soluble only in one thousand parts of cold water, but freely soluble in boiling water. It is only slightly soluble in alcohol. It melts at a temperature of 222° F., but becomes solid again at 226° F., and melts a second time at 335° F. Phloridzin is very similar to salicin, and heated with potash it yields phloretic acid, which is homologous with salicylic and anisic acids.

It has been employed as an antipyretic in doses of fifteen to thirty grains, but is not now used.

Phloridzin is utilized in physiological research, as it has been found to induce artificial diabetes. When given to the extent of eight grains per pound of body weight it causes polyuria and an excretion of sugar which continues for twenty-four or thirty hours, and is not influenced by diet. It sometimes produces diarrhœa, but no other ill effect has been detected, unless the drug is administered for a prolonged period, when marked emaciation and debility supervene. Phloridzin acts directly upon the renal epithelium, permitting the escape of sugar from the blood and lessening the amount of sugar held in solution in the blood. *Beaumont Small.*

PHONATION. See *Larynx, Physiology of the.*

PHOSOTE—creosote phosphate—is a colorless syrupy liquid, containing eighty per cent. of creosote, but with only a slight odor and taste of this substance. It is employed in tuberculosis as an easily borne form of creosote, and is given in dose of 0.7–1.3 gm. (gr. x.–xx.) three times a day. *W. A. Bastedo.*

PHOSPHATOL is a thick, reddish-yellow liquid prepared by the action of phosphorus trichloride on creosote in alcoholic soda solution. It has a burning taste, is slightly soluble in water, and is readily soluble in alcohol and oil. It can be given in milk or wine or in capsule in the same dosage as creosote. *W. A. Bastedo.*

PHOSPHORIC ACID.—By *phosphoric acid* is signified, in medicine, a solution of common or orthophosphoric acid (H_3PO_4) in water. Two grades of strength of such solution are official in the United States Pharmacopœia, as follows:

Acidum Phosphoricum, Phosphoric Acid. This preparation represents eighty-five per cent., by weight, of orthophosphoric acid and fifteen per cent. of water. It is a colorless fluid, without odor, but with a strongly acid taste. Its specific gravity is 1.710. It mixes in all proportions with water or alcohol. It should be preserved in glass-stoppered bottles.

Phosphoric acid is intensely acid and irritant, but does not immediately corrode living tissues and coagulate albumin, as do the majority of the strong mineral acids. In any considerable quantity, however, this grade of the acid would prove a sharp, and very likely fatal, irritant poison if swallowed without dilution. This strength of acid is rarely prescribed in medicine, being official simply as a convenient solution to be kept in stock by the druggist for the making of the following, the commonly prescribed preparation:

Acidum Phosphoricum Dilutum, Diluted Phosphoric Acid. This grade of the acid is compounded by mixing one part, by weight, of the foregoing strong acid with seven and a half parts of distilled water. The solution thus contains ten per cent. of orthophosphoric acid, and has the specific gravity 1.057. This acid resembles in general properties the other diluted mineral acids (see *Sulphuric Acid*), but is distinguished by having a pleasanter flavor (its acidity resembling that of the fruit acids) and by being, as a rule, better borne by the stomach than its congeners. It may, therefore, be used for the common purposes of the mineral acids, to allay thirst, improve digestion, repress tendencies to sour fermentation of the contents of stomach or bowels, and to check morbid sweating. By many it is further claimed that phosphoric acid, ingested, tends to revive an exhausted nervous system, to excite the sexual function, and generally to enhance nervous activity and power. By such claimants the acid is regarded as the therapeutic equivalent of uncombined phosphorus; but certainly it fails in that most pronounced therapeusis of free phosphorus, the frequent cure of neuralgia. A special claim for phosphoric acid, of capability to lessen the excretion of sugar in diabetes, is now probably pretty generally abandoned. Diluted phosphoric acid may be given in doses of from twenty drops to a teaspoonful or more, three times a day, the dose to be largely diluted with water, or with syrup and water. The precaution obtaining with the giving of other mineral acids, of taking the draught through a tube and rinsing the mouth after the swallowing, need not be insisted upon in the case of this acid.

Edward Curtis.

PHOSPHORIDROSIS.—Luminous sweating is a decidedly rare affection. Cases have been reported in which this curious phenomenon was observed after the ingestion of phosphorus and the eating of phosphorescent fish. It is probable that the phosphorescence is due to bacilli; for several species of photobacteria have been found, most of them being derived from fish.

Charles Townshend Dade.

PHOSPHORUS.—Phosphorus is available for medicinal purposes in the form of the element itself, or as it occurs in the special compound *zinc phosphide*, a compound that readily yields free phosphorus upon swallowing, under the conditions present in the stomach. Phosphorus is official in the United States Pharmacopœia under the title *Phosphorus*, Phosphorus. It is a solid body, of the appearance and consistence of white wax. It has a peculiar and disagreeable odor. On exposure to air, it gives off white fumes, luminous in the dark and of a garlicky odor. Phosphorus is insoluble in water, but dissolves in 350 parts of absolute alcohol at 15° C. (59° F.), in 240 parts of boiling absolute alcohol, in 80 parts of absolute ether, in about 50 parts of any fatty oil, and very abundantly in carbon disulphide, the latter yielding a solution which must be handled with the greatest care to prevent danger from fire. If left exposed to the air, phosphorus takes fire spontaneously. Accordingly it must be kept carefully under water, in a secure and moderately cool place, protected from light.

In its physiological relations, as in its chemical, phosphorus is unique. It is locally exceedingly irritant—even corrosive, although, strangely enough, in some experiments bits of solid phosphorus have lain embedded in the connective tissue of animals for weeks without exciting any local reaction. Ordinarily, however, upon skin or mucous membrane phosphorus in substance excites inflammation, possibly followed by ulceration and gangrene of the area exposed to contact. Even the fumes of phosphorus may inflame exposed mucous membranes, such as the conjunctiva and the mucous membrane of the mouth and respiratory tract, and inflame even to consecutive necrosis any accessible periosteum. Thus used to arise in match factories, in the days before the use of allotropic phosphorus, cases of necrosis of the jaw, the periosteum being generally reached by the poisonous fumes through the avenue of some defective tooth. Taken internally, even therapeutic doses are very apt to irritate the stomach, as shown by loss of appetite, nausea, uneasiness, and even pain and tenderness at the epigastrium, or, in higher grade, by the additional symptoms of vomiting and diarrhœa. Flatulence and eructations of phosphoreted gases are further disagreeable local effects of the medicine upon the digestive apparatus. Phosphorus when swallowed is readily absorbed, but exactly in what chemical status has not been definitely proven. That it reaches the blood, in part at least, as uncombined phosphorus dissolved by the alkalies of the intestinal juices or by fats is, theoretically, certainly not impossible, and is the obvious suggestion of many chemical considerations. On the other hand, that some portions undergo various grades of oxidation is again perfectly possible and likely.

The constitutional effects that follow the internal taking of phosphorus are symptomatic of modifications of nutrition. In therapeutic dosage in health there is ordinarily little obvious derangement beyond what may be a reflex of the gastric irritation set up by the drug; and, anatomically, the most striking result of the medication is a tendency, proven by dissection of animals,[1] toward increased activity of development of bone. Cartilaginous epiphyses ossify with undue speed and completeness, spongy bone tissues increase in thickness, and compact bone in hardness. And a similar special tendency toward nutritive activity in *nervous* tissues, under the administration of phosphorus, is commonly, and probably rightly, inferred from the two facts, first, that in nerve tissue, as in that of bone, compounds of phosphorus are prominent normal constituents, and, secondly, that many morbid derangements of nerve function which are fairly referrable to malnutrition or to exhaustion of nerve tissue, tend to abate under a régime of phosphorus medication. A special aphrodisiac action has been claimed for phosphorus, but cases in which any effect of this nature has been observed have probably been cases of previous debility or exhaustion of the sexual function, in which the renewed sexual desire is simply the natural consequence of restoration of power through improved nerve nutrition. In originally vigorous subjects several series of observations have shown that phosphorus does not produce any direct aphrodisiac effect.[2]

In over-doses, single or continued, phosphorus profoundly deranges nutrition, inducing fatty degeneration of glandular and other tissues, and hemorrhages. Death may result, or an impairment of health from which recovery is slow and difficult. For a detailed discussion of this singular poisonous operation of phosphorus see article *Phosphorus, Poisoning by.*

The therapeutic application of phosphorus is the internal administration of the drug for the bettering of deranged conditions of the nervous and the bony structures. Thus it is among the standard remedies to try in neuralgia. Naturally enough, the more recent the case, the greater the chance of relief and of cure, and unless relief comes within forty-eight hours, the medicine will probably fail altogether (Ashburton Thompson). In other nerve derangements it may be said, broadly, that in such as belong to the category of the naturally curable ones, recovery may perhaps be hastened by the use of phosphorus; but that in the incurable or difficultly curable nervous diseases the agent generally does little or no good. Thus the high hopes at one time formed of the avail of phosphorus in such maladies as epilepsy and locomotor ataxia have utterly failed of realization; but in such conditions as so-called nervous prostration, or incipient dementia, the drug is often of distinct benefit. Similarly phosphorus has been praised in osteomalacia and in rickets.

In the important matter of the *dose* of phosphorus, there is much difference in the practice of different physicians. Some confine their dosage to 0.0006 gm. (gr. $\frac{1}{100}$), thrice daily, while others begin at once with 0.003 gm. (gr. $\frac{1}{20}$), given with the same frequency, and aim to increase to double the amount, under guidance of the effects wrought—curative to the disease on the one hand, or irritative to the stomach on the other. Certainly, the larger of the doses cited are well borne in a very considerable number of cases, and certainly, also, the same may succeed, and speedily too, in curing a neuralgia, where the minute dose of the timid prescriber utterly fails of all impression upon the disease.

The *mode of administration* is an all-important matter in the case of phosphorus, since by faulty prescribing the dose may be unduly irritant or nauseous on the one hand, or inert on the other. In general, phosphorus must not be given in substance, no matter how extreme the subdivision, because of irritation; and in prescription in solution a solvent must be sought that will hold the phosphorus secure against oxidation, and at the same time not furnish too disgusting a potion. The most generally serviceable solvent, where the preparation is to retain the fluid condition, is a fixed oil, freed from contaminating oxygen and water by a preliminary superheating. Squibb has strongly advocated cod-liver oil,[3] fearing vegetable oils because of an alleged tendency of phosphorus in solution in the same to "develop poisonous properties," presumed to be "due to the formation of hypophosphorous acid." Sweet almond oil is, however, the most generally selected of fatty solvents, and has been adopted by the United States Pharmacopœia as the basis of the official oily preparation. Chloroform and ether are inconveniently volatile for the making of a permanent fluid preparation, and carbon disulphide is too disgusting and noxious. Absolute alcohol can be made the basis of an efficient fluid mixture, as in the official spirit of phosphorus and its derivate, elixir of phosphorus. For pills of phosphorus the plan should be followed of actually *dissolving* the phosphorus in some fluid, which either itself hardens, by cooling, to a solid, or which, incorporated with some indifferent powder, will form a pill mass. In either case, the indispensable feature is secured that phosphorus is in true solution still, although the pill as such is of course a solid. An obvious practice for the making of such pills is to dissolve phosphorus in melted resins, which on cooling reacquire the solid condition with, now, the phosphorus held in solution. But while these resinous pills are easy to make and to take, there is strong reason to fear that the contained phosphorus may easily be allowed and even helped to oxidize. The pharmacopœial procedure given below is probably as free from objection as any.

In whatever form or dose phosphorus be given, a cardinal rule, insisted upon by almost all who have had much experience with the medicine, is that the administration should never be upon an empty stomach, nor, on the other hand, *immediately* after eating.

The phosphorus preparations of the United States Pharmacopœia are as follows:

Oleum Phosphoratum, Phosphorated Oil. Phosphorus is dissolved by gentle heat in sweet almond oil which has been previously heated for fifteen minutes to a temperature of 250° C. (482° F.), and then cooled and filtered. After the phosphorus is fully dissolved and the solution cooled, a small charge of ether is added thereto. The finished product contains one per cent. of phosphorus and nine of ether. By measure, one minim represents about gr. $\frac{1}{115}$ of phosphorus (United States Dispensatory). Phosphorated oil should be clear and with a decided taste and smell of phosphorus, and the few drops which will constitute a dose (see remarks on dosage, above) may be given in capsule or in emulsion, flavored by a trace of oil of peppermint, or of gaultheria, or of bitter almond. The official emulsion of *almond* forms a convenient vehicle for an emulsion, flavored as just described. Phosphorated oil must be kept in small, glass-stoppered vials in a cool place, and the phosphorus keeps best when the vials are completely full.

Pilulæ Phosphori, Pills of Phosphorus. Phosphorus is dissolved in chloroform by gentle heat and the solution added to a mixture of acacia and althæa in a mortar. A little glycerin and a little water are next poured on, and the whole is rapidly beaten to a pill mass, which is immediately cut up into the proper number of pills. Each pill is then coated with a solution of balsam of tolu in ether, and when the coating is dry the pills are put up in well-stoppered bottles. These pills contain, each, 0.0006 gm. (gr. $\frac{1}{100}$) of phosphorus, and from one to five pills will constitute a dose. (See remarks on dosage, above.)

Spiritus Phosphori, Spirit of Phosphorus. This is a solution of phosphorus in absolute alcohol of the strength of 1.2 per cent. of phosphorus. It is official for the making of the elixir of phosphorus.

Elixir Phosphori, Elixir of Phosphorus. This preparation is a mixture of the spirit of phosphorus, glycerin, and aromatic elixir, with a flavoring of oil of anise. It is a transparent liquid, containing about 0.00025 gm. (gr. $\frac{1}{250}$) in each cubic centimetre (♏ xvi.). Unofficial, but well known and much used, is an alcoholic solution of phosphorus devised by Ashburton Thompson, of England, and commonly called *Thompson's Solution of*

Phosphorus. It is prepared as follows: One grain (0.065 gm.) of phosphorus is dissolved in fl. ʒ v. (16 gm.)* of *absolute* alcohol by the aid of heat, and the solution added to a *warmed* mixture of fl. ʒ iss. (56.25 gm.) of glycerin and fl. ʒ ij. (6.68 gm.) of alcohol. When the resulting mixture has cooled ♏ xl. (2.12 gm.) of spirit of peppermint is added. The preparation should be a bright, clear, colorless solution, wherein the odor and taste of phosphorus are almost completely masked by the pungency of the alcohol and peppermint. It is essential that the alcohol used to dissolve the phosphorus be literally *absolute;* and in such case the preparation, if kept in well-filled and well-stoppered bottles out of the light, will keep unaltered long enough for the treatment of an average case. If all the phosphorus be and remain dissolved, the solution contains 0.003 gm. (gr. $\frac{1}{20}$ nearly) in 4 c.c. (fl. ʒ i.)—a scant teaspoonful. The dose, averaging from one-third to one small teaspoonful, is best taken clear, but if too sharp in that condition, may be taken in water, the mixture to be made only at the time of each administration.

Under no circumstances should phosphorus be prescribed as an ingredient of extemporaneous composite medicinal mixtures.

Zinc Phosphide: Zn_3P_2. A peculiar compound of phosphorus, which practically amounts to a medicinal preparation of the element itself, is what is official in the United States Pharmacopœia under the title *Zinci Phosphidum*, Zinc Phosphide. This compound appears as a finely crystalline powder, or as crystalline lumps. It is gray-black in color, with a metallic sheen on broken pieces, and gives faintly the odor and taste of phosphorus. It is insoluble in water or alcohol, but dissolves in sulphuric or hydrochloric acid, with evolution of hydrogen phosphide. Zinc phosphide must be kept in small glass-stoppered vials.

This compound is lacking in the vigorously irritant action of phosphorus, yet even in therapeutic doses may easily upset the stomach and even excite vomiting. From its ready decomposition by acids it yields, in the stomach, some medicinally active condition of phosphorus, and its administration is therefore followed by therapeutic results similar to those attained by the use of the uncombined element. The phosphide is, however, not so certain as preparations of phosphorus itself, and is probably most commonly turned to as a last resort in cases in which phosphorus persistently disagrees. Zinc phosphide contains one-fourth of its weight of phosphorus, and the dose therefore ranges from 0.003 gm. (gr. $\frac{1}{20}$) to 0.016 gm. (gr. $\frac{1}{4}$). It may be given in pill form, and, unlike phosphorus, may be prescribed in combination with other medicines, avoiding only acids, which decompose it. After swallowing, however, the certainty of medicinal action will be enhanced by effecting this same decomposition through the agency of an acid draught, such as lemonade or a little vinegar. The most disagreeable features of the drug are a tendency to eructations of phosphoreted hydrogen and to disturbance of the stomach. With the larger of the doses mentioned above nausea is not at all unlikely. *Edward Curtis.*

[1] Wegner: Virchow's Archiv, June 22d, 1872.
[2] See Phillips' Materia Medica and Therapeutics, Inorganic Substances, p. 51.
[3] Note on the Administration of Phosphorus, E. R. Squibb, M.D., Proceedings of the Am. Pharmaceutical Assn. for 1876, and pamphlet, Philadelphia, 1877.

PHOSPHORUS, POISONING BY.—It is doubtful if there is another substance among the many common poisons which is of so much interest to the toxicologist as is phosphorus—an interest arising from an historical viewpoint, and because of the desire to discover the mysterious causes of its insidious action on living organisms. Moreover, we meet with the anomaly that, unlike most of the other inorganic poisons, and especially arsenic, antimony, and nitrogen, members of the same group in the Periodic System, this element is toxic in its free or elemental state, while its compounds (save the hydrides) are practically non-toxic.

Phosphorus was unknown to the layman as a poison prior to 1840. Shortly after the popularization of matches, about the year 1833, the public became acquainted with its deadly nature, and because of the ease with which the material could be procured, poisonings by phosphorus became alarmingly frequent. In no country have the number of cases been so numerous as in France, where from 1840 to 1880 there were 336 criminal cases of poisoning by this element. The maximum number in a single year was 94 in 1860, or, if we consider the period 1851–70, we find that out of a total of 793 deaths due to poisons 267, or 33.7 per cent., were due to phosphorus, while during this same period 287 are charged to arsenic. France still heads the list in the number of cases of poisoning by this element, which usually equal, or even exceed annually, those due to arsenic. The substitution of "Parlor" and "Safety" or "Swedish" matches (invented by Böttger in 1852) for the yellow phosphorus match was immediately followed by a decrease in the criminal use of phosphorus; the decrease was also due in part to the fact that it became known to criminals that a process had been devised by which the poison could be easily and surely detected (the Mitscherlich method).

Homicidal poisonings are now rare. The majority of cases are due to attempts at suicide or to accidents among children.

Only "yellow" phosphorus, the hydrides of phosphorus, and the phosphides of certain elements, such as calcium and zinc, are of toxicological interest.

Yellow Phosphorus.—The general properties of this almost colorless, wax-like substance are too well known to require review. A word as to its solubility is, however, necessary. In water pure phosphorus is practically insoluble; in fact, it has been asserted that what is thought to be a solution represents merely exceedingly fine particles in suspension, or else that it is a solution of the vapor. According to Hartmann 1 litre (about ʒ xxxiv.) of water at 38° C. (100.4° F.) will take up 2 mgm. (gr. $\frac{1}{1000}$) of phosphorus; while in oils its solubility varies from 1 to 100, to 1 to 10,000 parts, according to the nature of the oil and various conditions, such as temperature, etc. In bile phosphorus is readily soluble, 100 parts of this fluid dissolving 15 to 25 parts.

Because of the low solubility of phosphorus in most of the fluids of the body, only slight action generally follows the ingestion of large fragments of this substance. When taken, however, in a finely divided condition the action is very violent.

Poisoning by phosphorus usually results from matches, phosphorus pastes (vermin killers), or phosphorus oil (Oleum phosphoratum).

Matches.—The modern "parlor" and "safety" matches are usually harmless, so far as poisoning by phosphorus is concerned, owing to the fact that they are made of non-toxic red phosphorus and an oxidizing agent, such as potassium chlorate. The matches of a decade ago, known variously as "friction," "brimstone," "sulphur," "lucifer," "phosphorus," etc., matches, are to be charged with by far the majority of deaths. The heads of these matches contain on an average about five per cent. phosphorus, the limits varying from three to seven per cent. A single head usually contains from $\frac{1}{3}$ to 1.5 mgm. (gr. 0.005 to 0.023). In these matches the sticks after being dipped in sulphur are tipped with a mixture of glue or dextrin containing coloring matter, phosphorus, and an oxidizing substance such as lead nitrate, lead peroxide, nitre, potassium chlorate, or some similar compound. Dissolving these heads in water or a warm liquid yields a liquid in which the phosphorus exists in an emulsion in an exceedingly finely divided condition.

Phosphorus Pastes are now seldom employed, though formerly they were in great demand for destroying rats and other vermin. Here the phosphorus exists very finely divided with flour, lard, and sugar or molasses as a basis.

* In calculating the metric equivalents regard has been paid to the specific gravities of the several fluids.

These pastes vary greatly in composition. They contain, on an average, about two per cent. of phosphorus, but may contain as high as five per cent.

Phosphine.—The hydride H_3P is the only one of importance. One-fourth to one-half per cent. in air causes death in animals in twenty to thirty minutes, while 0.2 per cent. will produce symptoms of asphyxia in a few minutes. In man, when it is breathed in very small amount in air for any length of time, the symptoms closely resemble those produced by phosphorus vapors. Under this head there is another possible source of phosphorus, or rather phosphine, poisoning. It has been suggested that there may be a reduction of phosphates in the intestines by bacteria (a form of auto-intoxication well known in the case of reduction of sulphates to hydrogen sulphide). Some have even gone so far as to claim that acute yellow atrophy of the liver is due to this cause. This action of bacteria is well established for sulphur, arsenic, and antimony compounds; but although it is to be expected for compounds of phosphorus by analogy, all investigations have given thus far negative results with pure cultures of powerfully reducing bacteria, the reduction being carried only to phosphites.

Fatal Dose.—The weight of phosphorus which constitutes a fatal dose is quite uncertain. An examination of the records shows such a variation that it is difficult to make an accurate statement. The fatal dose seems to depend, more than is the case with most inorganic poisons, upon the nature of the material containing the poison, the state of division of the phosphorus, the nature of the material in the alimentary canal, and the idiosyncrasy of the individual. As regards matches, we find that a child has died after sucking the heads of 2 matches. In another case 8 heads caused death. Sixteen match heads have caused the death of an adult; and Tardieu cites a case in which 101 matches were immersed for seven or eight minutes in a cup of hot coffee with a resulting solvent action so low as to permit the matches when dry to be ignited by rubbing in the usual manner, yet the poisonous draught caused very dangerous symptoms. Other records show that where death has resulted from swallowing match heads the number of these taken in each case has varied from 60 to 3,000; and that, on the other hand, recovery has followed prompt medical aid where from 3,000 to 4,000 match heads have been taken.

In the case of Oleum phosphoratum it is probable that a dose of 200–250 mgm. (gr. iij.–iv.) will produce dangerous results, and that 500–600 mgm. (about gr. vij.–ix.) will almost invariably prove fatal.

Phosphorus itself, finely divided in hot water, has in a few instances been employed for homicidal and suicidal purposes. Although the smallest fatal dose recorded is about 8 mgm. (gr. $\frac{1}{8}$), this is abnormally low. It is believed that the toxic dose of well-dissolved or exceedingly finely divided phosphorus is probably about 15 mgm. (gr. 0.23), and that the fatal dose lies in the neighborhood of 150 mgm. (gr. ij.–iij.). Recovery has followed a dose of over 300 mgm. Occasionally cases are met with which seem to indicate that phosphorus may at times have a slight accumulative tendency. With animals the doses may be safely set as follows:

	Fatal dose. Grams.	Therapeutic dose. Grams.
Horses and cattle	0.5 to 2.00	0.010 to 0.050
Sheep and swine	.10 to .30	.002 to .005
Dogs	.05 to .10	.0005 to .002
Fowls and cats	.01 to .03	.0005 to .001

The most susceptible animals per kilogram weight are fowls, the next swine, then dogs. According to Naunyn parrots alone seem to be relatively immune.

Fatal Period.—This is quite variable, but there can be no doubt that phosphorus should be classed as a slow poison. The usual period lies between one and four or five days, with most deaths falling on the second or the third day; yet life may sometimes be prolonged until the seventh day, or very rarely until the seventeenth to the twentieth day. Several cases of remarkably rapid death are recorded. Caspar cites the case of a young woman who took 194 mgm. (gr. iij.) of phosphorus in an electuary and died in twelve hours, while Habershon is authority for the statement that death has taken place in thirty minutes.

Symptoms.—The differences in the symptoms between acute and chronic poisoning are chiefly only of degree, and yet at the same time they are quite marked. Even in acute cases it has been shown by Tardieu that it is possible to distinguish three distinct forms, which have been termed common, nervous, and hemorrhagic, according as certain symptoms predominate. The lack of space forbids a consideration of these. Occasionally a patient will show a combination of all these types, the one following tho other.

In what may be called for convenience a typical or normal case of poisoning (generally the result of matches), the victim first complains of pain in the throat. Usually, but not always, this pain extends downward with increasing severity, and is most marked in the epigastrium and abdomen. The tongue is enlarged and coated. Nausea in its most acute form sets in, followed later by vomiting of material of a mucous and bilious character. Very rarely at this stage is the vomit tinged with blood, but the ejected material is generally phosphorescent in the dark. There may be annoying eructations with an alliaceous odor and taste; the exhaled breath may even be luminous in the dark and give rise to a thin white vapor upon striking the air. Colic and diarrhœa set in at this stage, in about thirty per cent. of the cases. The pulse may for a short period be accelerated with an accompanying slight rise in temperature, but soon it becomes small, weak, slow, and often irregular. The temperature may fall as much as 3° or even 4° C. Respiration, which also suffered a slight acceleration, becomes slow, oppressed, and sometimes stertorous. This train of symptoms continues for from twenty-four to forty-eight hours when a remission often takes place; nausea and vomiting ceasing and the abdominal pain disappearing save for a few vague twinges. A period of apparent convalescence supervenes for two or three days; then suddenly, when all seems to be going well, the victim is stricken down with the most violent symptoms. Icterus appears, accompanied by hemorrhages, increasing in number and severity, in which practically all channels are affected. Vomiting and purging having again set in, the ejected matters are bloody in character and may at times consist almost wholly of blood; there is bleeding at the nose and even at the ears, and in women there is almost invariably more or less uterine hemorrhage. Up to the present time, in spite of the reputed aphrodisiac action of phosphorus, no venereal excitation has been observed in either sex in acute poisoning. The blood discharged is very thin and fluid. Hemorrhages have been known to continue for several months, the victim becoming weaker and weaker, and sinking into deeper and deeper apathy, being roused only by recurring nervous disturbances. Accompanying the hemorrhages is seen anæmic cachexia and urticaria, and a blotched skin. The eyes are icteric, blood-shot, and prominent. Owing to paralysis of the sphincter muscles there may be, in the last stages of the disease, involuntary expulsion of urine and fæces. Prior to this, however, the urine is apt to be suppressed, and when discharged or drawn will be found to contain albumin, peptones, hæmoglobin, bile pigments, biliary acids, fibrin and hyaline cylinders, fatty droplets, often leucin and tyrosin, almost invariably sarcolactic acid, subnormal urea, and abnormal ammonium salts, phosphates, and sulphates. It is quite safe to assert that icterus is absent in exceedingly rapid death only. Death takes place in coma or syncope, occasionally in convulsions preceded by delirium.

In addition to the above-mentioned symptoms there is often quite marked paralysis of the voluntary muscles, especially those of the legs, preceded by coldness or numbness and accompanied by formication and twinges