ORDER XVIII.—COMPOUNDS OF ANTIMONY.

1. ANTIMO'NII SESQUISULPHURE'TUM, *L.*—SESQUISULPHURET OF ANTIMONY.

(Antimonii Sulphuretum, *E. D.*) (U. S.)

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, *Nat. Hist.* xxxiii.) It was formerly called *Stimmi* (στιμμι vel στιμμις,) *Stibium* (στιβι,) *Platyophthalmon* (πλατυοφθαλμον,) or *Larbason* (Dioscorides, lib. v. cap. 99.) (λαρβασον.) In the native state it is technically termed *Antimony Ore*, and when first 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 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 sesquisulphuret from its siliceous gangue was to melt it in a covered crucible or pot, in the bottom of 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 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 gray colour, and a metallic brilliancy. The commercial sesquisulphuret is opake, 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. der Chemie*, i. 419.) sulphurous acid escapes during the process. 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. Digested in hydrochloric acid it evolves hydrosulphuric acid, and forms a solution of sesquichloride of antimony, which produces a white 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 nitrohydrochloric acid.

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

	Atoms.	*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. 524.) 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.

With heat it is totally dissolved by hydrochloric acid. From the acid in which it is boiled, a white precipitate is thrown down by distilled water; from the strained liquor, hydrosulphuric acid afterwards throws down a reddish coloured substance. *Ph. Lond.*

"Entirely soluble in muriatic acid, with the aid of heat." *Ph. Ed.*

Physiological Effects. *α. 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 twenty-four hours death, but without any peculiar symptoms. Moiroud (*Pharm. Vétér.* 428.) 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 (*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 (Rayer, *op. supra cit.*) 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, ʒj., 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. (Rayer, *Treatise on Diseases of the Skin*, by Dr. Willis, p. 1223.)

ANTIMONII SULPHURETUM PRÆPARATUM, D. *Prepared Sulphuret of Antimony.* (Take of Sulphuret of Antimony any requisite quantity. Reduce to powder, according to the mode directed in the preparation of chalk, and let the most subtile particles be preserved for use.) The powder sold in the shops as prepared sulphuret is usually prepared by grinding in mills without elutriation. Its uses are those of the sulphuret before described.

2. ANTIMO'NII SESQUICHLO'RIDUM.—SESQUICHLORIDE OF ANTIMONY.

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. It may also be prepared by dissolving the common crude antimony in muriatic acid. The addition of a little nitric acid facilitates the process. (See *Antimonii Oxydum Nitromuriaticum*, D. p. 550.)

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* (oxychloride of antimony.) The hydrosulphurets produce a dark reddish precipitate, alkalis a dirty white precipitate (*sesquioxide of antimony*, mixed with some *sesquioxide of iron.*) Nitrate of silver occasions a white precipitate (*chloride of silver* and *sesquioxide of antimony.*)

Composition.—Sesquichloride of antimony is thus composed:—

	Atoms.	*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*, a little *Nitrous Acid*, *Water*, and *Sesquichloride of 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 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 (*vide* pp. 262 and 409.) 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 antiphlogistic means.

3. ANTIMO'NII OXYSULPHURE'TUM, *L.*—OXYSULPHURET OF ANTIMONY.

(Antimonii Sulphuretum aureum, *E.*—Sulphur Antimoniatum fuscum, *D.*)
[Antimonii Sulphuretum Præcipitatum U. S.]

History.—Basil Valentine (*Triumphant Chariot of Antimony*, by Kirkringius, p. 131. Lond. 1678.) 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.—All the British Colleges give directions for the preparation of this substance.

The *London College* orders of Sesquisulphuret of Antimony, ℥vij.; Solution of Potash, 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 Hydrosulphuret of Antimony; then, with water, wash away the Sulphate of Potash, and dry what remains with a gentle heat.

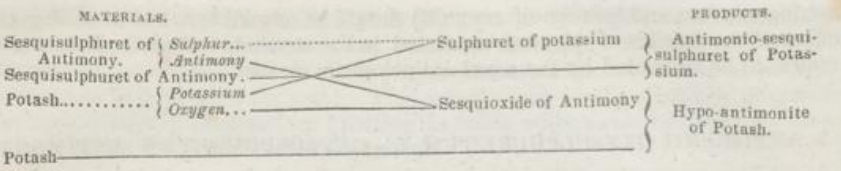
The *Edinburgh College* orders of Sulphuret of Antimony, in fine powder, ℥j.; Solution of Potash, f ℥xj.; Water, Oij.

The *Dublin College* directs of prepared Sulphuret of Antimony, *one part*; Water of Caustic Potash, *eighteen parts*; Diluted Sulphuric Acid, *eleven parts*, or as much as may be sufficient.

[The process of the U. S. Pharmacopœia is similar to that of the London College, six ounces of the Sulphuret of Antimony are ordered, to four pints of Solution of Potassa and Distilled Water and Sulphuric Acid, each a sufficient quantity, after ebullition the filtered solution is directed to be dropped while hot into the Diluted Sulphuric Acid as long as there is a precipitate.]

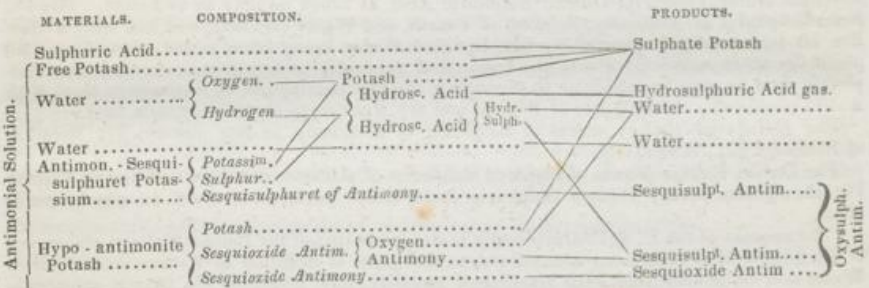
Theory of the Process.—If black or sesquisulphuret of antimony be boiled in an alkaline liquid, a solution is obtained which, on cooling, deposites a reddish powder called *Kermes Mineral*. If a dilute mineral acid be added to the filtered mother liquor, an orange red precipitate is produced, called the *Golden Sulphuret of Antimony* (Berzelius; Liebig.) If the acid be added before the kermes has deposited, we obtain the orange red precipitate, called in the London Pharmacopœia *Oxysulphuret of Antimony*. The Edinburgh College terms the latter substance the *Golden Sulphuret of Antimony*.

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, form 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 farther details respecting the theory of this process I must refer the student to the writings of Berzelius (*Traité de Chimie*, ii. 501.) and Liebig. (*Handwörterb. d. Chemie*, i. 439.)

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, chloride of antimony is formed in solution, and some sulphur remains undissolved. Heated in the air it burns, evolves sulphurous acid, and leaves a grayish 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 before mentioned for the sesquichloride of this metal (*vide* p. 546.) 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 (*vide* p. 556.)

Composition.—By boiling in a solution of bitartrate of potash, it loses, according to Mr. Phillips, 12 per cent.; the amount of sesquioxide that it contains. Its composition, according to the same authority, is as follows:—

	Atoms.	*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, *Ph. L.*	1	594	100	100·0

The *Antimonii Sulphuretum aureum*, Ph. Ed., has a similar composition. The Edinburgh College, however, states that it is a mixture or compound of *sesquisulphuret of antimony, sesquioxide of antimony* and *sulphur*. The sesquisulphuret and sesquioxide are perhaps 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 that it is prepared by boiling sulphur along with the sesquisulphuret of antimony and potash, and precipitating by an acid in the usual way.

Kermes Mineral consists of two equivalents of sesquisulphuret of antimony and one equivalent of sesquioxide of antimony (consequently it has the same composition as *Red Antimony Ore*,) and commonly contains also from 1 to 1½ 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. Chimie*, i. 427.)

The term *Golden Sulphuret of Antimony* is usually applied to the persulphuret of antimony, which consists of 1 eq. of antimony and 2½ eqs. of sulphur. (Liebig *op. cit.* i. 430.)

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

Totally soluble in nitro-hydrochloric acid, emitting hydrosulphuric acid.

But I find that it is not completely soluble in nitro-hydrochloric acid;—a portion of sulphur remaining behind.

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."

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.[1]

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*, commonly termed *Plummer's pill*.

Antidotes.—Vide *Potassæ Antimonio-tartras*.

[1] For some experiments and observations on the action of *Kermes Mineral* and the *Golden Sulphuret*, consult Rayer, in *Dict. de Med. et Chir. Prat.* iii. 57, *et seq.*

4. ANTIMO'NII SESQUIOX'YDUM.—SESQUIOXIDE OF ANTIMONY.

(Antimonii Oxydum, *E.*—Antimonii Oxydum Nitromuriaticum, *D.*)

History.—Basil Valentine (*Triumphant Chariot of Antimony*, by Kirkringius, p. 91. Lond. 1678.) was acquainted with sesquioxide of antimony prepared by the combustion of the metal, and which he termed *Flowers of Antimony* (*Flores Antimonii.*) He also knew that the same compound might be procured by the action of water on the sesquichloride of antimony.

Natural History.—This oxide 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.

The *Edinburgh College* direct 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.

The *Dublin College* order of prepared Sulphuret of Antimony, *twenty parts;* Muriatic Acid, *one hundred parts;* Nitric Acid, *one part.* Gradually add the sulphuret to the acids, previously mixed in a glass vessel, avoiding the vapours; then with a heat gradually increased, digest, until the mixture ceases to effervesce; then boil during an hour. Receive the cooled and filtered liquor in a gallon of water. Let the oxide of antimony, when it has subsided, be washed with a sufficiently abundant quantity of water, until the decanted fluid shall have become free from acid, which may be ascertained by means of litmus: finally, let the oxide be dried on bibulous paper.

By the mutual reaction of sesquisulphuret of antimony and hydrochloric acid, a soluble sesquichloride of antimony is formed (see p. 456.) The Dublin College uses a small quantity of nitric acid to decompose the hydrosulphuric acid remaining in the liquor, and which would impair the colour of the precipitate. When water is added to the solution of the sesquichloride, mutual reaction occurs, the products of which are free hydrochloric acid and sesquioxide of antimony; the latter combines with some undecomposed sesquichloride of antimony, and forms the Oxychloride of antimony, commonly termed the *Pulvis Algarothi, Algaroth's Powder* (from Algarotti, an Italian physician, who recommended its use in medicine.) It is sometimes called the *Mercury of Life* (*Mercurius Vitæ.*) By continued washing with hot water, the sesquichloride which it contains is decomposed, and the product is sesquioxide of antimony.

When Algaroth's powder is washed with a solution of carbonate of soda, its sesquichloride is converted into sesquioxide of antimony by the action of the soda. Chloride of sodium is also formed, and carbonic acid evolved.

Properties.—Sesquioxide 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.

Characteristics.—Heated in liquid hydrochloric acid it completely dissolves: the solution contains sesquichloride of antimony, which, when mixed with water, yields a white precipitate (*ozychloride of antimony.*) Hydrosulphurets form a red precipitate in the solution of the sesquichloride. Boiled with a solution of bitartrate of potash it is dissolved: the solution yields on cooling crystals of emetic tartar, the characteristics of which will be hereafter given. Sesquioxide of antimony melts before the blowpipe, and is volatilized in the form of a white vapour.

Composition.—Sesquioxide of antimony (*Antimonii Oxydum*, Ph. Ed.) has the following composition:—

	Atoms.	Eq. Wt.	Per Cent.	Berzelius.	John Davy.
Antimony	1	65	84·4	84·319	85
Oxygen	1½	12	15·6	15·681	15
Sesquioxide of Antimony	1	77	100·0	100·000	100

Oxychloride of antimony (*Antimonii Oxydum Nitro-muriaticum*, Ph. Dub.) is a compound of sesquioxide and sesquichloride of antimony. The proportion of the latter ingredient is diminished by washing. The composition of the oxychloride is thus stated by Phillips, Johnson, and Malaguti:[1]—

	Atoms.	Eq. Wt.	Per Cent.
Sesquioxide Antimony	9	693	74·44
Sesquichloride Antimony	2	238	25·56
Oxychloride Antimony	1	931	100·00

Antimony Ash (*Cinis Antimonii*) is composed of *antimonious acid, sesquioxide of antimony*, and *sesquisulphuret of antimony*. (See p. 549.)

Glass of Antimony (*Vitrum Antimonii*) is prepared by roasting the sesquisulphuret, and subsequently fusing it in an earthen crucible. It is transparent and of a red colour. It consists principally of *sesquioxide of antimony*, some *sesqui-sulphuret of antimony* and about five per cent. of *silica*.[2]

Purity.—The Edinburgh College give 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.—Sesquioxide of antimony possesses similar medicinal properties to Emetic Tartar, in the preparation of which it is used. It is rarely employed as a medicine. Algaroth's powder is uncertain in its operation.

Administration.—Algaroth's powder is sometimes given in doses of from one to ten grains.

5. PUL'VIS ANTIMO'NII COMPO'SITUS, *L.*—COMPOUND POWDER OF ANTIMONY.

(Pulvis Antimonialis, *E. D.*)

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 in 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.*

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

The *London College* orders, of Sesquisulphuret of Antimony, powdered, lbj.; Horn Shavings, lbij. Mix, and throw them into a crucible red-hot in the fire, and stir 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 *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-gray colour, and vapours no longer arise. Pulverize 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.

The process of the *Dublin College* is essentially similar to that of the London College.

[1] Brande, *Manual of Chemistry*, 5th ed. p. 854.
[2] Phillips, *Translation of the Pharmacopœia of the Royal College of Physicians*, for 1824. Lond. 1824. p. 81.

Manufacturers usually substitute bone sawings 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 (subphosphate 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 valuable 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, are 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, according to Dr. Maclagan, superphosphate 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 that portion of the antimonious acid which was in combination with lime.

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, with the second phosphate of silver, and with the third phosphate 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 deposites a white powder (*oxychloride of antimony*:) 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. and Surg.* 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 (*subphosphate 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.

"Distilled water, boiled with it and filtered, gives, with sulphuretted hydrogen, an orange precipitate: muriatic, 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.* 2nd ed. 1841.

Composition.—*Dr. James's Powder* has been analyzed 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, (*Op. supra cit.*) and was imperfectly examined by Mr. Chenevix. (*Phil. Trans.* for 1801, p. 57.) *Antimonial Powder* has been analyzed 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	—	—	—	2·89	9·80	—	—	3·98
Antimonious Acid	57	56·0	66	43·47	34·21	35	38	50·09
Subphosphate of Lime	43	42·2	33	50·24	53.21	65	62	45·13
Loss [Sesquioxide of Antimony and impurity *Phillips*]	—	1·8	—	—	0·53	—	—	[k] —
	100	100·0	100	100·00	100·00	100	100	100·00

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

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 deposites 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, *sesquioxide of antimony*, because the hydrochloric solution did not let fall any precipitate on the addition of water. But a small quantity of sesquioxide may be dissolved by this acid without our being able to obtain any evidence of it 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, on the addition of hydrochloric acid bichloride of antimony 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 sesquioxide 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 3j. morning and evening without any obvious effect; and the late Dr. Duncan, jun., administered ℈j. and 3ss. 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 but little if any 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 tea-spoonful,) 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, (*Treatise on Med. and 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 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 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 (see p. 565.)

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.

6. POTAS'SÆ ANTIMO'NIO-TAR'TRAS.—ANTIMONY-TARTRATE OF POTASH.

(Antimonii Potassio-Tartras, *L.*—Antimonium Tartarizatum, *E.*—Antimonii et Potassæ Tartras sive Tartarum Emeticum, *D.*) [Antimonii et Potassæ, Tartras, U. S.]

History.—This salt was first publicly noticed in 1631, by Adrian de Mynsicht. (*Thesaurus Medico-Chymicus.*) Besides the names above mentioned it has been known by various others, as *Tartarized Antimony*, *Emetic Tartar*, and *Stibiated Tartar* (*Tartarus Stibiatus.*)

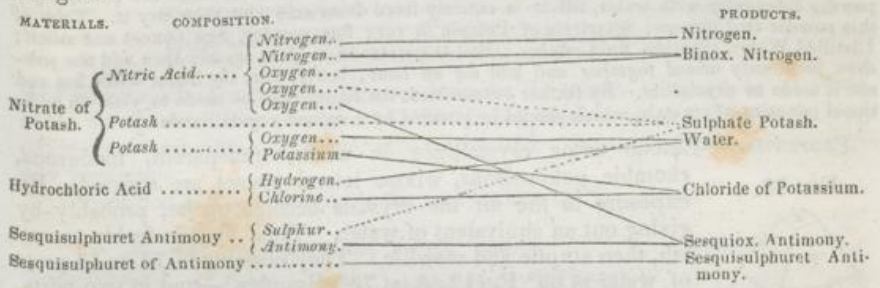
Preparation.—Antimony-tartrate of potash is prepared by boiling water, and bitartrate of potash with sesquioxide of antimony or with some antimonial preparation which contains it, as the oxychloride or oxysulphuret of antimony.

Antimony-ash (*Cinis Antimonii*) procured by roasting the sesquisulphuret, is employed to yield the sesquioxide in an extensive manufactory in London. As already stated (p. 544,) 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, I am informed, is the cheapest method of obtaining emetic tartar.

The *London College* directs this salt to be prepared as follows:—Take of Sesquisulphuret of Antimony, rubbed to powder; Nitrate of Potash, powdered, each, lbij.; Bitartrate of Potash, powdered, ℥xiv.; Hydrochloric Acid, f℥iv.; Distilled Water, *cong.* j. Accurately mix the Sesquisulphuret of Antimony with the Nitrate of Potash; the Hydrochloric Acid being then added, and the powder spread upon iron plate, ignite it. Rub what remains to very fine powder, when it is cold, and wash it frequently with boiling water until it is free from taste. Mix the powder thus prepared with the Bitartrate of Potash, and boil for half an hour in a gallon of distilled water. Strain the liquor while hot, and set aside that crystals may be formed. These being removed and dried, let the liquor again evaporate that it may yield 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

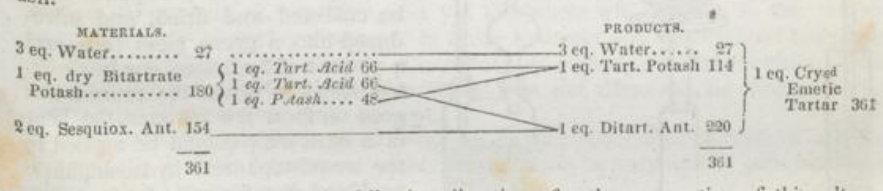
of nitrogen escape. The sulphuric acid unites with part of the potash of the nitrate. The hydrochloric acid reacts on another portion of potash, and produces water and chloride of potassium. If no hydrochloric acid had been employed, the potash would react on some undecomposed sesquisulphuret, and generate 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 of antimony. 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:—



Six equivalents of nitrate, 7 equivalents of sesquisulphuret, and $1\frac{1}{2}$ equivalents of hydrochloric acid, contain the elements of 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.

MATERIALS.		PRODUCTS.	
6 eqs. Nitrate of Potash	612	6 eqs. Binoxide of Nitrogen	180
7 eqs. Sesquisulphuret of Antimony	623	$4\frac{1}{2}$ eqs. Sulphate of Potash	396
$1\frac{1}{2}$ eqs. Hydrochloric Acid	55·5	$1\frac{1}{2}$ eqs. Water	13·5
		$1\frac{1}{2}$ eqs. Chloride of Potassium	114
		3 eqs. Sesquioxide of Antimony	231
		4 eqs. Sesquisulphuret of Antimony	356
	1290·5		1290·5

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.



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, ℥ij.; 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 crystallize. The mother liquor when concentrated yields more crystals, but not so free of colour, and, therefore, requiring a second crystallization.

By the mutual reaction of sesquisulphuret of antimony and hydrochloric acid, we obtain a sesquichloride of antimony (see p. 546.) When this is mixed with

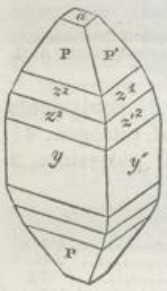
water an oxichloride of antimony is precipitated (see p. 550.) The sesquioxide contained in this unites with the bitartrate of potash and forms emetic water.

The *Dublin College* orders Emetic Tartar to be prepared with Nitro-Muriatic Oxide of Antimony (Oxichloride, see p. 550,) *four parts;* Bitartrate of Potash, triturated to a most subtile powder, *five parts;* Distilled Water, *thirty-four parts.*

[The process of the U. S. Pharmacopœia is similar to that of the Dublin College. The directions are as follows:—Take of Sulphuret of Antimony in fine powder, four ounces; Muriatic Acid, twenty-five ounces; Nitric Acid, two drachms; Water, a gallon. Having mixed the acids together in a glass vessel, add by degrees the Sulphuret of Antimony, and digest the mixture with a gradually increasing heat, till the effervescence ceases, then boil an hour. Filter the liquor when it has become cold and pour it into the water, wash the precipitated powder frequently with water, till it is entirely freed from acid and then dry it. Take of this powder two ounces; Bitartrate of Potassa in very fine powder, two ounces and a-half; Distilled Water, eighteen fluid ounces. Boil the water in a glass vessel; then add the powders previously mixed together and boil for an hour; lastly, filter the liquor while hot and set it aside to crystallize. By farther evaporation, the liquor may be made to yield an additional quantity of crystals, which should be purified by a second crystallization.]

PROPERTIES.—Emetic tartar crystallizes in white, transparent, inodorous, rhombic, octohedrons, whose lateral planes are striated. By exposure to the air the crystals become opake, 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 two parts, ($2\frac{79}{100}$ parts, Brandes) at 212°. The aqueous solution slightly reddens litmus and undergoes decomposition by keeping, like solutions of tartaric acid and most tartrates.[1] 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. 88.

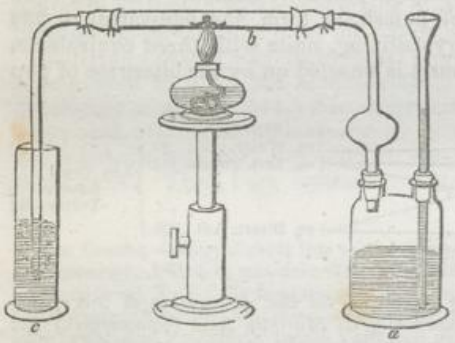


Octohedron of Emetic Tartar.

Characteristics.—Heated in a porcelain or glass capsule this salt is charred, showing that 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, the latter becomes orange-red (fig. 89:) 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, and a current of hydrogen gas transmitted over it. When the process has gone on for a few minutes, the heat of a spirit lamp should be applied to the sesquisulphuret: hydrosulphuric 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

FIG. 89.



Apparatus for reducing Sulphuret 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.

[1] The soft flexible mass which forms in a solution of Emetic Tartar, is said by Keitzing (*Repertoire de Chimie*, t. iii. p. 278; Paris, 1838) to be a vegetable organized being, which he has described and figured as before stated (see p. 361.)

one with hydrosulphuric acid gas, or hydrosulphate of ammonia. (See fig. 89.) This process was proposed by the late Dr. E. Turner.

A solution of emetic tartar forms *white* precipitates with oxalic and the strong mineral acids, the alkalis and their carbonates, and lime water: *grayish* 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. Leg.* 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 alkalis, 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:—

	Atoms.	*Eq. Wt.*	*Per Ct.*	*Wallquist.*	*R. Phill.*	*Thomson.*		*Atoms.*	*Eq. Wt.*	*Per Cent.*
Sesquioxide of Antimony	2	154	42·65	42·99	43·35	42·62	Ditartrate of Antimony	1	220	66·94
Potash	1	48	13·29	13·26	49·25	57·38	Tartrate Potash	1	114	31·57
Tartaric Acid	2	132	36·56	38·61			Water	3	27	7·47
Water	3	27	7·47	5·14	7·40					
Emetic Tartar.	1	361	99·97	100·00	100·0	100·00		1	361	99·98

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 deposite 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 too 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.

Emetic tartar is sometimes adulterated with bitartrate of potash. According to Mr. Hennell, (Phillips's *Transl. of the Pharm.* 4th 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 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, soluble in excess of water.

Totally soluble in water, no bitartrate of potash remaining in the vessel; and hydrosulphuric acid being added, a reddish coloured precipitate is obtained. Neither chloride of barium nor nitrate of silver being added to [a dilute] solution, precipitates any thing. Nitric acid throws down a precipitate, which is dissolved by an excess of it. *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. (Schübler and Zeller, in *Schweigger's Journ. f. d. Chem.* 1827, B. 50, S 54–66.)

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 (*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 (Orfila, *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 Méd. 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,[1] 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[2] has detected antimony in the viscera of animals to whom emetic tartar had been administered by the stomach.

γ. *On Man.* αα. *Local effects.*—Emetic tartar is a powerful local irritant. 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 (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 deposite 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 similar. The facility with which this eruption is produced varies considerably in different individuals, and in the same individual at different times.

A similar 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. (Lepelletier, *De l'Emploi du Tart. Stibié*, p. 171. Paris, 1835.) But these effects are rare. Severe inflammation of the throat (*angina antimonialis?*) has sometimes followed the employment of antimony. (*Lond. Med. Gaz.* March 20, 1840, p. 960.)

We have farther 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

[1] *Mémoires de l'Academie Royale des Sciences*, t. xvi. 1838; also *Journal de Chimie Méd.* ix. 21.
[2] *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.

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 Chimie 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. (*Méd. 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 a very large number of 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.[1]

ββ. Remote or *constitutional effects.*—Taken internally, *in small doses*, emetic tartar increases the 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 *Bibliothéq. 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, 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, (*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. 149) for some

[1] See also some experiments on this subject in *Mem. of the Med. Soc. Lond.* vols. ii. iv. and v.

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.* 5me 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, *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.[1] In another the pulse descended, in three days, from 72 to 44 beats per minute. (Trousseau, quoted by Lepelletier.)

Modus Operandi.—Emetic tartar (or the antimony of this salt) has been detected in the viscera of animals, as I have already stated, M. Barré, (Quoted by Rayer, *Dict. de Méd. et de Chir. Prat.* iii. 69.) however, endeavoured to prove that emetic tartar could not be absorbed by the healthy mucous membrane of the alimentary canal. Minaret (*Lond. Med. Gaz.* xiii. 496.) states that 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[2] and purging produced, not only when the medicine is swallowed, but when it is injected into the veins or into the wind-pipe, 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. 658.)

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

[1] Bouneau et Constant, quoted by Lepelletier, *De l'emploi du Tart. Stib.* 84.
[2] For some observations on the mode by which this salt induces vomiting, see p. 202.

by it, that the lungs were of an orange red or violet colour, incapable of crepitating, gorged with blood, and here and there hepatized. 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 (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 very irregular blackish spots, which extended more or less deeply into the parenchyma of this organ." Farthermore, 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 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.[1]

The influence of it over the *secreting organs* has been before referred to. (See *Liquefacientia*, p. 194.) 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 under its use.

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. 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

[1] I have already made some observations on the mode by which resolvents operate. See p. 194.

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 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. (Dieffenbach, *Transf. d. Blut. u. d. Infus. d. Arzn.*) 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. (*Ibid.* p. 49.) Meckel employed it to restore animation in asphyxia by drowning. (*Ibid.*) It has also been used in tetanus. (*Lancet* for 1836–7, vol. i. p. 35.)

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. (*Ibid.* p. 876.)

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; (*Treatise on Diseases of the Chest*, translated by Dr. Forbes.) and in this country by Dr. Balfour. (*Illustrations of the Power of Emetic Tartar*, 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, (*Gazette Médicale*, 1832, p. 503.) Broussais, (*Cours de Pathologie et de Thérapeutique générale*, ii. 521.) Bouillaud, (*Dictionnaire de Médecine et de Chirurgie pratique*, xiii. 495.) Dr. Mackintosh, (*Practice of Physic*, i. 426.) Drs. Graves and Stokes, (*Dublin Hospital Reports*, v. p. 48.) Dr. Davis (*Lectures on Diseases 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, *Bibliothèque Thérapeutique*, i. 246.) advises on no account to draw blood: and Trousseau (*Dictionnaire de Médecine*, 2de éd.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. Louis (*Recherches de la Saignée.* Paris, 1835.) 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 gave 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 sirup 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: 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. supra 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 its good effects are produced; as the following statement proves. Rasori explains its operation according to the principles of the theory of contra-stimulus, (*Vide* p. 143.) 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. Fontanelles supposes that the antiphlogistic effect depends on alterations in the composition of the blood. Eberle (*Materia Medica*, 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. (See p. 194 for some observations on the curative agency of resolvents.) 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. (I have already offered some remarks on the modus medendi of liquefacients and resolvents, at p. 194.)

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 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. and For. Med. Rev.* for July, 1838, p. 224.) 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;* (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, 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 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. (*Ibid*, xviii. 538 and 694.)

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 ner-

vous 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.[1] 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 frequently direct one part of the chest to 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 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 tumours of various kinds about the joints. In *tic douloureux* (Hausbrandt, *British and Foreign Medical Review*, Jan. 1837, 230.) 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 when one leg only is affected. It is sometimes necessary to keep an eruption out for many weeks. In *hysteria* (Tate, *A Treatise on Hysteria*. Lond. 1830.) the same application to the spine has been found serviceable.

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 antiplogistic, 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 prefera-

[1] *Vide* Laennec, *op. cit.* p. 260; Jacobi, *Lond. Med. Gaz.* iii. 784; and Mr. Ackerly, *Lond. Med. Gaz.* xxi. 56.

ble 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 (*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.

1. VINUM ANTIMONII POTASSIO-TARTRATIS, L.; *Vinum Antimoniale*, E.; *Liquor Tartari Emetici*, D.; *Antimonial Wine*. [Vinum Antimonii, U. S.] (Emetic Tartar, ℈ij.; Sherry, Oj., *L. E.*—Emetic Tartar, ℈j.; Hot distilled Water, f ℥viij.; Rectified Spirit of Wine, f ℥ij.) [Tartrate of Antimony and Potassa, ℈j.; Wine, f ℥x., U. S.]—Each fluid ounce 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 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 fluid drachms; as an emetic, about half a fluid ounce, or two fluid drachms 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 fluid drachm; and as an antiphlogistic in peripneumonia, from two or three fluid drachms 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 Tartari Emetici*, D.; *Tartar Emetic Ointment*. [*Unguentum Antimonii*, *Antimonial Ointment*, U. S.]—(Emetic Tartar, rubbed to very fine powder, ℥j.; Lard, ℥iv., *L. E.* The *Dublin College* orders ℥j. of the Emetic Tartar to ℥j. of Lard.) [The U. S. Pharmacopœia directs ℥ij. of Tartar Emetic to ℥j. Lard.]—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 farther 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. 559) that in a very few cases severe and even fatal constitutional disorder has appeared to have resulted from the use of antimonial ointment.

Order XIX.—GOLD AND ITS COMPOUNDS.

1. 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 alchemists 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; or by action of sulphuric acid (see *Cupri Sulphas.*)

Properties.—The crystalline forms of native gold are the cube, the regular octohedron, 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,—Thomson, 100,—Berzelius and Graham, 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 of iron, metallic gold in the finely-divided state, by protochloride of tin a dark or black precipitate, and by protonitrate of mercury a black precipitate: heated with borax by the blowpipe it forms a pink or rose-coloured glass, but is subsequently reduced.

Physiological Effects.—Gold, like other metals, has been frequently supposed to be inert while it retains its metallic condition, but in this, as well as in some other instances, the accuracy of the assumption has been denied. Both Chrestien (*Sur une Nouvelle Remède dans le Traitement des Mal. Vén.* Paris, 1811.) and Niel, (*Recherches et Observations sur les Effets des Préparations d'Or.* Paris, 1821.) as well as other writers, assert that finely-divided metallic gold (*pulvis auri*) produces the same constitutional effects as those caused by the various preparations of this metal, but in a milder degree, while it excites little or no local irritation. It is said to promote the secretions of the skin, kidneys, and salivary glands.

Uses.—It has been employed as an antivenereal and antiscrofulous remedy by