nately Ehrlich's diazo-reaction, which is so constant in typhoid fever, is also met with in general tuberculosis. The absence of the characteristic roseola is an important feature. Occasionally in acute tuberculosis reddish spots may develop and for a time cause difficulty, but they do not come out in crops, and rarely have the characters of the true typhoid eruption. Herpes is perhaps more common in tuberculosis. Toward the close, petechiæ may appear on the skin, particularly about the wrists. A rare event is jaundice, due possibly to the eruption of tubercles in the liver.

In a few instances the presence of tubercle bacilli has been demonstrated in the blood, which in doubtful cases should therefore be examined. The spleen has been punctured and cultivations made to determine the presence or absence of the typhoid bacilli The eye-grounds should be carefully examined for choroidal tubercles. Leucocytosis occurs in acute tuberculosis, but not in typhoid fever.

2. **Pulmonary Form.**—*Symptoms.*—From the outset the pulmonary symptoms are marked The patient may have had a cough for months or for years without much impairment of health, or he may be known to be the subject of chronic pulmonary tuberculosis. In other instances, particularly in children, the disease follows measles and whooping-cough, and is of a distinctly broncho-pneumonic type. The disease begins with the symptoms of diffuse bronchitis. The cough is marked, the expectoration muco-purulent, occasionally rusty. Hæmoptysis has been noted in a few instances. From the outset dyspnœa is a striking feature and may be out of proportion to the intensity of the physical signs. In adults, the respirations may be as hurried as in acute pneumonia, reaching from fifty to sixty; in children, as high as eighty or more. There is more or less cyanosis of the lips and finger-tips, and the cheeks are suffused. Apart from emphysema and the later stages of severe pneumonia I know of no other pulmonary condition in which the cyanosis is so marked. The physical signs are those of bronchitis. There is rarely much alteration in the percussion note. In children there may be defective resonance at the bases, from scattered areas of broncho-pneumonia; or, what is equally suggestive, areas of hyper-resonance. Indeed, the percussion note, particularly in the front of the chest, in some cases of miliary tuberculosis, is full and clear, and it will be noted (post mortem) that the lungs are unusually voluminous. This is probably the result of more or less wide-spread acute emphysema. On auscultation, the râles are either sibilant and sonorous or small, fine, and crepitant. There may be fine crepitation from the occurrence of tubercles on the pleura (Jürgensen). In children there may be high-pitched tubular breathing at the bases or toward the root of the lung. Toward the close the râles may be larger and more mucous. The temperature rises to 102° or 103°, and may present the inverse type. The pulse is rapid and feeble. In the very acute cases the spleen is always enlarged. The disease may prove fatal in ten or twelve days, or may be protracted for weeks or even months.

Diagnosis.—The diagnosis of this form offers less difficulty and is more frequently made. There is often a history of previous cough, or the patient is known to be the subject of local disease of the lung, or of the lymph-glands, or of the bones. In children these symptoms following measles or whooping-cough indicate in the majority of cases acute miliary tuberculosis, with or without broncho-pneumonia. Occasionally the sputum contains tubercle bacilli.

The choroidal tubercle occurs in a limited number of cases and may help the diagnosis. More important in an adult is the combination of dyspnœa with cyanosis and the signs of a diffuse bronchitis. In some instances the occurrence of cerebral symptoms at once give a clew to the nature of the trouble.

3 **Meningeal Form** (*Tuberculous Meningitis*).—This affection, which is also known as acute hydrocephalus or "water on the brain," is essentially an acute tuberculosis in which the membranes of the brain, sometimes of the cord, bear the brunt of the attack.

There are several special *etiological* factors in connection with this form. It is much more common in children than in adults. It is rare during the first year of life, more frequent between the second and the fifth years. In a majority of the cases a focus of old tuberculous disease will be found, commonly in the bronchial or mesenteric glands. In a few instances the affection seems to be primary in the meninges. It is very difficult, however, in an ordinary post-mortem to make an exhaustive search, and the lesion may be in the bones, sometimes in the middle ear, or in the genito-urinary organs. In those instances in which no primary focus has been discovered it has been suggested that the bacilli reach the meninges through the cribriform plate of the ethmoid from the upper part of the nostrils, but this is not probable.

Morbid Anatomy.—Tuberculous meningitis presents a very characteristic picture. The meninges at the base are most involved, hence the term basilar meningitis. The parts about the optic chiasm, the Sylvian fissures, and the interpeduncular space are affected. There may be only slight turbidity and matting of the membranes, and a certain stickiness with serous infiltration; but more commonly there is a turbid exudate, fibrino-purulent in character, which covers the structures at the base, surrounds the nerves, extends out in the Sylvian fissures, and appears on the lateral, rarely on the upper, surfaces of the hemispheres. The tubercles may be very apparent, particularly in the Sylvian fissures, appearing as small, whitish nodules on the membranes. They vary much in number and size, and may be difficult to find. The amount of exudate bears no definite relation to the abundance of tubercles. The arteries of the anterior and posterior perforated spaces should be carefully withdrawn and searched, as upon them nodular tubercles may be found when not present elsewhere. In doubtful cases the middle cerebral arteries should be very carefully removed, spread on a glass plate with a black background, and examined

with a low objective. The tubercles are then seen as nodular enlargements on the smaller arteries. The lateral ventricles are dilated (acute hydrocephalus) and contain a turbid fluid; the ependyma may be softened, and the septum lucidum and fornix are usually broken down. The convolutions are often flattened and the sulci obliterated owing to the increased intra-ventricular pressure. Histologically the tubercles are seen to develop in the perivascular sheaths, producing circumscribed aggregations of lymphoid and epithelioid cells. The lumen of the vessel is narrowed and thrombosis may result. The meninges are not alone involved, but the contiguous cerebral substance is more or less œdematous and infiltrated with leucocytes, so that anatomically the condition is in reality a *meningo-encephalitis*.

There are instances in which the acute process is associated with chronic meningeal tuberculosis; cases which may for months present the clinical picture of brain tumor.

Although in a majority of instances the process is cerebral, the spinal meninges may also be involved, particularly those of the cervical cord. There are cases indeed in which the symptoms are chiefly spinal. A sailor, who had fallen on the deck three weeks before his death, was admitted to the Montreal General Hospital. He presented signs of meningitis, chiefly spinal, which were naturally attributed to traumatism. The post-mortem showed absence of tubercles and lymph at the base of the brain, and an extensive eruption of miliary tubercles with much turbid lymph over the entire spinal meninges. There were small cheesy masses at the apices of the lungs.

Symptoms.—Tuberculous meningitis presents an extremely complex clinical picture. It will be best to describe the form found in children.

Prodromal symptoms are common. The child may have been in failing health for some weeks, or may be convalescent from measles or whooping-cough. In many instances there is a history of a fall. The child gets thin, is restless, peevish, irritable, loses its appetite, and the disposition may completely change. Symptoms pointing to the disease may then set in, either quite suddenly with a convulsion, or more commonly with headache, vomiting, and fever, three essential symptoms of the onset which are rarely absent. The pain may be intense and agonizing. The child puts its hand to its head and occasionally, when the pain becomes worse, gives a short, sudden cry, the so-called hydrocephalic cry. Sometimes the child screams continuously until utterly exhausted. I saw in West Philadelphia a case of basilar meningitis in a girl of thirteen, who for three days, when not under the influence of a powerful sedative or of chloroform, screamed at the top of her voice so as to be heard a square or more away. The vomiting is without apparent cause, and is independent of taking of food. Constipation is usually present. The fever is slight, but gradually rises to 102° or 103°. The pulse is at first rapid, subsequently irregular and slow. The respirations are rarely altered. During

sleep the child is restless and disturbed. There may be twitchings of the muscles, or sudden startings; or the child may wake up from sleep in great terror. In this early stage the pupils are usually contracted. These are the chief symptoms of the initial stage, or, as it is termed, the *stage of irritation*.

In the second period of the disease these irritative symptoms subside; vomiting is no longer marked, the abdomen becomes retracted, boat-shaped or *carinated*. The bowels are obstinately constipated, the child no longer complains of headache, but is dull and apathetic, and when roused is more or less delirious. The head is often retracted and the child utters an occasional cry. The pupils are dilated or irregular, and a squint may develop. Sighing respiration is common. Convulsions may occur, or rigidity of the muscles of one side or of one limb. The temperature is variable, ranging from 100° to 102·5°. A blotchy erythema is not uncommon on the skin. If the finger-nail is drawn across the skin of any region a red line comes out quickly, the so-called *tâche cérébrale*, which, however, has no diagnostic significance.

In the final period, or stage of *paralysis*, the coma increases and the child cannot be roused. Convulsions are not infrequent, and there are spasmodic contractions of the muscles of the back and neck. Spasms may occur in the limbs of one side. Optic neuritis and paralysis of the ocular muscles may be present. The pupils become dilated, the eyelids are only partially closed, and the eyeballs are rolled up so that the corneæ are only covered in part by the upper eyelid. Diarrhœa may develop, the pulse becomes rapid, and the child may sink into a typhoid state with dry tongue, low delirium, and involuntary passages of urine and fæces. The temperature often becomes subnormal, sinking in rare instances to 93° or 94°. In some cases there is ante-mortem elevation of temperature, the fever rising to 106°. The entire duration of the disease is from a fortnight to three or four weeks.

There are cases of tuberculous meningitis which pursue a more rapid course. They set in with great violence, often in persons apparently in good health, and may prove fatal within a few days. In these instances, more commonly seen in adults, the convex surface of the brain is usually involved. There are again instances which are essentially chronic and display symptoms of a limited meningitis; sometimes with pronounced psychical symptoms, and sometimes with those of cerebral tumor.

There are certain features which call for special comment.

The irregularity and slowness of the pulse in the early and middle stages of the disease are points upon which all authors agree. Toward the close, as the heart's action becomes weaker, the pulsations are more frequent. The temperature is usually elevated, but there are instances in which it does not rise in the whole course of the disease much above 100°. It may be extremely irregular, and the oscillations are often as much as three or four degrees in the day. Toward the close the temperature may

sink to 95°, occasionally to 94°, or there may be hyperpyrexia. In a case of Bäumler's the temperature rose before death to 43·7° C. (110·7° F.).

The ocular symptoms of the disease are of special importance. In the early stages narrowing of the pupils is the rule. Toward the close, with increase in the intra-cranial pressure, the pupils dilate and are irregular. There may be conjugate deviation of the eyes. Of ocular palsies the third nerve is most frequently involved. The changes in the eye-grounds are very important. Neuritis is the most common. According to Gowers, the disk at first becomes full colored and has hazy outlines, and the veins are dilated. Swelling and striation become pronounced, but the neuritis is rarely intense. Of twenty-six cases studied by Garlick, in six the condition was of diagnostic value. The tubercles in the choroid are rare and much less frequently seen during life than post-mortem figures would indicate. Thus Litten found them (post mortem) in thirty-nine out of fifty-two cases. They were present in only one of the twenty-six cases of tuberculous meningitis examined by Garlick. I have never met them clinically, and have only found two instances post mortem. Heinzel examined with negative results forty-one cases.

Among the motor symptoms convulsions are most common, but there are other changes which deserve special mention. A tetanic contraction of one limb may persist for several days, or a cataleptic condition. Tremor and athetoid movements are sometimes seen. The paralyses are either hemiplegias or monoplegias. Hemiplegia may result from disturbance in the cortical branches of the middle cerebral artery, occasionally from softening in the internal capsule, due to involvement of the central branches. Of monoplegias, that of the face is perhaps most common, and if on the right side it may occur with aphasia. In two of my cases in adults aphasia developed. Brachial monoplegia may be associated with it. In the more chronic cases the symptoms persist for months, and there may be a characteristic Jacksonian epilepsy when the tubercles involve the meninges of the motor cortex.

The *prognosis* in this form of meningitis is always most serious. I have neither seen a case which I regarded as tuberculous recover, nor have I seen post-mortem evidence of past disease of this nature. Cases of recovery have been reported by reliable authorities, but they are extremely rare, and there is always a reasonable doubt as to the correctness of the diagnosis. The differential features will be considered in connection with acute meningitis.

III. Tuberculosis of the Lymph-glands (*Scrofula*).

Scrofula is tubercle, as it has been shown that the bacillus of Koch is the essential element. It is not yet definitely settled whether the virus which produces the chronic adenitis or scrofula differs from that which produces tuberculosis in other parts, or whether it is the local conditions

in the glands which account for the slow development and milder course. The experiments of Arloing would indicate that the virus was attenuated or milder, for he has shown that the caseous material of a lymph-gland killed guinea-pigs, while rabbits escaped. The guinea-pig, as is well known, is the more susceptible animal of the two. The observations of Lingard are still more conclusive, as showing a variation in the virulence of the tubercle bacillus. Guinea-pigs inoculated with ordinary tubercle showed lymphatic infection within the first week, and the animals died within three months; infected with material from scrofulous glands, the lymphatic enlargement did not appear until the second or third week, and the animals survived for six or seven months. He showed, moreover, that the virulence of the infection obtained from the scrofulous glands increased in intensity by passing through a series of guinea-pigs. Eve's experiments show that scrofulous material invariably produces tuberculosis in guinea-pigs and very often in rabbits.

Tuberculous adenitis is met with at all ages. It is more common in children than in adults, but it is not infrequent in the middle period of life, and may occur in old age.

The tubercle bacillus is ubiquitous. All are exposed to infection, and upon the local conditions, whether favorable or unfavorable, depend the fate of those organisms which find lodgment in our bodies. It is possible, of course, that tuberculous adenitis may be congenital, but such instances must be extremely rare. A special predisposing factor in lymphatic tuberculosis is catarrhal inflammation of the mucous membranes, which in itself excites slight adenitis of the neighboring glands. In a child with constantly recurring naso-pharyngeal catarrh, the bacilli which lodge on the mucous membranes find in all probability the gateways less strictly guarded and are taken up by the lymphatics and passed to the nearest glands. In conditions of health the local resistance, or, as some would put it, the phagocytes, would be active enough to deal with the invaders, but the irritation of a chronic catarrh weakens the resistance of the lymph-tissue and the bacilli are enabled to develop and gradually to change a simple into a tuberculous adenitis. The frequent association of tuberculous adenitis of the bronchial glands with whooping-cough and with measles, and the frequent development of tubercle in the mesenteric glands in children with intestinal catarrh, find in this way a rational explanation. After all, as Virchow pointed out, an increased vulnerability of the tissue, however brought about, is the important factor in the disease.

The following are some of the features of interest in tuberculous adenitis:

(*a*) The local character of the disease; thus, the glands of the neck, or at the bifurcation of the bronchi, or those of the mesentery, may be alone involved.

(*b*) The tendency to spontaneous healing. In a large proportion of the cases the battle which ensues between the bacilli and the tissue-cells is

long; but the latter are finally successful, and we find in the calcified remnants in the bronchial and mesenteric lymph-glands evidences of victory. Too often in the bronchial glands a truce only is declared and hostilities may break out afresh in the form of an acute tuberculosis.

(*c*) The tendency of tuberculous adenitis to pass on to suppuration. The frequency with which, particularly in the glands of the neck, we find the tuberculous processes associated with pus is a special feature of this form of adenitis. In nearly all instances the pus is sterile. Whether the suppuration is excited by the bacilli or by their products, or whether it is the result of a mixed infection with pus organisms, which are subsequently destroyed, has not been settled.

(*d*) The existence of an unhealed focus of tuberculous adenitis is a constant menace to the organism. It is safe to say that in three fourths of the instances of acute tuberculosis the infection is derived from this source. On the other hand, it has been urged that scrofula in childhood gives a sort of protection against tuberculosis in adult life. We certainly do meet with many persons of exceptional bodily vigor who in childhood had enlarged glands, but the evidence which Marfan * brings forward in support of this view is not conclusive.

Clinical Forms.—1. **General Tuberculous Lymphadenitis.**—In exceptional instances we find diffuse tuberculosis of nearly all the lymph-glands of the body with little or no involvement of other parts. The most extreme cases of it which I have seen have been in negro patients. Two well-marked cases occurred at the Philadelphia Hospital. In one, a woman, aged thirty-four, was admitted April 4th, with enlarged glands in the right side of the neck and irregular fever. The chart from April, 1888, until March, 1889, showed persistent fever, ranging from 101° to 103°, occasionally rising to 104°. On December 16th the glands on the right side of the neck were removed. After an attack of erysipelas, on February 17th, she gradually sank and died March 5th. The lungs presented only one or two puckered spots at the apices. The bronchial, retro-peritoneal, and mesenteric glands were greatly enlarged and caseous. No intestinal, uterine, or bone disease. The continuous high fever in this case depended apparently upon the tuberculous adenitis, which was much more extensive than was supposed during life. In these instances the enlargement is most marked in the retro-peritoneal, bronchial, and mesenteric glands, but may be also present in the groups of external glands. Occurring acutely, it presents a picture resembling Hodgkin's disease. In a case which died in the Montreal General Hospital this diagnosis was made. The cervical and axillary glands were enormously enlarged, and death was caused by infiltration of the larynx.

2. **Local Tuberculous Adenitis.**—(*a*) *Cervical.*—This is the most common form met with in children. It is seen particularly among the poor

* Archives générales, 1886.

and those who live continuously in the impure atmosphere of badly ventilated lodgings. Children in foundling hospitals and asylums are specially prone to the disease. In this country it is most common in the negro race. As already stated, it is often met with in catarrh of the nose and throat, or chronic enlargement of the tonsils; or the child may have had eczema of the scalp or a purulent otitis.

The submaxillary glands are first involved, and are popularly spoken of as enlarged *kernels*. They are usually larger on one side than on the other. As they increase in size, the individual tumors can be felt; the surface is smooth and the consistence firm. They may remain isolated, but more commonly they form large, knotted masses, over which the skin is, as a rule, freely movable. In many cases the skin ultimately becomes adherent, and inflammation and suppuration occur. An abscess points and, unless opened, bursts, leaving a sinus which heals slowly. The disease is frequently associated with coryza, with eczema of the scalp, ear, or lips, and with conjunctivitis or keratitis. When the glands are large and growing actively, there is fever. The subjects are usually anæmic, particularly if suppuration has occurred. The progress of this form of adenitis is slow and tedious. Death, however, rarely follows, and many aggravated cases in children ultimately get well. Not only the submaxillary group, but the glands above the clavicle and in the posterior cervical triangle, may be involved. In other instances the cervical and axillary glands are involved together, forming a continuous chain which extends beneath the clavicle and the pectoral muscle. With them the bronchial glands may also be enlarged and caseous. Not infrequently the enlargement of the supraclavicular and axillary group of glands on one side precedes the development of a tuberculous pleurisy or of pulmonary tuberculosis.

(*b*) *Bronchial.*—The mediastinal lymph-glands constitute filters in which lodge the various foreign particles which escape the normal phagocytes of bronchi and lungs. Among these foreign particles, and probably attached to them, tubercle bacilli are not uncommon, and we find tubercles and caseous matter with great frequency in the mediastinal glands, particularly those about the bronchi. It is stated that this process is always secondary to a focus, however small, in the lungs, but my experience does not bear out such a statement. As already mentioned, Northrup found them involved in every one of a hundred and twenty-seven cases at the New York Foundling Hospital. This tuberculous adenitis may, in the bronchial glands, attain the dimensions of a tumor of large size. But even when this occurs there may be no pressure symptoms. In children the bronchial adenitis is apt to be associated with suppuration.

A more serious danger in tuberculous disease of the bronchial glands is systemic infection, which takes place through the vessels. Local infection of the lungs may also occur. In the tuberculous broncho-pneumonia of children it is usual to find the bronchial glands enormously en-