

Various effects have been ascribed to this acid, which require to be further investigated ere they are admitted. Thus Hecker (*Arzneimittel*. Bd. 2. S. 305) says, it has a specific operation on the nervous system, in virtue of which it possesses the power of allaying pain and spasm. Lentin (*Beitrag zur ausüb. Heilk.* Bd. 2. S. 139) considers it to be endowed with a specific power of influencing secreting surfaces and the bones, whereby it is enabled to ameliorate various morbid conditions of these parts. Sundelin (*Heilmittel*, Bd. 2, S. 234) regards it as a stimulant and tonic to the sexual organs. Various effects have been ascribed to it by Herder (*Hufeland's Journ.* Bd. 9, St. 3, S. 148).

USES.—Phosphoric acid has been employed in the same cases in which sulphuric and other mineral acids have been used, and under the same regulations. It may be employed for a longer period, without disturbing the digestive functions, than the other agents of this class.

It has been used in certain cases rather on theoretical than practical grounds. Thus its power of dissolving phosphate of lime has led to its employment in those forms of lithiasis attended with phosphatic deposits in the urine,—in ossification of the arteries and cardiac valves,—and in exostosis and other osseous tumours. Lentin used it as a local agent to check caries, from a notion that this disease depends on a deficiency of phosphoric acid in the part affected. Woulff applied it to promote the formation of bone.

There are several other diseases against which this acid has been administered. Thus it has been given in blenorrhœa and leucorrhœa, when the secreted fluid was thin and acrid (Sundelin),—in profuse suppuration, to diminish the quantity and improve the quality of the secreted matter,—in hysterical affections of young and irritable subjects, Sundelin has found it useful,—in impotency of the male (Berends),—in diabetes, and in jaundice.

ADMINISTRATION.—Internally the dilute phosphoric acid should be given in doses of from ten minims to half a drachm, properly diluted. Mixed with eight or ten times its volume of water, it may be employed as a wash in caries.

ANTIDOTES.—(See *Sulphuric Acid*.)

ORDER 9.—SULPHUR AND ITS NON-METALLIC COMPOUNDS.

Sulphur.—*Sulphur* or *Brimstone*.

HISTORY.—Sulphur has been known from the most remote periods of antiquity. It is mentioned by Moses (*Genesis*, xix. 24), Homer (*Iliad*, lib. xvi.) and other ancient writers.

NATURAL HISTORY.—It is found in both kingdoms of nature.

(a.) *In the inorganic kingdom*.—*Native or virgin sulphur* occurs in two forms: either imbedded in rocks (*common native sulphur*), or produced by sublimation (*volcanic sulphur*). In Sicily it is found in beds in a blue clay formation, which, in the opinion of Dr. Daubeny, is more recent than chalk, but is of the same age with the gypsum beds in the neighbourhood of Paris. Solfatara (called by the ancients *Forum Vulcani* or the *Court of Vulcan*), a kind of half-extinct volcano, in the vicinity of

FIG. 47.



Warm Spring of Solfatara.

combination with sulphur. Dr. Thomson (*Outlines of Mineralogy*, &c. vol. i. p. 76) mentions fourteen native sulphurets and seventeen sulphur salts.

(b.) *In the organized kingdom.*—Sulphur is found in *Liliaceæ* (as in garlic); in *Cruciferae* (as in mustard); in *Umbelliferae* (as in asafetida), and in many other orders of plants. The alkaline and earthy sulphates are frequently met with in vegetables. Sulphur is also a constituent of some animal substances (thus it is found in eggs, urine, &c.); sulphates are found in the urine.

PREPARATION.—Sulphur is procured in two ways; by the purification of native sulphur, or by the decomposition of the native sulphurets. The sulphur of British commerce is almost exclusively obtained in the first way. It is brought principally from Italy and Sicily. During the year 1830 no less than 236,338 cwts. of rough brimstone were imported from Italy and the Italian islands (*Parliam. Ret.* 367, ordered to be printed, April 1832).

(a.) *Purification of native sulphur.*—In Sicily, from whence most of this substance is procured, the native sulphur is submitted to a rude process of fusion: it is collected in heaps, which are set fire to on the surface: the heat developed by the combustion of one portion fuses another (Daubeny, *Description of Volcanoes*, p. 197).

Another mode of purifying native sulphur is to distil it in earthen pots. These are arranged in two rows in a large oblong furnace (fig. 48, 1, 1), the top of each pot, which serves for the introduction of the sulphur and for the removal of the residuum, being kept closed during the operation. The upper and lateral part of each pot communicates with an inclined tube of about two inches diameter and fourteen long. When the fire is lighted in the furnace, the sulphur fuses and sublimes, and passes through this tube into another pot (2), placed on the outside of the furnace, and perforated near its bottom to allow the melted sulphur to flow into a pail (3) containing water, where it congeals, and forms the rough or crude sulphur (*sulphur crudum*). (Dumas, *Traité de Chimie*, t. 1^{er}. p. 121).

FIG. 48.



Distillation of native sulphur.

Crude sulphur is purified in this country. The process formerly adopted was to submit it to fusion in an iron cauldron: the earthy impurities subside, and the liquid sulphur is ladled out and cast in moulds.

The improved method of purifying it is to submit it to distillation in a large cast-iron still: the receiver, which is made of iron, is kept cool by immersion in water. The sulphur obtained by this process is called *refined sulphur*. When cast in wooden moulds it constitutes *stick, roll, or cane sulphur* (*sulphur in baculis*,—*s. rotundum*,—*s. in rotulis*). If it be required to obtain the sulphur in a pulverent form, the above process of distillation is modified, thus:—The communication between the still and the iron receiver is shut off, while another is opened with a large chamber or sulphur-house, on the walls of which the sulphur condenses in a pulverent form: in this state it constitutes *sublimed sulphur*, or *flowers of sulphur* (*sulphur sublimatum*, seu *flores sulphuris*). When washed with water to separate a little adhering acid, it is termed *washed sulphur* (*sulphur lotum*). The method of purifying sulphur adopted at Marseilles, as described by Dumas (*op. cit.*), is somewhat different to that now described, and which I have seen practised in the neighbourhood of London.

(b.) *Decomposition of metallic sulphurets*.—In some places sulphur is procured by the decomposition of metallic sulphurets (iron or copper). In Anglesea it is (or was) prepared by roasting copper pyrites, by which part of the sulphur is burned, while the remainder is volatilized and collected in chambers connected with the domes of the furnaces by means of horizontal flues (*Aikin's Dict. of Chem.* vol. ii.)

The dregs remaining after the purification of sulphur are called *horse brimstone* (*sulphur vivum*; *sulphur caballinum*; *sulphur griseum*).

PROPERTIES.—At common temperatures, pure sulphur is a brittle, crystallizable solid, of a yellowish green colour, without smell, and with a very weak and almost imperceptible taste. The specific gravity of ordinary sulphur is about 1.99, but, when free from air-bubbles, 2.087. It is a bad conductor of electricity, and, therefore, by friction becomes powerfully electric. It is a bad conductor of heat, and when grasped in the warm hand crackles, and sometimes breaks to pieces. It is fusible, volatilizable, and combustible. In atmospheric air it burns with a pale blue flame, and emits a large quantity of fumes having a peculiar suffocating odour (*sulphurous acid*).

It is called *dimorphous* because it has two distinct primary forms. The primary form of the crystals of native sulphur, or of those deposited from its solution in bisulphuret of carbon, is a right rhombic octahedron; while that of the crystals obtained by the fusion and slow cooling of sulphur, is an oblique rhombic prism. Now these two forms are incompatible, and cannot be derived the one from the other: the first belongs to the *rectangular or rhombic right prismatic system*; the second to the *rectangular or rhombic oblique prismatic system*.

When sulphur is heated to 340°, it becomes viscid; and by increasing the heat the viscosity increases, until the temperature arrives at between 400° and 500°. If while in this state it be suddenly cooled, as by throwing it into water, it remains quite soft, so that it may be drawn out into threads. The cause of this change, which seems to be merely physical, is not understood. The atomic weight of sulphur is about 16.

CHARACTERISTICS.—Sulphur is easily distinguished from other bodies, by its colour, its fusibility, its volatility, and its burning with a blue flame, and the evolution of sulphurous acid gas, the odour of which can be easily recognized.

IMPURITIES.—Rough sulphur is always mixed with variable quantities

of foreign substances. Vauquelin (*Ann. de Chim.* 25, 50) distilled 200 grains, and obtained a residuum of 0·82, composed of silica, carbonate of lime, iron, bituminous charcoal, alumina, and magnesia, but the proportion of earthy matters is generally more considerable. Sulphur obtained from pyrites sometimes contains orpiment (*sesquisulphuret of arsenicum*). The purity of any specimen is determinable by dissolving it in oil of turpentine, which does not act on the foreign matters. It should be perfectly volatile.

PHYSIOLOGICAL EFFECTS. (a.) *On vegetables*.—Sulphur does not appear to be injurious to vegetables, for seeds vegetate and produce thriving plants when sown in sulphur.

(b.) *On animals*.—The veterinary school at Lyons found that a pound of sulphur killed horses by producing violent inflammation, recognizable during life by the symptoms, and after death by the morbid appearances. (Christison's *Treatise on Poisons*.)

(c.) *On man*.—In *small and repeated doses* sulphur acts as a gentle stimulant to the secreting organs, especially to the skin and the mucous membranes, (particularly the bronchial membrane). It promotes the capillary circulation of these parts and increases their secretions. Sundelin (*Heilmittell.* Bd. 1, s. 196) says it operates specifically on the mucous membrane of the rectum, and thereby promotes critical hæmorrhoidal secretions. That it becomes absorbed is shewn by the odour of hydro-sulphuric acid which it communicates to the sweat, urine, and milk, and by silver articles becoming blackened in the pockets of patients who are under the influence of it. By the Germans, sulphur is called a resolvent, and is ranked with the mercurial and antimonial preparations. (See Sundelin, *op. cit.*, and Vogt, *Pharmakodyn.*) That is, they regard it as an agent powerfully influencing the nutrition of organs, and, therefore, well adapted for ameliorating various disordered conditions, by what is usually denominated in this country an alterative action. "From mercurial and antimonial medicines," says Sundelin, "sulphur is distinguished by its great diffusibility, in virtue of which it comes near the exciting-tonic agents [*e. g.* the carminative fruit of *Umbelliferae*], and also by its not possessing the defluxing (*verflüssigenden*) properties of these agents."

In *larger doses* (as one or two drachms) sulphur acts as a mild purgative, without exciting the pulse or occasioning griping. As the stools are usually solid, Dr. Paris (*Pharmacologia*, vol. i. art. *Cathartics*) concludes that the action of sulphur on the bowels is confined to the muscular coat.

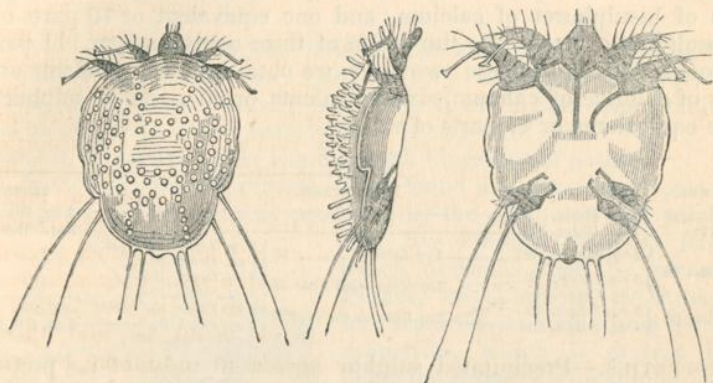
USES.—Sulphur is employed both internally and externally.

(a.) *Internally*.—It is given for various purposes. In *affections of the rectum*, as stricture, hæmorrhoids, and prolapsus, it is a valuable agent as a mild purgative. I have frequently employed it when patients had great disgust for castor oil. In order to promote its purgative effect, it will be sometimes necessary to conjoin magnesia or the bitartrate of potash. In *chronic cutaneous diseases*, more especially prurigo, impetigo, and scabies, the internal use of sulphur is sometimes attended with great benefit. In *pulmonary affections*, as chronic catarrhs and asthma, it is said to be sometimes useful. In *rheumatic and gouty affections* also. Some have employed it as an *anthelmintic*. Vogt (*op. cit.*) employs it as a *resolvent* in inflammation: as in croup, bronchitis, peripneumonia, and abdominal inflammation. In some constitutional diseases (as scrofula

and secondary syphilis) it has been used as an *alterative*. Tortuol has proposed sulphur as a preservative against measles: but, as might be expected, experience shews sulphur possesses no prophylactic power of this kind, and that the only preservative is isolation.

(b.) *Externally*.—Sulphur is a most valuable remedy in various skin diseases, more especially *scabies*; and notwithstanding many substitutes have been proposed for it in the latter disease, none are so generally successful. It is supposed by some that the curative powers of sulphur in this disease depend on its poisonous influence over the so-called *itch-insect* (*Sarcoptes hominis* of Raspail, the *Acarus Scabiei* of other writers): a little parasite belonging to the class *Arachnida* of articulated animals, and, therefore, improperly termed an *insect* (Raspail, *Mémoire sur l'Insecte de la Gale*, Paris 1834).

FIG. 49.

*Sarcoptes hominis*—(Raspail.)

But before adopting this explanation of the *modus medendi* of sulphur, it is to be proved that the animal is the *cause* of the disease: for, at present, it has not been satisfactorily shewn whether it be the cause, effect, or mere accompaniment of itch. Rayer (*Treatise on Diseases of the Skin*, by Dr. Willis, p. 344) observes, that it is indubitable that the number of these insects bears no proportion to that of the vesicles. “It is, further,” he adds, “rare to discover these insects on the abdomen and on groins, where the eruption of scabies is nevertheless very common and very apparent; moreover, scabies is known to continue when no more acari are to be discovered.” Besides scabies, sulphur is a most valuable application to various other skin diseases, as porrigo, impetigo, &c.

ADMINISTRATION.—Internally, sulphur is usually given with syrup, or treacle, in the form of an electuary, or suspended in milk. The dose of it, as a purgative, is from one to three or four drachms. As an alterative and sudorific, the dose is about half a drachm. The preparation sold under the name of *milk of sulphur*, or *precipitated sulphur*, is a more convenient and agreeable preparation for internal use, than the ordinary sublimed sulphur.

Externally sulphur is principally employed in the form of ointment. The *unguentum sulphuris* (Ph. L.) consists of three ounces of sulphur to half a pound of lard: twenty minims of the oil of bergamot are added

to counteract, in part, the unpleasant odour of sulphur. The *unguentum sulphuris compositum* is composed of half a pound of sulphur, two ounces of powdered white hellebore, half a pound of soft soap, a pound and a half of lard, and thirty minims of the oil of bergamot: it is a much more irritant application than the simple ointment of sulphur. Both are employed for the cure of itch, and, sometimes also, in the various forms of porrigo which affect the heads of children.

1. *SULPHUR PRÆCIPITATUM*.—This preparation, commonly termed *milk of sulphur* (*lac sulphuris*), was known to Geber. It may be prepared by boiling one part of sublimed sulphur, two parts of slacked lime, and eight parts of water. To the filtered solution add sufficient hydrochloric acid to precipitate the sulphur, which is to be washed and dried.

The *theory* of the process is the following:—When sulphur and lime are boiled in water, six equivalents or 96 parts of sulphur react on three equivalents or 84 parts of lime, and produce two equivalents or 104 parts of bisulphuret of calcium, and one equivalent or 76 parts of the hyposulphite of lime. By the action of three equivalents or 111 parts of hydrochloric acid on these two salts, we obtain three equivalents or 168 parts of chloride of calcium, six equivalents or 96 parts of sulphur, and three equivalents or 27 parts of water.

REAGENTS.	RESULTS.			
	FIRST STAGE.		SECOND STAGE.	
3 eq. Hydrochl. Acid 111	{ 3 eq. Hydr. 3			3 eq. Water . . . 27
	{ 3 eq. Chlor. 108			3 eq. Chlor. Calc. 168
3 eq. Lime . . 84	{ 1 eq. Lime . . 28	— 1 eq. Lime 28	{ 1 eq. Oxyg. 8	
	{ 2 eq. Oxyg. 16		{ 1 eq. Calc. 20	
	{ 2 eq. Calc. 40	— 1 eq. Hyposulph. Acid 48	{ 2 eq. Oxyg. 16	
6 eq Sulphur 96	{ 2 eq. Sulph. 32		{ 2 eq. Sulph. 32	
	{ 4 eq. Sulph. 64	— 2 eq. Bisulph. Calc. 104	{ 2 eq. Calc. 40	
			{ 4 eq. Sulph. 64	6 eq. Sulphur . . 96

PROPERTIES.—Precipitated sulphur agrees in most of its properties with sublimed sulphur, but is much whiter, and is in a finely pulverent form. Berzelius says, that when melted, it gives out a little sulphuretted hydrogen; and on cooling, resumes the yellow colour it had before it was boiled with the alkali.

COMPOSITION.—It is composed of sulphur with a little water; and hence it is frequently termed *hydrate of sulphur*. According to Bucholz, however, when well dried, it contains hardly a trace of water, and, therefore, any present under ordinary circumstances must be regarded as hygroscopic; so that the term hydrate is hardly applicable to it.

IMPURITIES.—If sulphuric be substituted for hydrochloric acid, in the manufacture of this substance, sulphate of lime will be formed, and mixed with the precipitated sulphur. The impurity may be detected by volatilizing the sulphur in a crucible, or by solution in oil of turpentine or liquor potassæ.

The EFFECTS, USES, and DOSES, are the same as those of common sublimed sulphur.

2. *OLEUM SULPHURATUM*.—Sulphur is soluble in both volatile and fixed oils, and formulæ are still found in some continental works for the preparation of pharmaceutical compounds of them. A formula for sulphurated oil is still retained in the Edinburgh Pharmacopœia, but has been omitted in the last edition of the London Pharmacopœia. This preparation was formerly denominated *balsam of sulphur*.

It is prepared by boiling one part of sublimed sulphur in eight parts of

olive oil. The compound thus procured cannot be regarded as a mere solution of sulphur in oil, since the odour of hydrosulphuric acid, which it possesses, proves that the oil has undergone partial decomposition: in fact, the heat to which the oil is raised in order to boil it, causes a chemical change.

It is a dark reddish-brown viscid substance, having an extremely unpleasant odour. Its local action is that of an acrid: its remote operation that of a stimulant, causing thirst and febrile heat. It has been supposed to possess expectorant and diaphoretic properties. It is applied to foul ulcers, and is employed internally in chronic pulmonary affections. The dose of it is from 40 to 50 drops: but its unpleasant taste and smell almost preclude its use.

Ac'idum Sulphu'ricum.—Sul'phuric Ac'id.

HISTORY.—This acid appears to have been known to Geber as early as the seventh century (Thomson's *Syst. of Inorg. Chem.* vol. ii. p. 29.) In the state in which we usually meet with it in English commerce, it is termed *oil of vitriol*, or the *protohydrate of sulphuric acid*.

NATURAL HISTORY.—It is found in both kingdoms of nature.

(a.) *In the inorganized kingdom.*—It is found in the waters of some volcanic regions, and is evidently produced by the combustion of sulphur.

FIG. 50.



Cascade of Vinagre, in Colombia.

The *Río Vinagre* (Vinegar River), which descends from the volcano of Puracé, in Colombia, to Popayan, has received its name from its acid properties, which it derives from being impregnated with sulphuric and hydrochloric acids (A. de Humboldt, *Vues des Cordillères*, p. 220).

Issuing from the crater of Mont Ida, in Java, is a river which also contains this acid. Dr. Thomas Thomson (*Mineralogy*, vol. i. p. 75) states, that in Persia there is an earth so strongly impregnated with it, that it is used by the natives as an acidulous seasoner of food. This author also says (*op. cit.* p. 77), that there are no less than twenty-seven

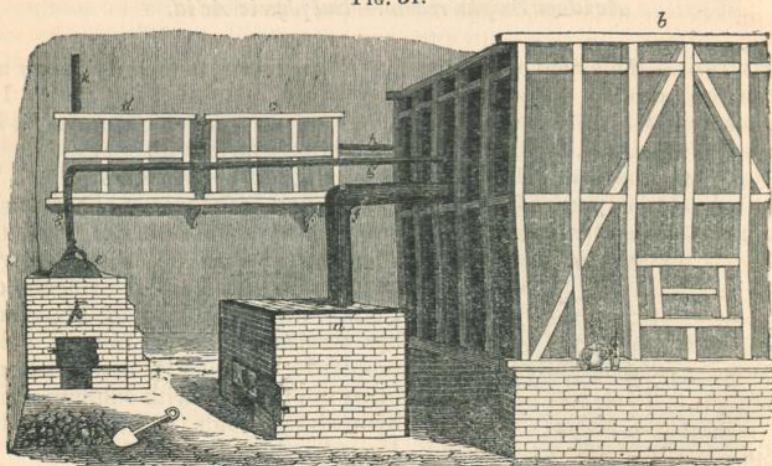
sulphates (consisting of combinations of sulphuric acid with one or more bases) in the mineral kingdom. The most abundant of these is the sulphate of lime.

(b.) *In the organized kingdom.*—The sulphates of lime, potash, and soda, have been found in plants (Decandolle, *Phys. Végét.* p. 390). The sulphates of potash and soda are mentioned by Berzelius (*Traité de Chim.* t. 7^{me}, p. 393) as constituents of human urine.

PREPARATION.—The most improved method of manufacturing oil of vitriol adopted in this country is the following:—Crude sulphur is burned on an iron plate in a furnace, and the gas (sulphurous acid), thereby produced, is conveyed by a pipe or chimney into a leaden cham-

ber, the bottom of which is covered to the extent of four or five inches with water. The furnace door has two apertures to regulate the supply of atmospheric air. After combustion has continued for several hours, an iron pot containing a mixture of the nitrate of potash or soda and oil of vitriol, is introduced into the furnace, and steam is conveyed into the leaden chamber. So that sulphurous acid, nitric or nitrous acid (generated by the action of the oil of vitriol on the nitrate of potash, and volatilized by the heat produced by the combustion of the sulphur), and steam, are conveyed into the leaden chamber, and by their mutual reaction produce sulphuric acid, which is absorbed by the water at the bottom of the chamber. To prevent loss in the process, the residual gases are conveyed through two other small leaden chambers (also containing water) before they are allowed to escape into the air.

FIG. 51.



Oil of Vitriol Manufactory.

- (a) Furnace.
 (b) First leaden chamber.—In the manufactory from which the above sketch was made, this chamber was 70 feet long, 20 feet wide, and 20 feet high; but the size varies considerably in different establishments.
 (c) Second ditto.
 (d) Third ditto.
 (e) Steam boiler.
 (f) Pipe or chimney of the furnace.
 (g) Steam pipe.
 (h) Pipe conveying the residual gas

- from the first to the second leaden chamber.
 (i) Pipe conveying the gas not absorbed in the first and second chambers into the third.
 (k) Waste pipe conveying the unabsorbed gas into the atmosphere.
 (l) Man-hole, by which the workmen enter the chamber when the process is not going on.
 (m) Pipe for withdrawing a small portion of sulphuric acid from the chamber, in order to ascertain its sp. gr. by the hydrometer.

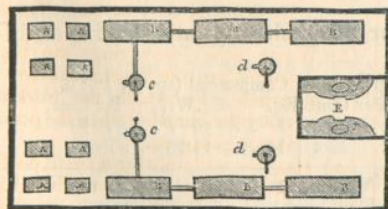
When the liquid in the leaden chamber has acquired a specific gravity of about 1.5, it is conveyed by leaden pipes into rectangular leaden boilers, where it is evaporated and concentrated until its sp. gr. is 1.70; but in some manufactories this part of the process is omitted. The final concentration is effected by boiling it down in *glass* or *platinum retorts*: the latter, notwithstanding their great cost, are now usually adopted. Their price, of course, depends on their size. Mr. Parkes (*Chem. Essays*, vol. i. p. 535) had one which held thirty gallons, and cost about £360;

but sometimes they are made so large, that they are worth £1000 each. In this apparatus the acid is deprived of a part of its water and some sulphurous acid, and when it has attained a sufficient degree of concentration, it is drawn off by means of a platinum syphon into carboys.

The theory of the process is the following:—When sulphurous and nitric acids come in contact, the first loses, the second gains, oxygen, by which sulphuric and nitrous acids are formed. Dry nitrous acid and sulphurous acid gases undergo no change when mixed; but, if a little moisture be admitted, re-action takes place, and a crystalline compound, of sulphuric acid, hyponitrous acid, and water, is formed. This, falling into water, is immediately decomposed: sulphuric acid is dissolved, and the hyponitrous acid is resolved into nitrous acid and binoxide of nitrogen, which escape with effervescence in a gaseous form. The nitrous acid thus disengaged, with that produced by the union of the binoxide with oxygen of the atmosphere, becoming mixed with more sulphurous acid and water, gives rise to a fresh portion of the crystalline compound. One part of the nitrous acid is converted by the water present into nitric acid and binoxide of nitrogen; while another portion loses the whole of its oxygen, by which a little nitrogen gas is disengaged. In oil of vitriol manufactories the crystalline compound is rarely formed, owing to the excess of aqueous vapour present. Sometimes, however, it is deposited in the pipe which conveys away the superfluous vapour, as in the instance mentioned by Dr. Henry (*Ann. Phil.* vol. xi. new series, p. 368). For further information respecting the manufacture of sulphuric acid, see the papers of Gaultier de Claubry, in *Ann. de Chim.* xlv. 284; and *Dict. de l'Indust.* tom. i. pp. 108, *et seq.*

The old method of manufacturing oil of vitriol, and, indeed, one still followed in some places, consists in burning a mixture of eight parts of sulphur and one part of nitrate of potash (or nitrate of soda) on iron or leaden plates, either within the leaden chamber or in a furnace on the outside of it (Parkes's *Chemical Essays*, vol. i. 465). Fig. 51 is the ground plan of a manufactory of this kind. Iron pyrites (bisulphuret of iron) is sometimes substituted for sulphur.

FIG. 52.



Plan of a Sulphuric Acid Manufactory.

- A, Rectangular leaden boilers.
- B, Leaden chambers.
- E, Retort house.
- c, Leaden pump for acid.
- d, Water pump.

In this process the greater part of the sulphur combines with oxygen of the air to form sulphurous acid: but a portion abstracts oxygen from the nitric acid of the nitrate, and thereby becomes sulphuric acid, which, with the potash of the nitre, forms sulphate of potash. Binoxide of nitrogen is evolved by the decomposed nitric acid, and this, combining with oxygen of the air, becomes nitrous acid. The mutual action of sulphurous and nitrous acid gases has been before explained.

At Goslar, Nordhausen, and other parts of Saxony, sulphuric acid is made thus:—Crystallized sulphate of iron is calcined, by which the greater portion of its water of crystallization is expelled. It is then distilled in earthen vessels, by which *fuming sulphuric acid* is procured, while sesqui-

oxide of iron is left in the retort. If this acid be heated in a glass retort, it yields real or anhydrous sulphuric acid.

PROPERTIES. (a.) *Of anhydrous sulphuric acid.*—It is a crystalline solid, having very much the appearance of asbestos. It gives out dense white fumes in the air, like fluoride of boron. It melts at 66° F. and boils at from 104° to 122° F. The sp. gr. of the liquid acid, at 78° F. is 1.97.

(b.) *Of the Nordhausen or fuming sulphuric acid.*—This is usually a dark brown oily-like liquid, which gives out copious white fumes in the air. Its sp. gr. is about 1.9. It is imported in stone bottles, having a stoneware screw for a stopper.

(c.) *Of oil of vitriol or English sulphuric acid.*—When pure it is a colourless, transparent, inodorous, highly acrid, and corrosive liquid. It possesses the usual properties of a powerful mineral acid in a very eminent degree, such as reddening the vegetable blues, saturating bases, and displacing other acids. Its affinity for water is most intense, and by virtue of this, it absorbs aqueous vapour from the atmosphere, and chars animal and vegetable substances. When mixed with water there is a mutual condensation with the evolution of heat. Various substances when heated in sulphuric acid decompose it; they abstract oxygen and evolve sulphurous acid. This is the case with charcoal, organic substances, phosphorus, sulphur, and several of the metals, as copper, tin, and mercury.

The sp. gr. of this acid at 60° F. is about 1.84. Genuine *commercial* acid should never surpass 1.8455; when it is denser, we may infer sophistication or negligence in the manufacture (Brande's *Man. of Chemistry*). Acid of sp. gr. 1.845 freezes at -15° F. and boils at 620° F. In commerce the acid has frequently a sp. gr. of only 1.8433, and its boiling point is 545° F. (Phillips's *Transl.*)

COMPOSITION.—Pure or anhydrous sulphuric acid is thus composed:—

	Eq.	Eq.Wt.	Per Cent.	Berzel.		Vol.	sp. gr.
Sulphur	1	16	40	40.14	Sulphurous acid gas	1	2.222
Oxygen	3	24	60	59.86	Oxygen gas	0.5	0.555
Sulphuric acid	1	40	100	100.00	Sulphuric acid vapour	1?	2.777?

The composition of oil of vitriol or English sulphuric acid is as follows:—

	Strongest (sp. gr. 1.845)			Commercial (sp. gr. 1.8433)		
	Eq.	Eq.Wt.	Per Cent.	Eq.	Eq.Wt.	Per Cent.
Real sulphuric acid	1	40	81.6	1	40	78
Water	1	9	18.4	1½	11.25	22
Oil of vitriol	1	49	100.0	1	51.25	100

According to this statement the strongest oil of vitriol which can be procured (sp. gr. 1.845) is the *protohydrate of sulphuric acid*, while that met with in commerce is a $\frac{5}{8}$ *hydrate of sulphuric acid*.

The *German* or *Nordhausen sulphuric acid* consists of—

	Eq.	Eq.Wt.	Per Cent.		Eq.	Eq.Wt.
Real sulphuric acid	2	80	89.88	} Real sulphuric acid	1	40
Water	1	9	10.115		} Protohydrate sulphuric acid	1
Nordhausen sulphuric A ^d	1	89	99.99			1

CHARACTERISTICS.—Free sulphuric acid or the soluble sulphates are recognized by a solution of any of the barytic salts, which throws down a heavy white precipitate (sulphate of baryta) insoluble in acids or alkalis. If this precipitate (or any insoluble sulphate) be ignited with charcoal, it is decomposed and converted into a sulphuret, which, on the addition of hydrochloric acid, evolves hydrosulphuric acid, known by its odour and its blackening paper moistened with acetate of lead. If sulphuric acid be heated with organic matter, sulphurous acid is given out: this may be known by its odour, and by its occasioning the formation of the blue iodide of starch when mixed with iodic acid and starch.

To determine whether sulphuric acid is free or combined with a base, Dr. Christison (*Treatise on Poisons*, 3d ed. p. 142) recommends the liquid to be boiled with pure carbonate of lead. If any free sulphuric acid be present sulphate of lead will be formed, which, being insoluble in dilute nitric acid, may be thereby distinguished from carbonate of lead. But this test is liable to objection: alum and other supersulphates re-act on carbonate of lead like free sulphuric acid; and, furthermore, sulphate of ammonia is decomposed at a boiling temperature by carbonate of lead.

IMPURITIES.—Pure sulphuric acid should be colourless: the presence of organic matter, as cork, communicates a brownish or black colour. The acid of commerce usually contains traces of sulphate of lead: this may be detected either by adding water, when the white sulphate is precipitated; or by the addition of hydrosulphuric acid to the dilute sulphuric acid, when a very slight change of colour is observed, owing to the formation of sulphuret of lead. "What remains after the acid has been distilled to dryness does not exceed the $\frac{1}{100}$ part of its weight."—(*Ph. Lond.*) The residuum here referred to is sulphate of lead.

PHYSIOLOGICAL EFFECTS. (a.) *On vegetables.*—In the concentrated state sulphuric acid chars the parts of plants to which it is applied. In the dilute form it destroys vegetables in a few hours (Marcet, in Decandolle's *Phys. Végét.* p. 1345).

(b.) *On animals generally.*—The action of sulphuric acid on animals generally is precisely the same as that on man. Thrown into the veins of a dog, Orfila found that it coagulated the blood, and caused immediate death.—(*Toxicol. Génér.*)

(c.) *On man.*—Properly diluted and administered in small but repeated doses, sulphuric acid acts as a tonic and refrigerant, like the other mineral acids (see pp. 80, 84, 96). Thus it promotes the appetite, diminishes febrile heat, allays excessive thirst, checks profuse sweating, and, not unfrequently, reduces the frequency of the pulse. Sometimes it increases the secretion of urine, and likewise renders this fluid unusually acid. Under its use the milk frequently acquires a griping quality.

The continued use of it, however, generates a slow kind of gastro-enteritis: heat and pain are experienced in the throat, stomach, and intestines; the digestive functions become disordered; gripings are experienced; sometimes purging, and subsequently fever. Of all the mineral acids, save the phosphoric, this may be administered for the longest period without occasioning the above symptoms.

Concentrated sulphuric acid acts as an energetic caustic poison, promptly disorganizing the different tissues with which it is brought in contact. Its chemical action depends principally on its affinity for

water, so that it chars or carbonizes the parts with which it is placed in contact. But its power of coagulating albuminous liquids, of combining with albumen to form a sulphate of this organic substance, and of dissolving fibrin, as well as coagulated albumen, contribute to its energetic escharotic action on the animal tissues. The parts to which the acid is applied become, in the first place, white; but by the more prolonged action of the poison, they assume a brownish or blackish appearance, so that we can thereby frequently distinguish poisoning by this from poisoning by nitric acid; since this last-mentioned agent produces a yellow colour when applied to the skin. Black spots are frequently observed in the stomachs of those who have swallowed the acid; and in the surrounding parts the blood is usually coagulated in the blood-vessels. Such are the topical chemical effects of this acid. But besides these there are other phenomena of a local nature which may be denominated vital, since they depend on the re-action of the living parts. I refer now to the acute inflammation set up in the tissues in the immediate neighbourhood of those destroyed.

When strong sulphuric acid has been swallowed the symptoms of poisoning are the following:—Alteration, or even destruction, of the soft parts about the mouth; burning pain in the throat, stomach, and bowels; frequently alteration of the voice, from the swelling and disorganization of the parts about the larynx; breath fœtid, from the decomposed tissues; constant and abundant vomiting of matters, which may be bloody or otherwise, but which effervesce by falling on a marble hearth; bowels variously affected, sometimes constipated, though usually purged, the stools being bloody. The constitutional symptoms are principally those arising from a disordered action of the vascular system: thus the pulse is frequent and irregular, feeble, often imperceptible; extremities cold; great febleness, or even fainting, with cold sweats. The same constitutional symptoms are observed when the stomach is wounded or ruptured. One remarkable characteristic is, that the mental faculties are unaffected, even up to a few minutes before death.

USES.—1. *MEDICINAL.* (a.) *Internal.*—In *febrile diseases* it may be administered, largely diluted, as a refrigerant, to diminish thirst and preternatural heat; though, in most of these cases the vegetable acids are to be preferred. In the latter stage of fever (especially the kinds called typhoid) considerable benefit is sometimes gained by the use of a vegetable bitter (as calumba or cinchona) in combination with the diluted sulphuric acid. To assist the appetite and promote digestion, it is administered to patients recovering from fever. To check profuse sweating in pulmonary and other affections, whether phthisical or not, it is sometimes a valuable agent, as I have found on many occasions. No other remedy is so efficacious in relieving colliquative sweatings as this. In *hæmorrhages*, as those from the nose, lungs, stomach, and uterus, it is commonly administered as an astringent, but its efficacy is doubtful. So also in *purpura hæmorrhagica* it is given with the same intention; but though I have several times employed it, I have not observed any evident benefit derived therefrom.

In those forms of *lithiasis* attended with phosphatic sediments in the urine, the use of the mineral acids is at times beneficial. The sulphuric is preferred to the hydrochloric acid, since it can be continued for a longer period without occasioning gastric disorder. In *skin diseases*,

especially lichen and chronic nettle-rash, it is sometimes serviceable. In those forms of *dyspepsia* connected with an alkaline condition of the stomach, as in pyrosis, the sulphuric has been found to succeed better than hydrochloric acid (Dr. R. D. Thomson, *British Annals of Med.* March 31, 1837).

(b.) *External*.—As a local agent, sulphuric acid is employed as a caustic, irritant, or astringent. As a caustic it has no advantage over many other agents, except that which arises from its liquid form, which, in most cases, renders it disadvantageous. For example, the difficulty of localizing it would be an objection to its employment in the production of an issue, but would be an advantage in applying it to wounds caused by rabid animals or poisonous serpents, since the liquidity of the acid enables it to penetrate into all parts of the bites. In entropium, or that disease in which the eyelid is inverted, or turned inwards upon the eye, this acid has been applied as a caustic. In this complaint the friction of the eyelashes on the globe is most distressing, giving rise not only to inflammation, but even ulceration of the cornea. Now, when the disease is permanent, two modes of curing it have been proposed; either to remove a fold of the integument by the knife, so that, by the subsequent cicatrization, the lid may be drawn outwards—or to destroy a portion of the skin by a caustic, as sulphuric acid. The latter plan of treatment has been practised successfully by several eminent oculists, among whom I may name Mr. Guthrie and Mr. Lawrence. So also in ectropium, in which the lid is everted or turned outward, Mr. Guthrie has applied the concentrated acid to the inner side of the everted lid with advantage.

An ointment containing sulphuric acid has been employed as a rubefacient in paralysis, and in the second stage of inflammation of the joints, when the violence of the disease has subsided; as a styptic to wounds, to suppress hæmorrhage from numerous small vessels; and as a cure for scabies. Lastly, this acid, properly diluted, is employed as an astringent gargle in ulcerations of the mouth and throat; but after using it the mouth should be well rinsed, to prevent the action of the acid on the teeth.

2. *PHARMACEUTICAL*.—Sulphuric acid is used in the manufacture of various preparations contained in the Pharmacopœia, as some of the acids, ether, the vegetable alkalies, several salts, &c.

ADMINISTRATION.—For internal use we generally make use of the *diluted sulphuric acid* of the Pharmacopœia, or the *elixir of vitriol*.

1. *ACIDUM SULPHURICUM DILUTUM*.—This compound is prepared by adding, gradually, a fluidounce and a half of sulphuric acid to fourteen fluidounces and a half of distilled water. Condensation ensues, and heat is evolved. Mr. Phillips states, that a fluidrachm of it contains about ten grains of the strong acid, and will saturate 28 grains of crystallized carbonate of soda. The dose of it is from ten to thirty minims diluted with two or three table spoonfuls of some mild liquid. A most convenient preparation of it is the *compound infusion of roses*. It is sometimes given with conserve of roses.

2. *ACIDUM SULPHURICUM AROMATICUM*.—This preparation, which is contained in the Edinburgh, Dublin, and United States Pharmacopœias, is known in the shops as *elixir of vitriol*. The Dublin formula for it is the following:—"Take of rectified spirit two pints, sulphuric

acid (by weight) six ounces. Add the acid to the spirit gradually: digest the mixture in a closed vessel, with an inferior heat, for three days; then add of cinnamon bark (bruised) an ounce and a half, ginger root (bruised) an ounce. Digest the mixture again for six days; and, lastly, filter through paper placed in a glass funnel." An analogous preparation, but containing a much greater number of aromatics, is contained in the French Codex, under the name of *tinctura aromatica sulfurica*. It has been usually supposed that some sulphuric ether was generated in this preparation, but the late Dr. Duncan observes—"I have ascertained that there is no reaction upon the sulphuric acid, at least that not a particle of gas is evolved by the mixture of alcohol and sulphuric acid in the proportions indicated." It is not improbable that some sulphovinic acid may be formed: the evolution of gas is not essential to the formation either of this compound or of ether. Elixir of vitriol is used in the same cases and doses as the dilute sulphuric acid.

3. *UNGUENTUM ACIDI SULPHURICI* (*Ph. Dub.*)—This compound is prepared by mixing, in a glass or earthenware mortar, a drachm of sulphuric acid with an ounce of lard. The mixture is of a slight buff colour. It is a powerful stimulant.

ANTIDOTES.—In cases of poisoning by sulphuric acid, the antidotes are, chalk, whiting, or magnesia suspended in water. In the absence of these, soap-suds, infusion of wood-ashes, weak solutions of the alkaline carbonates, white of eggs, gelatine, milk, oil, or in fact any mild diluent, should be instantly administered. The subsequent treatment is that for gastro-enteritis. External parts burnt with oil of vitriol should be washed with a solution of soap or simple water.

Ac'idum Sulphuro'sum.—*Sulphurous Ac'id.*

HISTORY.—Homer (*Iliad*, xvi.) mentions sulphur fumigations: Stahl, Scheele, and Priestley, were the first to submit this acid to an accurate examination. It has been termed *volatile sulphurous acid*, and, from the old mode of procuring it, *spirit of sulphur by the bell* (*spiritus sulphuris per campanam*).

NATURAL HISTORY.—It escapes from the earth, in a gaseous form, in the neighbourhood of volcanoes.

PREPARATION.—For chemical purposes it is prepared by mixing two parts of mercury with three parts of strong sulphuric acid, applying heat, and collecting over mercury. The results are, the bipersulphate of mercury and sulphurous acid.

For medical purposes, however, it is rarely, if ever, necessary to procure it in this way. By the combustion of sulphur in atmospheric air this gas is readily obtained; and when we are about to employ it, either as a disinfectant or vapour bath, this method is always followed.

PROPERTIES.—At ordinary temperatures and pressures it is a colourless and transparent gas, and has a remarkable and well-known odour. It is neither combustible nor a supporter of combustion. It reddens litmus and bleaches some colouring matters, especially infusion of roses, but the colour is restored by sulphuric acid. It is irrespirable, and has a sp. gr. of 2.2. It readily dissolves in water: recently boiled water takes up 33 times its volume of this gas. By cold and pressure, sulphurous acid gas is readily condensed into a limpid liquid.

CHARACTERISTICS.—This acid is readily known by its peculiar odour (that of burning sulphur). If the puce-coloured or binoxide of lead be added to it, the white protosulphate of lead is formed. An aqueous solution of this acid, mixed with iodic acid, deoxidizes the latter, and sets iodine free, which may be recognized by its producing a blue colour with starch. The sulphates evolve sulphurous acid by the action of strong sulphuric acid.

COMPOSITION.—If 16 parts (by weight) of sulphur be burned in one volume or 16 parts (by weight) of oxygen gas, we obtain one volume or 32 parts (by weight) of sulphurous acid gas.

CONSTITUENTS.

RESULTING COMPOUND.

2 eq. Oxygen = 16

and
1 eq.
Sulphur
= 16.

1 eq. Sulphur- ous Acid = 32.

The composition of this substance may, therefore, be thus expressed:—

	Eq.	Eq. Wt.	Per Cent.	Berzelius.
Sulphur	1	16	50	49.968
Oxygen	2	16	50	50.032
Sulphurous Acid	1	32	100	100.000

PHYSIOLOGICAL EFFECTS. (a.) *On vegetables.*—It is a most powerful poison to plants even in very minute quantities (Christison, *On Poisons*, 3d ed. p. 750).

(b.) *On animals generally.*—The effects on animals have not been examined: but they are probably those of an irritant and an asphyxiating agent.

(c.) *On man.*—Applied to the skin this acid gas causes heat, pain, and itching. If an attempt be made to inhale it in the pure state, it excites spasm of the glottis. Diluted with air it may be taken into the lungs, and there acts as a local irritant, causing cough, heat, and pain.

USES.—It has been used as a disinfectant, as a remedy for the cure of itch, and as a nasal stimulant in syncope.

As a *disinfectant* it is mentioned by Homer. The mode of using it for this purpose is very simple. A pot containing burning sulphur is introduced into the room or place to be fumigated, and the doors and windows carefully closed.

As a *remedy for itch*, baths of sulphurous acid gas are mentioned by Glauber in 1659. They are commonly termed *sulphur baths*, and may be had at most of the bathing establishments of the principal towns of this country. At the Hôpital St. Louis, in Paris, a very complete apparatus for the application of this remedy in diseases of the skin has been erected by D'Arcet. It is a kind of box, inclosing the whole body, with the exception of the head. The sulphur is placed on a heated plate in the lower part of the box. From ten to twenty baths, or even more, are requisite for the cure of itch. "Sulphureous fumigations," says Rayer (*Treatise on Diseases of the Skin*, by Dr. Willis, p. 347), "which are employed in some hospitals, are not attended with expense, leave no unpleasant smell, and do not soil the linen; but the long continuance of the treatment necessary to relieve the disease, more than counterbalances these generally insignificant recommendations." There are various other diseases of the skin in which baths of sulphurous acid have been found more or less successful, such as chronic eczema, lepra, psoriasis, impetigo, and pityriasis. (For further information on this subject, consult

Mémoire et Rapports sur les Fumigations Sulphureuses, par J. C. Galés, 1816: *Observations on Sulphurous Fumigations*, by W. Wallace: *An Essay on Diseases of the Skin*, by Sir A. Clarke).

As a stimulant in syncope or asphyxia this gas has been recommended by Nysten. It is readily applied by holding a burning sulphur match under the nose.

ANTIDOTES.—When sulphurous acid gas has been inhaled, the patient should be made to respire the vapour of ammonia. A few drops of the solution of this substance should be swallowed.

Iodidum Sulphuris.—Iodide of Sulphur.

HISTORY.—This compound was first described by Gay-Lussac (*Ann. de Chimie*, xcl.)

PREPARATION.—It is prepared by heating gently four parts of sulphur with one part of iodine. Part of the iodine volatilizes, and the remainder unites with the sulphur.

PROPERTIES.—It is a black crystallizable compound, having the colour and radiated appearance of sesquisulphuret of antimony. It has the odour of iodine, and stains the cuticle, paper, &c. like this substance. Its elements are easily separated by heat.

COMPOSITION.—Its composition has not been determined. It is probably the following:—

	Eq.	Eq.Wt.	Per Cent.
Iodine	1	126	88.732
Sulphur	1	16	11.267
Iodide of sulphur	1	142	99.999

CHARACTERISTICS.—Boiled in water the iodine volatilizes with the steam, and the sulphur is deposited nearly in a state of purity.

PHYSIOLOGICAL EFFECTS. (a.) *On animals*.—Dr. Cogswell (*Experim. Essay on Iodine and its Compounds*) gave three drachms to a bitch: the animal lost her appetite, was dull, and on the fourth day could not support herself properly upon her legs. On the twelfth day she was well.

(b.) *On man*.—It has not been exhibited internally. It probably operates like iodine. Its local operation is that of a powerful stimulant and resolvent.

USES.—Iodide of sulphur has been principally employed, in the form of ointment, in various skin diseases. In *lupus* it has been found most efficacious by Biett (Cazenove and Schedel, *Abrégé pratiq. sur les Malad. de la Peau*), as well as by Rayer (*Treatise on Diseases of the Skin*, translated by Dr. Willis.) The last mentioned writer places it in the foremost rank of local remedies for this disease. In *acne indurata* and *rosacea* it has proved highly useful in the hands of Biett (*op. cit.*), Rayer (*op. cit.* p. 476), and Dr. Copland (*Dict. of Pract. Med.* art. *Acne*, p. 31). In *lepra*, Rayer has observed good effects from its use; but in one case in which I tried it, it caused so much irritation that its use was obliged to be discontinued. In *herpes pustulosus labialis* it has been employed with great success by Dr. Volmar (Dierbach, *die neuesten Entdeck in d. Mat. Med.* 2^{te}. Aug. 1^{er}. B. S. 449). In *tinea capitis* it has also been recommended (*Med. Gaz.* vol. xx. p. 879.)

Dr. Copland (*op. cit.* art. *Asthma*, p. 149) has employed the inhalation

of the vapour of this substance in humoral asthma with temporary advantage.

ADMINISTRATION.—The *ointment of iodide of sulphur* is composed of iodide of sulphur and lard. The proportions vary according to circumstances: usually from 10 to 30 grains of the iodide to an ounce of lard. Magendie's formulæ are 1 part of iodide to 18 or 19 of lard.

Ammoniacæ Hydrosulphas.—*Hydrosulphate of Ammonia.*

HISTORY AND SYNONYMES.—This compound is said to have been first prepared in the seventeenth century by Boyle or Beguin: hence the terms *Boyle's fuming liquor* and *Beguin's sulphuretted spirit*, applied to one variety of it. The ordinary designation of it is *hydrosulphuret of ammonia*, or *hepatized ammonia*. Berzelius calls it *sulphuret of ammonium*.

NATURAL HISTORY.—It is evolved from decomposing animal matter, as in privies, with hydrosulphuric acid and nitrogen.

PREPARATION.—It is prepared, according to the Edinburgh, Dublin, and United States Pharmacopœias, by passing hydrosulphuric acid gas (sulphuretted hydrogen) into water of ammonia to perfect saturation.

PROPERTIES.—As thus prepared the solution of hydrosulphuret of ammonia is a liquid, having a greenish yellow colour, a very fetid odour, and an acrid disagreeable taste. The mineral acids decompose it, evolve hydrosulphuric acid, and precipitate sulphur. A considerable number of metallic solutions have precipitates produced in them by the addition of hydrosulphate of ammonia. Thus with the salts of lead, bismuth, silver, and copper, the precipitates are blackish; with those of antimony, red; with those of cadmium and tin (persalts), and with the arsenites (on the addition of an acid), yellow; lastly, with the salts of zinc, white. In all these cases the precipitates are sulphurets of the respective metals.

By exposure to the air it attracts oxygen and deposits sulphur: its action on metallic solutions is then considerably modified. For example, if two or three fluidrachms be exposed to the air, in a wine-glass, for a day or two, the solution will then be found to have the property of causing a red precipitate with the salts of lead, yellow with tartar emetic, and white with arsenious acid.

CHARACTERISTICS.—Its odour will readily distinguish it. As a sulphuret or hydrosulphuret it is known by its action on the metallic solutions already noticed. Caustic potash causes the evolution of ammonia.

COMPOSITION.—It is composed of hydrosulphuric acid and ammonia, in the following proportions:—

	Eq.	Eq.Wt.	Per Cent.	Vol.
Hydrosulphuric Acid	1 . . .	17 . . .	50·00	Hydrosulphuric Acid gas 1
Ammonia	1 . . .	17 . . .	50·00	Ammoniacal gas 2
Hydrosulphate of Ammonia	1 . . .	34 . . .	100·00	

The fuming liquor (*liquor fumans Boylei*) obtained by distilling four parts of slacked lime, two of hydrochlorate of ammonia, and one of sul-

phur, contains, according to Gay-Lussac (*Cours de Chimie*, Leçon 20^e), hydrosulphate of ammonia, with excess of sulphur; but in what state of combination has not been determined.

PHYSIOLOGICAL EFFECTS. (a.) *On vegetables*.—The vapour of this compound is injurious to vegetation.

(b.) *On animals*.—I am unacquainted with any experiments made with it on animals; but analogy leads us to believe that its action is that of a powerful poison, analogous to other alkaline sulphurets, and to hydrosulphuric acid.

(c.) *On man*.—In *small but repeated doses* it acts powerfully on the secreting organs, the action of which it promotes, but at the same time modifies. Its principal influence is directed to the skin (on which it acts as a sudorific), and to the pulmonary mucous membrane. In *somewhat larger doses* it occasions nausea and giddiness. In *still larger doses* it causes nausea, vomiting, diminished frequency of pulse, giddiness, extreme languor, drowsiness, and sleep. *Excessive doses* would, of course, produce death, though I am unacquainted with any case of this kind.

In the gaseous state it acts, when inhaled, as a powerfully asphyxiating agent. Instances of its deleterious operation, in conjunction with hydrosulphuric acid, have occurred in France, in workmen exposed to the vapours from the pits of the necessaries. The symptoms are, sudden weakness, insensibility, and death; or where the vapours are less concentrated, there are sometimes delirium and convulsions.

USES.—In this country it has been principally employed in *diabetes mellitus*, with the view of reducing the morbid appetite and increased action of the stomach, as well of the system in general (*Rollo*, on *Diabetes Mellitus*, p. 28, ed. 2nd). Combined with alcohol, F. Hoffmann administered it under the name of *liquor anti-podagricus*, as a powerful sudorific in gout. It has also been used in old pulmonary catarrhs; and by Brauw and Gruithuisen in vesical catarrh (*Vogt*, *Pharmakodyn.*)

ADMINISTRATION.—It is given in doses of from four to six drops, in some proper vehicle (distilled water is the best). On account of its speedy decomposition, it should be dropped from the bottle at the time of using it.

ANTIDOTES.—The antidotes for hydrosulphate of ammonia, as well as for hydrosulphuric acid, are chlorine and the chlorides of lime and soda. In cases of asphyxia by the inhalation of these substances, the treatment consists in placing the patient on his back in the open air, with his head somewhat elevated; applying cold affusion to the face and breast; producing artificial respiration of air, through which chlorine is diffused, by pressing down the ribs and forcing up the diaphragm, and then suddenly removing the pressure; using strong friction in the course of the vertebral column, chest, soles of the feet, &c., and injecting into the stomach, stimulants; as, a weak solution of chlorine (or of chloride of lime) or brandy, &c. In the event of hydrosulphuret of ammonia being by accident swallowed in poisonous doses, dilute solutions of chlorine, or of the chlorides of lime or soda, should be immediately given, and the contents of the stomach removed by the stomach-pump as soon as possible.