

of all four limbs. Such cases, however, are very rare. Death has occurred by involvement of the diaphragm. Oliver reports a case of Philipson's in which complete paralysis supervened. Déjérine-Klumpke also recognizes a febrile form of general paralysis in lead-poisoning, which may closely resemble the subacute spinal paralysis of Duchenne.

There is also a primary saturnine muscular atrophy in which the weakness and wasting come on together and develop proportionately. It is this form, according to Gowers, which most frequently assumes the Aran-Duchenne type.

The electrical reactions are those of lesions of the lower motor segment, and have been described under lesions of the nerves. The degenerative reaction in its different grades may be present, depending upon the severity of the disease.

Usually with the onset of the paralysis there are pains in the legs and joints, the so-called saturnine arthralgias. As a rule, however, sensation is unaffected and the sensory nerves are not involved.

(e) The *cerebral symptoms* are numerous. Optic neuritis or neuroretinitis may develop. Hysterical symptoms occasionally occur in girls. Epilepsy is not uncommon, and in fits developing in the adult the possibility of lead-poisoning should always be considered. An acute delirium may occur with hallucinations. The patients may have trance-like attacks, which follow or alternate with convulsions. A few cases of lead encephalopathy finally drift into lunatic asylums. Tremor is one of the commonest manifestations of lead-poisoning.

(f) *Arterio-sclerosis*.—Lead-workers are notoriously subject to arterio-sclerosis with contracted kidneys and hypertrophy of the heart. The cases usually show distinct gouty deposits, particularly in the big-toe joint; but in this country acute gout in lead-workers is rare. According to Sir William Roberts, the lead favors the precipitation of the crystalline urates of the tissues. Ralfe has shown that lead diminishes the alkalinity of the blood, and so lessens the solubility of the uric acid.

Prognosis.—In the minor manifestations of lead-poisoning this is good. According to Gowers, the outlook is bad in the primary atrophic form of paralysis. Convulsions are, as a rule, serious, and the mental symptoms which succeed may be permanent. Occasionally the wrist-drop persists.

Treatment.—Prophylactic measures should be taken at all lead-works, but unless employes are careful poisoning is apt to occur even under the most favorable conditions. Cleanliness of the hands and of the finger-nails, frequent bathing, and the use of respirators when necessary, should be insisted upon. When the lead is in the system, the iodide of potassium should be given in from five- to ten-grain doses three times a day. For the colic, local applications and, if severe, morphia may be used. An occasional morning purge of sulphate of magnesia may be given. For the anæmia iron should be used. In the very acute cases it is well not

to give the iodide, as, according to some writers, the liberation of the lead which has been deposited in the tissues may increase the severity of the symptoms. For the local palsies massage and the constant current should be used.

IV. ARSENICAL POISONING.

Acute poisoning by arsenic is common, particularly by Paris green and such mixtures as "Rough on Rats," which are used to destroy vermin and insects. The chief symptoms are intense pain in the stomach, vomiting, and, later, colic, with diarrhoea and tenesmus; occasionally the symptoms are those of collapse. If recovery takes place, paralysis may follow. The treatment should be similar to that of other irritant poisons—rapid removal with the stomach pump, the promotion of vomiting, and the use of milk and eggs. If the poison has been taken in solution, dialyzed iron may be used in large doses of from six to eight drachms.

Chronic Arsenical Poisoning.—Arsenic is used extensively in the arts, particularly in the manufacture of colored papers, artificial flowers, and in many of the fabrics employed as clothing. The glazed green and red papers used in kindergartens also contain arsenic. It is present also in many wall-papers and carpets. Much attention has been paid to this question of late years, as instances of poisoning have been thought to depend upon wall-papers and other household fabrics. According to J. J. Putnam, the greatest danger is from the dust blown off by currents of air or detached by the brush. It is thought, too, that possibly some volatile compound of arsenic may be formed. Arsenic is eliminated in all the secretions, and has been found in the milk. J. J. Putnam, it should be remembered, has shown that it is not uncommon to find traces of arsenic in the urine of many persons in apparent health. The effects of moderate quantities of arsenic are not infrequently seen in medical practice. In chorea and in pernicious anæmia, steadily increasing doses are often given until the patient takes from fifteen to twenty drops of Fowler's solution three times a day. Flushing and hyperæmia of the skin, puffiness of the eyelids or above the eyebrows, nausea, vomiting, and diarrhoea are the most common symptoms. Redness and sometimes bleeding of the gums and salivation occur. In the protracted administration of arsenic patients may complain of numbness and tingling of the fingers. In the large number of patients to whom I have administered arsenic, often in doses which might be termed excessive, I have seen only one case in which numbness and tingling were marked. Pigmentation of the skin I have seen on several occasions.

In the slow poisoning by the absorption of arsenic in minute doses, as from wall-paper and fabrics, the symptoms are varied. J. J. Putnam groups them into the cases in which the symptoms mainly concern the general nutrition without signs of local irritation; those in which the symptoms

are due to irritation of the conjunctivæ, mouth, or pharynx; those with symptoms pointing to the digestive tract; cases with marked nervous phenomena; and those in which the nutrition of some special part of the body is involved. The most common symptoms are those of anæmia and debility, perhaps with slight irritation of the mucous membrane, and numbness and tingling. How far these symptoms are to be attributed to the small quantities of arsenic absorbed from wall-papers and fabrics is by some considered doubtful. That children and adults may take with impunity large doses for months without unpleasant effects, and the fact of the gradual establishment of a toleration which enables Styrian peasants to take as much as eight grains of arsenious acid in a day, speak strongly against it.

Arsenical paralysis has the same characteristics as lead-palsy, but the legs are more affected than the arms, particularly the extensors and peroneal group, so that the patient has the characteristic *steppage* gait of peripheral neuritis.

The electrical reaction in the muscles may be disturbed before any loss of power, and when the patient is asked to extend the wrist fully and to spread the fingers slight weakness may be detected early.

V. PTOMAIN POISONING.

In the bacterial decomposition of animal matters chemical compounds are formed, the putrefactive alkaloids, known as ptomaines and toxins, some of which are highly poisonous. They differ extraordinarily in their chemical characters and physiological effects. Some only are poisonous, and these Brieger has designated as toxins. The specific action of the micro-organisms in disease is now attributed in large part to the formation of these bodies, and the whole question of immunity and protection is now being worked out in this direction, a special stimulus having been given of late in the discovery by Hankin of the so-called defensive alkaloids (see under pneumonia).

Our interest here is in the effects of these poisons when taken with foods.*

It is quite possible that the leucomaines, the basic substances formed in the living body, may under certain circumstances be capable of causing disease. Products also of the bacterial decomposition in the intestines may be absorbed and act as poisons. Our knowledge on these points is as yet scanty and uncertain. A suggestive chapter (XIII) upon the subject is to be found in the work of Vaughan and Novy.

* For a full discussion of the whole subject the student is referred to the Manual upon Ptomaines and Leucomaines, by Vaughan and Novy, second edition, Philadelphia, 1891.

Among the more common forms are the following:

(1) **Meat Poisoning.**—Cases have usually followed the eating of sausages or pork-pie or head-cheese, and also occasionally beef, veal, and mutton. Sausage poisoning, which is known by the name of *botulism* or *allantiasis*, has long been recognized, and there have been numerous outbreaks, particularly in parts of Germany. Similar attacks have been produced by ham and by head-cheese. The precise nature of the poison in these cases has not yet been determined. Other outbreaks have followed the eating of beef and veal. In the majority of these cases the meat has undergone decomposition, though the change may not have been evident to the taste. The symptoms of meat poisoning are those of acute gastrointestinal irritation. Ballard's description of the Wellbeck cases, quoted by Vaughan, holds good for a majority of them:

"A period of incubation preceded the illness. In 51 cases where this could be accurately determined, it was twelve hours or less in 5 cases; between twelve and thirty-six hours in 34 cases; between thirty-six and forty-eight hours in 8 cases; and later than this in only 4 cases. In many cases the first definite symptoms occurred suddenly, and evidently unexpectedly, but in some cases there were observed during the incubation more or less feeling of languor and ill-health, loss of appetite, nausea, or fugitive, griping pains in the belly. In about a third of the cases the first definite symptom was a sense of chilliness, usually with rigors, or trembling, in one case accompanied by dyspnoea; in a few cases it was giddiness with faintness, sometimes accompanied by a cold sweat and tottering; in others the first symptom was headache or pain somewhere in the trunk of the body—e. g., in the chest, back, between the shoulders, or in the abdomen, to which part the pain, wherever it might have commenced, subsequently extended. In one case the first symptom noticed was a difficulty in swallowing. In two cases it was intense thirst. But however the attack may have commenced, it was usually not long before pain in the abdomen, diarrhoea, and vomiting came on, diarrhoea being of more certain occurrence than vomiting. The pain in several cases commenced in the chest or between the shoulders, and extended first to the upper and then to the lower part of the abdomen. It was usually very severe indeed, quickly producing prostration or faintness, with cold sweats. It was variously described as crampy, burning, tearing, etc. The diarrhoeal discharges were in some cases quite unrestrainable, and (where a description of them could be obtained) were said to have been exceedingly offensive and usually of a dark color. Muscular weakness was an early and very remarkable symptom in nearly all the cases, and in many it was so great that the patient could only stand by holding on to something. Headache, sometimes severe, was a common and early symptom; and in most cases there was thirst, often intense and most distressing. The tongue, when observed, was described usually as thickly coated with a brown, velvety fur, but red at the tip and edges. In the early stage the skin was often cold to the