joint—for instance, the knee, shoulder, elbow, or hip. In the course of a few days there is noted a collection of fluid in the joint and in the periarticular bursæ, and on puncture a lemon-yellowish transparent serum can be withdrawn. In one or two weeks later one is able to make out more or less well-marked crepitation, due to changes in the joint surfaces. The joint becomes extraordinarily movable, and luxations frequently occur, especially when the ends of the bone are worn away (Figs. 174 and 175).

Occasionally the tarsus is affected by the process. In such cases a marked swelling of the foot occurs in a relatively short time, the joints become affected in the way stated above, and at the post-mortem examination the tarsal bones are found to be altered in the manner represented in Fig. 176 ("tabetic foot").

The real cause of the affection is not yet known. While Charcot considered it due to an atrophy of the anterior ganglionic cells in the cord, Virchow pointed out that it might be due to a state of lowered nutrition of the bone following a disturbance of nerve influence. Oppenheim and Siemerling demonstrated a degeneration in the peripheral nerves, and according to Volkmann the analgesia produced by tabes creates a predisposition to the occurrence of the joint affection which he attributes to disturbances in the cartilages. Rotter divides the cases into three groups—true arthritides deformantes, primary fractures of the joints, and a third class in which there are most pronounced changes, but in which we are unable to determine whether they are due to an arthritis or a primary fracture.

We may add that arthrectomy has lately been performed several times for tabetic affections of the knee joint, and has been followed by success (Wolff, Sitzung der Berliner med. Gesellsch., 7. März, 1888, Deutsche Med.-Ztg., 1888, 22, p. 268).

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For the last few years only we have known that the peripheral nerves play a large and important part in tabes; previous to this Türck and later Friedreich had reported alterations

in the mixed nerves, but we were ignorant of their character until the publication of the work of Westphal (1878), which was soon followed by other articles, among them those of Dejerine, Pitres and Vaillard, Oppenheim and Siemerling, Sakaky and Pierret. The results of their work showed that the peripheral nerves suffer a parenchymatous degeneration, a destructive process, which, being associated with an increase of the perineurium, a proliferation of the nuclei, and extensive connective-tissue formation, leads to a final atrophy of the nerve elements. This peripheral neuritis is not necessarily followed by marked symptoms, but, according to our views, it is the main factor in the production of the analgesias which are often observed so early in the course of tabes, and to which O. Berger has already directed attention. Under certain circumstances this neuritis may produce deformities; thus if it involve the nerves which supply the muscles of the plantar surface of the foot these latter atrophy. The muscles concerned are those of the inner surface of the foot affecting the great toe, those of the outer surface to the little toe, the flexor brevis communis, and the interossei; the plantar aponeurosis retracts, and the toes become flexed and immovable (Fig. 177).

If larger nerves be affected by the process, the symptoms, which are characteristic of neuritis, and which have been described on page 386, make their appearance. They are chiefly pains, motor disturbances, and muscular atrophies. To this class belong the musculo-spiral paralyses caused by tabes, described by Strümpell (Berl. klin. Wochenschr., 1886, xxiii, 37), lesions of the median, described by Remak (ibid., 1887, xxiv, 26), and lastly, lesions of the peroneus longus, as described by Joffroy (Gaz. hebdom., 1883, xxxii, 48). Lately Dejerine has described a widespread muscular atrophy in tabetics, which has its origin in a peripheral neuritis (Neurite motrice periphérique des ataxiques, Revue de méd., 1889, 2). The observations of Remak seem to indicate that the muscles which are subjected to an unusual strain in the patient's occupation are particularly prone to become atrophied. In confirmation of this I can add two cases of my own: (1) In a cigar-maker, who exerted particularly the first three fingers of the right hand in making the cigar-tips, atrophy developed in the muscles of the ball of the thumb supplied by the median. (2) A dentist with tabes, who overexerted the musculature of the hand in filling teeth and in other manipulations, came under my obser-

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vation on account of an atrophy of the hypothenar muscles supplied by the ulnar. Similar cases are not uncommon.

Fig. 177.—Plantar Flexion of the Toes in the Course of Tabes (personal observation).

It is not at all rare in the course of tabes for the peripheral nerves to be attacked by neuralgias; the sciatic nerve calls for first mention, as it is usually affected early in the disease and very severely. We have already stated on page 372 that double sciatica is more particularly a frequent accompaniment of tabes. Branches of the pudic nerve may also be affected, and often recto-vesical neuralgia may be a source of great trouble (Neftel, Arch. f. Psych. und Nervenkrankheiten, 1880, 10); in this the patients complain of a painful burning sensation in the rectum after each defecation, which is often followed by marked depression of spirits, and the longer the interval between the acts of defecation and the firmer the consistence of the stool, the more intense becomes the suffering. After all, it is not easy to distinguish the peripheral from the above-described central affection, which may run a similar course.

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We will now attempt to say something as to the relative frequency of the symptoms and the time of their occurrence, but, of course, such statements can not lay claim to accuracy, and can only serve to give an approximate idea concerning the points in question.

Among the most frequent symptoms belonging to the brain, are, as we have already shown, lesions of the cranial nerves, and particularly of the oculomotorius, by which transient diplopia and irregularities in the condition of the pupils (anisocoria, myosis) are produced; next come lesions of the abducens. Almost as frequently will one recognize disturbances of the vagus, among which the gastric crises deserve particular mention. Among the spinal symptoms belonging to this category the first to be mentioned are the manifold disturbance of sensibility, among them cutaneous analgesias, particularly in the lower extremities, then, the paræsthesias and the lancinating pains which occur more particularly in the legs; how far these symptoms in a given case are due to disease (irritation) of the posterior spinal roots or to lesions of the peripheral nerves can only be determined by microscopic examination. At all events, degeneration of the peripheral nerves in the most varied cutaneous areas is to be classed among the regular occurrences in tabes. The disappearance of the patellar reflex and some form of the various bladder troubles are almost constant accompaniments of the affection, and these, taken in connection with the symptoms just mentioned, must be considered as the foundation for the diagnosis.

Lesions, particularly atrophy, of the optic nerve, symptoms of irritation and paralysis in the domain of the fifth nerve, and ataxia of the lower extremities, are frequent but less regular occurrences.

Less frequently met with are the laryngeal crises, due to lesions of the vagus, and affections of the nerves of taste and of the accessorius; the same may be said of the psychoses, hemiplegias, and attacks of epilepsy observed in the course of tabes. Certain disturbances of sensibility, the so-called rectal crises, cutaneous hyperæsthesias, neuralgias of the peripheral

spinal nerves, paraplegia of the legs, the tremor, and disturbances in the sexual functions also belong to this category. The trophic disturbances, the muscular atrophy, the falling out of the nails and hair, the "*mal perforant du pied*," and Charcot's disease of the joints are also comparatively rare.

To the symptoms which occur only seldom, one might almost say exceptionally, belong those referable to the hypoglossal, the auditory, and the facial nerves; among the motor disturbances of spinal origin, the so-called associated movements and ataxia of the upper extremities, among the sensory disturbances, the so-called polyæsthesias, double sensations, and delayed sensations belong to this class; marked diminution in the muscular strength is also exceptional.

As to the time at which these various symptoms severally arise, it is even more difficult to give reliable data, since there exists no uniformity; still, one can state with some amount of certainty that next to a feeling of slight weariness, particularly in the legs, the lesions of the oculo-motor and abducens are often the first to make their appearance; the disturbances of sensibility, particularly analgesia and paræsthesia, as a rule also occur early, while lancinating pains make their appearance at a later period. The gastric crises are observed relatively early, and bladder troubles are among the more frequent occurrences before the disease has advanced very far. The disappearance of the patellar reflex, as it usually constitutes one of the initial symptoms of the disease, plays an important part in the diagnosis, as we have already shown. Pronounced motor disturbances, particularly ataxia of the lower extremities, are often not observed until later in the disease, often only after years; and paraplegia of the legs, when it occurs at all, characterizes the last stages of the disease. Optic atrophy sometimes makes its appearance relatively early; in other instances it occurs only at a late period and comes on very gradually. For the time of its occurrence no definite rules can be laid down. Hemiplegias, epileptic attacks, and psychical disturbances, if they occur at all, manifest themselves sometimes earlier, sometimes later. As far as our own observations go, the trophic disturbances mentioned above, particularly the muscular atrophies and Charcot's joint affection, usually belong to the later stages.

The course of tabes is rarely markedly influenced by complications, but such may nevertheless occur. Lesions of the

pyramidal tracts in the spinal cord (Eulenburg, Deutsche med. Wochenschr., 1887, 35), valvular diseases of the heart, especially aortic insufficiency, Graves' disease, pernicious anæmia, diabetes, general paralysis, and bulbar paralysis are to be regarded as complications. Coexisting hysterical symptoms we may at times not be able to distinguish from those arising from the tabetic changes.

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5. Complications.

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Course.—About the general course of the disease the following remarks will hold good in a large number of cases: A middle-aged person who has become infected with syphilis some years previously, usually from eight to fifteen years before, begins to complain of slight fatigue on walking and occasional pains in the lower extremities. In spite of all treatment the pains continue to be troublesome, and occasionally become so severe that they disturb the patient's rest at night or even

render sleep impossible. At the same time it appears to him that his vision is becoming affected, and he complains particularly that he sees double, and in consequence suffers from vertigo. The diplopia may last only for a few moments at a time. The vertigo, which at the onset of the trouble was insignificant, becomes more and more pronounced, more especially in the dark, so much so that it is almost impossible for the patient to pass through a dark room without help. He also discovers that he staggers or falls to one side in the morning when in washing he covers his face with the towel, and only regains his equilibrium when his eyes are free again. Only rarely do disorders in the innervation of the larynx occur in the incipient stage of the affection, but an abductor paralysis may be found very early (Grabower, Deutsche med. Wochenschr., 1893, 18), and the laryngeal examination should therefore never be omitted in suspicious cases. Finally, he complains that he is obliged to pass water more often than usual, and that he consumes more time and must exert himself more when urinating than previously. The objective examination shows that there is widespread anæsthesia, particularly analgesic areas, about the lower extremities, and a loss of the patellar reflex. He may be inconvenienced in this way for years without his condition becoming serious. He suffers more or less all the time, sometimes quite severely, but, on the whole, his existence is quite bearable. The state of his mind is hopeful, for the daily occupation has not yet been interfered with by the disease.

The aspect of affairs is quite different when the patient suffers from gastric disturbances. The appetite becomes poor, and occasionally—sometimes for weeks at a time—there is morning vomiting, which is quite profuse and occurs as soon as the patient awakes, when, without effort, watery, slimy masses are discharged. After lasting for a longer or shorter time this ceases, probably only to return later on. The appearance of the patient, which was previously natural, now becomes altered for the worse. The skin becomes yellow and wrinkled, and his friends and acquaintances, who have not seen him for some time, begin to inquire about his health. At the same time a new symptom makes its appearance, and he notices that his gait is becoming uncertain and that in walking he must invoke his eyes to aid his legs, which, instead of carrying out the movements he intends, are thrown out in a peculiar aimless manner, so that if he be not led or supported he runs the risk of

tumbling down. This trouble in walking, which is associated, perhaps, with occasional gastric and more rarely with laryngeal crises, may likewise continue for years; but if the ataxia implicates the upper extremities, as happens in a small proportion of the cases, it may so interfere with the patient's occupation that he may be unable to continue it. In the meanwhile the bladder symptoms become more prominent and are aggravated to such an extent that it becomes necessary for the patient to wear some sort of receptacle, while the marked contraction or inequality of the pupils is apparent even to the layman.

Gradually another change for the worse in the gait comes on. The legs, which, although thrown out in the characteristic manner, in other respects performed their duty and even enabled the patient to cover considerable distances, begin to be fatigued on the slightest exertion; they become heavier and heavier, and it becomes more and more difficult, and at last needs the greatest effort, to walk at all. The legs are so weak that they are no longer able to support their owner, who is forced to take to the invalid's chair, and in this he ends an existence, the last years of which are as wretched as could be imagined, especially if atrophy of the optic nerve has robbed him of sight and the lancinating pains make his days and nights miserable. When the disease progresses in this or a similar manner its duration varies from ten, fifteen, even to twenty years or more. It can, however, be considerably shorter. I have seen cases in which only from three to five months elapsed between the beginning of the affection, from the first appearance of the disturbances in the movements of convergence of the eyes, to the appearance of well-marked paralysis of the legs.

On the other hand, there are cases in which the course may extend over a space of thirty or more years; in these paralytic symptoms may not come on at all, and the ataxia may continue to the end. There are tabetics who during their entire illness are hardly prevented at all from carrying on their work; they are always able to be up and about, and it appears as if the different symptoms never attained their full development. These are the so-called "*formes frustes*" of the French, analogous to those with which we have already become acquainted in Graves' disease and in multiple sclerosis. Again, in other cases, tabes sets in with brusque symptoms, such as apoplecti-

form attacks, disturbances of speech, and lesions of the optic nerve, and then pursues a mild course for a long period—violent symptoms, such as laryngeal crises, intense neuralgias, etc., only occurring occasionally; these are the so-called atypical forms of the authors.

From what has been said it is evident how difficult it is to make a positive statement concerning the general course of the affection. Scarcely one case follows the same course as another, and it often requires a great amount of caution and experience to enable one to take a correct view of all that occurs.

Just as much uncertainty exists about the prognosis, which is influenced by various factors. One most important question is, of how long standing is the disease, for in recent cases in which there are no other symptoms than disturbances of sensibility and absence of the knee jerks, and the course of which has not as yet exceeded three or four months, and in which there is no ataxia, the prognosis is not at all unfavorable, and the disease is under some conditions curable. Advanced cases of tabes in which there are numerous spinal and cerebral symptoms offer a much more serious prognosis, but even here the possibility of cure is not excluded, though the highest percentage of recoveries is estimated at one per cent (Eulenburg). Of course, one can not expect that the anatomical changes will disappear, and at the autopsy a widespread degeneration of the posterior columns has been found in cases in which during life all symptoms had practically disappeared. In the majority of the so-called recoveries from tabes one is led to believe that there was a mistake in the diagnosis, and that these were cases of chronic nicotine poisoning, peripheral neuritis, hysteria, neurasthenia, etc. The prognosis of old cases with paraplegia of the legs, paralysis of the bladder, and so forth, is altogether unfavorable, and any attempts at cure are not only useless, but may even interfere with the comfort of the patient.

It is a matter of indifference, so far as the prognosis is concerned, whether one is able to demonstrate that the patient has at one time or other been infected with syphilis or not; a so-called specific or luetic tabes, especially when the infection has taken place ten or twenty years previously, does not afford a better outlook than the more rare idiopathic affection.

It is clear, then, that one must be very cautious in predicting the duration of the disease; one can not say definitely how