they may be compressed by swellings at the bony foramina. The resulting symptoms are anæsthesia, hyperæsthesia, analgesia, neuralgia, paralysis, or disturbances of the special senses.

Syphilitic lesions being most frequent in the neighborhood of the interpeduncular space, the nerves near this region are most commonly involved. The third pair are perhaps most often affected, the first, second, fourth, and sixth quite frequently, while syphilitic changes of the seventh pair, or facial nerves, are rather exceptional.

The syphilitic lesions of the optic nerve have been studied by Barbar,[1] Arcoleo,[2] and Hulke,[3] but more recently by Schott,[4] who describes them very accurately, and illustrates them copiously with lithographic plates. This observer confirms the view of Virchow, that there may be both neuritis and perineuritis. In two cases he found free proliferation of young, round, nucleated cells in the connective-tissue sheath, with some increase of the spindle-shaped cells. He found similar cells, in rows and solitary, in the nerve tissue itself and around the nutrient vessels of the nerves. The nerve bundles were separated and thinned by the pressure. In one case the process was limited to a portion of one optic nerve, and was more pronounced near its origin. In the other case, though both nerves were involved, the left was more markedly affected.

Other cranial nerves and the spinal nerves may be altered in a similar manner, with or without coincident lesions of adjacent parts. Heubner states that a nerve has been found to pass through a syphilitic new growth and yet remain normal.

We know little of the changes caused by syphilis in the peripheral nerves, but certain clinical facts indicate that they may be affected in a similar way. A number of writers describe the gross appearances as follows: in the early stage they lose their rounded shape and become swollen; they assume a reddish-yellow color and a soft and pulpy consistency; at the same time, the swelling may give them a bulbous appearance; subsequently, they become atrophied into yellowish-white, cartilaginous cords. This, like all other syphilitic lesions, is limited to certain portions, and never attacks the entire length of a nerve. We are wholly ignorant of any primary change in the nerve fibres and axis-cylinder.

The *sympathetic* nerves may undergo two varieties of change: one affecting the nerve cells and characterized by pigmentary and colloid degeneration; the other consisting of a connective-tissue proliferation. These conditions were found by Dr. Petron, on microscopic examination both of fresh specimens and of those hardened in chromic acid, in the cervical, thoracic, and solar plexuses of syphilitic subjects. He draws the following conclusions from his studies:[5]

[1] Ueber einige seltenere syph. Erkrankungen des Auges, Zürich, Inaug. dissert, 1873.
[2] Clin. ottal. di Palermo, 1871. Quoted by Schott.
[3] Ophth. Hosp. Rep., London, 1869.
[4] On some Affections of the Optic Nerve, Arch. of Ophth. and Otol., N. Y., 1877, vol. vi., Nos. 1, 2.
[5] Arch. f. path. Anat., etc., Berlin, 1873, S. 121.

1. The syphilitic diathesis affects the sympathetic nerve, determining very distinct alterations.
2. The nerve cells may undergo change independently of the connective tissue, consisting of pigmentary, and, less frequently, of colloid degeneration.
3. The connective tissue may undergo, as elsewhere, sclerosis, and cause atrophy of the nervous elements.
4. The membrane covering the nerve cells may be involved, at first by hypertrophy from cell-infiltration, which may afterwards undergo fatty degeneration.

Cerebral Syphilis sine Materia.

There are certain groups of symptoms observed in syphilitic subjects, which can be explained only by admitting the possibility, now generally recognized, of a temporary condition, possibly hyperæmic, of the nervous system, caused by the syphilitic virus.

The term *cerebral syphilis sine materia* has been given by some prominent authors to syphilitic nervous affections, which present no perceptible nervous lesion. The view that these affections may exist without structural change, is based on the autopsies of several cases, in which severe nervous symptoms had been present, yet nothing abnormal was found. Some, who hold this view, think that the morbid change may have been so occult and delicate as to have eluded discovery by the methods of investigation then known.

Our present knowledge of the lesions, which may cause syphilitic nervous affections, is much more extensive and precise. There is reason, therefore, for the suspicion that changes actually did exist in the cases referred to, which were overlooked; possibly minute tumors, which easily escape notice, or structural changes in the walls of the cerebral arteries, which may be invisible except on longitudinal section of the vessels.

We cannot deny that *cerebral syphilis sine materia* may exist, but before accepting it as the diagnosis in a given case, it must be proved that the autopsy was carefully and thoroughly made.

Prodromal Symptoms.

The sudden invasion of cerebral syphilis is unusual. In most cases there is a well-marked prodromal stage, in which one or more of the following symptoms may be presented.

One of the most frequent, and often the only symptom of this stage is headache, which is usually general but may be limited to the occipital and frontal regions. It may be very slight or so excruciating that patients say they feel as though the head were in a vice. In mild cases the pain ceases at night, but in others sleep is entirely prevented. It may disappear without treatment in a week or ten days, but has been observed to continue fully two months. Its duration is wonderfully influenced by mercury, even though it

may resist the most powerful narcotics. Several recurrences of this form of headache may take place within the first year or two of syphilis. Neuralgia of one or more of the cranial nerves may accompany it, especially in those subject to this affection. The fact that this form of headache occurs when the blood is most profoundly modified by syphilis indicates that it is due to changes in that fluid.

A variety of headache which sometimes comes on early in the secondary stage exhibits an important diagnostic feature in nocturnal exacerbation. It may exist during the day with abated severity or may be wholly absent, and begin at some time during the evening or night. It is usually confined to a single region, and frequently small patches of syphilitic lesions of the bone or of the meninges may be defined by pressure with the tip of the finger, which intensifies the pain. It is always symptomatic of grave structural change, and is likely to vary in intensity with the seriousness of the lesion. Its course is always chronic. Sometimes it is distinctly intermittent, or it may cease spontaneously for days or weeks, then return and continue for weeks or even months. Usually it does not cease with the onset of the profound symptoms of which it is a premonition, but persists throughout. A headache with somewhat similar features may accompany the development of nodes on the exterior of the cranium.

In exceptional cases, sleeplessness is a troublesome and persistent prodromal symptom, and exists without any disturbance of the general health, or towards night there may be a feeling of uneasiness and nervousness. Sometimes this feeling persists through the day. Such patients are indisposed to active exercise, and become excessively tired on slight exertion. They may seem to be otherwise in good health and well nourished, or cachexia may set in, with emaciation and that earthy pallor peculiar to syphilis. This cachectic state is probably present in one-half of the cases of cerebral syphilis, especially those in which the nervous symptoms appear late in the course of the disease.

Vertigo is a prominent prodromal symptom, and a constant accompaniment of that headache which lasts through the day. It may be a temporary dizziness, or so extreme that the patient feels at times as though he were losing his senses.

There may be a varying degree of mental confusion or weakness. Slight impairment of the memory, slow, and perhaps incoherent mental action may be exhibited, while the speech may be hesitating, not from difficulty of phonation, but from impaired intellection. Such patients may become petulant, melancholy, and morbidly emotional. They frequently complain of nervousness and a tendency to become frightened and to tremble on the slightest cause. Numbness in the head, darting pains, hyperæsthesia or anæsthesia, with weakness of the extremities, may be experienced. Sometimes choreic movements are marked. Photophobia, intermittent or continuous,

and often coexisting with dull frontal headache, has been noticed in some cases. There may also be mild ataxic symptoms in the prodromal stage, and not infrequently paralysis of one or more of the cranial nerves, especially those distributed to the muscles of the eye.

Finally, nocturnal delirium, mild or maniacal, is in some cases a very prominent symptom. This condition leaves the patient in the morning depressed and uninvigorated, with a dull, heavy sensation in the head.

Some or all of the preceding symptoms may exist for variable periods, and, on the outbreak of grave manifestations, they undergo modifications to be hereafter described.

Syphilitic Tumors of the Nervous System.

Two forms of syphiloma, or syphilitic tumor, are found in the cranio-vertebral cavity, which differ widely in gross appearances, but are composed of similar structural elements. These tumors are usually connected with the cerebrum; they have rarely been found in the medulla oblongata or in the cord, and we are not aware of any having been observed either upon or within the cerebellum.

The first form is of a grayish-red color, and is extremely vascular, most of the vessels being very minute, while some are plainly visible to the naked eye. When developed exclusively in the pia mater and arachnoid, the tumor is soft and slightly fibrous; but, if it is formed only in the dura mater, its consistence is quite firm, owing to the abundance of fibrous tissue.

Under high powers of the microscope the tumor is found to consist of small round cells, arranged regularly or without order in a very delicate alveolar stroma of connective tissue. The walls of the newly-formed vessels are usually much thickened by cell increase.

The second form of tumor, which is harder and of a yellowish color, is merely a late and degenerating stage of the first variety. Excess of fibrous tissue renders its structure more dense, and its boundaries more clearly defined. The bloodvessels are few, and, while permeable at the periphery, at the centre of the tumor they are converted into fibrous cords. On section, the tumor is slightly resistant to the knife, and appears more or less desiccated. Microscopic examination shows a distinctly fibrous stroma, in which is imbedded a large quantity of withered cells, granular and fatty matter, and blood crystals.

These tumors vary greatly in number and in size; there may be a single one, or the surface of the hemisphere may be studded with large numbers of them, resembling the condition in miliary tuberculosis; they may be of the size of a pea or of a small walnut. They are usually round or oval, but in some situations they become flattened. They have been found encircling an artery, and it is probable that their origin is always around some vessel, particularly one trav-

ersing the large fissures of the brain. In rare instances the soft form of tumor has been found in large patches, involving chiefly the vascular cerebral membranes, and having a thickness of from one-quarter to one-half an inch, and constituting in reality a gummatous meningitis.

These tumors are found chiefly on the inferior surface of the brain, in the region of the fissure of Sylvius. Great care must be employed in examining the hemispheres, since such growths may exist in any recess of the brain into which the vascular membranes are reflected. Heubner says that frequently, after having, as he supposed, finished an autopsy, he has run across minute tumors hidden in such situations.

The facts thus far recorded warrant the opinion that these tumors are always peripheral, and, if found imbedded in the brain tissue, they have grown inwards from the vascular membranes.

Meningeal Symptoms.

There is a group of symptoms of constant occurrence, especially in the early years of syphilis, which are distinctly referable to inflammation of the meninges.

The first of the group is the headache already referred to. This symptom continues for a variable period, during which the general health is gradually but evidently becoming impaired. The patient complains of feeling weak; he is fatigued on slight exertion, and is indisposed to physical or mental effort. Emaciation may be a marked symptom in some cases, while in others there is a tendency to fatty development with a consequent flabby appearance. Not infrequently there is true syphilitic cachexia, with its typical facies. Coincidently with these general disturbances of nutrition, we find prominent symptoms of mental impairment. Thus, a patient affected in this manner expresses himself vaguely in conversation, is slow and uncertain in his utterance or even incoherent. His statements are confused and rambling; his replies hesitating, more or less inexact, and perhaps inappropriate. In short, there is general dulness and torpor of the intellect.

In other cases we find the patient with a dull, vacant stare upon his face. If asked what he is thinking of, he gives no intelligent answer. His memory, his reasoning, and his perceptive faculties are sadly at fault. In health he may have been vivacious and quick of comprehension; he is now dull, stupid, and morose; his ordinary habits, tastes, and inclinations are changed and debased. He is fault-finding, suspicious, and quarrelsome, often very emotional, laughing or crying on the slightest provocation; or, again, he may present the silly, stupid appearance of complete hebetude. A case of this kind, if not checked by treatment, is likely to terminate in confirmed dementia.

Again, the above series of symptoms may be varied. Hemiplegia,

aphasia, or convulsions may appear at either an early or a late period. In very many instances paralysis of one or more cranial nerves supervenes at an early date, and mydriasis, either with or without ptosis of one or both lids, has been so frequently noted that its occurrence should always excite suspicion. Other ocular disturbances, such as progressive atrophy of the optic nerve, paralysis of the muscles of the eyeball, serous iritis of one or both eyes, with its accompanying photophobia, are not uncommon, and have been more fully described in a previous chapter.

I have noticed, and several authors also allude to it, a peculiar and persistent hyperæmia of the eye and lids, similar to that which accompanies iritis. This condition may become chronic, and it has often been found to be intermittent, becoming most marked during exacerbation of the nervous symptoms. Such patients complain of photophobia, which is sometimes so intense that they are completely dazed by any sudden or strong ray of light. These symptoms are undoubtedly dependent upon a low stage of choroiditis.

Other special senses may also, though less frequently, be impaired. That of smell is sometimes diminished, or, at an advanced stage, wholly lost, or it may be much perverted, so that unpleasant odors are constantly complained of. The hearing may be impaired or destroyed. Noises of various kinds (tinnitus aurium) are experienced, while otalgia, generally nocturnal, is an occasional symptom.

A general adynamic condition sometimes supervenes in patients affected with chronic inflammation of the meninges, which either ends fatally, or renders them hopelessly bedridden. This weakness may be due to mere lack of innervation, or may be complicated by mild ataxic phenomena, characterized by unsteady gait and uncertain movements. The dulness of intellect by day is succeeded by nocturnal delirium. When lying in bed, such a patient resembles one in typhoid fever, but there are marked points of difference. He is sleepy and dull, and his face is utterly expressionless. The tip and edges of his tongue are red, but the organ is never, unless late in fatal cases, dry, cracked, and covered with sordes.

Anorexia and constipation are often quite marked.

The pulse ranges from 80 to 110, is full and not wiry. The temperature may be elevated in the morning to 100° F., and at night to 103° or 104° F.

If conscious, the patient complains of intense headache and weariness. In a week or ten days he passes into a condition of complete unconsciousness, perhaps broken by brief lucid intervals.

The urine and fæces are passed involuntarily. If not relieved, the condition soon becomes more serious; the temperature continues to rise, and the pulse increases in rapidity; no food is taken, and the stupor merges into fatal coma.

The above course of events has been observed in a number of instances of quite recent syphilitic infection, varying between the second and sixth years; it may occur even as early as the first year.

Thus it is seen that inflammation of the meninges has a distinct group of symptoms by which it may be recognized, and that it may be complicated by other, and perhaps more formidable symptoms. In the simple inflammation, the lesion is probably limited to the convexity of one of the hemispheres; when the opposite side of the brain is involved, or when the basal portion, where the cranial nerves have their origin, is attacked, the case becomes complicated by a series of new features, such as paralyses, and other impairments of nervous function.

This view, which is supported by the clinical history of cerebral hyperæmia and simple meningitis, and by our knowledge of the course and pathology of syphilis, seems to simplify a large number of apparently obscure cases. The various phenomena, such as paralysis, epilepsy, aphasia, etc., which may arise from similar causes in both the chronic and the more acute form of syphilitic meningitis, will receive separate attention hereafter.

The time of the invasion of meningitis is uncertain; the acute form is generally observed in the early years of syphilis. It is only the adynamic form which is liable to be mistaken for typhoid fever. A correct diagnosis may be reached from the history of the case, from the severity and early supervention of the head symptoms, and from the absence of the characteristic typhoid tongue and of signs indicating intestinal lesions. In certain cases of sunstroke, which may present features of striking resemblance, the acuteness of the invasion and the totally different character of the headache, in addition to the previous history of the patients, may enable us to avoid error.

Syphilophobia.

Syphilophobia is sometimes included among the manifestations of syphilis, but we do not believe that it is directly due to this disease. It is quite as often met with in patients affected only with gleet, prostatorrhœa, or who have nothing in the world the matter with them, except their own disordered imagination. Moreover, in truly syphilitic cases the fear of syphilis often increases in proportion as the specific symptoms disappear. A few years ago, I had under my charge a member of Congress, affected with syphilis, who imagined, while his eruption was fading, that he was "rotting internally." So long as I was willing to continue treatment, he was somewhat pacified, but one day, when every trace of his affection had long since passed away, and I told him that he needed no more medicine, he went to his room and shot himself dead with a pistol.

Syphilitic patients will sometimes state that they have resolved to give up their business, and devote their time to the cure of their disease. Such a course should always be discouraged, since it favors mental depression, interferes with the general health, and thus retards the effect of remedies, and may lead to confirmed hypochondria or syphilophobia.

Hemiplegia.

One of the most frequent phenomena of cerebral syphilis is hemiplegia, which may occur as early as the sixth month, or as late as twenty years after infection. The interference with the motor function may be slight, or there may be complete loss of power. It is generally preceded by a stage, in which a prominent symptom is localized headache, often associated with many of the other symptoms already mentioned, such as mental disturbance, hebetude, vertigo, and convulsions, which are often immediately followed by the paralytic stroke.

In some cases muscular spasm, a form of pre-paralytic chorea, has been observed in the limbs afterwards paralyzed. For instance, the arm may be jerked in various directions, or the patient may find it impossible to place the foot firmly on the ground, the leg being pulled suddenly from under him when he attempts to stand.

In other cases, darting pains are felt in the leg or arm, or constant neuralgic pain may exist in some part of the limb; or there may be numbness or tingling in the hands and feet, with patches of hyperæsthesia or anæsthesia.

In cases of gradual invasion, total paralysis seldom occurs. The patient first notices that he is losing strength, perhaps in his fingers, so that he finds himself unable to button his clothing or to hold a pen firmly. This condition may continue until paralysis comes on, or it may be intermittent, the normal strength returning at intervals. When the leg is thus affected the patient naturally has more or less difficulty in walking. Complete hemiplegia has been seen to come on in this gradual manner, but is generally sudden. Sometimes the leg is affected several hours before power is lost in the arm. The reverse, however, is infrequent. Patients are usually attacked with hemiplegia when engaged in some act of muscular effort, such as pulling on the boots, walking briskly, reaching for some object, or on the point of shooting at game (Van Buren and Keyes). On the contrary, the attack may happen during the night, and the patient be unable to rise from the bed in the morning.

The course and duration of hemiplegia vary greatly. When partial the paralysis may gradually improve, and even disappear spontaneously in a few days; or, as improvement takes place, the opposite side may be similarly affected, followed by recurrence of the paralysis on the side first involved. These cases are accompanied by excessive mental impairment, and, as a rule, have an early fatal termination. Syphilitic hemiplegia is caused by lesions of the arteries, and, in cases of the latter class just mentioned, the vessels of each side of the brain are implicated.

Disturbance of general sensation is usually limited, but instances of slight loss of motor power, with complete loss of the sensory function, have been reported. In exceptional cases there may be total loss of both motion and sensation.