

the air, without odor but with the usual sweetish, astringent and metallic taste of the soluble lead salts. The salt dissolves in two parts of cold water and more freely in boiling water. It is almost insoluble in alcohol. Lead nitrate acts like the acetates, and is used only for external applications. A peculiar property of the salt is that it decomposes sulphuretted compounds, and thus proves deodorant to parts generating foul secretions, such as nasal surfaces in ozæna. *Ledoyen's disinfecting fluid* is a twelve and a half per cent. aqueous solution of lead nitrate. Lotions of the nitrate average two per cent. in strength.

**Lead Plaster (Diachylon Plaster).** Under the title *Emplastrum Plumbi*, Lead Plaster (Diachylon Plaster), the United States Pharmacopœia recognizes the product resulting from boiling together in a sufficiency of water thirty-two parts of lead oxide and sixty parts of olive oil. Such product, an oleo-palmitate of lead, is a fairly hard solid, of a yellowish-white color, pliable and tenacious, but not greasy. Upon keeping it turns brown on the surface. Lead plaster exerts but feebly the peculiar effects of lead compounds, though a case of lead colic has been recorded as resulting from long-continued application of the plaster as a dressing to an ulcerated surface. The main use of lead plaster is as a basis, non-specific, for medicated plasters.

Edward Curtis.

**LEAD PALSY.**—Muscular paralysis resulting from the toxic effect of lead is seen most frequently among those whose occupation requires frequent or continuous contact with lead. Thus, it is commonly found in those employed in lead-works, and among painters, typesetters, file-makers, plumbers, glass grinders, and those who glaze pottery with lead, and also in other industries. The accidental causes are numerous, such as the contamination of drinking-water by leaden pipes, the cooking of food in vessels containing lead, the use of various cosmetics, hair dyes, etc. It has also been traced to snuff which was found to contain lead. As a rule, the lead enters the system by way of the alimentary canal, as a result of uncleanliness, and through the pollution of food by hands that have been in contact with lead. It may also enter the system through inhalation, and by absorption from the skin. As in other forms of toxæmia, individual susceptibility to the effect of lead has much to do with the development of lead palsy. Females suffer oftener than males, and people in general ill-health and those addicted to alcoholics seem more predisposed to its toxic action. Only a certain proportion of individuals whose occupation requires the frequent handling of lead are thus poisoned, while many similarly employed are never affected, although no special precautions are taken. After lead poisoning has existed for some time, and not necessarily manifesting any conspicuous symptoms, a peculiar form of multiple neuritis ensues. This is characterized by paralysis of several of the muscles of the upper extremities, occurring first and most pronounced in the distribution of the musculospiral nerve, affecting the extensors of the hands and fingers, but rarely involving the sensory fibres.

As a rule, other symptoms of lead poisoning—especially lead colic, acute constipation, and at times articular and muscular pains, or some of the manifestations of encephalic saturnism—precede the paralysis. It is rarely acute as a sequel of an attack of colic, but generally develops itself in the course of several weeks.

The paralysis may be the first and only recognizable symptom. These patients are frequently found anæmic, with a blue line on the gums close to the teeth, due to the deposit of lead, and signs of arterio-sclerosis or chronic nephritis may also be present. Almost always the common extensors of the fingers are first affected, especially the extensors of the third and fourth fingers; then the extensors of the wrist and little fingers follow; later, the extensors of the wrist, and ultimately the long thumb muscles. The extensors of the hand and fingers are in most cases exclusively involved. These different muscles are affected in varying degrees. The hands and fingers

are held in the position of flexion, and drop as soon as they are placed in extension. On account of the lack of opposing force, the flexors are weakened in their action, but when support is given to the hand by passive extension they act normally. The paralysis of the extensor muscles of the wrist causes "wrist-drop," which produces the characteristic attitude of the hands commonly seen in these cases. In some instances the paralysis is not confined to the distribution of the musculospiral nerve, but all of the intrinsic muscles of the hand which are supplied by the ulnar and median nerves may also be involved. In the majority of cases, the triceps and supinators remain intact. It is only in the most severe forms that the latter muscles are involved. This condition is usually found associated with paralysis in the distribution of other branches of the brachial plexus and with pronounced symptoms of saturnism. Although lead has a strong predilection for the muscles already mentioned, these may escape. Lead palsy usually affects both upper extremities simultaneously, but it is not at all uncommon for it to attack only one arm. The right upper extremity is generally more paralyzed than the left in right-handed persons, and vice versa. It is quite uncommon, however, for both sides to be equally affected. Atypical cases occur in which the supinators, biceps, brachialis anticus, and deltoid are the principal muscles affected (upper arm type of Remak). To this group is generally superadded paralysis of the supra- and infraspinati. This form of paralysis is usually bilateral, and occurs in the most inveterate types of lead poisoning. When this group of muscles is affected, the patient is unable to lift his arm, and it hangs powerless by his side. Sometimes the deltoid is the only muscle involved.

The paralysis is always of a degenerative form, and is most frequently attended or followed by atrophy and loss of faradic irritability and the reaction of degeneration in the affected muscles, as a result of degeneration of the nerve fibres. Fibrillary tremor is usually present. As a rule, there is no disturbance of sensibility. In the more chronic cases there may be a slight swelling over the extensors of the wrist joint. This is due to the long-continued flexion of the carpus producing displacement backward of the bones and distention of the synovial sheaths. The lower extremities are very rarely affected. When this does take place, the muscles involved are the long extensors of the toes and the peronei muscles. The tibialis anticus usually escapes. In fatal cases, the paralysis invades the muscles of respiration, *i.e.*, the intercostals, the diaphragm, and the muscles of the larynx. In some chronic cases the symptoms may closely resemble those of bulbar paralysis.

Primary atrophy (the atrophy preceding the motor paralysis) may occur in the intrinsic muscles of the hands. It sometimes becomes permanent and progressive, just as in other forms of progressive atrophy of spinal origin. The lesion producing lead palsy usually affects the peripheral motor neurons. In chronic cases the peripheral nerves are the seat of well-marked interstitial neuritis. Changes have also been found in the cells of the anterior horns of gray matter of the spinal cord, and also in the anterior nerve roots.

**DIAGNOSIS.**—In the majority of cases a correct diagnosis of lead palsy is based on the following conditions: its etiology; the peculiarity of onset and its association with other signs of lead poisoning; the characteristic degenerative type of the paralysis and its limitation to certain groups of muscles in the distribution of the musculospiral nerve, with the escape of other muscles supplied by the same nerve; and its frequent bilateral character.

**PROGNOSIS.**—If there are no serious complications the prognosis as to life is favorable. When the paralysis is not extensive and is of recent occurrence, recovery usually takes place, under proper conditions. The presence of the reaction of degeneration does not militate against recovery. The voluntary power may return before faradic irritability. Recovery occurs, as a rule, when the source and continuance of the lead absorption is eliminated. On the other hand, the course of primary atro-

phy is extremely chronic, and it has little tendency to recover.

**Treatment.**—The treatment should consist in removal from the source of contamination by lead and its elimination from the system by the administration of small doses of iodide of potassium three times a day, and an occasional cathartic dose of sulphate of magnesia. The joints and paralyzed muscles should be supported by suitable prosthetic apparatus. The daily application of the galvanic current and gentle massage will hasten the restoration of normal function. General tonic treatment is usually indicated.

William M. Leszynsky.

**LEAD POISONING, ACUTE AND CHRONIC.**—**ACUTE POISONING.**—Cases of acute lead poisoning are comparatively rare and are ordinarily of accidental origin. The form of lead swallowed is usually the acetate, sometimes the basic acetate in the form of Goulard's extract. It may be the ordinary white lead or other lead salts, and cases have not infrequently been reported of poisoning by the yellow lead chromate used in coloring candy. There is no danger of acute lead poisoning by lead salts prescribed medicinally, since the toxic dose is so much larger than the medicinal dose. From 3 iv. to 3 viij. (15.5 to 31 gm.) is, for example, the poisonous dose of lead acetate.

**Symptoms.**—It is a curious fact that acute lead poisoning presents, within the period of a few hours, almost the entire series of symptoms caused, in much slower stages, by chronic poisoning. Within a few minutes after swallowing a large portion of any of the soluble lead salts the patient perceives a sweetish, followed by a metallic, taste. This is quickly succeeded by a burning sensation in the throat and stomach and by nausea and vomiting. Severe colicky pains in the bowels follow, with a retracted rather than distended abdomen. There are great thirst and marked general distress and prostration, with slow pulse and cold extremities. The bowels are constipated and the urine is scanty. Sometimes there are cramps in the extremities, and it is said that even paralysis has resulted from acute poisoning. Fatal cases usually terminate in convulsions and coma, within two or three days. Recovery is, however, the rule, even after the ingestion of such a large quantity as one ounce and over of lead acetate.

**Post-mortem Appearances.**—These are not specially characteristic, being usually those of an acute gastro-enteritis or entero-colitis with particularly contracted small intestines.

**Treatment.**—If the patient is seen early the stomach should be emptied with the stomach tube or pump. In the absence of such appliances nature's efforts at evacuating the stomach should be aided by the hypodermic use of apomorphine or the internal administration of sulphate of zinc. The latter is supposed also to be of value by contributing to the formation of an insoluble lead sulphate in the stomach. Magnesium sulphate and sodium sulphate are also employed for their combined chemical and cathartic action. After these come emollient drinks and the use of opiates to relieve pain.

**CHRONIC POISONING.**—The introduction of small quantities of lead into the body, during a considerable period of time, brings about a peculiar disease known as lead poisoning or plumbism, accompanied by a varied train of symptoms, some of which are of brief and others of quite long duration. The methods of exposure to lead poisoning fall under two heads—first, those which may be called accidental, and to which every one may be exposed; and secondly, those which are incident to certain occupations. Under the first head comes the accidental introduction of some of the lead salts into food, as by the use of cooking utensils lined with an enamel containing lead; the use of canned goods, especially acid fruits, long canned, which may absorb lead from the solder; the drinking of beer which has stood for many hours in a lead pipe; the use of flour ground with stones the holes of which have been filled with lead, etc. The employment of lead pipes for the conduction of drinking-water

has undoubtedly often caused lead poisoning. This is particularly true if the water is rain or snow water, containing no mineral ingredients. Lead-lined tanks for the holding of such water are absolutely to be interdicted. Hard waters, which contain lime and magnesium sulphates and carbonates, cause the deposit of a comparatively insoluble lead sulphate or carbonate within the pipe, thus protecting the water from contamination. Even then it is always wise, before drinking water from lead pipes, first to let that which may have stood in the pipes run to waste.

Lead suction pipes in wells are very dangerous. The best metal for this purpose is block tin.

By far the greater number of cases of lead poisoning, however, are those which are due to the inevitable exposure incident to certain occupations. Workers in lead mines and workers in lead alloys, as plumbers, lead-pipe makers, type-founders, and even typesetters, furnish frequent instances of poisoning. The same is true of those engaged in the making or handling of lead pigments.

Still more frequent are the cases occurring among those employed in the manufacture of white lead (lead carbonate), and in the honest old days, when they actually handled white lead extensively, the painters gave their name (*colica pictorum*) to one of the prominent symptoms of lead poisoning. A comparatively recent industry, which contributes a very heavy contingent to the cases of lead poisoning in this country, is the smelting and refining of the silver-bearing lead carbonate ores of this country and of Mexico. These smelters, scattered over the land from the crest of the Rocky Mountains (Leadville) to the Atlantic Ocean (Perth Amboy), employ many thousands of men among whom occur many hundreds of cases of lead poisoning annually. The considerable number of deaths and the much larger number of permanently disabled men for which this industry is responsible, and which, under proper precautions, might be avoided, is a matter that ought to be taken cognizance of by state and local health boards, wherever such smelting works exist.

**Method of Introduction of the Poison.**—Practically the only method by which lead is introduced into the system, among lead workers, is by means of lead-laden dust, this dust entering the nose and mouth and being conveyed to the stomach. There is no such volatilization of lead as would permit of its introduction in gaseous form, through the respiratory system, although the so-called smoke from blast-furnaces or retorts or the steam from kettles carries lead dust, just as ordinary smoke carries soot. The moustache, the fingers, and the clothing of the workman are loaded with this very fine dust, and this is not only swallowed when he opens his dinner bucket and eats with unwashed hands in the workroom, but it coats his upper mucous membranes all the time, is carried home in and disseminated from his clothing, and is present with him constantly.

**Symptoms.**—These may be divided as follows: 1. Lead cachexia, which often precedes more violent manifestations and generally persists through the entire history of the disease. 2. Lead colic. 3. Lead encephalopathy. 4. Lead paralysis.

**Lead Cachexia.**—After a variable period of exposure, sometimes extending over but two or three weeks, but oftener over from three to twelve months or even longer, the patient shows signs of failing health. He complains of a loss of appetite, of a sweetish taste in the mouth, sometimes of vomiting, especially after breakfast, always of constipation, of a general sense of lassitude, often of pains simulating rheumatism, either about the joints or in the muscles, perhaps of frequent cramps in the calves of the legs or in other muscles, very likely of vague abdominal pains. On examination he will be found to be somewhat emaciated, sallow, with a foul, coated tongue and very bad breath, the tongue not seldom betraying a tremor on being protruded. If to these signs and symptoms is added the characteristic blue line on the gum, the diagnosis is fairly assured. This blue

line, about 2 mm. wide at the junction of the gum with the teeth, occurs in a large proportion of cases of chronic lead poisoning. It is often hard to distinguish from the discoloration due to an accumulation of tartar on the teeth of people who give their teeth no care. Nor must the absence of the blue gum line be considered conclusive evidence against lead poisoning.

The symptoms above enumerated being present, it is essential that the patient be removed from the danger of further poisoning. This can sometimes be done, in a smelting or manufacturing plant, without throwing the man out of work, by giving him some different employment, out of reach of lead dust or smoke, and if possible out of doors. Moderate purgation and warm baths; if possible sunshine and good food; a little later, when the stomach is in better shape, bitter tonics with iron; and then the exhibition of iodide of potassium for a time, may bring the patient out of his cachectic condition without his developing the more violent symptoms presently to be described. The only safe course for a person who has shown well-marked symptoms of lead poisoning is to abandon the occupation which has induced the malady, but it is often impossible to bring this about.

2. *Lead Colic.*—Quite frequently persons who are attacked with lead colic have previously observed none of the symptoms above described, either because of the general stupidity of the individual or because the symptoms were truly absent. The colic comes on suddenly and soon attains great violence. It has usually been preceded by and is accompanied with obstinate constipation. The abdominal walls are rigid and sunken, there is no tenderness on pressure, and the pain is referred to the region of the umbilicus. The pain is usually continuous, with violent exacerbations every few minutes, or at longer intervals. The attack, under proper treatment, may last for two or three hours or for as many days. It rarely subsides until there has been a copious evacuation of the bowels and not always then. Retching and vomiting are not infrequent. The pulse is usually slow and hard. There is no rise of temperature.

The treatment consists in the hypodermic use of morphine, large doses, not less than half a grain, being often required, and the evacuation of the bowels. The latter may be a difficult task. It may be accomplished by repeated doses of Epsom salts or it may require the use of croton oil in doses of two or three drops. Enemata are helpful at the last. Mercurial purgatives are to be avoided on account of their possible retention, with subsequent salivation. In one instance after two or three days of colic and constipation, in spite of all cathartics, violent convulsions having supervened, the writer has seen the inhalation of chloroform promptly followed by free catharsis and recovery. A severe attack of colic is not likely to be very soon followed by another. A period of some weeks more commonly intervenes, even though the individual may still be exposed to the same malign influences as before.

3. *Lead Encephalopathy.*—By this vague term, which is practically a confession of ignorance, we refer to those graver disturbances of the nervous system, such as convulsions, mania, and coma, which sometimes follow in the wake of other and often repeated symptoms of lead poisoning and are very likely to end the life of the victim. Although, as just stated, these grave disturbances most frequently follow prolonged lead cachexia, repeated attacks of colic, lead arthralgia, and perhaps even paralysis, yet it is possible for them to be the first, as well as the last symptom of lead poisoning in a given case. This seems to be particularly true in the case of members of the negro race. The writer has repeatedly seen able-bodied negroes, in early or middle manhood, who had been working for months or years at lead furnaces, who were well nourished and had never lain off on account of sickness, suddenly fall in convulsions, which recurred frequently for a few days and were followed by coma and death. Other cases have been reported in which encephalopathy appeared as the first symptom after very brief exposure to the influence of lead. More commonly,

however, it is the old lead-worker who has been through the whole list of the symptoms of plumbism, who finally develops lead eclampsia or who falls into a state of mental hebetude and apathy, gradually deepening into coma or breaking into delirium and mania. Not all of these cases prove fatal. Subjects with eclampsia may have but few seizures or may remain subject to them for years. Those with active delirium and mania frequently recover.

The treatment of these patients, during the attack, is the same as of those suffering from similar conditions not dependent on lead poisoning.

4. *Lead Paralysis.*—This subject is fully treated under the heading *Lead Palsy*, and will therefore not be here considered.

*Lead Arthralgia* has not been treated of under a separate heading because it is never met with alone, but always accompanies some one of the other forms of lead poisoning. It is, however, a very troublesome accompaniment and may require for its relief the use of the salicylates, antipyrin, or similar drugs until the iodides, which are being used for the elimination of the lead, have had their effect.

Chronic nephritis is one of the terminal complications of chronic lead poisoning which should not escape the notice of the practitioner.

*Pathological Anatomy.*—There is very little known of the pathological changes which take place in connection with lead cachexia, colic, or encephalopathy. In death following colic the intestines have been found contracted, the muscular coat hypertrophied, and the mucous membrane more or less atrophied. This would seem only to point to nature's effort for the relief of the habitual constipation due to lead. In spite of many theories on the subject the philosophy of the poisonous action of lead on the body is as yet not understood.

*Prognosis.*—The prognosis as to life is good. As to recovery it is also good, except in a few extreme cases, provided the subject can be induced to withdraw himself entirely from exposure to lead. The vast majority of such persons recover entirely, lead paralysis even disappearing. Even those who do not abandon the occupation in which they have been poisoned, who have suffered from repeated attacks of colic and from paralysis, having recovered from the latter, may return to their former work and keep at it for years before being again prostrated. But sooner or later the cachexia will deepen and the victim, unless carried off by some intercurrent disease, will succumb to his old malady.

*Treatment of Lead Poisoning.*—The treatment has already been considered in the preceding sections, but the reason for recurring to the subject here under an independent head is to insist on the prophylaxis against the disease. In ordinary life all that is necessary is to bear in mind the possibilities of accidental poisoning and to guard against them. In carrying on industries that inevitably expose their employees to lead poisoning, proprietors should adopt all such precautions as will reduce the danger to the minimum, and it is the duty of the state, through its health authorities, to see to it that this is done. Otherwise thousands of ignorant and stupid workmen will suffer in health and become a burden to the state. Much can be done to lessen the amount of dust and smoke in workrooms and to carry it away by means of hoods over the mouths of furnaces or over work-tables, with proper suction or blast attachments. Respirators, sponges tied over the mouths of operatives, and like appliances are impracticable, interfering too much with free respiration. Supplying eating-rooms away from the dust or smoke and absolutely enforcing the rule that no man enters the eating-room without removing his hat if worn at work and outer body garment and thoroughly washing his face and hands, would do much to prevent lead poisoning. Eating in working rooms should be strictly prohibited. The drinking-water supplied to operatives should be strictly pure, and kept in closed receptacles that cannot be opened in the dust- or smoke-laden atmosphere.

Facilities for free bathing should be furnished and men should be urged to avail themselves of the same. Instruction should be given as to the precautions whereby the risk of poisoning is reduced to a minimum.

In addition to these measures a competent medical service should be inaugurated, not only for the treatment of the sick but for the inspection of the employees; and, on the recommendation of the medical man, such employees as show the early symptoms of lead poisoning should be removed from posts of danger, being either assigned to work that is not dangerous, laid off temporarily, or discharged.

As regards the medicinal treatment of lead poisoning the old methods have not been improved upon. Such laxatives as will answer the purpose must be employed; iron, quinine, and strychnine should be given in full tonic doses; and, for the elimination of the lead, iodide of sodium or potassium should be prescribed in fifteen-grain doses three times a day for two or three weeks or more at a time, to be resumed again after an intermission of a couple of weeks. Except in cases of confirmed eclampsia resembling epilepsy, some cases of paralysis, and those in which organic changes in the kidney have supervened, this line of treatment, with absence of further exposure to the poison, will usually result in a cure.

Edward W. Schauffler.

**LEBANON SPRINGS.**—Columbia County, New York.  
POST-OFFICE.—Lebanon Springs, Hotel.

ACCESS.—From Bennington, Vermont, or from Chatham, New York, via Lebanon Springs Railroad. The location is in the extreme northeastern corner of Columbia County, 155 miles north of New York and 25 miles northeast of Chatham. This spring claims our attention as being the only thermal water in the extensive territory embraced by New York and the New England States. The temperature, 75° F., is about the same as the Old Sweet Springs of Virginia. The spring yields about 30,000 gallons hourly. The following analysis was made by Prof. H. Dussance:

LEBANON THERMAL SPRING.	
ONE UNITED STATES GALLON CONTAINS:	
Solids.	Grains.
Sodium carbonate	2.41
Calcium carbonate	4.04
Potassium sulphate	1.04
Magnesium sulphate	1.06
Sodium chloride	.96
Sodium sulphide	.94
Iron oxide	.45
Alumina	.45
Silica	3.25
Organic matter	10.21
Total	24.38
Gases.	Cu. in.
Carbonic acid	0.48
Oxygen	2.00
Nitrogen	3.52

This place has been a well-known resort since pre-Revolutionary days. The salubrity of the climate and the beauty of the scenery tend to make the surroundings very attractive. The water is used principally for bathing. A valuable chalybeate spring is located in the village of the Brickyard Shakers, a short distance from Lebanon Springs.  
James K. Crook.

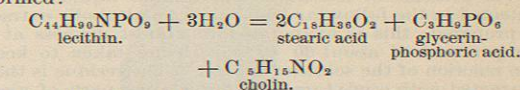
**LECITHIN.**—Lecithin is a complex phosphorized fat occurring, apparently, in all forms of protoplasm but most abundantly in the brain, spinal cord, and nerves of the higher animals and in the eggs of all animals. In the nervous tissues it is usually combined with other substances to form protagon and similar compounds. In the egg it seems to be combined with a proteid (vitellin); this combination is easily broken up by boiling with alcohol.<sup>1</sup> It has been found in the mucous membrane of the stomach, in the lungs, kidney, liver, spleen, semen, blood, milk, bile, pus, and serous fluids and exudates; in many cases it is combined more or less firmly with pro-

teids to form lecithalbumins (Liebermann<sup>2</sup>). It is a prominent constituent of the electrical organ of the ray. It has also been obtained from the yeast and other vegetable cells.

Lecithin was first obtained in quantity by Gobley from the yolk of the egg of the fowl. It is usually prepared<sup>3</sup> from the hen's egg as follows. The yolk is shaken with ether until the latter is no longer colored; the insoluble residue is then extracted with alcohol at a temperature of from 50° to 60° C. The ether-alcohol extract is concentrated to a syrup at 60° C.; this is then dissolved in a small amount of absolute alcohol and the solution exposed to a temperature of about -10° C. for twelve to twenty-four hours. The lecithin separates out in the form of small round clumps. It may be purified by dissolving it in chloroform and precipitating with acetone.

Lecithin is a colorless or yellowish-white, waxy, imperfectly crystalline substance which may be kneaded but often crumbles during the process. It is very hygroscopic; upon the addition of water it swells up and forms a kind of emulsion. It is soluble in alcohol, less so in ether; it also dissolves in chloroform, benzol, and oils. On cooling a solution of lecithin in alcohol it separates in crystalline clumps. When a little lecithin under the microscope is treated with water or glycerin it is seen to swell and little curling filamentous processes protrude from the edge of the solid; these are the so-called "myeline forms" and they may simulate nerve fibres or nerve cells. When lecithin is burned it leaves a residue of metaphosphoric acid. Lecithin combines readily with acids; the hydrochloride forms a double compound with platinum and cadmium chlorides. The platinum compound, which has the formula (C<sub>44</sub>H<sub>90</sub>NPO<sub>3</sub>Cl)<sub>2</sub> + PtCl<sub>4</sub>, is insoluble in alcohol, easily soluble in water, and contains 10.2 per cent. of platinum. By removing the metal with hydrogen sulphide the lecithin may be obtained in a perfectly pure form; analysis shows it to have the formula C<sub>44</sub>H<sub>90</sub>NPO<sub>3</sub>.

Lecithin is easily decomposed by acids and alkalis; it also undergoes decomposition when allowed to stand in contact with water. When an ethereal solution of lecithin is shaken with dilute sulphuric acid the water is found to contain the base cholin (*q. v.*), while in the ether is found distearyl-glycerin-phosphoric acid. The latter is glycerin-phosphoric acid (C<sub>2</sub>H<sub>5</sub>(OH)<sub>2</sub>OPO<sub>3</sub>H<sub>2</sub>) in which the two hydroxyl hydrogens are replaced by the radicle of stearic acid; hence its formula is C<sub>2</sub>H<sub>5</sub>O<sub>2</sub>(C<sub>17</sub>H<sub>35</sub>CO)<sub>2</sub>OPO<sub>3</sub>H<sub>2</sub>. When lecithin is boiled with barium hydroxide, cholin, glycerin-phosphoric acid, and barium stearate are formed:



The cholin is readily identified by the formation of a characteristic double compound with platinum chloride (see *Cholin*). These decompositions show that lecithin is a compound of cholin with distearyl-glycerin-phosphoric acid. At one time it was thought that lecithin was simply a salt in which cholin plays the part of a base, but Hundeshagen<sup>4</sup> prepared synthetically a cholin salt of distearyl-glycerin-phosphoric acid which was isomeric with lecithin but which did not possess the characteristic properties of lecithin. Hence lecithin is more probably an ether-like combination, the cholin being united to the acid by means of the oxygen of the hydroxyl. So far, efforts to prepare lecithin synthetically have failed.

Instead of stearic acid, palmitic or oleic acid, or both, may occur in the lecithin molecule; hence there are a number of lecithins, and the one considered above is more properly termed distearyl lecithin. In some of the lecithins of plant origin the acid radicle seems to be combined not with cholin, but with a similar base, betain; such lecithins have been found in the beet root and cotton seed. It is possible that in the brain some of the lecithin contains neurin instead of cholin.<sup>5</sup>