from committing so heinous an act? Something at least to prevent the ever-constant increase? The solution of the problem must lie largely in the better care of the insane, and earlier and more scientific treatment of mental diseases. Hospitals properly equipped for the treatment, supervision, and restraint of the mentally weak and infirm, and the disappearance of the popular prejudice against insane asylums, will do much to decrease the number of suicides in this large class.

Legislation.—In epidemic suicide and in alarming increase of the act, it has been found necessary to enforce stringent laws against the bodies, property, and families of the suicide at various periods of the world's history, and at times with some apparent success.

Laws were established in regard to suicide at a very early day. Zeno's motto, which was such a favorite phrase of the Stoics, "*Mori licet cui vivere non placet,*" was found not to have an application to the individual whose act caused injury to others and loss to the state. It was opposed to the teaching of the Bible, which says, "Thou shalt not kill."

Esquirol thinks some threatening law against the individual should be enforced with reference to the social usages of the people of each particular country. He says comminatory laws have caused suicide to cease in Egypt and Miletus.

Legislation, though not powerful to accomplish much, should nevertheless exist. It will undoubtedly deter a few, and this alone will prove its usefulness.

The attempt at suicide is punishable in New York State by five years' imprisonment, according to existing laws recently enacted.

The confiscation of property and denial of the right of burial, formerly practised in France, have of late years been stricken from the Code.

Formerly, in England, the body of a suicide was treated with ignominy, buried in the highway, and transfixed by a stake. When this law was abolished, the body could still only be buried at night and without religious rites. The canons of the Roman Catholic Church still forbid the burial of a suicide in consecrated ground.

The laws of antiquity, severe as they were upon the family, name, and possessions of the individual, had but slight effect in repressing suicide, as would naturally be expected in the case of the insane, who contribute most largely. In some countries the bodies of all suicides are given for dissection.

The public press has it in its power to favor an increase in suicide by publishing, with minute details, descriptions of all suicides, thus exciting depraved tastes, pampering to the vicious, and putting ideas regarding the act into the minds of nervously weak and predisposed persons. Fortunately, this tendency is much less marked than at a former period, but the danger should be constantly pointed out and guarded against when suicides become at all frequent in a community.

Silence is the antidote for this form of nervous, imitative suicide, as Moreau has aptly and truly said.

TREATMENT.—When a tendency to self-destruction has been discovered, moral treatment may be of much benefit. Kindness, cheerful attention, and society, and the assurance of aid and support, may brighten hope. Argument and sympathy have never done good. When an individual threatens to kill himself, the best treatment is probably to tell him to go ahead and do it. This usually results in a cessation of the threats.

Those mentally afflicted should be placed in institutions, and it has been recommended that all having suicidal tendency be placed together, at least at night, and this plan is carried out in many of our institutions. Tonics and sedatives are usually called for, and remedies suited to the physical derangement, whatever that may be.

Charles W. Allen.

Revised by *Samuel W. Abbott.*

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SULFOSOT is a syrup containing about five per cent. each of guaiacol and cresol sulfonates of potassium. These are obtained by treating creosote with concentrated sulphuric acid and combining with potassium. The remedy is used for tuberculosis in dose of 4 c.c. (℥i.).

W. A. Bastedo.

SULPHAMINOL.—An antiseptic formed by the action of sulphur upon certain salts of the aromatic series. In the body it is supposed to decompose into carbolic acid and sulphur compounds. It was introduced for the purpose of replacing iodoform, on account of its active antiseptic action and freedom from odor. It is a pale yellow powder, without taste or odor, insoluble in water but dissolved by the addition of alkalies; it is soluble in alcohol. When subjected to heat it turns brown and melts at about 155° C. The dose for internal administration is four grains three times a day, but it does not appear to have been used to any extent.

Externally, it has been used in all cases in which iodoform is employed.

Beaumont Small.

SULPHIDES.—Sulphides of four metallic bases occur among medicines, namely, sulphides of *mercury, antimony, potassium,* and *calcium.* Of these, the sulphides of mercury and antimony are, medicinally, not specifically peculiar, and will be found discussed under the titles of the several metals. The sulphides of the other two bases exhibit marked properties, evidently due to the sulphur of their composition, and accordingly form a distinct group of medicines. The common characteristics are, physically, an alkaline reaction, a disagreeable smell, and an alkaline and offensive sulphureted taste; physiologically, quite intense, irritant properties, and a special obnoxiousness to animal and vegetable skin parasites; and, therapeutically, a local healing influence over many skin diseases in their chronic stage, and, given internally, an uncertain tendency to abate chronic glandular, or cutaneous, or arthritic disease, and to control or repress suppuration. In full dose too long continued, the compounds tend to impair general nutrition, leading to emaciation and muscular weakness. Following are in detail the pharmaceutical preparations containing the sulphides in question, with their special properties and uses:

POTASSA SULPHURATA: *Sulphurated Potassa.*—This is an official preparation of the United States Pharmacopœia, made by heating in a covered crucible, to melting, a mixture of dried potassium carbonate and sublimed sulphur. The product solidifies upon cooling, and is then broken into pieces and put up in well-stoppered bottles of hard glass. Products obtained by the foregoing general process are commonly called, generically, *hepar sulphuris* (liver of sulphur), the name being expressive of the color. Such products are composite bodies, but the composition varies according to the degree of heat to which the mixture of potassium carbonate and sulphur has been subjected in the preparation. By the comparatively low heat directed in the United States pharmacopœial process, the product is probably a mixture of potassium hyposulphite and trisulphide ($K_2S_2O_3 + 2K_2S_3$). At a higher heat, such as is used in the British pharmacopœial process, the hyposulphite first formed splits into potassium sulphate and pentasulphide. When freshly made, sulphurated potassa appears in irregular, liver-colored lumps, which, on exposure to the air, gradually absorb oxygen, carbon dioxide, and water, and change color to a greenish-yellow. Finally they turn into a gray material containing potassium carbonate, sulphate, and hyposulphite. Liver of sulphur dissolves, all but a small residue, in two parts of cold water. Alcohol dissolves the potassium sulphide, but leaves undissolved the other component substances of the preparation. Sulphurated potassa should contain at least fifty-six per cent. of potassium sulphide. It is decomposed by mineral acids, and by most solutions of metallic salts.

Sulphurated potassa possesses the general properties detailed above; it is violently irritant, even to corrosiveness, and overdosage may easily kill by excessive gastro-intestinal irritation. The medicine is used, locally, to kill parasites, and to favor the healing of skin disease or the abatement of rheumatic or gouty troubles, and, internally, to assist in the two latter-named operations. The parasiticide action is utilized mainly for the destruction of the itch insect, for which purpose this compound is exceedingly efficacious. The preparation is applied locally, in the form of ointment, lotion, or general bath. For an ointment of proper average strength, sulphurated potassa may be mixed with lard in the proportion of six per cent. of the former; for a lotion, an aqueous solution ranging from three to six per cent. in strength may be used; and, for a bath, about 125 gm. (four ounces) may be dissolved in about 120 litres of water (about 30 gallons). Concentrated applications never should be made, because of the sharp irritation which would result. Baths containing sulphurated potassa (commonly spoken of as *sulphur baths*), besides their foregoing use, are sometimes employed in the treatment of chronic lead-poisoning, because of the finding that patients suffering from lead contamination show upon their skins, after immersion in a sulphur bath, a dark discoloration, as from the forming there of lead sulphide. The inference is that the sulphur in some mysterious way coaxes the lead out of the system through the skin emunctories, in order to satisfy its chemical longing for a union with the metal. Sulphur baths are administered warm or hot, and of a duration from half an hour to two or three hours. They are apt, particularly when protracted, to produce a good deal of irritation of the skin, even to the development of a papular or vesicular eruption. These baths should be prepared in wooden tubs. For internal giving, the dose of sulphurated potassa ranges from 0.12 to 0.40 gm. (two to six grains), several times a day, given in pill or in some aromatized syrup.

CALX SULPHURATA: *Sulphurated Lime.*—The preparation thus named in the United States Pharmacopœia is what is commonly, but incorrectly, called *sulphide of calcium.* It is a mixture in varying proportions of calcium sulphide, calcium sulphate, and carbon, but should contain at least sixty per cent. of calcium sulphide—the salt which gives the substance its medicinal activity. Sulphurated lime is made, by the process directed in the United States Pharmacopœia, by heating to a bright red heat in a closed crucible a mixure of dried calcium sulphate, charcoal, and starch. The product, after cooling, is pulverized, and at once put up in small glass-stoppered vials. It appears as a grayish-white or yellowish-white powder, which slowly decomposes on exposure to the air. It has a faint odor of hydrogen sulphide, and an offensive and alkaline taste. It is alkaline in reaction, is very slightly soluble in water, and insoluble in alcohol.

Sulphurated lime, like sulphurated potassa, has the general properties of the alkaline sulphides, as already detailed. It is powerfully irritant, even medicinal doses being apt to upset the stomach. And it is a disagreeable medicine for internal taking, also, because of its giving rise to eructations of sulphureted gases. The preparation has been used, locally, principally as a depilatory. For this purpose it is applied in powder, and, after fifteen minutes, the part is wiped with a wet sponge. Medicine and hairs then come away together. Internally, sulphurated lime has acquired a certain reputation as tending to control suppurations, the discharge lessening in quantity and offensive pus acquiring a better character under the medication. Given between times in recurring suppurations, as in recurring crops of boils, it is also held to abate the frequency and severity of the attacks. The dose of sulphurated lime ranges from 0.003 to 0.006 gm. (gr. $\frac{1}{20}$ to gr. $\frac{1}{10}$), several times a day, or even hourly, given most conveniently in trituration with sugar of milk.

Edward Curtis.

SULPHITES AND "HYPOSULPHITES" (Thiosulphates).—I. GENERAL MEDICINAL PROPERTIES OF SULPHITES AND "HYPOSULPHITES."—A number of sulphites and "hyposulphites" are used in medicine because of a virtue which they are considered to derive, in common, from their acid radicals, and accordingly such salts form a distinct group of medicines, which it is convenient to discuss under a single heading. The class characteristics are as follows: The salts are soluble in water, have a combined saline and sulphurous flavor, and are, in physiological operation, locally bland and constitutionally innocuous. From a medicinal point of view, their most important reaction is that in the presence of stronger acids they are decomposed, with the evolution of sulphurous acid. Given medicinally, they are thought to undergo this change in the stomach through the agency of the free acid of the gastric juice. The decomposition is said to be slower with "hyposulphites" than with sulphites. As a secondary result of the chemical change, sulphates are formed, such being the combination in which the base reappears in the urine when a sulphite or "hyposulphite" is swallowed in ordinary dosage. Medicinally, these salts are employed with the single view of obtaining by their means the germicide and antiseptic action of sulphurous acid. But in this connection it must carefully be borne in mind that sulphites and "hyposulphites," while maintaining their chemical composition as such, have been proved experimentally to be practically devoid of either germicide or antiseptic power.[1] They can, therefore, even theoretically, be of avail in this line only under circumstances determining their decomposition and the evolution thereby of sulphurous acid. Such reaction may take place in the stomach, but is seemingly impossible in the blood, and with the inference naturally following from these premises clinical experience is in accord. For these salts have been vaunted in the treatment of pyrosis and sarcinæ, and their employment has proved fairly efficacious; but they have been even more strenuously advocated for the treatment of constitutional diseases assumed to be caused by infection of living organisms (Polli), and have, in the

hands of the majority of the profession at least, signally failed. The salts have also been used, with variously reported success, as lotions for the cure of parasitic skin disease, or for the abatement of the pain of chilblains, sprains, etc.—applications in which it is certainly doubtful if they exert any specific influence.

II. The Sulphites and "Hyposulphites" Used in Medicine.—The salts of this category are the normal and acid sulphite, respectively, of *sodium*, and the normal thiosulphate of *sodium* (commonly called *hyposulphite*).

Normal Sodium Sulphite, $Na_2SO_3.7H_2O$.—The salt is official in the United States Pharmacopœia as *Sodii Sulphis*, Sodium Sulphite. It occurs in colorless, transparent, monoclinic prisms, which effloresce in dry air. It is odorless, with a cooling, salty, and sulphurous taste. It dissolves in 4 parts of cold water and in 0.9 part of boiling water. It is sparingly soluble, only, in alcohol. The salt should be kept in well-stoppered bottles in a cool place.

Sodium sulphite may be used locally in twelve-per-cent. aqueous solution, and may be given internally in doses ranging from 1 to 4 gm. (gr. xv. to gr. lx.) three or four times a day.

Acid Sodium Sulphite, $NaHSO_3$.—The salt is official in the United States Pharmacopœia as *Sodii Bisulphis*, Sodium Bisulphite. It occurs in opaque, prismatic crystals, or a crystalline or granular powder, and on exposure to air slowly oxidizes and becomes the sulphate. The salt has an odor of sulphur dioxide and a disagreeable, sulphurous taste. It dissolves in 4 parts of cold water and in 2 parts of boiling water, in 72 parts of cold alcohol, and in 49 parts of boiling alcohol. It should be kept in small vials, well-stoppered and well-filled.

This sulphite is less stable than the normal sodium salt, and more disagreeable to taste. In other respects it is similar.

Normal Sodium Thiosulphate ("Hyposulphite"), $Na_2S_2O_3.5H_2O$.—The salt is official in the United States Pharmacopœia under its former chemical title of *Sodii Hyposulphis*, Sodium Hyposulphite. The present confusion in the use of the term *hyposulphite* arises from the fact that before the discovery by Schützenberger of what is now, and properly, called hyposulphurous acid—namely, the body H_2SO_2—the name in question was applied to thiosulphuric acid ($H_2S_2O_3$). Hence it comes about that though a true sodium hyposulphite is known, the salt that passes current by that name is not a hyposulphite, but a thiosulphate. The old title, however, is so firmly fixed by long and popular usage that it has been retained by the United States Pharmacopœia, and is the title by which the salt is universally known as a medicine. Sodium "hyposulphite" occurs as large, colorless, transparent, monoclinic prisms, or plates, which effloresce in dry air of a higher temperature than 33° C. (91.4° F.). It is odorless, with a cooling, bitter, and somewhat sulphurous taste. It dissolves in 0.65 part of cold water and in about 0.5 part of water at temperature 20° C. (68° F.). In boiling water it decomposes rapidly. It is insoluble in alcohol. It should be kept in well-stoppered bottles.

Sodium "hyposulphite" is more stable than the sulphites, undergoing decomposition by acids less easily. In properties, uses, and modes of administration it resembles sodium sulphite. The internal dose is generally from 1 to 1.30 gm. (gr. xv. to gr. xx.).

Besides the foregoing, potassium sulphite and magnesium sulphite have been used in medicine, but are out of vogue and not now official in the United States Pharmacopœia. They are, medicinally, duplicates of the sodium salts.

Edward Curtis.

[1] Sternberg: American Journal of the Medical Sciences, April, 1883, p. 321.

SULPHOCARBOLATES—*Phenolsulphonates.*—Carbolic acid (*phenol*), added to strong sulphuric acid, dissolves with the formation of the acid body, $C_6H_4(OH).SO_3H$, termed *phenolsulphonic acid* by the chemist, but commonly known as *sulphocarbolic acid*. Sulphocarbolic acid unites with bases to the formation of salts, and in these salts it was hoped there might be found substances which would retain the therapeutic powers of carbolic acid while free from the poisonous properties of that body. So far as observation has gone, however, this hope does not seem to have been realized. A single salt of sulphocarbolic acid is official in the United States Pharmacopœia, as follows:

Sodii Sulphocarbolas, *Sodium Sulphocarbolate*, $NaSO_3C_6H_4(OH)$.—This salt occurs in colorless, transparent, rhombic prisms, which effloresce somewhat in dry air. It is odorless, with a cooling, saline, and bitterish taste. It dissolves in 4.8 parts of cold water, and readily in boiling water. It dissolves in 132 parts of cold alcohol and in 10 parts of boiling alcohol.

Sodium sulphocarbolate is a bland salt, producing but little constitutional disturbance in ordinary medicinal doses beyond some lightness of the head. It has been prescribed in doses ranging from 0.65 to 2 gm. (from gr. x. to xxx.) for the purpose of constitutional antisepsis in so-called zymotic diseases, but without striking results.

Edward Curtis.

SULPHOCYANIDES (*Rhodanides, Thiocyanates*).—The sulphocyanides, or salts of sulphocyanic acid (CNSH), are of interest in medical science chiefly from the fact of their occurrence in certain of the secretions and excretions of the animal body. Even before the discovery of sulphocyanic acid, Treviranus noted the red coloration which results when human saliva is mixed with a solution of ferric chloride; but Tiedemann and Gmelin first correctly attributed the reaction to the presence of a sulphocyanide. Their experiments further indicated the possibility of finding sulphocyanide in the urine, in which its normal occurrence was subsequently investigated by Gscheidlen, Külz, I. Munk, and Bruylants.

The observations of F. Krüger have demonstrated, in contrast to those of some earlier investigators, that sulphocyanides are almost constantly present in the saliva of man, although the quantity involved is subject to considerable variation. With this the experience of Schneider and of the writer fully agrees. The latter found an average sulphocyanide content of 0.007 per cent. (as KSCN) in mixed human saliva. Notable is the fact that the content of sulphocyanide is decidedly higher in the case of smokers, contrasted with non-smokers, while it is independent of age, sex, or the state of preservation of the teeth. Claude Bernard was the first to call attention to the pronounced difference just referred to, but he failed to appreciate the true cause in attributing it to the presence of nicotin from the tobacco. A post-secretory formation of sulphocyanide in saliva has also failed of proof. The following data, collected under the writer's direction from observations on two hundred and twenty-nine individuals, give an indication of the average difference between the saliva of smokers and that of non-smokers:

Sulphocyanide Reaction in Human Saliva (Schneider).

	Smokers, per cent.	Non-smokers, per cent.
Traces (less than 0.0016 per cent.) in....	1	23
Weak reaction (0.0016–0.008 per cent.) in	23	72
Strong reaction (more than 0.008 per cent.) in.....	76	5

Our observations completely confirm those of Krüger, who found 0.0117 per cent. of KSCN in the combined saliva of a number of smokers, and only 0.0041 per cent. in the secretion of an equal number of non-smokers. No quantitative variations from these results were obtained with saliva from women and children. The excretion of sulphocyanide may be considerably diminished by prolonged stimulation of the salivary glands. For example, in one case when the flow of saliva was continuously

provoked by chewing a piece of soft paraffin for three hours, it diminished as follows: At 8:15 o'clock the saliva contained approximately 0.004 per cent. (KSCN); at 10 o'clock, approximately 0.003 per cent. (KSCN); at 11 o'clock, approximately 0.002 per cent. (KSCN); at 12 o'clock, approximately 0.002 per cent. (KSCN). No constant relationship between the content of sulphocyanide and the composition of the saliva has been ascertained.

The parotid saliva of man has uniformly been found to be richer in sulphocyanide than the submaxillary saliva collected from the same individual at the same time. The two corresponding glands (right and left) usually afford reactions of like intensity. The difference between smokers and non-smokers is found to hold good for the individual glands also, as the following data from Schneider indicate:

Comparison of the Sulphocyanide Reaction of the Parotid and Submaxillary Salivas.

HSCN reaction.	Smokers.		Non-smokers.	
	Parotid saliva.	Submaxillary saliva.	Parotid saliva.	Submaxillary saliva.
Trace.....	None.	4	2	19
Weak.....	4	13	22	5
Strong.....	24	11	None.	None.

Regarding the origin of sulphocyanides in the organism little is known. Since they contain Nitrogen and Sulphur, they have been assumed to arise from the metabolism of proteids. Various attempts have been made to establish some clinical significance for the variations in the sulphocyanide output (Fenwick, Grober, Muck). Thus Grober states that of one hundred patients in the Jena medical clinic, sixty who yielded weaker sulphocyanide reactions in their saliva were more ill in general than the remaining forty with whom stronger reactions were obtained. He concluded from these observations that the excretion of KSCN is presumably dependent upon the extent to which proteid utilization and katabolism proceed in the organism; that, since these processes are diminished in cachectic patients with severe chronic illness, the excretion of sulphocyanide which is derived ultimately from proteids must be slight or wanting. An exhaustive systematic study of this subject is necessary before any deductions of importance can be made.

According to Ellenberger and Hofmeister, sulphocyanides are missing in the saliva of the horse, ox, sheep, goat, and pig. Whether they occur in the saliva of the dog is doubtful (Munk). Nencki has succeeded in isolating sulphocyanic acid from the gastric juice (obtained free from contamination with saliva) from the dog and cat. The quantity was estimated at 5 mgm. per litre. In the pancreatic juice, muscle, and liver of the dog none could be detected. With blood positive results have been obtained (Nencki, Gscheidlen, Bruylants). Wróblewski has shown that sulphocyanic acid retards the action of pepsin and rennin in artificial digestions.

Sulphocyanides have been detected in the urine of the dog, cat, rabbit, horse, and cow. The quantity found in human urine is given by various investigators at 0.003–0.035 gm. per litre, thus yielding about one-third of the so-called "neutral" sulphur of the urine. According to Bruylants, sulphocyanide occurs only in the urine of those species which excrete their Nitrogen in the form of urea; in birds and reptiles it is wanting.

In cow's milk Musso has estimated a minimum of 0.0021 and a maximum of 0.0046 sulphocyanide (as NaSCN) per litre. Whether the compound arises within the cells of the mammary gland, or is merely secreted directly from the blood as a preformed product, is left undecided.

Muck has demonstrated the presence of sulphocyanide in the fluid which bathes the conjunctiva, as well as in the secretion from the nasal mucosa. He obtained the reaction in individuals with catarrhal as well as healthy membranes, and observed that its intensity varied with that of the saliva.

The antiseptic value attributed to the sulphocyanide in the saliva has no experimental justification. Even relatively strong solutions possess little bactericidal power (Nicolas and Dubief, Treupel and Edinger). Sodium sulphocyanide has been administered to rabbits for months without producing unfavorable symptoms, thus contrasting with the corresponding toxic cyanide. Cyanogen compounds may be transformed in the body into sulphocyanides, the latter being a synthetic product formed from the ingested cyanogen radical and the SH group of decomposed proteid (Lang). The reaction is a purely chemical one, apparently not dependent on the living tissue (Paschelcs). Administration of a thiosulphate (or sulphide) may greatly diminish the toxicity of a cyanide, owing to the formation of the comparatively harmless sulphocyanide, thus:

$$NaCN + SO_2\diagup\!\!\diagdown\begin{matrix}SNa\\ ONa\end{matrix} + O = NaSCN + Na_2SO_4.$$

On the basis of this theory the intravenous injection of sodium sulphide has been advised in poisoning with prussic acid and cyanides; and animals seem to survive an otherwise lethal dose when this is done.

Sulphocyanides introduced directly into the organism are excreted again unchanged. The path of excretion lies through the kidneys, and several days usually intervene until the salt is completely eliminated. This is well shown in the experiments of Pollak, from which the following table is constructed:

Excretion of Sulphocyanides.

Animal.	Substance introduced.	Quantity eliminated in urine.	Duration of elimination.
Dog, 6,350 gm.	1.268 gm. NaCNS subcutan.	1.189 gm.	Four days.
Dog, 6,350 gm.	1.440 gm. NaCNS subcutan.	1.482 gm.	Four days.
Dog, 8,970 gm.	.907 gm. NaCNS subcutan.	.904 gm.	Five days.
Dog, 8,970 gm.	1.012 gm. NaCNS per os....	1.038 gm.	Five days.
Dog, 7,800 gm.	.510 gm. $(NH_4)CNS$ subcutan.	.49 gm.	Five days.
Rabbit 1,420 gm.	.220 gm. NaCNS subcutan.	.206 gm.	Nine days.
Man.....	2.200 gm. NaCNS per os....	2.167 gm.	Six days.

Of the various tests which have been proposed for the detection of sulphocyanides in animal fluids, the *ferric chloride reaction* is most commonly used. Thus if a few cubic centimetres of saliva are slightly acidified with hydrochloric acid and then treated with a very dilute solution of ferric chloride, a red color develops in the presence of the sulphocyanide. Occasionally it is necessary to concentrate the saliva before trying the reaction. Gscheidlen recommended the use of filter paper which has been dipped in a very dilute acidified solution of ferric chloride and allowed to dry. The amber-colored test paper takes on a reddish stain when a drop of saliva is applied to it. Solera suggested the use of *iodic acid* in the presence of starch paste. Iodine is liberated by the sulphocyanide and reacts with the starch to form the characteristic blue compound. This reaction is exceedingly delicate. Krüger has introduced the use of test papers prepared as follows: Filter paper of good quality is saturated with a half-per-cent. starch paste containing a little pure iodic acid in solution, and is then dried in the air. When carefully prepared, this test paper responds readily to very small quantities of sulphocyanide by giving a blue coloration due to the liberation of iodine; and with proper precautions the reagent papers can be preserved without decomposition for a considerable time.

In testing for, or estimating sulphocyanides in the urine, special precautions are necessary; and these must be ascertained from appropriate handbooks, such as Huppert's "Analyse des Harns." The quantitative determination of sulphocyanic acid in the saliva may be carried out by Munk's method:

A known weight of saliva is evaporated to dryness, and an alcoholic solution of the dry residue is made; this

is evaporated to dryness, dissolved in water, and the clear solution is precipitated by means of silver nitrate and nitric acid; the precipitate is washed, collected on a filter, and dried at 100° C.; it is then ignited in a silver dish, with pure sodium hydrate and potassium nitrate. The fusion products are dissolved in water, and the solution is treated with hydrochloric acid and barium chloride, to precipitate the sulphuric acid formed by the oxidation of the sulphocyanic acid. From the weight of the barium sulphate precipitate the amount of sulphur originally present in the sulphocyanide is then calculated. *Lafayette B. Mendel.*

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SULPHONAL. — (*Dimethyl-methane-diethyl-sulphone*) $(CH_3)_2C(SO_2C_2H_5)_2$. Sulphonal was not placed in the Pharmacopœia on account of its being a proprietary article. It is official in the British Pharmacopœia as "a product of the oxidation of mercaptol, obtained by the oxidation of acetone and mercaptan." It forms in colorless, odorless, and nearly tasteless prismatic crystals; soluble in 450 parts of cold water and 15 parts of boiling water. It is soluble in 50 parts of alcohol.

Professor Kast introduced it in 1888 as an hypnotic, and it has proved so efficacious that it is now recognized as one of the best drugs we possess for that purpose. It is purely a soporific, and is rarely employed for any other purpose than to procure sleep. It does not influence the body temperature, it has no antiseptic qualities, and as an analgesic is of no practical value. Unlike other narcotics, it has no period of excitement, does not check or alter the secretions or derange the digestive organs, and is almost without any influence upon the heart or circulation. Devoid of these many disadvantages, its success as an hypnotic is readily understood.

The action of sulphonal is directed to the central nervous system as a sedative, inducing a quiet and calm sleep from which the patient awakens refreshed. In the case of animals, when excessive doses are given the sleep deepens into coma, convulsions, and paralysis. Its sedative action extends to the spinal cord, lessening reflex action. In animals the loss of power in the hind limbs may be an early symptom. After absorption sulphonal is decomposed in the system and excreted in the urine in the form of sulphur compounds. Some observers have reported the presence of pure sulphonal in the urine after its free administration. At times sulphonal proves irritating to the kidney, causing lessened secretion and pain. It may also give rise to a peculiar reddish-brown discoloration due to the presence of *hæmatoporphyrine*, which may terminate in death (*British Medical Journal*, 1901, i., p. 1473).

Sulphonal has proved of greatest service where the insomnia is of purely nervous origin, as in neurasthenia, mental depression, overwork, and worry, and has found a field of great usefulness in the various forms of mental disease. When pain is the cause of the sleeplessness, its good effects are greatly modified, but in many forms of neuralgia and pain of a reflex character it may be used with success. Where pain is due to organic disease it has no influence whatever. In the insomnia of acute and chronic disease, and during convalescence from disease, it is of much benefit, but requires to be given with some caution, particularly when there is much debility or prostration, and in the aged. In the sleeplessness of cardiac disease and of other forms of organic or mechanical derangement, it is not of much use. In delirium tremens it has been much used, in many instances with benefit, but in these cases the effect is uncertain, and the dose required is excessive and approaching the limit of its physiological action.

As an hypnotic, the dose is from fifteen to thirty grains. It is usual to commence with fifteen grains and increase the quantity until the proper effect is produced. Ten grains will often be sufficient in the aged and debilitated, or where the insomnia is of a mild degree. Under ordinary conditions thirty grains is a perfectly safe dose, and this quantity is usually required to produce its full hypnotic action. On account of its insolubility the action is slow, and the dose should be administered at least one hour before bedtime in hot solution. Six or eight ounces of boiling water are recommended to dissolve thirty grains. Hot milk and broth may also be made use of; tea and coffee are frequently used, but they undoubtedly, to a certain extent, counteract its effect. It may also be administered in alcohol or any spirituous liquor.

The sedative action of sulphonal on the spinal cord and nerve centres has led to its use in some nervous troubles. In chorea it has been given to children in doses of from two to five grains, and has been followed by a fair percentage of successes. In old-standing cases it has little or no influence.

It is now fully recognized that sulphonal is not without its toxic action, and numerous fatal cases have followed its employment. The simplest symptoms that may arise include drowsiness and stupor, giddiness, vertigo, ataxia of the tongue and muscles of the throat and face, and of the extremities. These symptoms gradually disappear after an interval of from ten to twelve hours, without leaving any ill effects. The more severe symptoms are profound coma, muscular twitchings, paralysis of sphincters, hallucinations, delirium, anuria, great prostration.

An erythematous patch is often produced, accompanied by itchiness and pain. The symptoms of toxic action generally appear after large doses, or after repeating an ordinary dose of thirty grains several times. In some instances, when the patient is debilitated and the subject of some wasting disease, very small doses may be followed by toxic symptoms. It has been remarked that poisonous symptoms are much more frequent in females.

The fatal cases that have been reported were due to overdoses or to the prolonged use of the drug.

In one case (*British Med. Journal*, October 25th, 1890) the patient was supposed to have taken about an ounce of sulphonal. The stupor which followed deepened into

insensibility and anæsthesia, the pupils remaining normal and acting to light, while the conjunctiva was insensitive. Breathing was natural, pulse very slightly disturbed, but the temperature ranged between 100° and 103° F. A profuse perspiration bathed the body, and there was total suppression of urine after the first day. On the third day the breathing suddenly became short and jerky and ceased altogether. Another case is reported (*Medical News*, August 10th, 1890) in which two doses of fifteen grains, given within an hour and a quarter of each other, caused death. The patient was a young insane woman who had formerly been given large quantities of chloral and other hypnotics. No medicine had been given on the day she took the sulphonal. She slept quietly all night, and on the following day was drowsy, but could be roused and made to talk rationally; sleep at once came on when she was left alone. The pulse and respiration were slightly accelerated and the pupils normal. Eighteen hours after taking the medicine the pupils began to contract and her temperature rose to 102° F.; in forty hours cyanosis began, and she died from failure of respiration.

Lépine (*La Semaine médicale*, January 20th, 1893) has collected a series of thirteen cases terminating in death. These patients had taken the drug for periods varying from sixty to over a hundred days in ordinary doses. Severe symptoms suddenly supervened, which would indicate a cumulative action, and death followed within a few days, although the medicine was stopped at once. In some instances very large doses have been taken without causing death; in one case four hundred and sixty-three grains were recovered from after one hundred and fourteen hours' sleep (London *Lancet*, 1889, i., 915). See also *Synthetic Products, Poisoning by.*

Beaumont Small.

SULPHO-PARALDEHYDE, tri-thialdehyde $(C_4H_4S_2)_3$, occurs in crystals, is soluble in alcohol and insoluble in water, and is used in dose of 1–4 gm. (gr. xv.–℥ i.) as a hypnotic. *W. A. Bastedo.*

SULPHO-SALINE SPRING.—Hamilton County, Ohio.

POST-OFFICE.—Cincinnati.

ACCESS.—By Elm Street cars to Henry Street, thence one block west.

This well is 2,408 feet in depth and flows in an abundant and continuous stream at a temperature of 62° F. An analysis by Professor Wayne, of Cincinnati, shows the following ingredients: One United States gallon contains (solids): Magnesium carbonate, gr. 9.13; calcium carbonate, gr. 19.34; calcium sulphate, gr. 29.20; potassium sulphate, gr. 2.30; sodium phosphate, gr. 1.34; sodium chloride, gr. 534.77; magnesium chloride, gr. 17.27; calcium chloride, gr. 22.19; potassium chloride, gr. 3.95; magnesium bromide, gr. 0.39; magnesium iodide, gr. 0.30; iron oxide, gr. 0.43; silica, gr. 0.79; loss, gr. 0.76. Total, 642.16 grains. This analysis shows the presence in considerable amounts of valuable ingredients. The water is well adapted for the treatment of portal congestion, hemorrhoids, metallic poisoning, etc. In the form of baths it is useful in many of the chronic skin affections and in advanced syphilis. A very elegant and elaborate bath-house has been fitted up and supplied with all the modern appurtenances of such an establishment. *James K. Crook.*

SULPHUR.—Sulphur is used in medicine in the condition of fine powder, three styles of which are official in the United States Pharmacopœia, as follows:

SULPHUR SUBLIMATUM, *Sublimed Sulphur.*—This preparation, commonly called *flowers of sulphur*, is crude sulphur purified by distillation in an apparatus so arranged that the vaporized sulphur shall condense in the form of a powder upon the walls of the receiving chamber. Sublimed sulphur is a fine, citron-yellow powder, of a slight, characteristic odor, and generally of a faintly acid taste and an acid reaction. It is insoluble in water or alcohol. When ignited, it burns with a blue flame, forming sulphur dioxide gas. Sublimed sulphur always contains a little sulphuric acid, whereby it is unfitted for internal medicinal use.

Sulphur Lotum, Washed Sulphur.—This preparation is simply sublimed sulphur freed from contaminating sulphuric acid. The sulphur is digested for three days with diluted ammonia water, by which process the sulphuric acid is fixed as ammonium sulphate, and the mass is then thoroughly washed with water upon a muslin strainer. The ammonium sulphate is thus washed away, and the purified sulphur is finally dried at a gentle heat, and passed through a No. 30 sieve. Washed sulphur is a fine, citron-yellow powder, odorless and almost tasteless, insoluble in water or alcohol. When derived from a sulphur originally obtained from metallic sulphides, washed sulphur may contain the very dangerously contaminating substance, arsenic, in the form of the trioxide or trisulphide of that element. Proof of absence of arsenic is afforded by digesting a sample of washed sulphur with two parts of ammonia, filtering, and finding the filtrate unaffected by supersaturation with hydrochloric acid, and not precipitated by passing through it a stream of hydrogen sulphide.

SULPHUR PRECIPITATUM, *Precipitated Sulphur.*—This preparation, formerly known as *milk of sulphur*, is an exceedingly fine powder of sulphur, gotten by precipitating with diluted hydrochloric acid a solution of sulphur salts of calcium, obtained by mixing sublimed sulphur and slaked lime with water. The sulphur, after precipitation, is collected upon a strainer, thoroughly washed with water, and dried at a gentle heat. Precipitated sulphur is a very fine, yellowish-white, amorphous powder, odorless and almost tasteless, insoluble in water or in alcohol. Precipitated sulphur should stand the same tests for absence of free acid and of contaminating arsenic as washed sulphur (see above). This variety of sulphur powder differs from the foregoing in being lighter in color and of finer particles. From the latter fact it derives the advantages of greater smoothness and readiness of mixing with fluids; but, to offset, it has the disadvantage of tending to develop an acid upon keeping.

Sulphur is insoluble in water and practically so in alcohol, but dissolves in varying proportions in solutions of the alkalies and in oils, fixed and volatile. Because of its insolubility in aqueous fluids, sulphur is practically devoid of physiological activity while under its own form, but, when rubbed in ointment upon the skin or when taken internally, a feebly irritant action appears, presumably due to a sulphide formed in small quantity by the chemicals present in the secretions of the part. What little of an internally taken dose of sulphur is absorbed is also probably in the condition of a sulphide, and the constitutional effects that follow are a feeble reflex of those of the alkaline sulphides (see *Sulphides*). In single, considerable dose the local irritation displayed by sulphur determines increased intestinal activity, showing itself by relaxation of the bowels, but this with but little increase of secretion. The stools are therefore generally composed of solid or semisolid fecal matter, and the operation of the medicine is mild and slow, the call to stool rarely occurring until from six to eight hours after the taking of the sulphur. If habitually used as a laxative, sulphur may induce a low catarrh of the alimentary tract. A disagreeable feature of its internal taking for any purpose is the tendency to the generation of flatus, offensive from the presence of sulphureted gases.

The therapeutic applications of sulphur are as follows: By some it is given internally as a means of getting the constitutional effects of the sulphides in constitutional diseases, but by the majority of practitioners the internal use is in laxative dose only, for a laxative effect. Such dose is from 4 to 12 gm. (℥ i.–iij.), the washed or precipitated preparations being selected, and the powder mixed with molasses or diffused in milk for the taking. Externally, ointments containing sulphur are a good deal used