude antimony of commerce is rarely, if ever, quite pure. It frequently contains the sulphurets of iron, lead, arsenicum, and copper, and on this account is not adapted for medicinal use. When pure it is completely soluble in hydrochloric acid: but when mixed with sulphuret of arsenicum this remains undissolved, and may be detected by reducing it with a mixture of charcoal and carbonate of soda (*vide* p. 378.) If the hydrochloric solution be diluted with water (so as to precipitate the greater part of the antimony), and filtered, the presence of lead, iron, or copper, may be determined by the appropriate tests for these metals, hereafter to be mentioned.

Physiological Effects. (*a.*) *On animals.*—Rayer (*Dict. de Méd. et Chir. Pratiq.* iii. 54) 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 24 hours death, but without any peculiar symptoms. Moiroud (*Pharm. Vétér.* 428) says, that given to horses, in doses of from 2 to 4 ounces, it acts as an excitant, causing increased frequency of pulse and respiration, and softer stools.

(*b.*) *On man.*—In most cases it produces no obvious effects, even when taken in very large doses. Rayer (*op. cit.*) gave half an ounce of it in powder, for several days, without the slightest effect. Cullen (*Treat. of Mat. Med.* ii. 482), 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 the sesquisulphuret is much more active than an equal quantity of the same preparation in powder. How are these facts to be explained? Rayer ascribes the activity of the decoction to arsenious acid formed by boiling sulphuret of arsenicum (contained in the ordinary crude antimony) with water; for Guibourt obtained in this way $1\frac{44}{100}$ grs. of arsenious 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 sesquisulphuret of antimony yields hydrosulphuric acid and sesquioxide of antimony (Geiger, *Handb. d. Pharm.*) 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) ℥j., in a pint and a half of water; then add isinglass, ℥iv., previously dissolved in water, and reduce the whole (by boiling) to a pint, which is to be taken during the day (Rayer, *Treatise on Diseases of the Skin*, by Dr. Willis, 1223).

Antimo'nii Sesquichlo'ridum.—Sesquichlo'ride of An'timony.

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*.

Preparation.—The impure hydrated sesquichloride, sold in the shops as butter of antimony, is usually prepared by dissolving roasted sesquisulphuret of antimony (*cinis antimonii*) in hydrochloric acid, and adding pernitrate of iron to the solution as a colouring matter.

In the Dublin Pharmacopœia an analogous compound is prepared (in the manufacture of the *nitro-muriatic oxide of antimony*) by digesting, and afterwards boiling, 20 parts of sesquisulphuret of antimony in a mixture of 100 parts hydrochloric acid and 1 part of nitric acid. One

equivalent or 89 parts of sesquisulphuret of antimony require an equivalent and a half or 55·5 parts of hydrochloric acid for their complete decomposition: the products are, an equivalent and a half or 25·5 parts of hydrosulphuric acid, and one equivalent or 119 parts of sesquichloride of antimony. The nitric acid is employed to decompose the hydrosulphuric acid remaining in the liquor; this it does by converting the hydrogen into water, and precipitating the sulphur.

Pure sesquichloride of antimony is not used in medicine: its preparation need not, therefore, be described in this work.

Properties.—The butter of antimony of the shops is a transparent liquid, varying in its colour (which depends on the presence of iron) from yellow to deep red. Its specific gravity is 1·2 to 1·5. 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 yellowish white powder called *powder of Algaroth*, or *mercury of life* (oxychloruret of antimony). The hydrosulphurets produce an orange-red precipitate: alkalies a white precipitate (sesquioxide of antimony). Nitrate of silver occasions a white precipitate, composed of chloride of silver and sesquioxide of antimony: the latter is dissolved by digestion in hydrochloric acid.

Composition.—Sesquichloride of antimony is thus composed:—

	Eq.	Eq. Wt.	Per Cent.	Göbel.	H. Rose.
Antimony	1	65	54·62	54·98	53·27
Chlorine	1½	54	45·37	45·02	46·73
Sesquichloride Antimony	1	119	99·99	100·00	100·00

The butter of antimony of the shops contains *sesquichloride of antimony*, *free hydrochloric acid*, *water*, and *iron*. It may also contain other impurities derived from the sesquisulphuret from which it is directly or indirectly prepared. 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 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 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 tumor 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 (*vide* pp. 154 and 268.) After the use of antacids, vegetable astringents (tea and infusion of nutgalls) should be administered to neutralize the effect of the powder of Algaroth separated in the stomach. Gastro-enteritis is of course to be combated by the usual means.

Antimo'nii Oxysulphure'tum.—Oxysul'phuret of An'timony.

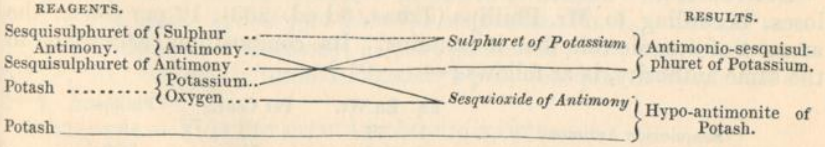
History.—Basil Valentine (*Triumphant Chariot of Antimony*, by Kirkringius, p. 131) was acquainted with this preparation; and probably also knew the substance called *Kermes mineral*, though he does not mention it in his writings. Glauber, in 1658, and Lemery, in 1707, are both said to be discoverers of the latter substance; but it is hardly possible for Basil Valentine to have been unacquainted with it.

Natural History.—Kermes mineral, which is an oxysulphuret of antimony, though not identical with, yet nearly allied to, the preparation of the Pharmacopœia, is found native in Saxony and other places: it is called by mineralogists *red antimony* or *native kermes*.

Preparation.—If black or sesquisulphuret of antimony be boiled in an alkaline liquid, a solution is obtained which, on cooling, deposits a reddish powder called *kermes mineral*. If a dilute mineral acid be added to the filtered mother liquor, an orange red precipitate is produced, called the *golden sulphuret of antimony*. If the acid be added before the kermes has deposited, we obtain the orange red precipitate, called in the Pharmacopœia *oxysulphuret of antimony*.

The oxysulphuret of antimony, Ph. L. is prepared by mixing together 7 ounces of powdered sesquisulphuret of antimony, 4 pints of solution of potash, and 2 gallons of distilled water: boil for two hours, frequently stirring, distilled water being often added, that it may fill the same measure. Strain the liquor, and gradually drop into it as much sulphuric acid as may be sufficient to throw down the oxysulphuret: then wash away the sulphate of potash with water, and dry what remains with a gentle heat.

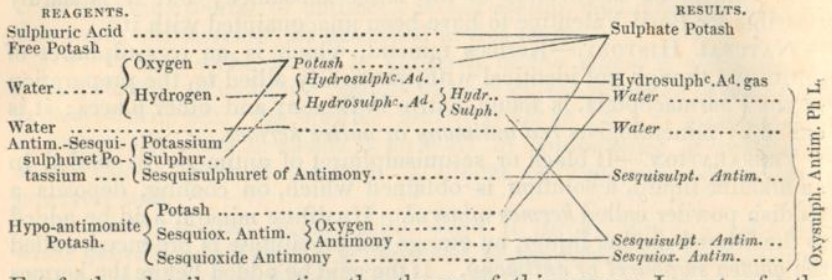
Theory of the Process.—When sesquisulphuret of antimony and potash are heated together, the latter gives oxygen to the antimony, and potassium to the sulphur of the sesquisulphuret; and thus sesquioxide of antimony and sulphuret of potassium are produced. The sesquioxide combines with some undecomposed potash, forming hypo-antimonite of potash, and the sulphuret of potassium with sesquisulphuret of antimony, forming a double sulphur salt (the antimonio-sesquisulphuret of potassium). These changes are explained in the subjoined diagram:—



The solution contains free potash, the antimonio-sesquisulphuret of potassium, and part of the hypo-antimonite of potash. There is a dark-red, undissolved residuum (similar to *crocus antimonii*) composed of hypo-antimonite of potash and oxysulphuret of antimony: this is got rid of by filtering.

On the addition of sulphuric acid, sulphate of potash is produced by the combination of the acid with free potash,—with some potash formed by the union of the potassium of the sulphuret with the oxygen of some decomposed water,—and with the potash of the hypo-antimonite. By these changes sesquisulphuret and sesquioxide of antimony are set free:

the whole of the first, and part of the second, precipitate. The hydrogen of the decomposed water, with the sulphur of the sulphuret of potassium, forms hydrosulphuric acid, a portion of which escapes in a gaseous form, while the remainder, reacting on some sesquioxide of antimony, produces water and sesquisulphuret, which are precipitated along with some water of the solution. These changes will be better comprehended by reference to the following diagram :—



For further details respecting the theory of this process I must refer the student to Berzelius's *Traité de Chimie*, ii. 501, and Liebig and Poggendorf's *Handwörterb. d. Chemie*, i. 439.

Properties.—Oxysulphuret of antimony, Ph. L. is a bright red, odourless, almost tasteless powder. It is insoluble in cold water, and only slightly soluble in liquor ammoniæ. Boiled in nitro-hydrochloric acid, chloride 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, shewing 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 shewn to contain antimony by the tests before mentioned for the sesquichloride of this metal (*vide* p. 400.) When boiled in a solution of bitartrate of potash we obtain a solution of emetic tartar, which may be recognized by the characters hereafter to be mentioned for this salt. It may be reduced by hydrogen and heat (*vide* p. 409.)

Composition.—When boiled in a solution of bitartrate of potash, it loses, according to Mr. Phillips (*Trans.* 3d ed. 203), 12 per cent.: the amount of sesquioxide that it contains. Its composition, according to the same authority, is as follows :—

	Eq.	Eq. Wt.	Per Cent.	Phillips.
Sesquioxide Antimony	1	77	13	12
Sesquisulphuret Antimony	5	445	75	76·5
Water	8	72	12	11·5
Oxysulphuret Antimony	1	594	100	100·0

But the sesquisulphuret and sesquioxide are probably only mechanically mixed.

The commercial oxysulphuret is of a brighter colour than that obtained according to the process of the Pharmacopœia. A manufacturer of it informs me it is prepared by boiling sulphur along with the sesquisulphuret of antimony and potash, and precipitating by an acid in the usual way.

Kermes antimonii consists of 2 equivalents of sesquisulphuret of antimony and 1 equivalent of sesquioxide of antimony (consequently it has the same composition as *red antimony ore*), and commonly contains also from 1 to $1\frac{1}{2}$ per cent. of alkali combined with sesquioxide of antimony. By continued washing with water the hypo-antimonite of potash and sesquioxide of antimony may be extracted, leaving the sesquisulphuret only. (Liebig, *Handwörterb. d. Chemie*, i. 427.) *Golden sulphuret of antimony* is the persulphuret of antimony, and consists of 1 equivalent of antimony and $2\frac{1}{2}$ equivalents of 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.

Physiological Effects.—The medicinal activity of this preparation is principally or wholly owing to sesquioxide of antimony; and as the quantity of this is probably inconstant, the preparation is uncertain in its operation. 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. (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.*)

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 guaiacum or narcotics. Kermes mineral has been employed as an antiphlogistic in inflammatory affections of the respiratory organs, and sometimes as an *emetic*.

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*, Ph. L. (chloride mercury; oxysulphuret of antimony, $\overline{aa}$ ʒii.; guaiacum resin, powdered, ʒss.; treacle, ʒii.) commonly termed *Plummer's pill*, the dose of which is from five to ten grains.

Antidotes.—Vide Potassæ Antimonio-tartras.

Pul'vis Antimo'nii Compos'itus.—Com'pound Pow'der of An'timony.

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 (*Affidavits and Proceedings of W. Baker*, Lond. 1754). The specification which Dr. James lodged in the Court of Chancery is so ambiguously worded, that we cannot prepare his powder by it. Hence

the present preparation has been introduced into the Pharmacopœia as a succedaneum for it. In preceding editions of the London Pharmacopœia it was termed *pulvis antimonialis* (*antimonial powder*); but in the edition for 1836 this name was unnecessarily (as I conceive) altered to *pulvis antimonii compositus.* In the Edinburgh Pharmacopœia it is denominated *oxydum antimonii cum calcis phosphate;* in the French Codex, *pulvis cum stibio compositus.*

Preparation.—In the London Pharmacopœia it is directed to be prepared by throwing a mixture of one pound of sesquisulphuret of antimony in powder, and two pounds of hartshorn shavings, into a crucible red hot in the fire, and stirring constantly until vapour no longer arises. Rub that which remains to powder, and put it into a proper crucible. Then apply fire, and increase it gradually, that it may be red hot for two hours. Rub the residue to a very fine powder.

The process of the Dublin Pharmacopœia is analogous to the above, as are also those of the Edinburgh Pharmacopœia and French Codex, with the exception that in the two latter works equal parts of sesquisulphuret and hartshorn shavings are used.

Manufacturers usually substitute bone sawdust for hartshorn shavings.

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 (sub- or $\frac{2}{3}$, phosphate of lime, with a little calcareous carbonate). The sulphur of the sesquisulphuret is expelled in the form of sulphurous acid, while the antimony attracts oxygen from the air, forming antimonious acid, and a variable quantity of sesquioxide of antimony. By the subsequent heating the sesquioxide is, for the most part, converted into antimonious acid; but one portion is usually left unchanged, while another is volatilized. 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, is found, at the end of the operation, to be lined with a yellow glaze, and frequently with yellow crystals of sesquioxide.

Properties.—Antimonial powder is white, gritty, tasteless, and odourless. Boiling water extracts the antimonite (and superphosphate, *Dr. Maclagan*) of lime: the liquid becomes cloudy on cooling. Hydrochloric acid, digested in the residue, dissolves the subphosphate of lime, all the sesquioxide of antimony, and a portion of the antimonious acid.

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: 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: 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 (*Observations on the Dublin Pharmacopœia*, 204); but neither Mr. Phillips (*Ann. Phil.* iv. N. S. 266) nor Dr. Maclagan (*Edinburgh Med. & Surg. Journ.* No. 135) have 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 (phosphate of lime) 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 charcoal, and heated to redness, it is converted into sesquioxide, or metallic antimony.

Composition.—*Dr. James's Powder* has been analysed by Dr. Pearson (*Phil. Trans.* lxxxi. for 1791, p. 317); by Mr. Phillips (*Ann. Phil.* N. S. vi. 187); by Berzelius (*Traité de Chimie*, iv. 481); by M. Pully (*Ann. de Chim.* 1805, lv. 74); by Dr. D. Maclagan (*Edinb. Med. & Surg. Journ.* xlix. 462); and was imperfectly examined by Mr. Chenevix (*Phil. Trans.* for 1801, p. 57). *Antimonial powder* has been analysed by Mr. Phillips (*Ann. Phil.* N. S. iv. 266), and by Dr. D. Maclagan (*op. cit.*) 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 do.	
Antimonite of Lime [with some superphosphate, *Maclagan*]	—	—	1	3·40	2·25	—	—	0·8
Sesquioxide of Antimony	57	56·0	66	2·89	9·80	—	—	3·98
Antimonious Acid	43	42·2	33	43·47	34·21	35	38	50·09
Subphosphate of Lime	—	—	—	50·24	53·21	65	62	45·13
Loss [Sexquioxide of Antimony and impurity, *Phillips*]	—	—	—	—	0·53	—	—	—
	100	100·0	100	100·00	100·0	100	100	100·00

Pully found sulphate of potash and hypo-antimonite of potash in James's powder. Mr. Brande has found as much as 5 per cent. of sesquioxide 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 deposits 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 assumed the non-existence of *sesquioxide of antimony*, because the hydrochloric solution did not let fall any precipitate on the addition of water: an assumption which is certainly not correct, since a small quantity of sesquioxide may be dissolved in this acid without our being able to obtain any evidence of its presence by the action of water. Dr. Maclagan (*op. cit.*) 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 sesquioxide. 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, an hydrated hydrochlorate of antimonious acid is obtained, which, it is well known, not only produces an orange red precipitate with hydrosulphuric acid, but even causes a white precipitate on the addition of water (Gmelin, *Handb. der Chemie*, ii. 986).

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 sesqui-

oxide 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 (*Manual of Pharmacy*, 3d. ed. p. 292) has justly observed, "upon slight modifications in the process, which can scarcely be controlled."

Mr. Hawkins gave ℥j. morning and evening without any obvious effect; and the late Dr. Duncan, jun. administered ℈j. and ℥ss. doses, several times a-day, without inducing vomiting or purging (*Edinb. New Dispensat.* 11th ed.) Dr. Elliotson (*Cases illustrative of the Efficacy of the Hydrocyanic Acid*, p. 77) found even 120 grains nearly inert; nausea alone being in some of the cases produced. In these instances I presume it contained little or no sesquioxide.

But, on the other hand, a considerable number of practitioners have found it to possess activity. Dr. Paris (*Pharmacologia*) 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 no sesquioxide, are inconclusive, as Dr. Maclagan (*op. cit.*) has shown. 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. Monro (*Treatise on Med. & Pharm. Chem.* i. 367), 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 operates 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 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 (*Dubl. Hosp. Rep.* i. 315) 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.

Potas'sæ Antimo'nio-Tar'tras.—An'timony-Tar'trate of Pot'ash.

History.—This salt was first publicly noticed in 1631, by Adrian de Mynsicht (*Thesaurus Medico-Chymicus.*) It has been known by various appellations, as *tartarized antimony* (*antimonium tartarizatum*), *emetic tartar* (*tartarus emeticus*), *stibiated tartar* (*tartarus stibiatus*), and *potassio-tartrate of antimony* (*antimonii potassio-tartras*, Ph. L.)

Preparation.—Antimony-tartrate of potash is prepared by boiling bitartrate of potash and sesquioxide of antimony (or some antimonial preparation which contains it, as the oxychloride or an oxysulphuret) with water: the sesquioxide combines with the bitartrate to form antimony-tartrate of potash.

Antimony-ash (*cinis antimonii*), procured by roasting the sesquisulphuret, is employed to yield the sesquioxide in a manufactory in London. As already stated (p. 398), this compound is a mixture of sesquioxide, antimonious acid, and some undecomposed sesquisulphuret. The proportions of ash and bitartrate used vary according to the quality of the former: the average being equal parts. This is the cheapest method of obtaining emetic tartar.

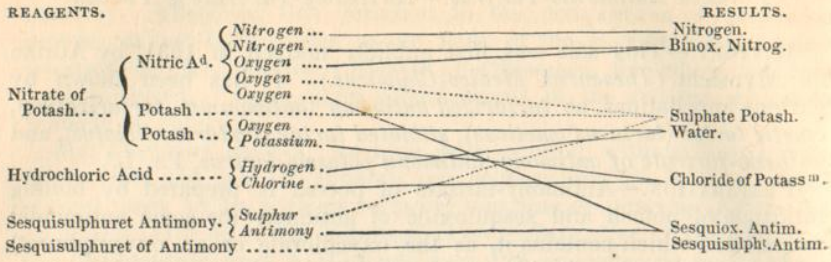
In the Dublin and United States Pharmacopœias the oxychloride (*oxydum antimonii nitro-muriaticum*, Ph. Dub.), commonly called Algaroth's powder, is employed. This is procured by pouring the sesquichloride (common butter of antimony, *vide* p. 399) into a large quantity of water, and washing the precipitate. In the preparation of the sesquichloride a small quantity of nitric acid should be employed to decompose the hydro-sulphuric acid remaining in the liquor, and which would impair the colour of the precipitate.

In the London Pharmacopœia an oxysulphuret, very similar in composition to the old *saffron of antimony* (*crocus antimonii*) is used. It is thus prepared: two pounds of powdered sesquisulphuret of antimony are to be accurately mixed with the like quantity of powdered nitrate of potash: four fluidounces of hydrochloric acid are then to be added, and the powder, ignited, spread out on an iron plate. The residue is to be rubbed to a very fine powder, and, when cold, washed with boiling water until it is void of taste.

It is then to be boiled for half an hour with fourteen ounces of bitartrate of potash in a gallon of distilled water. The liquor is to be strained while hot, and set aside to form crystals.

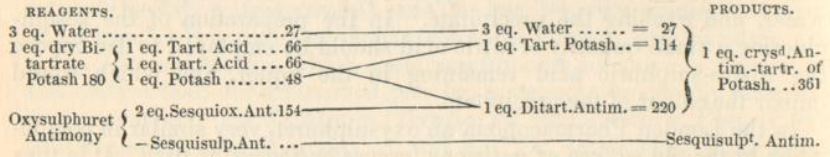
The *theory* of the process is this: part of the sulphur and of the antimony are oxidized at the expense of the oxygen of the acid of the nitrate, by which sulphuric acid and sesquioxide of antimony are formed, while nitrogen and binoxide of nitrogen escape. The sulphuric acid unites with part of the potash of the nitrate. The hydrochloric acid reacts on another portion of potash, and produces water and chloride of potassium. If no hydrochloric acid had been employed, the potash would react on some undecomposed sesquisulphuret, and generate antimonio-sesquisulphuret of potassium and sesquioxide of antimony. The residuum of this operation is, then, sulphate of potash, chloride of potassium, sesquioxide of antimony, and some undecomposed sesquisulphuret. By washing, the sulphate and chloride are got rid of. The following diagram,

though imperfect, may perhaps assist the student in comprehending the foregoing changes:—



The reacting equivalents have been omitted in the above diagram: but the results may be explained by assuming that 6 equivalents of nitrate, 7 equivalents of sesquisulphuret, and $1\frac{1}{2}$ equivalents of hydrochloric acid, are employed. The products will be 6 eqs. of binoxide of nitrogen, $4\frac{1}{2}$ eqs. of sulphate of potash, $1\frac{1}{2}$ eqs. of water, $1\frac{1}{2}$ eqs. of chloride of potassium, 3 eqs. sesquioxide of antimony, and 4 eqs. sesquisulphuret.

The changes in the second stage of the process are readily comprehended: two equivalents or 154 parts of sesquioxide of antimony combine with one equivalent or 180 parts of dry bitartrate of potash, to form one equivalent or 334 parts of dry emetic tartar, which, in crystallizing, unite with three equivalents, or 27 parts of water. The sesquisulphuret is unacted on by the bitartrate of potash.



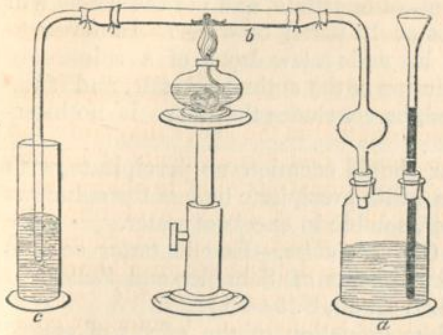
Properties.—Emetic tartar crystallizes in white, transparent, inodorous, rhombic octahedrons, whose lateral planes are striated. By exposure to the air they become opaque, probably by giving out an equivalent of water. Their taste is feebly sweetish, then styptic and metallic. They dissolve in 14 or 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°. Their aqueous solution slightly reddens litmus and undergoes decomposition by keeping, like that of tartaric acid and most tartrates. Alcohol will not dissolve this salt. By calcining emetic tartar in close vessels we obtain a pyrophoric alloy of antimony and potassium. They decrepitate in the fire.

Characteristics.—Heated in a porcelain or glass capsule it chars: shewing it contains an organic substance (tartaric acid.) If the charred salt be heated in a glass tube by a blowpipe, globules of antimony are obtained.

If a stream of hydrosulphuric acid gas be transmitted through a watery solution of emetic tartar (*vide* fig. 65, p. 409), the latter becomes orange-red: if a small quantity of hydrochloric acid be then added, a flocculent orange-red precipitate (hydrated sesquisulphuret of antimony) takes place. This precipitate is to be collected and dried, and introduced into a green glass tube. Then transmit a current of hydrogen gas over it, and after a few minutes apply the heat of a spirit lamp to the sesquisulphuret: hydrosul-

phuric acid and metallic antimony are produced. A portion of the latter is [spuriously?] sublimed. The metal is known to be antimony by dissolving it in nitro-hydrochloric acid: the solution forms a white precipitate (powder of Algaroth) on the addition of water, and an orange-red one with hydrosulphuric acid gas, or hydrosulphate of ammonia. The mode of reducing the sesquisulphuret will be readily understood by the accompanying diagram (fig 65). This process was proposed by the late Dr. E. Turner.

FIG. 65.



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

A solution of emetic tartar forms *white* precipitates with oxalic and the strong mineral acids, the alkalies and their carbonates, and lime water: *greyish* or *yellowish white* (*tannate of antimony*), with infusion of nutgalls: and *reddish* with the soluble hydrosulphates. Their relative delicacy, as well as the delicacy of hydrosulphuric acid, has been thus determined by Devergie. (*Méd. Lég.* ii. 770.)

	Dilution of the Solution.
Hydrochloric acid does not form a precipitate at	2,500
Sulphuric (or oxalic) acid ditto	1,000
Tincture of nutgalls . . ditto	1,000
Lime water . . . . stops at	1,200
Potash (soda, ammonia, or carbonate of ammonia) stops at	2,000
Hydrosulphuric acid (or hydrosulphate of ammonia) ditto	100,000

The sesquioxide of antimony thrown down by the alkalies is soluble in an excess of the precipitant. The precipitate formed by sulphuric or nitric acid is the sesquioxide combined with a small quantity of the acid. Acetic acid does not occasion any precipitate.

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

	Eq. Wt.	Per Ct.	Wallquist.	R. Phill.	Thoms.		Eq. Wt.	Per Cent.
Sesquioxide of Antimony	2	154	42·65	42·99	43·35	42·62		
Potash	1	48	13·29	13·26				
Tartaric Acid	2	132	36·56	38·61	49·25	57·38		
Water	3	27	7·47	5·14	7·40			
Emetic Tartar	1	361	99·97	100·00	100·00	100·00		
or Ditrartrate of Antimony	1	220				60·94		
Tartrate Potash	1	114				31·57		
Water	3	27				7·47		
or Antimonio-Tartrate of Potash	1	361				99·98		

We regard this compound, then, as a double salt, in which the ditartrate of antimony performs the function of the electro-negative or acid constituent, —the tartrate of potash, the electro-positive or basic constituent.

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 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 ferrocyanuret of potassium.

Emetic tartar is sometimes adulterated with bitartrate of potash. According to Mr. Hennell (Phillips's *Transl. of the Pharm.* 3d ed.) 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 pure solution of emetic tartar should occasion no precipitate with chloride of barium: it produces a white precipitate (unless the solutions be very dilute) with nitrate of silver, soluble in excess of water.

Physiological Effects. (*a.*) *On vegetables.*—Emetic tartar acts as a poison to plants (*vide* the experiments of Schübler and Zeller, in *Schweigger's Journ. f. d. Chem.* 1827, B. 50, S. 54-66.)

(*b.*) *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 (*Pharm. Vétér.* 287) has given two drachms to horses, and gradually increased the dose to six ounces, without perceiving any remarkable and 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 (in Orfila's *Toxicol. Gén.*) 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 effects, and in some cases half an ounce caused no ill effects. From his experiments it appears to operate 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 (*Dict. de Med. et de Chir. Prat.* iii. 69) 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 (*Journ. de Chim. Méd.* ix. 21) 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.

(*c.*) *On man.* *a. Local effects.*—Emetic tartar is a powerful local irritant, but not a caustic; that is, it does not exercise any known chemical influence over the parts with which it is placed in contact. Its irritant

properties may be regarded as of a peculiar or specific kind, at least if we are to judge from its well-known effects when applied to the epidermis. To observe these, we may sprinkle the powder over a plaster, or employ the salt in the form of solution or of ointment. By any of these modes of application we obtain an eruption of painful pustules, resembling those of variola or ecthyma. The smaller ones are semiglobular; 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 pharmacological agent producing an eruption precisely similar. The facility with which this eruption is produced varies considerably in different individuals, and in the same individual at different times.

In consequence of the internal use of it, a similar pustular eruption has been met with in the mouth, œsophagus, and small intestines, and white aphthous spots have been observed on the velum and tonsils (Lepelletier, *De l'Emploi du Tart. Stibié*, p. 171). But these effects are rare.

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, pain in the epigastric region, and, 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 emetic tartar exerts over the stomach, independent of its direct local irritation, since the same symptoms have been induced by the application of this substance to wounds, or by its injection into the veins.

Occasionally constitutional effects (nausea, vomiting, and griping pains) have appeared to result from the application of emetic tartar to the skin (*Journ. de Chim. Méd.* iv. 478). In one instance death resulted from its employment: the patient was an infant two years of age, and death occurred in forty-eight hours (*Med. Repos.* xvi. 357). 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 more than a hundred cases, without having observed any constitutional effect; though I have occasionally fancied that it ameliorated pulmonary affections, even when no eruption or redness was produced, and which might arise from absorption.—(See some experiments on this subject in *Mem. of the Med. Soc. of Lond.* vols. ii. iv. and v.)

β. Remote or *constitutional effects*.—Taken internally, *in small doses*, emetic tartar increases secretion and exhalation of the gastro-enteritic 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 (Orfila, *Toxicol. Gén.*) In a third 40 grains caused death (*ibid.*) 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 than 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 (Bayle's *Bibliothèq. de Thérap.* i. 198) 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 (*Treatise on Diseases of the Chest*, by Dr. Forbes, p. 249) 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 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, in 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 (*op. cit.*) we ought to ascribe the *tolerance* of, or capability or *aptitude* of bearing, these immense quantities of so powerful a medicine (*vide* p. 33, for some remarks on the Italian *theory of contra-stimulus*). Consequently, if the opinion be worth any thing, the susceptibility to the influence of the medicine 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 fact. "It is certainly true," observes Laennec (*op. cit.*), "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 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 the 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 (*Nouv. Elém. d. Thérap.* 5^{me} ed.

i. 259) saw, at the Hôpital St. Louis, a man who took a drachm of this salt, in order to poison himself, but suffered no remarkable inconvenience from it. Lebreton (Orfila's *Toxicol. Gén.*) 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 of this salt, but I must content myself with referring to the Memoir of Magendie (*De l'influence de l'emetique*) for notices 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; but 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 of this salt reduced the pulse, in nine days, from 120 to 34 beats per minute, and diminished the number of inspirations from 50 to 18 (Bouneau et Constant, quoted by Lepelletier, *De l'emploi du Tart. Stib.* 84). In another the pulse descended, in three days, from 72 to 44 beats per minute (Trousseau, quoted by Lepelletier).

Modus Operandi.—Though emetic tartar has not hitherto been detected by its chemical characters in the solids or fluids of the body, yet analogy is much in favour of Magendie's statement, that it gets into the circulation, and in this way produces its constitutional effects. M. Barré, (quoted by Rayer, *Dict. de Méd. et de Chir. Prat.* iii. 69) has endeavoured to prove the reverse of this; namely, that emetic tartar cannot be absorbed by the healthy mucous membrane of the alimentary canal; but, in my opinion, neither his experiments nor his inferences are worth much. A fact mentioned by Minaret (*Lond. Med. Gaz.* xiii. 496) strongly supports the common opinion of absorption. A young woman labouring under pleuritis took emetic tartar, which operated on the child at her breast as well as on herself.

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 and sometimes 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 mentioned (p. 411).

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 hepatized. Moveover, 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 (Orfila, *Toxicol. Gén.*) has been referred to: it is that of a man who died of apoplexy, but who, within five days of his death, had taken 40 grains of tartar emetic. "In the lungs were observed blackish spots, very irregular, which extended more or less deep into the parenchyma of this organ." Furthermore, it is argued, 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 would remark, that in cases of poisoning by this substance in the human subject, no mention is made of 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 (Orfila, *op. cit.*) 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: it is, however, not always evident.

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 over 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 effusions under its use. Moreover, Laennec (*op. cit.* p. 203) ascribed the efficacy of it in peripneumonia to the increased activity of the interstitial absorption.

The influence of it over the *secreting organs* has been before referred to. 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 occasionally has come on under its use.

Uses.—As an *emetic*, this salt is usually administered by the stomach, but it is sometimes used as an enema, and 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. It is most efficacious when given at the very commencement of the symptoms, and before the disease is fully formed. In such cases it occasionally puts an entire stop to the progress of fever. But, unfortunately, the practitioner is not usually called in to see the patient until the proper period for the exhibition of an emetic has passed by,—that is, until the disease is fully established. 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 (*Dict. of Pract. Med.* i. 467) 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 (*Essay on Cynanche Trachealis*, 1801) 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 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 6 to 12 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 (Dieffenbach, *Transf. d. Blut. u. d. Infus. d. Arzn.* 105.) 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 used in epilepsy and trismus: frequently with dangerous consequences (Dieffenbach, *op. cit.* 49.) Meckel employed it to restore animation in asphyxia by drowning (*ibid*).

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.

Emetic tartar, in large doses, is a most powerful and valuable remedy in the treatment of inflammation, especially peripneumonia. As an emetic, nauseant, or diaphoretic, it has long been in use in this disease; 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 (see the French translation of his Memoir, in Bayle's *Biblioth. de Thérap.* i. 198), 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 (*Treat. on Dis. of the Chest*, translated by Dr. Forbes); in this country by Dr. Balfour (*Illust. of the Power of Emet. Tart.* 2d edit. 1819). Its value as an antiphlogistic is now almost universally admitted. Practitioners, however, are not quite agreed as to the best method of using it. Rasori (*op. cit.*), Laennec (*op. cit.*), Recamier (*Gaz. Méd.* 1832, p. 503), Broussais (*Cours de Path. et de Thérap. gén.* ii. 521), Bouillaud (*Dict. de Méd. et de Chir. pratiq.* xiii. 395), Dr. Mackintosh (*Pract. of Phys.* i. 426), Drs. Graves and Stokes (*Dubl. Hosp. Rep.* v. p. 48), Dr. Davis (*Lect. on Dis. of the Lungs and Heart*, 188), 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 (Bayle, *Bibl. Thér.* i. 246) advises us on no account to draw blood: and Trousseau (*Dict. de Méd.* 2d edit. iii. 220) 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. On these statements I would observe, that few practitioners in this country have ventured to trust to emetic tartar alone in the treatment of violent pulmonary inflammation. Of its efficacy when used alone, in several slight cases of pneumonia, I can bear testimony; but in severe cases I have invariably conjoined blood-letting, and I believe most British practitioners have done the same. Louis (*Rech. de la Saignée*) 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 (*op. cit.* p. 62). But he particularly states that blood-letting must not be omitted (p. 32).

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

is 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: but many practitioners deny this. 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" (*op. cit.* p. 251). A few drops 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 the good effects of this remedy are produced; as the following statement proves. Rasori explains its operation according to the principles of the theory of contra-stimulus (*vide* p. 33), 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. Fontaneilles supposes that the antiphlogistic effect depends on alterations in the composition of the blood. Eberle (*Mat. Méd.* i. 66) refers it to the sedative effects, first, on the nervous system, and consecutively on the heart and arteries. Teallier thinks that, like many other therapeutic agents, it influences the organism by concealed curative properties. Dr. Macartney (*A Treatise on Inflammation*, 1838) 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. 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 (*op. cit.* p. 259); "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 (*vide* also Dr. Kemp, *Lond. Med. Gaz.* xix. 300, and Mr. Ellis, *op. cit.* p. 369). In *rheumatism* (especially the kind called *articular*), next to peripneumonia, emetic tartar has been found by some practitioners (especially by Laennec, *op. cit.*) 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 only seven or eight days (see also Bayle's *Bibl. Thérap.* i. 311, and Lepelletier, *De l'Emploi du Tart. Stib.* p. 220). 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 (Laennec, *op. cit.* p. 263, and Gimelle, *Brit. & For. Med. Rev.* for July 1838, p. 224). My own experience of the use of this medicine in rheumatism is not so favourable to its employment as the above reports would lead us to expect. In *arachnitis*, Laennec has seen all the symptoms disappear, under the use of emetic tartar, in 48 hours. In three instances of acute hydrocephalus, all the symptoms disappeared in the same space of time. In *phlebitis* (Laennec, *op. cit.*); in *inflammation of the mammæ*, occurring after delivery (Dr. E. Kennedy, Mr. Lever, and Dr. Ashwell, *Lond. Med. Gaz.* xx. 761); in *ophthalmia*, and various other inflammatory affections, emetic tartar has been successfully employed as an antiphlogistic.

In continued fever emetic tartar 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 stages of typhus fever, accompanied with intense cerebral excitement, manifested by loss of sleep, delirium, &c. Dr. Graves (*Lond. Med. Gaz.* xx. 538) 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 (*Lond. Med. Gaz.* xviii. 538 & 694).

Emetic tartar is one of our most valuable sudorifics, being oftentimes available when other agents of this class are inadmissible: for example, in fevers and other diseases, where we are desirous of producing diaphoresis, but which are accompanied with preternatural vascular action about the head, the use of those sudorifics (the compound ipecacuanha powder, for example) which contain a narcotic substance, 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 enteritic 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 (*vide* Laennec, *op. cit.* p. 260; Jacobi, *Lond. Med. Gaz.* iii. 784; and Mr. Ackerley, *Lond. Med. Gaz.* xxi. 56). In *apoplexy* it has been employed to depress cerebral vascular action, but its tendency to occasion vomiting renders it objectionable.

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 blisters, or any other kind of counter-irritant. I sometimes order one part of the chest to be rubbed until the eruption is produced; and then, after the interval of a day or two, apply it to 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 most serviceable in chronic catarrhs, peripneumonies, and pleurisies. Even in lingering phthisis I have seen the cough and pain alleviated by the occasional use of antimonial frictions. 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* (Hausbrandt, *Brit. & For. Med. Rev.* Jan. 1837, 230) it has also been employed with benefit.

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 an application to 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 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 to thirty grains of the salt in fine powder over a Burgundy pitch plaster.

1. *Vinum Antimonii Potassio-tartratis*, Ph. L.; *Vinum Antimonii*, Ph. U. S. (Emetic tartar, ℈ij.; Sherry wine, fℨxx.) *Liquor Tartari Emetici* (emetic tartar, ℈j.; hot distilled water, fℨviij.; rectified spirit, fℨij.) The Edinburgh formula is essentially the same as that of London. In all these formulæ the solution contains two grains of emetic tartar to one fluidounce of the liquid. It is important that Sherry, and not an inferior kind of wine, be employed: for the latter frequently contains matters which precipitate the sesquioxide 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, or until the desired effect is produced; as an emetic for children, from thirty drops to a fluidrachm; as an antiphlogistic in peripneumonia, from two or three fluidrachms to an ounce; but for this purpose an extemporaneous but carefully made aqueous solution is to be preferred.

2. *Unguentum Antimonii Potassio-Tartratis*, Ph. L. (Emetic tartar, in fine powder, ℥j.; lard, ℥iv. M.) *Unguentum Tartari Emetici*, Ph. Dub. (Half the strength of the London formula.) 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 (*Gaz. Méd.* 1832, p. 842.) But I believe with Rayer (*Treat. on Diseases of the Skin*, by Dr. Willis, p. 540), 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 skin, and, therefore, leech-bites, the scarifications from cupping, wounds, &c. 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 (p. 411) that in a very few cases severe and even fatal constitutional disorder has appeared to have resulted from the use of antimonial ointment.

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 (*Lond. Med. Gaz.* xvi. 703) 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 (*Diseases of the Chest*, Forbes's Translation, 257), as well as of Rayer (*Dict. de Méd. et Chir. Prat.* iii. 57), is to the same effect. Opium is a most valuable agent for checking excessive evacuations. Venesection and the warm bath are also important means of relieving the gastro enteritis.

Order 18. Gold and its Compounds.

Au'rum.—*Gold.*

History.—Gold has been known from the most remote periods of antiquity. It was in common use 3,300 years since (*Exodus*, xi. 2), and was probably the first metal with which mankind was acquainted. The alchymists termed it *Sol* or *Rex metallorum.*

Natural History.—It is found only in the metallic state; commonly alloyed with other metals, especially with silver, tellurium, copper, and iron. It occurs in veins in primitive rocks; and is also found in alluvial deposits in small lumps or particles called *gold dust.* It is found in several parts of Europe, Asia, and Africa, but principally in America, especially the southern part.

Preparation.—The mode of extracting gold varies in different places, principally according to the nature of the gangue. The ore is freed as much as possible from foreign matters, by mechanical processes (stamping, washing, &c.); and sometimes by roasting; and is then smelted with some flux, as borax, to separate the stony matters. Or it is fused with lead, and afterwards submitted to cupellation: or amalgamated with mercury, and, after straining, distilled.

The separation of gold from silver (*parting*) may be effected in the *dry way* by fusion, either with sulphur, by which metallic gold and sulphuret of silver are procured, or with sesquisulphuret of antimony, by which sulphuret of silver and an alloy of gold and antimony are procured: the last mentioned metal may be separated by heating the alloy in the air, as well as by other methods. Gold may also be freed from silver in the *wet way* by the process of *quartation*: that is, by treating an alloy of three parts of silver and one of gold with nitric acid, which dissolves the silver.

Properties.—The crystalline forms of native gold are the cube, the regular octahedron, and their modifications. Pure gold has a rich yellow colour, a sp. gr. of 19·2 to 19·4, is soft, very ductile, and malleable, fuses at a bright red heat (2016° F. according to Daniell) and in the liquid state has a brilliant greenish colour. Its equivalent is somewhat uncertain: Gmelin fixes on 66,—Thompson, 100,—Berzelius, 99·6,—Turner, 199·2,—and Brande, 200: I shall adopt the last.

Characteristics.—Gold is readily distinguished by its colour and softness, by its being unacted on by nitric acid, and by its ready solubility in nitro-hydrochloric acid. The solution is yellow, stains organic matters (as the skin) purple, throws down, by the addition of protosulphate