the medullated nerve fibres. Non-medullated nerves often appear varicose and exhibit a marked tendency to branch and form plexuses. Their ultimate fibrillæ are more widely separated than are those of the medullated fibres, protoplasm in the former taking the place of the cement substance in the latter. As independent fibres they occur principally in the sympathetic system, but not infrequently they are associated with medullated fibres in nerve trunks, as in the vagus.

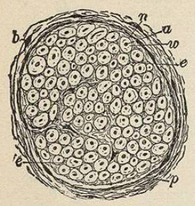

FIG. 3585.—A Simple Funiculus More Highly Magnified. The apparent small nucleated cells are sections of the nerve fibres and their axis cylinders. *a*, Axis cylinder; *w*, white substance of Schwann or medullary substance; *n*, neurilemma; *e*, endoneurium; *p*, perineurium; *b*, connective-tissue cells of the same. (Piersol.)

Nerve Trunks.—The nerve fibres are usually collected in bundles or funiculi, several of which constitute the nerve trunk. The individual fibres are held together by a delicate connective tissue, the *endoneurium*. A certain number of the fibres are grouped to form a funiculus, the latter being surrounded by a more dense connective-tissue envelope, the *perineurium*. The funiculi in turn are grouped together to form a nerve trunk, and are surrounded by a larger amount of loosely arranged connective tissue, the *epineurium*. This tissue supports the blood-vessels and the lymphatics, which invariably are present in the interior of the nerve trunk, as well as the adipose tissue often present in the larger nerve trunks.

The Neuroglia.—The supporting substance in the white matter of the brain and cord, as well as a considerable portion of the matrix of the gray substance, is made up of a network of exceedingly delicate fibres, the *neuroglia* fibres, and the neuroglia cells, two varieties of which are distinguished—the *spider cells* and the *mossy cells*. The cell body of the spider cell is smaller, while their processes are long, thin, rigid, with very little branching. They occur chiefly in the white substance of the brain and cord. The mossy cells have a larger cell body, short, richly branched processes, and are principally found in the gray substance, where they are often in intimate relation with the walls of blood-vessels.

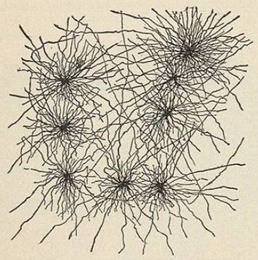

FIG. 3586.—A Group of Spider Cells from the White Substance of the Brain of Man, stained by Golgi's method. Drawn as seen under high magnifying power. (Kölliker.)

Robert Formad.

NERVOUS SYSTEM, TRAUMATIC AFFECTIONS OF.—It is not purposed here to attempt a detailed description of all the affections of the nervous system which are caused by trauma. Within the limits of the present article nothing further can be attempted than a brief analysis of the causal relations in which trauma stands to nervous diseases, with especial consideration of the place which nervous diseases, when caused in this manner, occupy at law. What is to be said, therefore, will be chiefly interesting to the medical man who is brought in contact with injuries to the nervous system and their legal complications. Personal-injury claims form a very important feature of modern life. Not only transportation companies, but private individuals as well, fully expect to pay for injuries which are received through actionable negligence for which they are responsible. Similarly, few receive injuries traceable to the negligence of others without promptly demanding compensation. In our mechanical times the frequency of accidents is enormous. Consequently, the evaluation of injuries received and the compensation to which the injured person is entitled are matters of prime importance. Greater interests are involved than in any other medico-legal question. This becomes plain as soon as we reflect upon the large sums which are annually paid out in such cases. From the report of the Brooklyn Rapid Transit Company for the year 1901 it appears that in that year more than one million dollars was paid for personal injuries and expenses incident thereto. This sum represented nearly ten per cent. of the gross receipts of the company for the year named. Individual verdicts are also often very high. As much as thirty-five thousand dollars has been paid for a personal injury, and for a death claim resulting from the Tunnel accident of the New York Central and Hudson River Railroad of February 8th, 1902, a verdict of $60,000 was returned by the jury. Verdicts varying from $10,000 to $20,000 are not at all unusual, and anything under $1,000 is considered virtually a victory for the defendant. Court calendars are overcrowded with these cases, which form the bulk of jury trials to-day. But the calendar is not a complete index of the degree of activity in this branch of law, as for every case that comes to trial it is safe to estimate that ten are settled by mutual agreement out of court. If the magnitude of the interests at stake are taken into consideration, it is not surprising that trial lawyers should be on the alert, or that there should be great competition for plaintiff's cases. As a result, "runners" or "ambulance chasers," representing legal firms which specialize in accident cases, are constantly stationed about centres of traffic; they rush to the scene of accident, and make their appearance at the hospital door almost simultaneously with the injured person. Thenceforth the claim is prosecuted on the contingent fee plan. The system has doubtless been much abused, and has been made the object of much attack and ridicule. It is made possible solely through the poverty of the plaintiff, who is generally unable himself to carry on the great expense of trial at law, and who consequently is forced to accept professional services which are to be paid for, on a percentage basis, out of the damages awarded. It has many very objectionable features. By such a system the lawyer is made more than an advocate, and the expert medical witness more than a mouthpiece of science. But no practical and better substitute has yet been suggested. The question will probably resolve itself eventually by fewer claims being litigated, and more being settled by mutual agreement. Mr. Herbert W. Page, whose book, "Injuries of the Spine," published in 1882, marked a distinct epoch in the history of this subject, told me a year or two ago that litigation of personal-injury claims in England was becoming more and more infrequent. Erichsen's book, which appeared in 1866, and which furnished the original description of the peculiar symptoms resulting from railway and allied injuries, gave the first effective impetus to litigation of this character. For years afterward personal-injury claims were prominent in the English courts. But now, according to the statement of Mr. Page, they are so infrequent that, in his position as consulting surgeon to the London and Northwestern Railway, he is called upon to go to court only three or four times a year. It has seemed to me that the willingness for compromise is growing in this country also. Among the litigated cases those hardest to compromise are the ones in which injury to the nervous system is alleged. In purely surgical injuries, such as the loss of a limb or of an eye, the cause is definite, and the question quickly resolves itself into one of liability and the appraisal of the value, as far as such an appraisal is possible, of the injured or missing member. But in nervous affections, and especially in the functional affections, with their obscure causation, their indefinite and often bizarre symptomatology, agreement is much more difficult. The contending parties are often at variance in regard to every particular. Neither is inclined to give in, and the case, if it is a case, goes to the jury.

Nervous diseases are divided into two great classes, organic and functional. A functional, as opposed to an organic disease, is one in which the anatomical integrity of nervous structure remains unimpaired. Functional diseases doubtless have a material pathology. But such a pathology remains inaccessible by any methods of investigation at present at our disposal, and we are therefore obliged to retain this classification, artificial as we know it to be. Of the organic nervous affections caused by trauma, the vast majority are definite surgical injuries to the central or peripheral nervous system. Thus, injuries of all kinds to the head, with injury of the brain; to the back, with injury to the spinal cord; or to the peripheral nerves, are causes. When, in addition to the cause, we can demonstrate certain cardinal abrogations of function of these organs, which we have learned to rely upon as indications of structural alterations in them, the diagnosis of organic injury is justifiable. Thus, after head injuries, paralysis of one or more cranial nerves, or of the extremities, together with other general symptoms, speaks for injury to the brain; paralysis, with anæsthesia in characteristic areas, and loss of control of the sphincters, speaks for injury to the spinal cord; paralysis, with degenerative electrical reactions, speaks for injury to a peripheral nerve. Injuries of this character are ordinarily easy to recognize, and the prognosis in regard to them can usually be formulated with considerable precision. Consequently, in common with other surgical injuries, when they are seen in court, which they rarely are, the questions for the jury to decide concern the legal aspects of the accident rather than its surgical results.

There is a group of chronic organic diseases, with uncertain and indefinite causation, which are not infrequently the subjects of litigation. The most important of these are locomotor ataxia and general paralysis of the insane, or general paresis. Others of this class are ataxic paraplegia, progressive muscular atrophy, paralysis agitans, syringomyelia, multiple sclerosis, etc. These latter are, however, much rarer diseases than the two first mentioned, and consequently of much less importance. Both locomotor ataxia and general paresis are comparatively common (the latter chiefly in cities). As has been said, their causes are obscure and undetermined. It is possible, and indeed probable, that injury can act as a contributing cause in their development. But the weight of scientific evidence is against their ever occurring solely as the result of trauma. Both diseases are often latent for a long time, and both may undergo a sudden outbreak of symptoms as the result of disease or injury. Both diseases, by their symptoms, expose the victims of them to accidents. It is consequently not surprising that both are frequently made the subjects of personal-injury claims. Juries often award verdicts in such cases, in view of the fact that sworn experts, who frequently do not at all understand the condition about which they testify, affirm that the injury was the sole cause of the trouble.

Epilepsy is another disease, which in this connection can be considered organic, and about which legal interest frequently centres. That typical epileptic convulsions follow head injuries, even when there is no discoverable injury to the brain, is an incontestable fact. In order to establish a reasonable support for such a contention in any given case, it is necessary to prove that the patient had not had epilepsy before the accident, and that the accident, in character and severity, was of a nature to produce such a result.

While the three diseases named above not infrequently figure in litigated cases, the chief interest, both legal and scientific, in traumatic affections of the nervous system, centres about the functional disorders known, since the appearance in 1889 of Oppenheim's monograph, as the traumatic neuroses. In the earlier treatises, and especially in Erichsen's, these neuroses were totally misunderstood and were classified with organic injuries. Progress throughout the whole field of neurology has now made it possible, in most cases at least, to distinguish these two great classes. As originally described by Oppenheim, the traumatic neuroses present chiefly the symptoms of neurasthenia and hysteria, but also some which indicate structural lesions. The term was a taking one, and has attained a rather different meaning from that which Oppenheim intended. To-day, by a traumatic neurosis is understood a simple neurosis, without known organic basis, plus such characteristics as its traumatic origin has added to it. Thus considered, the traumatic neuroses are composed of symptom groups which can, in nearly all cases, be brought under the rubric of neurasthenia or hysteria. In causation, they have many points in common. They have both attained their prominence through railway accidents. This is partly due to railway accidents so often being due to actionable negligence, and partly to the fact that in such accidents physical injury and mental shock are conspicuously combined. Both mental and physical elements are present in nearly all accidents. In most cases of neurasthenia the bruising and shaking up have been considerable, although severe surgical injuries are usually absent. Hysteria, on the other hand, is a fright neurosis above all else, and the history of injury in its causation is often very inconspicuous. It is well to observe in this connection that in the State of New York there can be no recovery of damages unless there has been a definite physical injury. Injuries resulting from fright alone do not constitute a cause of action.

Much has been written and much said about litigation as a cause of functional nervous diseases following trauma. If one were to be guided by the fluent generalizations of some railway claim agents, one would have to believe that any real injury to the nervous system could not occur on a railway; that all persons who allege such injuries either deceive themselves or wish to defraud the company. Certain experts, on the other hand, who are especially prominent in plaintiff's cases, are not inclined to accord much importance to the financial side of the question. Leaving aside actual simulators and impostors, who are very rare, I may say that my experience has taught me that the question of damages has a great influence on both neurasthenia and hysteria, and that in neither disease is restoration of health probable while litigation is pending. This baneful effect is due to the difficulty of carrying out proper treatment so long as legal questions are pending. Were the treatment for such cases simply medicinal, such a statement would naturally appear absurd. Medicines, however, play a very insignificant rôle in the treatment. They are of some indirect service, but far more important is the psychological direction of the patient. The diversion of the patient's thoughts away from morbid channels, the arousing of his interest in matters not connected with himself or his troubles, the exclusion from his consciousness of suggestions which may magnify or create symptoms,—these are the keys to the successful treatment of the traumatic neuroses. They are rendered powerless by the damage claim. The frequent examinations by experts (in some cases as many as five or six doctors examine a plaintiff), the law's delays, the legal inadvisability of the patient's returning to work, and the thousand and one annoyances inevitable to litigation, render futile any attempt to control the patient psychologically. These factors, in my opinion, are much more responsible for the continuance of symptoms than is any desire which the patient may possess to profit by his misfortune. This is especially true for traumatic hysteria, in which disease, aside from its being an agent in suggestion, the money question has little or no influence. The question of litigation as a cause of the traumatic neuroses must be kept separate from the question of voluntary exaggeration of symptoms actually present, and of simulation or fraud pure and simple. As far as actual simulation is concerned, it is very rare, and should not pass undetected by a phy-

sician who is skilful and reasonably resourceful in his methods of examination. Voluntary exaggeration of symptoms actually present is more difficult to detect. It is not often encountered in hysteria. But in neurasthenia, the making the most of symptoms is an integral part of the disease and inseparable from it. It is, therefore, not an easy matter to determine when it reaches the point where the patient exaggerates in spite of himself and involuntarily, or when it is intentional, voluntary, and purposeful. There is no rule to guide us in determining how this question may be satisfactorily answered in any given case. Some help may be derived from information obtained from outside sources. But as a general rule the physician's conclusion must be based on his own examination, and the soundness of it is usually directly proportional to his experience and acumen, both professional and worldly.

In what has now been said, it has been plainly hinted that the traumatic neuroses are the results of mental impressions, rather than of physical injuries. The different ways in which these impressions act and in which their effects are elaborated constitute the two main symptom groups of neurasthenia and hysteria. Each group has some characteristics in common with the other. But each has also its own individuality, which stamps it as a definite clinical entity. Neurasthenia represents irritability, fatigue, and exhaustion. Such perversion of mental function as exists is in the line of exaggeration of tendencies common to all mankind. Hysteria, on the other hand, is absolute delusion. The premises of the neurasthenic's reasoning may be sound, but the deductions which he draws from them are too general. The hysteric, on the other hand, is wrong in his premises, and the deductions which he draws are insane delusions. The former is within the boundary line of mental alienation, the latter way beyond it. The characteristics of a case of traumatic neurasthenia are usually somewhat as follows:

A man, whose previous life has, according to the evidence, been healthy, is in an accident in which he is considerably shaken up and badly frightened. He is astonished to find that he has escaped without severe physical injury. He is able to walk, and in general accidents he can often render assistance to those more severely injured than he. That night he does not sleep well. He is disturbed by dreams; or thoughts recalling the catastrophe thrust themselves into his consciousness. From then on he finds himself becoming more nervous, more easily fatigued, and more irritable than formerly. His sleep is regularly disturbed, and trifles upset him. He has lost his nerve. In short, he develops the ordinary symptoms of neurasthenia (*q. v.*), with which every practitioner is only too familiar. He differs in some respects from the ordinary neurasthenic. Pain in the back, only occasionally complained of in non-traumatic neurasthenia, is very prominent in the traumatic variety. It may exist as a dull constant pain, or be in the form of lumbago, increased by all movement. The mental state also is dominated by the recurring thoughts of the accident, and by a dread of its repetition. With such slight variations the picture is the same as in ordinary neurasthenia. The mental state varies from that of the irritable, querulous, self-centred, introspective semi-invalid, to that of the pronounced hypochondriac. Depression is a dominant feature, and may entirely do away with working capacity.

Neurasthenic complaints, in addition to those of fatigue, fear, depression, etc., may refer to nearly all parts of the body. Some of them have objective substantiation. There is no true paralysis, but the muscles are quickly fatigued as has been shown by the ergograph. There is often tremor of the face, and with it there is generally associated a fine tremor of the fingers. In addition to subjective pain in the back, there are usually one or more vertebral spines which are extremely sensitive to touch. These spots are often shifting, they are not always in the same places. Headache is another common symptom. It is referred, most frequently, to "the base of the brain." Feelings of numbness and tingling are regularly complained of, but there is never any objective anæsthesia. The vascular disturbances are particularly important. All neurasthenics have unstable sympathetic nervous systems. This condition is shown by the sudden changes in color of the face, by the cold hands and feet, and by the fact that sensations of heat and cold pass over the whole body. The heart is also irritable and often constantly over-active. Attacks of palpitation are common, and are induced by trivial causes. There is also a more or less persistent tachycardia.

Digestive disturbances are almost constant. They, in common with the mental state, are responsible for the poor nutrition of many of these patients. Complaints regarding the genital apparatus are frequent. Women notice disturbances of menstrual function. In men these complaints are chiefly in regard to seminal losses, to prostatorrhœa, etc. In a certain proportion of cases there is loss of sexual desire. The patients worry and reason about this, and fear that they are becoming impotent. As a result they approach the sexual act with timidity and often with great excitement. As a result of their fears there may fail to be an erection, or the excitement under which they labor may cause ejaculation. These failures become more pronounced with succeeding attempts, until finally, in despair, the patient is convinced that his virility is gone permanently. In some litigated cases impotency is the chief item in the complaint. In a recent case a young Swede, a superb specimen physically, brought suit for $25,000 for such a cause. He had fallen with some wooden structure into a river, and in rising to the surface had been struck across the thighs by a wooden beam. He was bruised, but the testicles were not directly injured. Active sexually before, he alleged that after the accident he experienced great loss in sexual power. Experts in his behalf testified that he was sterile and incurable. The jury, however, apparently adopted the view of neurasthenia, for they awarded a verdict of only $2,000, which sum the judge promptly cut in two.

In hysteria, the mental state often has many neurasthenic features, but in its salient characteristics it is totally different. The striking symptoms of hysteria—namely the palsies, the blindness, and the anæsthesias—although they constitute physical manifestations, are of purely psychic origin, dependent upon delusional beliefs or on fixed ideas. That they do not result from structural alterations is proved by their inconstancy and sudden fluctuations. Their occurrence in all peoples and in all times, and their conformity to definite and consistent symptomatic behavior in all classes of people, render absurd the position of those who contend that hysteria is voluntary simulation and not a disease. It seems to me very important that it be more generally recognized that hysteria is a distinct affection of the mind, and that its symptoms, while varied, are none the less characteristic and distinct. Contrary to the popular impression, and to the etymology of the name, it is not rare in men. Traumatic hysteria, in my personal experience, has been more frequent in men than in women. Present conceptions regarding mental diseases lead us to assume that they occur chiefly if not exclusively in persons who are hereditarily predisposed. In most of the cases which I have seen it has been impossible to prove the existence of an hereditary predisposition. I should add, however, that most of these cases were litigated; consequently too great scientific value should not to be given them.

The symptoms of traumatic hysteria are striking and varied. They may appear immediately after the accident, or they may be delayed until the morning after, or even for several days. This interval has been called by Charcot the "period of meditation." During it the patient is reflecting on the accident, is reasoning about it, subconsciously, and then he finally develops the symptoms. These may be referred to every organ and every system of the body. They may very closely resemble symptoms due to organic disease. But in the imitation there is always a flaw. The reproduction is never perfect. Thus, in hysterical paralysis, there are not the

degenerative electrical reactions which are characteristic of peripheral palsies, or the changes of reflexes, rigidity, etc., which are characteristic of cerebral paralysis. In hysterical anæsthesia, also, the loss of sensibility is too transitory, or its association with other symptoms too contradictory, or its distribution too irregular, to warrant the belief that it rests upon an organic basis. It would be impossible, within the limits of the present article, to go into the symptoms of traumatic hysteria in detail. The reader is referred to the article *Hysteria* in The Handbook, or to the chapter on Traumatic Hysteria in my work on "Accident and Injury in their Relations to Diseases of the Nervous System." The following brief summary of the more important symptoms may be useful here. Paralysis is usually in the form of hemiplegia, without involvement of the face. In an overwhelming majority of cases it affects the left side. Monoplegia usually affects the arm and is generally the sequence of some slight injury to that member. Paraplegia is rare in traumatic cases. It is not accompanied by involvement of the sphincters. Polyplegia is most unusual. The paralysis of hysteria is of a flaccid type, and usually affects the limb in its entirety. It gets better and worse, according to changes in environment. It is not accompanied by electrical degenerative reactions nor by changes in the deep reflexes. Anæsthesia varies in distribution with the paralysis. Sometimes it affects the whole body. In hemiplegia, there is hemianæsthesia on the paralyzed side; in monoplegia, the sensory loss may affect the whole side, or only the paralyzed member. In paraplegia the genitals retain their sensibility. The anæsthesia of hysteria is profound and affects all forms of cutaneous sensibility. It may change its situation and extent as a result of mental impressions. Sight, hearing, taste, and smell are also commonly affected. The visual disturbances consist in concentric limitations in the visual fields, changes in the color fields, or amblyopia. Spasm of the orbicularis sometimes prevents the patient from opening the eyes. Hysterical deafness is a common symptom. If there is paralysis, at the same time, the deafness is unilateral and on the side of the paralysis. Deaf-mutism is rare; it occurred in one case in my experience. The deafness, which was complicated by hemiplegia, led to mutism, and at last report, one year and a half after the litigation had ceased, this condition still persisted. The hysterical attack is very important in litigated hysteria, as the patient is almost certain to have an attack in court. At a recent trial the plaintiff was in convulsions for two hours and a half in the court-room. Such demonstrations appeal very strongly to the sympathies of the jury, though in the case referred to the jury disagreed on the first trial, and returned a verdict for the defendant on the second. These attacks are commonly called hystero-epilepsy—clearly a misnomer, as they are not in any way allied to epilepsy. They differ from epileptic attacks in the character of the aura, the quality and duration of the convulsive phenomena, and the absence of biting of the tongue and of the involuntary passage of urine. Epileptic attacks are not precipitated by excitements and crowds. Hysterical attacks have a predilection for dramatic surroundings. The lack of conformity to organic types makes the distinction of hysteria from the diseases which it simulates nearly always possible. Juries, however, fail to recognize this fact and consequently the medico-legal relations of traumatic hysteria are very peculiar. Under existing conditions it is almost impossible for a jury, composed of laymen, to decide justly with regard to traumatic hysteria. The plaintiff is generally brought before them, and he is almost sure to present the acme of all the symptoms which he has had. If some of these symptoms had previously disappeared, they are quite sure to return during the progress of the trial. The psychosis is nourished upon suggestion and introspection, facilities for which are so profusely furnished by the excitement and observation attendant upon court proceedings. It is entirely consistent with the nature of this malady that existing symptoms should become worse or vanished ones return on such occasions. It is not necessary to assume, in explanation, any voluntary exaggeration or simulation on the part of the patient. The effect of this clinical idiosyncrasy on a jury, however, is disastrous to the cause of the defendant. The twelve jurors have heard from the medical experts of the two sides testimony too often directly conflicting. On the one side the opinion has been expressed that the patient's condition is due simply to nervousness aggravated, if not caused by the suit, and that the symptoms will soon subside when the legal proceedings are at an end; on the other side, the belief has been sworn to that the injury is of organic and irreparable character, or, if perchance its functional nature is admitted, that the nervous system has sustained a shock from which it can never recover.

The jurors may be convinced of the honesty of all the views which they have heard expressed, and yet they are unable to determine, from the character of the testimony, which of the opposing opinions is the more likely to be correct. They are, therefore, obliged to rely upon the impression made upon them by the injured person himself. They see before them an individual in an even worse condition, perhaps, than his doctors had depicted. They see an alleged paralyzed limb absolutely motionless; they become witnesses of an emotional outburst more harrowing than any related in the evidence. And they see these things one or two years after the accident has occurred. Their natural inference is that the injuries are permanent. They find it hard to believe that the outlook for a malady which has so long defied the resources of medical skill is anything but hopeless. They are unwilling, if not unable, to believe in the unreality of physical symptoms. They cannot comprehend a part being the seat of paralysis or insensibility, unless there is some grave physical defect behind it; they do not know that a limb which is immobile to-day may be in wonted activity to-morrow. Thrown on their own resources by the contradiction in medical testimony, they render a verdict in accordance with their own impressions as to the plaintiff's injury. These impressions indicate a person severely and probably incurably injured; and the verdict, rendered accordingly, is generally in excess of anything to which the plaintiff is entitled.

The two types, hysteria and neurasthenia, as above sketched out, are in most cases distinct and unmistakable. In some cases the type of mental state is neurasthenic, with enough of the hysterical added to cause a hemianæsthesia or other permanent stigma of hysteria. To this type has been given the name of hystero-neurasthenia. In other cases, coupled with the symptoms of functional disease, are certain signs indicative of material destruction in the nervous system. These latter cases are difficult to classify. It is not to be denied that some of them are the direct outcome of severe traumatic physical injuries. Most of them, however, can better be explained on the assumption that some pre-existing organic disease, such as general arteriosclerosis, syphilis, or alcoholism, has been made worse, or has first been called into prominence, by traumatic agencies.

The prognosis of hysteria and neurasthenia provoked by trauma is a subject on which very diverse views are held. Reliable statistics bearing on the question are few. Certain facts, however, are in our possession. Neither disease is fatal. Some writers maintain that the vascular disturbances of neurasthenia lead to serious degeneration in the heart and arteries and so to premature death. Some few instances also are on record in which death during the convulsive phenomena of hysteria has occurred. Such cases are, however, so rare and so poorly substantiated by reliable evidence that we are safe in asserting that these diseases do not kill. It is not to be denied, however, that some patients have the same symptoms for years and years, and, as far as is known, never get well. On the other hand, there is nothing about either disease which makes recovery impossible. Organic diseases, such as locomotor ataxia or progressive muscular atrophy, are manifestly incurable. But in the neuroses a cure, in the widest sense of that term, is possible.

The vital question concerns working capacity: What are the chances for a return of working capacity, provided that had been lost? To this question the answer is, that under reasonably favorable conditions these chances are very good. They are the best in patients who try to return to work as soon as is feasible after the accident, who are young, previously healthy, and of good family history.

The prognosis which can be given in a case of neurasthenia is not always permissible for a case of hysteria. A person suffering from traumatic neurasthenia can often be brought to a condition in which he can safely return to work soon after the accident. The subjective disturbances, however, of which he complains may persist for months or years afterward. Indeed, it is very difficult to tell when they stop, and the patient may never himself admit that he is the same as he was before the accident. In hysteria, on the other hand, recovery may be longer delayed, but when it comes it is generally more complete. Few if any hysterical persons can undertake any work before the question of litigation is settled. But when that is once out of the way, a period of a few months generally, though not always, is sufficient for a fairly complete return of working capacity.

Pearce Bailey.

NEURALGIA.—Definition and Nature.—The term neuralgia in its strict sense signifies pain along the course of a nerve. The word has been used, however, to indicate conditions in which such pain exists purely as a neurosis, to distinguish it from the cases in which inflammatory and degenerative changes are present in the nerve, to which class the name "neuritis" is applied.

Probably the majority of the neuralgias are due in part only to any primary or essential neurosal disorder of the nervous centres, and indicate, in addition, some irritation of the sensory nerves from without.

This is eminently true of most of the typical neuralgias of the superficial nerves, and as our knowledge of the course and pathology of these diseases advances, many of the conditions formerly classed under the neuralgias are shown to be cases of neuritis. For instance, the gradual onset and decline of certain forms of sciatica and brachial neuralgia, their protracted course, the limitation of the pain to the tract and distribution of single nerves, and the fact that the pain is apt to be remittent rather than intermittent, together with the presence of tenderness along the nerve trunk, persistent alterations in the sensibility of the skin, and even muscular atrophy and trophic changes in the skin, all tend to point to the neuralgia being secondary to a neuritis, while examination of the nerve shows characteristic changes of inflammation and degeneration.

Then there are cases, such as some of the facial neuralgias, in which the character of the pain is that of neuralgia, persistent, intermittent, and frequently in neurotic individuals; and here examination of the nerve, after the affection has existed some time, often shows degenerative changes. The question then arises, Are these changes primary or secondary—*i.e.*, is the case a slow progressive neuritis from the start, or are these changes in the nerve secondary to the long persistent disorder of function which underlies the pain? The recent ion theory of Loeb, that the transmission of nerve stimuli is due to chemical change in the nerve substance, might well account for a permanent change resulting from constant severe pain persisting in the nerve.

Finally, there is the class of neuralgias in which the character, situation, severity, and duration of the pain are wholly determined by processes acting on healthy sensory nerves, and may be called reflex or symptomatic neuralgias. These irritative causes, however, if long continued, may induce a permanent neuralgic habit of the nervous centres.

The group of habit pains might also be classed as neuralgias, and both these and other forms may often be relieved by mental influences.

It is uncertain whether there are special nerves and nerve centres intended for the conveyance and perception of painful impressions, but the results of experimentation and the difference in the behavior in disease of this function—if so it may be called—from the other sensory functions, lead to the belief that such may be the case.

Again, it may be that the nerves of pain are the same with the nerves for the general feelings (*Gemeingefühle*) of satisfaction or discomfort, which accompany, and yet are distinct from, the special sensations of relation, such as touch, temperature, and the like.

If there are special nerves and nerve centres for pain, it is probable that they are the seat of the disease in neuralgia.

It is common to hear the neuralgias of the superficial nerves spoken of as the only affections really deserving the name, and as belonging in a different category from the visceralgias and the periodical headaches, as well as from the pains of intermittent recurrence, but of ill-defined seat, to which children and feebly nourished persons, and especially neurotic persons, are liable.

In so far, however, as these painful disorders occur under similar conditions with typical neuralgias of the superficial nerves, and are themselves of unknown origin, there is much gained in treating of them both as kindred affections, and contrasting them with each other.

General Etiology and Pathology.— An *inherited neuropathic tendency* is the most important cause of neuralgia, and it is often impossible, in a given case, to measure the degree to which its influence is felt. It is, however, a far more important element in the migraines and the visceralgias than in the superficial neuralgias, and among the latter its effect is most strongly felt in the neuralgias of the fifth pair, and of the intercostal nerves.

The exact pathological state of the nervous centres in neuralgia is not known, any more than it is in the case of the other neuroses. Some of the conditions that give rise to it are, however, better understood.

Chief among these are: *Anæmia*, which acts both by impoverishment of the blood, and by overcharging the blood with carbonic acid; the *presence of abnormal substances in the blood*, as in gout, diabetes, malaria, chronic nephritis, and metallic poisoning; *absorption of the products of imperfect digestion or metabolism; the impairment of the vascular tonicity*, as in fatigue; *peripheral irritations*, such as disease of the teeth, eyes, respiratory and digestive tracts, uterus, and ovaries; chronic inflammation of the nerve sheath; *localized anæmia or congestion of nerves or nerve centres.*

Anæmia and states of *nervous debility* or *chronic fatigue* are common underlying causes of neuralgia, even though not the whole cause, and it is almost always best to suspect them and to fortify the patient against them by ample nourishment and tonic treatment. Although anæmic and debilitated patients are more prone than healthy persons to neuralgias of every sort, this is especially true with regard to the superficial neuralgias, the sufferers from migraine and the visceralgias being often in good, even robust, health so far as any anæmic tendency is concerned.

Anæmic neuralgias are, as a rule, protracted, like their cause, but may in the end pass away rapidly under appropriate treatment.

Diabetes sometimes causes intractable and often symmetrical neuralgias, especially sciatica, even though the symptoms of the underlying disease are not marked.

Gout and kindred disorders (lithæmia) may cause neuralgia, partly by alteration of the blood, or by direct irritation of the nervous centres, and partly by inducing neuritis. These neuralgias are sometimes bilateral and fugitive, sometimes lasting, according to their origin. Visceralgias are also common in the gouty, but it is an open question whether this may not be, in part, because of the neuropathic tendency which is intimately connected with gout.

Chronic nephritis, and the vascular and nutritive disorders associated with it, may cause various neuralgias, both superficial and visceral.

Syphilis likewise causes neuralgias both in its early and

in its late stages, and here also the manner of its action may be either direct or indirect. It is also worthy of reflection, in a given case of this kind, whether the cause of the neuralgia may not be the antisyphilitic treatment which has been used, and not the disease itself.

The neuralgias due to *mineral poisoning* are apt to be bilateral, or to attack different parts successively. The arthralgias and visceralgias of lead poisoning belong in this category, but will be treated of with the other symptoms of the same origin.

Peripheral irritations cause neuralgia which is sometimes confined to the region irritated, sometimes located in distant parts, and are always to be carefully sought for and eliminated, since, even when they constitute only partial causes, they may be practically responsible for the seizures. Carious teeth may excite neuralgia in other branches of the fifth pair besides that directly irritated.

Injuries, such as *severe jars*, as in railroad accidents, or *blows*, even when they do not apparently injure any particular nerve, may excite severe neuralgias, and the same is true of *emotional excitement or mental overstrain, acute or chronic*.

The pains due to the pressure of *cancerous growths*, or other *tumors*, and *aneurisms*, though often classed as non-neuralgic, are really not always to be distinguished from neuralgia by any intrinsic characteristic. The diagnosis is often established by other indications of the presence of morbid growths, and, so far as the nervous system is concerned, is rendered probable by unusual persistence and severity of the pain, the occurrence of signs of neuritis, such as marked atrophy, contracture, anæsthesia, etc. A *bilateral distribution* of the pain is also suggestive of such a cause, pointing either to pressure upon symmetrical nerve trunks at their exit from the spinal canal, or, in the case of the brachial nerves, to a symmetrical enlargement of lymphatic glands. Neuralgia of the fifth pair has occasionally been traced to aneurism of the internal carotid.

Cold and damp weather and the atmospheric changes preceding and accompanying storms are fruitful causes of neuralgic attacks, acting no doubt in part by depressing the general nervous tone, and in part by causing congestion or anæmia of the sensitive cutaneous nerve fibres, and even increasing any neuritis that may be present.

It is proper to speak here of the relation to neuralgia of such general influences as *age* and *sex*.

Childhood is usually considered nearly free from neuralgia, but this is only true of the typical, peripheral neuralgias of protracted course. The so-called "growing pains" of childhood may fairly be called neuralgic, and children suffer from visceral neuralgias, and sometimes from typical migraine or periodical headache.

Puberty brings an increased tendency to migraine and headache, which then usually lasts until the age of forty-five or fifty. The neuralgias of acute anæmia and chlorosis occur also largely at this period, though anæmia is probably also a cause of some of the pains of childhood.

All neuralgias are most common in *middle life*, mainly because it is then that the nervous strains incident upon increased cares and exposures of all kinds make themselves most strongly felt, and act both directly and indirectly by increasing neuropathic tendencies.

Neuralgias *rarely begin in old age*, and when they do they are very intractable, perhaps because they depend upon tissue degenerations in the nervous and vascular systems. It is, however, a noticeable fact to which the writers can bear testimony that, in spite of their severity and persistency, the neuralgias of old age sometimes unexpectedly disappear for longer or shorter periods, or even permanently.

The *female sex* shows a relatively great liability to the neuralgias of neuropathic origin; the *male sex* to neuralgias of peripheral origin.

General Symptomatology.—All neuralgias have in common a greater or less tendency to *periodic* and apparently spontaneous *recurrence*, but the degree to which this periodicity is seen varies greatly.

The most regular and spontaneous periodicity is met with in the malarial neuralgias and in those of mainly neurosal origin, especially migraine and the periodic headaches. The visceralgias recur less regularly, but their outbreaks also are frequently, to all appearance, spontaneous, that is, due to cyclic changes within the nervous centres themselves, and not to irritation from without. In both cases this tendency to cyclic outbreaks may be interrupted, and attacks precipitated, by various causes.

Besides these neuralgias of regular recurrence, persons of neuropathic constitution are often liable in some degree to spontaneous attacks of pain, of relatively short duration; but the typical superficial neuralgias of protracted course, as a rule, show but little of this tendency to periodical and spontaneous recurrence, so characteristic of the more distinctly neurosal neuralgias. They may recur, it is true, but this is either from a recurrence of their underlying cause, or because the neuritis, which is usually present as an important complication, if not a cause, does not entirely pass away and excites the neuralgia to fresh outbreak.

Almost all neuralgias have in common a tendency to excite *vaso-motor* and *trophic changes*. The *vaso-motor* phenomena are most marked in cases of the migraines, which are often characterized by a marked pallor or redness, or both in turn, of one side of the head. These vascular changes have, in fact, been widely believed to be the essential feature of migraine, and to be directly responsible for the pain; but this is, in the writers' judgment, a mistaken opinion. Similar symptoms are seen in the other neuralgias, especially those of the neighborhood of the eye, and probably attend, if they do not cause, the changes in the glandular secretions (tears, urine, mucus, gastro-intestinal fluids), which are also very common near the seat of any severe neuralgia, and even at a distance from it. The writers have seen a sharp attack of intercostal neuralgia, for instance, of short duration and due to acute fatigue and exposure, pass entirely away with a copious discharge of limpid urine, such as often attends the close of a migrainoid attack. Finally, migraine is often unattended by any noticeable vascular changes.

The *trophic* phenomena are most marked in the case of the superficial neuralgias, and range from such changes as are obviously due to neuritis (herpes zoster and other cutaneous eruptions, muscular atrophy, and the like), to the more temporary alterations which are partly of vaso-motor origin, or due to irritation of trophic or glandular nerves, and partly of unknown origin (œdema of the skin, changes of color and increased brittleness of the hair, temporary muscular enfeeblement, impairment of the eyesight, possibly even glaucoma, etc.). The cases associated with herpes are occasionally accompanied by palsy of the muscles innervated by the affected or related nerves. The trophic changes in migraine are but slight.

It is often included in the definition of neuralgia, that the pain is confined to the *region of distribution of one or more nerve branches*, but this applies only to the neuralgias of the superficial nerves.

It is common to most neuralgic attacks that the pain is *intermittent or remittent* in severity. When a continuous dull aching is present, it may be suspected that the neuralgia is complicated by a material degree of neuritis.

For further examination of their symptomatology, neuralgias may be divided into:

1. Superficial neuralgias.
2. Migraine and the periodical headaches.
3. Visceralgias.
4. Unclassified neuralgias of irregular distribution.

1. The *superficial neuralgias* are limited to the course and areas of distribution of one or more nerves or parts of nerves supplying the skin and adjacent structures.

The principal varieties are: (1) The neuralgia of the fifth nerve, of which there are several subdivisions; (2) the neuralgia of the occipital nerve; (3) the neuralgia of the cervico-brachial nerves; (4) the neuralgia of the abdominal nerves; (5) the neuralgia of the anterior crural nerves; (6) the neuralgia of the sciatic nerves.