

ally by entodermal epithelium, but the character of the epithelium may vary in one and the same cyst. Simple cubical and cylindrical epithelium, either with or without cilia, stratified cylindrical ciliated epithelium and pigmented epithelium may be found. Mucous glands may also be present. Of the connective-tissue elements, fibrous tissue, myxomatous tissue, cartilage, bone, striped and unstriped muscle, are most frequently present. All these present a more cellular and embryonal character than the tissues found in the ovarian teratomata. As a rule, some one of the tissues predominates, and a carcinomatous or sarcomatous proliferation occurs in the majority; hence the teratomata of the testis have been reported under a great variety of names: *adenochondroma*, *adenocystoma*, *chondrosarcoma*, *malignant chondroma*, *rhabdomyosarcoma*, *adenomyosarcoma*, *cystosarcoma*, *cystocarcinoma*, *adenocarcinoma*, *myxosarcoma*, etc. In some cases an endothelial or perithelial proliferation predominates, and the tumor assumes the character of an *endothelioma* or a *perithelioma*. Syncytial-like formations have also been described as occurring in these growths. In some cases the formation of cysts with fluid or mucoid contents is the most striking feature of the tumor; in other cases the growth may be cystic only in part, while in other cases it is solid throughout. They are often of very rapid growth, and those in which carcinomatous or sarcomatous proliferation occurs are of very malignant character, giving rise to numerous metastases throughout the peritoneum, retroperitoneal glands, lungs, etc. The metastasis in the majority of cases is hematogenous, like that of sarcoma. To what extent the teratomata of the testicle are to be classed with the embryomata as of ovulogenous origin, or to what extent they are due to tissue-implantations, cannot at present be determined. Those containing tissues derived from all three of the germ layers may be classed with the embryomata or embryoid tumors; those consisting of single tissue-formations may be explained by the assumption of a tissue-transplantation or inclusion.

The complex teratoid cysts and solid teratomata of other regions, as well as those of the sexual glands, are in many instances to be regarded as local disturbances of development, due to a misplacement or separation by constriction of tissue anlage or tissue within a single individual (*monogerminal tissue-implantation*, *autochthonous teratoma*). The hairy polypi of the throat and mouth cavity, the cystic or solid teratomata at the base of the skull or in the hypophysis may be explained as due to inclusions of ectoderm. The presence of cartilage and mucous glands in the mediastinal teratomata may be explained by the proximity of the trachea. The teratoid mixed tumors of the cervix and vagina are probably due to inclusions of the myotome or sclerotome, and to malformations in the development of the Wolffian duct; those of the kidney are due to proliferation of remains of the Wolffian body, and to inclusions of the myotome; those of the lumbo-sacral and coccygeal regions are due to proliferations of remains of the neuro-enteric canal, hind-gut, and medullary canal, in association with ectodermal and mesodermal inclusions.

There is, however, another possibility of origin for these tumors—they may arise from a rudimentary twin (bigeminal implantation). Such an explanation receives support when the teratoma in question contains fully developed or rudimentary organs or body parts, or tissue-formations that cannot be explained by the misplacement of tissue of a single fetus. The complex teratomata at the base of the skull, in the sacral region, in the mediastinum, and in the abdominal region are regarded by the majority of investigators as bigeminal implantations. Such teratoid tumors are then to be interpreted as parasitic twin malformations, and are to be classed with the double monsters (see *Teratology*). All possible transition forms exist between those composed of rudimentary tissue-elements and the double monsters with symmetrically developed twins. In those cases in which partly or fully developed extremities or organs lie within the tumor mass or cyst the diagnosis of

bigeminal inclusion is clear, but in the case of a more rudimentary development of tissues which are not arranged in an orderly manner it is not always possible to differentiate between monogerminal and bigeminal inclusions.

**Malignant Teratoma (*Teratoma malignum*).**—Malignant changes may take place in any form of teratoid tumor or cyst, the simple forms as well as the more complex, but are of more common occurrence in the latter. Of the simple teratomata the epidermoids and dermoids most frequently take on a malignant activity of growth (*branchiogenic* and *subcutaneous carcinoma*), although ectodermal inclusions in any part of the body may be the starting-point for an epitheliomatous growth. The tumors of the kidney, vagina, and cervix that contain striped muscle and myxomatous tissue usually behave as sarcomata. The mixed tumors of the salivary and lachrymal glands become malignant much more rarely. Since the great majority of other forms of teratoid tumors are usually benign, the term malignant teratoma is more appropriately applied to the malignant embryomata and embryoid tumors. The complex dermoids are less frequently malignant, or at least but relatively few cases of carcinomatous or sarcomatous dermoid of the ovary have been reported. Yamagiva has reported a unique case of a dermoid of the ovary, showing adenocarcinomatous changes. The patient was a woman sixty-three years old, dying from the effects of a large ovarian tumor, which was in part composed of solid mixed tissues and cysts, and partly dermoid. The adenocarcinomatous changes present he regarded as primary in a mammary gland which presented itself on the inner surface of the large dermoid cyst. Metastases were present in the retroperitoneal, mesenteric, and right supraclavicular glands. To Bierman belongs the credit of having recorded the first case of epidermal cancer arising from the epidermal lining of the cyst cavity. Similar cases have been reported by Krukenberg, Clark, and others. The majority of the cases have been in women at or near the menopause. The metastases are found chiefly upon the peritoneum. Of much greater frequency is the development of carcinoma or sarcomatous changes in the solid complex teratomata of the ovary, testis, and mediastinum. In the case of the malignant teratomata of the testis the metastases may present the appearances of cystocarcinoma, cystosarcoma, chondrosarcoma, chondrocarcinoma, myosarcoma, myxosarcoma, endothelioma, etc. Occasionally the metastases show differences of structure, or may present a combination of tissue elements. This may be explained by the metastasis of undifferentiated cells. In some cases the tumor presents the appearance of a mixture of sarcomatous and carcinomatous proliferation (*"sarco-carcinoma"*). The distribution of the metastases varies somewhat with the character of the malignant changes. In the case of adeno- or cystocarcinoma of either an ovarian or a testicular teratoma the metastases are found chiefly upon the peritoneum; in other cases the metastases are usually hematogenous, and are found chiefly in the lungs.

**TREATMENT.**—The fact that a large class of tumors is composed of tissue-formations resembling those of the normal body, and derived from misplaced anlage or tissue, or from foetal inclusions, throws important light upon the treatment. Since such tumors are manifestly not of parasitic origin, their treatment by toxins, antitoxins, Roentgen rays, etc., is naturally contraindicated. Only those toxins would destroy the mixed tumors which would at the same time destroy the normal tissues. The treatment is purely operative, and even here the knowledge of the mixed nature of the tumor is of great importance in modifying the operation. The mixed tumors of the mamma do not set up metastases in the axillary glands; and since the encapsulated mixed tumors in general usually give rise to hematogenous metastases, and not lymphogenous, a more conservative operation may be carried out than in the case of carcinoma. In the case of the tumors of the testis the greater tendency to malignancy with the rapid setting up of

metastases in the peritoneum in the case of carcinomatous change, and in the lungs in the case of sarcomatous or endotheliomatous changes, speak for the necessity of early operation. (See also *Teratology*, *Hypernephroma*, etc.)  
*Aldred Scott Warthin.*

**TEREBENE.**—Terebene,  $C_{10}H_{16}$ , is a liquid hydrocarbon, obtainable by the action of strong sulphuric acid on oil of turpentine. It is a colorless, mobile fluid, of a pleasant pine-wood odor and taste, free from the acidity of oil of turpentine. It is insoluble in water, but dissolves in an equal measure of alcohol.

Under the name *Terebenum*, Terebene, the United States Pharmacopœia makes official "a liquid consisting chiefly of pinene, and containing not more than very small proportions of terpinene and dipentene." Terebene should be kept in well-stoppered bottles and in a cool dark place.

Terebene seems to affect the human system like a mild oil of turpentine. It has been taken in so large quantities as a teaspoonful every four hours, continued for a week, without untoward effects; but such quantities are unsafe. Under the influence of the medicine the urine acquires an odor as of violets, and may increase slightly in quantity. Medicinally, terebene has been found of service for the alleviation of cough and dyspnea from respiratory disease, and of dyspepsia with flatulence and acidity. The drug is commonly given in doses of ten drops, or thereabouts, in emulsion or in capsules. It is not at all unpleasant to take, clear, washed down with a small sip of water. In respiratory affections the vapor of terebene may be inhaled in addition to the internal administration.  
*Edward Curtis.*

**TERPIN HYDRATE.**—When a mixture of turpentine oil and water is permitted to stand, crystals of terpin hydrate,  $C_{10}H_{18}(OH)_2 + OH_2$ , often deposit. For artificial preparation of the crystals in quantity, a mixture is made of oil of turpentine, nitric acid, and alcohol, which is set aside in shallow vessels for crystallization to occur. The substance is official in the United States Pharmacopœia under the title *Terpini Hydras*, Terpin Hydrate. Terpin hydrate is in the form of colorless, rhombic crystals, practically devoid of odor and taste. It dissolves in about 250 parts of cold water and in 32 parts of boiling water; in 10 parts of cold alcohol and in 2 parts of boiling alcohol. The drug is claimed to possess the medicinal "expectorant" virtues of the terebinthines, while free from the deranging influence of the class. It may be administered in doses ranging from 0.20 gm. to 0.65 gm. (from gr. iij. to x.), given a number of times daily, in emulsion or pill.  
*Edward Curtis.*

**TERPINOL** is an oily liquid of hyacinthine taste, obtained by distilling terpin hydrate with dilute sulphuric acid. It consists of *terpinol*,  $C_{10}H_{17}OH$ , mixed with three terpenes,  $C_{10}H_{16}$ , and is insoluble in water and soluble in alcohol and ether. Lazarus employs it like terpin hydrate as a bronchial stimulant and antiseptic in dose of 0.3 c.c. (m. v.). Janowsky gives it in hæmoptysis, three drops frequently repeated. It is sometimes added to iodoform as a deodorizer. Under the name of "stomatol," a mixture of terpinol, soap, alcohol, and aromatics, is sold as a mouth wash and general antiseptic and deodorizer.  
*W. A. Bastedo.*

**TESTICLES, DISEASES OF.** See *Sexual Organs, Male, Diseases of.*

**TETANUS.**—(Synonyms: Trismus, Lockjaw.) Tetanus is an acute infectious disease caused by inoculation with the tetanus bacillus, and characterized by tonic spasm of certain muscles, sometimes by clonic spasms as well. The more severe acute cases usually end fatally in from one to seven days. Mild cases, sometimes called chronic, may last for some weeks and end in recovery.

For a full description of the tetanus bacillus the reader is referred to the article on *Bacteria*, p. 698, vol. 1., of

this HANDBOOK. It must be remembered that this organism is almost everywhere to be found in garden and field soil, in the street dirt of cities, about manure piles, and in the foul mud of marshes and river beds. The reason that more people are not infected by this well-nigh omnipresent germ is because it is anaerobic and quickly killed by sunlight.

**ETIOLOGY.**—For the growth of the tetanus bacillus in or upon the human body it is essential that there be a wound upon which the bacillus shall be received. If the wound be septic or becomes septic, it offers the best soil for the growth of this bacillus, since the ordinary septic organisms absorb all the oxygen present and so produce the anaerobic conditions necessary for the life of the tetanus bacillus. It is doubtful whether any truly aseptic wound was ever the seat of tetanus infection. There need, however, be no gross solution of continuity in order for the development of the tetanus bacillus, since it has been found at the site of a severe blow or bruise.

**PATHOLOGY.**—There are no definite anatomical changes as yet known to belong to this disease. The bacillus is to be found in or near the infected wound, although the local lesion may not be prominent and the wound may have healed. A few observations are on record in which the bacilli were found on the *placenta mater* and arachnoid of the spinal cord. In the brain and cord are found perivascular exudation, congestion, and granular degeneration of nerve cells. The local infection with the tetanus bacillus seems to produce a toxin, which, when it reaches the brain and spinal cord, causes symptoms similar to those of strychnine poisoning. A substance called tetanin has been isolated from tetanus cultures; it is said to be four hundred times more poisonous than strychnine.

**SYMPTOMS.**—The period of incubation varies considerably. In temperate climates it is likely to be two weeks, sometimes three. In tropical climates, or in localities where the disease is especially virulent, there may be as short a period as one day. The onset is gradual, with soreness and stiffness in the muscles of the neck and jaw, until at the end of from one to three days the mouth cannot be opened (trismus or lockjaw). This muscular rigidity or tonic spasm extends to the muscles of the face and trunk, in less degree to those of the legs, while the arms are often exempt. The contraction of the face muscles so draws up the corners of the mouth as to produce a fixed grin, the so-called *risus sardonius*. The abdominal and chest muscles become board-like in their rigidity, greatly impeding respiration. The body is often arched backward (opisthotonos), or it may be fixed in some other position. An aggravation of the spasms, which may have somewhat relaxed, is produced by any sudden stimulant, such as a loud noise, a draught of cold air, or an attempted movement. These spasms are always tonic or continuous, never intermittent. Some patients complain of great pain connected with the spasms, others of none whatever. The mind usually remains clear throughout. The temperature in mild cases may be but little raised. Usually, however, it reaches 104° or 105° F., sometimes as much as 108° during life, and it often rises a degree or two after death. The body is bathed in sweat, the urine is scanty and often albuminous. Death may occur in twenty-four hours from the outbreak of the disease, or not for four or five days.

Chronic tetanus usually begins a longer time after infection, is milder in form, often without fever, and the spasmodic contractions may be limited to the part of the body near the wound, although they may also be general. This form may last for two or three weeks and is much less fatal. A variety of the chronic form, called by the Germans *Kopf-tetanus*, follows injuries about the distribution of the cranial nerves, especially those of the supra-orbital margin. It is marked by trismus with facial paralysis, although both tonic and clonic spasms may occur in other parts of the body.

**DIAGNOSIS.**—The history of a poisoned wound, especially a dirty, punctured wound of the foot or hand, is an important factor in the diagnosis. Mild forms of tris-

mus, with none of the other symptoms of tetanus, sometimes follow dental irritation, as from a carious tooth or an unerupted wisdom tooth. Apparent trismus may also be hysterical. Tetanus may be distinguished from strychnine poisoning by the fact that in the former the onset is comparatively gradual, while in strychnine poisoning it is sudden. In tetanus the muscles are continuously rigid, even during the intervals of spasm, while in strychnine poisoning they are relaxed during the interval. Trismus is always present in tetanus, not so after strychnine. The arms are always involved in strychnine poisoning, very rarely in tetanus. Hydrophobia is to be distinguished from tetanus by the character of the spasms, which are clonic in the former, tonic in the latter. In hydrophobia the muscles of respiration, and especially those of deglutition, are early and prominently involved; not so in tetanus. In hydrophobia there is no trismus nor opisthotonos. The demonstration of the presence of the tetanus bacillus in a suspected wound would be conclusive evidence of the character of the malady.

**PROGNOSIS.**—This is very unfavorable. From seventy to ninety per cent. of all cases are fatal. This, at least, has been the record of the past. Under more recent methods of treatment (antitoxin and carbolic-acid injections) better results are claimed in some countries. Thus, at a recent congress of surgery Dr. Valles, of Lyons, France, had collected 373 cases with 145 deaths, or 39 per cent. There is no doubt but that the very acute cases are almost uniformly fatal, and that a short period of incubation is proportionately dangerous. In Rose and Carless' "Manual of Surgery" (William Wood & Co., 1901) the statement is made that if the period of incubation is under ten days only 4 per cent. recover; if it lasts from eleven to fifteen days, 27 per cent. recover; while if the outbreak is delayed for fifteen to twenty days, 45 per cent. live.

**TREATMENT.**—The preventive treatment consists, first, of thorough antiseptics applied to wounds, and the worse the sanitary conditions under which patients are found the more radical should be this antiseptics. This means the thorough laying open and cauterization of recent wounds, with pure carbolic acid, for instance, or the excision of cicatrices of longer standing, with cauterization of the site. The immediate prophylactic injection of 10 to 20 c.c. of Behring's tetanus antitoxin, in case of the existence of "a suspicious wound," and the repetition of this treatment every day or every other day for a week or ten days have been recently advocated in Germany. It is evident that any amount of good results can be claimed from such treatment, when it is not certain that the wound is infected with tetanus. The best that can be said for it is that it is safe.

After the appearance of the general symptoms of tetanus three methods of treatment are before us, viz.: the old treatment, with absolute quiet and sedatives; second, the antitoxin treatment; and third, the Bacelli treatment, with hypodermic injections of carbolic acid. In view of the dire nature of the disorder and the unsatisfactory results of all treatment, the probabilities are that the wide-awake practitioner will avail himself of all three of these methods at once. The old method of treatment consists in the isolation of the patient, so as to secure absolute quiet, and the free administration of chloral and the bromides or of hypodermic morphine, enough being used to insure quiet rest. Chloroform by inhalation is also used to control spasms, or to permit of feeding by the stomach tube two or three times a day. The *antitoxin treatment*, as ordinarily practised, consists in the subcutaneous injection of some one of the various preparations of tetanus antitoxin serum. The original serum is that of Behring, of which 20 to 30 c.c. should be injected every five or six hours. Of Behring's dried serum 5-10 gm., dissolved in distilled water, is used. Various manufacturing houses in this country prepare these antitoxin serums, and they are also prepared by certain of our state boards of health. It is of the utmost importance that the article should be obtained from a reliable source, and that it should be reasonably fresh.

Much disappointment has followed the use of tetanus antitoxin. Even early prophylactic treatment by this method, vigorously pushed, has often failed. And yet there is no doubt that when the statistics of large numbers of cases are studied a decided lowering of the mortality can be recognized. Large doses, begun early and used thoroughly and persistently, will often accomplish the desired result.

Of late years the opinion has been gaining ground that subcutaneous injections of antitetanus serum are merely preventive of further general infection; that when the first symptoms of tetanus appear the nerve centres are already gravely poisoned, and that the best results must be sought by bringing the antitoxin into immediate contact with those nerve centres. Hence the employment of *intracerebral injections* of antitetanus serum. Rose and Carless (*opus cit.*) thus describe the procedure: "The injection is made through the dura mater into the posterior portion of the second frontal convolution on each side; 2.5 c.c. of the dried serum dissolved in 5 c.c. of sterilized water are injected very slowly, and this may be repeated several times, if an interval of a few days be allowed to elapse between two consecutive injections. The point selected is placed midway between the external angular process of the frontal bone and the centre point of the line between the root of the nose and the external occipital protuberance. A small trephine may be applied here, or simply a hole drilled through the skull sufficient to allow of the introduction of a syringe, which is pushed about two inches deep into the brain. Of course the strictest antiseptics are essential. Probably it will be found wise to restrict this method to the treatment of the worst cases, and it must be augmented by subcutaneous injections and other subsidiary measures."

Some brilliant results from this method have been reported. The greatest number of cases of intracerebral injection which the writer has been able to find tabulated is 233, with 96 recoveries and 137 deaths, giving a mortality of 58.7 per cent.

*Spinal subarachnoid injections* have also been employed and good results reported, although the total number of cases recorded is still too small to permit of positive conclusions. Five to ten cubic centimetres of cerebro-spinal fluid are withdrawn and 10-20 c.c. of antitoxin injected very slowly under weak pressure.

The *carbolic-acid treatment*, also called the Bacelli treatment, after the name of its distinguished originator, consists in the subcutaneous injection of a two-per-cent. solution of carbolic acid, at intervals of from two to four hours, in such quantity that not less than three grains of the acid is used the first day. As much as six or eight grains per diem may be employed, according to the urgency of the case. No poisonous effects have been noted and excellent results have been claimed, especially in Italy. It is believed by some observers that tetanus is not so virulent in Italy as in some other countries.

As previously stated, there is no reason why the various methods of treatment above given may not all be employed at the same time. The writer recently saw a case of tetanus following the usual punctured wound of the foot from stepping on a nail. Tetanus developed on the fifth day, with trismus, opisthotonos, and violent periodical spasms. Antitetanus serum (Parke, Davis & Co.'s) was injected every six hours, carbolic-acid injections were used to the extent of five grains a day, and the periodical spasms were controlled by the hypodermic use of hyoscine hydrobromate, gr.  $\frac{1}{10}$  *pro re nata*. The disease yielded on the fourth day so as to permit of the patient's drinking from a cup. An individual case, such as this, proves nothing, and it is only mentioned as an example of the combined treatment.

As this article goes to press the writer learns of certain experiments on animals made by Prof. A. P. Matthews, of Chicago, which may in the near future give us the means of successfully combating the toxins of tetanus as well as other toxins. It appears that Profs. J. Loeb and A. P. Matthews have for some time been experimenting in the production of a saline infusion which

should cause stimulation of the cells as well as produce cell catharsis and diuresis. Having attained this object, so far as the washing out of ordinary metabolic bodies is concerned, and wishing to ascertain whether bacterial toxins could also be thus eliminated, the experiment was made with tetanus toxin. After careful control experiments it was found that the toxin could be washed out of an animal after the symptoms of tetanus had been well established for some time, many times the lethal dose of toxin having been administered. For full particulars of the process we must wait until the investigators themselves publish their results.

Edward W. Schaeffler.

**TETANY or TETANILLA.**—The "little tetanus" is a disease characterized by attacks during which there occur bilateral tonic spasms of various groups of muscles, most frequently of those of the upper extremities; also by extreme hyperexcitability of the peripheral motor nerves in response to mechanical and electrical stimulation. We shall see that, although the disease has a very distinct symptomatology, it is often confounded with other diseases, and is so little known that no special mention is made of it in some of our largest treatises, that it is referred to incidentally only in Reynolds' "System of Medicine," as a symptom associated with others of spinal irritation, and that in Pepper's "System" it is merely alluded to in the article on Tetanus.\*

**HISTORY OF OUR KNOWLEDGE OF TETANY.**—In 1830 Steinheim described this disease as a special form of articular rheumatism; in the following year Dance published "Une observation sur une espèce de tétanos intermittent," and in this article expressed the view that the intermittent character of the spasms proved the disease to be of the malarial order. In 1852 the entire subject was reviewed by Lucien Corvisart, and it was he who proposed the name tetany. Previously to Corvisart, the great Trousseau, as early as 1845, had observed this disease in nursing women, and supposed a connection between tetany and the function of lactation; he therefore termed it "contracture rhumatismale des nourrices," but, having observed the same trouble later on in children and adults after intestinal obstruction, he was forced to abandon his "nourrice" theory. It was Trousseau also who first discovered the very important fact that these attacks could be excited by compression of the arteries and nerve trunks of the affected extremity.

Many of these cases were regarded, in Germany particularly, as cases of professional neuroses, professional spasms, until Kussmaul showed conclusively that there was a distinct difference between this affection and the ordinary professional neuroses. Riegel insisted on the causal relation between the disease and the presence of entozoa in the intestines. Erb and Chvostek examined the electrical behavior of the affected muscles, Chvostek directing particular attention to the increased mechanical excitability of the affected muscles and nerves. In 1874 Langhans published the first case of tetany in which a careful post-mortem examination had been made, and in 1881 the late Dr. Nathan Weiss, of Vienna, published an excellent monograph on "Tetany"† (Volkmann's Vorträge, No. 189), in which he described the disease most carefully, reviewed the entire literature of the subject, and showed an interesting connection between tetany and the surgical removal of goitre.

**ETIOLOGY.**—The disease is most apt to occur in young persons; in children between the ages of four and six years; then again at the age of puberty; while the majority of cases of tetany are observed in persons between the ages of sixteen and thirty-five years.‡

\* An excellent chapter on tetany will be found in Gowers' "Diseases of the Nervous System."

† The present writer is greatly indebted to this monograph for many of the historical and other facts to be found in this article. He has made liberal use of Weiss' monograph, without in each instance acknowledging his indebtedness.

‡ Gowers has tabulated 142 cases, and of these he found that 42 occurred at the ages of from one to four years and 36 at the ages between ten to nineteen years.

child-bed, and lactation appear to be predisposing causes. It is now well established that it is *not* one of the professional neuroses, although cobblers evince an unusual predisposition to the disease. Persons who have been exposed to cold or wet seem particularly liable to attacks of tetany. Intestinal irritation is another cause; stubborn constipation or protracted diarrhoea has been followed by tetany. Riegel (*Deutsches Arch. f. klin. Med.*, Bd. xii.) instances a case in which attacks of tetany were inhibited by the removal of the ova of *tania mediocanelata* and *trichocephalus dispar*; and Weiss makes mention of a case in which tetany occurred as a complication of typhoid fever. The attacks of tetany disappeared as the typhoid (intestinal) symptoms subsided, and returned with a relapse of the intestinal symptoms. Tetany has also been observed in the wake of smallpox, Bright's disease, malaria, cholera, and in children during the period of dentition. It has also been observed after severe mental shocks. The causal connection between extirpation of goitre and tetany, as proven by the cases of Weiss, has been referred to above. The frequent association of tetany with gastro-intestinal disorders has led to a belief in the auto-intoxication origin of some of the cases. Eulenburg states that non-malignant stenosis of the pylorus, with subsequent dilatation of the stomach, is a condition particularly favorable to the development of tetany. And finally, it is to be noted that tetany occurs frequently as an epidemic,\* and that it is of much more frequent occurrence in some countries than in others. The present writer observed a number of cases of tetany in Vienna, while he has seen only very few typical instances, in this country, among a large number of neurological cases of every description.

**SYMPTOMATOLOGY.**—In describing the symptoms of the disease we must mention the symptoms noticed during the *attack* and during the period of *latency*.

The *attack* is preceded by vague tingling pains, by formications in the hands, forearms, and legs; these sensory symptoms are followed by a feeling of stiffness in the hands and legs, and soon afterward the spasms are fully developed. These tonic spasms occur most frequently in the upper extremities, and give rise to such a marked rigidity of the muscles that passive movements are impossible. The position of the hand varies according to the groups of muscles affected by the spasms, whether flexors or extensors. It is a common occurrence for the hand to assume the shape of the accoucheur's hand as it is ready to be introduced into the vagina. Occasionally, also, the thumb is so firmly pressed upon by the flexed fingers that the nails are buried in the skin of the palm of the hand. In some rare cases there is complete extension of all fingers. As a rule, the forearms are flexed, the upper arms in adduction; it is exceptional for the arms to be in abduction and removed from the trunk of the body.

Mild cases of tetany are apt to consist only of a series of such attacks as have just been described; and this is true even of the earlier stages of severe forms of tetany. In a large majority of cases, however, and particularly in the later stages of the disease, spasms are apt to affect other groups of muscles, viz., the muscles of the lower extremities, causing adduction of the thighs, with extension of the hip- and knee-joints, and plantar flexion of the foot, the toes being bent forcibly toward the soles of the feet. The spasms may also affect the muscles of the abdomen, chest, and back. The tonic contractions of the abdominal and thoracic muscles may interfere with the movements of the diaphragm and with respiration, causing severe dyspnoea and universal cyanosis. If the muscles of the neck be involved additionally, the return of venous blood from the brain may be retarded, and Weiss reports one case in which loss of consciousness was the result. Opisthotonos is frequently the result of spasms affecting the muscles of the back. Trismus is occasionally observed, but never in the beginning as in

\* Cases of epidemic tetany have been reported as occurring in schools and prisons of France.

tetanus. In other (severe) cases again, spasms of the ocular muscles, of the oesophagus, of the larynx (spasmus glottidis), and of the muscular apparatus of the bladder (desire to urinate, but micturition impossible) have been observed.

During the attack patients complain of severe pain in the affected muscles; there is, furthermore, marked diminution of tactile sensibility in the extremities, the patients not being able to distinguish the character of objects placed upon the skin, and having the feeling, when standing on the bare floor, as though they were walking on velvet.

In a few cases a rise of temperature to 104° F. has been observed; Weiss observed a rise in only one case out of twelve.

Headache, vertigo, tinnitus aurium, and excessive perspiration are other symptoms which are occasionally observed during an attack of tetany. The attacks may last only a few minutes, but may at times last for hours and even days. Severe attacks of tetany may bear a striking resemblance to genuine tetanus; but it may be noted that there is no initial spasm of the masseters in tetany, and that in this form the spasms spread from the periphery centripetally, and not centrifugally as is the case in tetanus; and, furthermore, it is evident that the reflex excitability is not nearly so great in tetanus as in tetanus. There is also this further distinguishing characteristic, that in cases of tetany the patient may be entirely free from attacks for hours, days, weeks, and even months.

A. Westphal (*Berl. klin. Wochenschrift*, 1901, p. 849) has called attention to the occasional association of epilepsy with tetany, and believes that toxic products are important etiological factors in both diseases.

*Symptoms of the Latent Period.*—In the intervals between the attacks the patient may be entirely well; but some exhibit even at this time weakness, with rigidity of the affected muscles. The calf muscles are particularly apt to be the seat of slight tonic contractions. Weiss observed in one case, during the latent period of the disease, tonic rigidity of the calf muscles, and fibrillary as well as fascicular contractions in the quadriceps cruris and vastus externus; in another case Chvostek observed slight contractions of the orbicularis palpebrarum.

The intervals between the attacks of tetany may vary in duration from several hours to a few days, and even a few months. Of course, we can speak of a latent interval in the course of the disease only in case the disease can be proven still to exist. This can be done by proving the presence of Trousseau's symptom, and of increased electrical and mechanical excitability.

*Trousseau's Symptom.*—This symptom refers to the fact discovered by Trousseau, that in persons afflicted with tetany a characteristic attack can be elicited by pressure upon the large nerve trunks and arteries of the extremities usually affected during an attack. The attacks cease as soon as the pressure is removed. Kussmaul and Quincke maintain that in some cases pressure on arteries only is necessary, while in other cases the slightest pressure on a nerve trunk is sufficient to produce contractions of all the muscles supplied by this nerve. *Trousseau's symptom is present in no other convulsive disease.*

*Increased electrical excitability* is another symptom observed during the latent period. Erb, Chvostek, and Weiss showed that the motor nerves of the extremities and of the trunk, in cases of tetany, exhibited an increased response to both the faradic and the galvanic currents. They could not only obtain the cathodal closure contraction (CCC) with very small currents, but were able, with moderate currents, to obtain CCT and even an AOT, which had not been observed in any other condition; while Chvostek reports having obtained a COT—a condition unheard of in man. Erb failed to obtain these phenomena in the facial, but Chvostek and Weiss claim that they were as well able to obtain these phenomena with the facial as with any nerve of the extremities. J. Hoffman found an increased excitability upon mechanical and electrical stimulation of the sen-

sory as well as of the motor nerves. Erb found the electrical excitability greatest at a time when the attacks were most frequent, and it was he who first ventured the suggestion that the increased electrical excitability might be used as a diagnostic test during the latent period of the disease.

*Increased mechanical excitability* is another well-marked symptom; a simple tap with a percussion hammer upon a nerve trunk being sufficient to produce contractions of the muscles supplied by the nerve. Pressure with a lead-pencil upon the focal point of the pes anserinus is followed by contractions similar to those which a strong faradic current applied to this point would have produced. Increased reflex excitability of the nerve must be taken as an explanation of this phenomenon. At all events this should be the first employed diagnostic test during the latent period of the disease, as it certainly is better to try this test than to attempt to excite an attack by pressure upon a large nerve trunk or a large artery.

*PATHOLOGICAL ANATOMY.*—In spite of the post-mortem examinations made by Langhans, Weiss, and others, there is little or nothing known of the pathology of tetany. Langhans claimed to have found a periarteritis and periphlebitis of the blood-vessels of the white commissure, and of the anterior horns in the cervical portion of the spinal cord. Weiss found nothing of the sort in his case. He has built up an ingenious theory of the disease, according to which he believes that the attacks of tetany are due to an irritable condition of the gray matter of the medulla and spinal cord, and that this irritable condition is due to sympathetic disturbances, causing irregularities in the vascular innervation of the blood-vessels of the spinal cord; but this is mere theory. H. Schlesinger is of the opinion that tetany is a disease of the entire nervous system; that some of the symptoms are due to involvement of the peripheral nerves, and that the spasms and Trousseau's symptom are due to an increased excitability (of vaso-motor origin?) of the central nervous system, brain, medulla oblongata, and spinal cord. A satisfactory explanation of the disease or of the attacks cannot be had.\*

*DIFFERENTIAL DIAGNOSIS.*—There can be no difficulty as to this. There is the mere possibility of confounding an attack of tetany with genuine tetanus. It is necessary to remember the distinctly centripetal character of the attack of tetany, the fact that the disease never begins with trismus, and, above all, the shortness of the attacks, and the existence of a latent period—all of which differs widely from what is observed in real tetanus. During the latent period Trousseau's symptom, and the increased electrical and mechanical excitability, help to establish the diagnosis.

*PROGNOSIS* is favorable except in those few cases in which the spasms affecting the respiratory muscles may lead to serious lung trouble.

*TREATMENT.*—In the way of treatment, it is necessary above all things to remove the active or predisposing cause, to change the patient's abode, to procure absolute rest for him, and, if there is suspicion of intestinal irritation, to look to this, to purge the bowels, and to remove entozoa that may happen to be present.

During the attack, the physician will have to resort to the hypodermic use of morphine, possibly of hyoscyanine. Applications of ice to the back of the neck helped to inhibit an attack in one of Weiss' cases. As soon as the attack is over, it will be well to administer chloral hydrate in daily dose of 3 i.-3 ij.; or the combined bromides in doses of 3 iss.-3 iiss. pro die. During the intervals careful electrical treatment (stable currents ascending from peripheral nerve trunks), as well as methodical lukewarm baths, deserves a trial; but it is gratifying to know that the majority of cases will get well without any treatment at all. The use of thyroid gland and of thyreoidine has been favored by some. There can be no objection to a careful use of these prepara-

\*Gowers, relying on cases in which a wasting of the muscles has followed upon tetany, believes that the trouble starts in the motor cells of the spinal cord.

tions in suitable cases. By way of warning, we would suggest to the physician not to employ either counter-irritation or the faradic current. *B. Sachs.*

**TETRA-ALLYL-AMMONIUM ALUM** and **TETRA-ETHYL-AMMONIUM-HYDROXIDE** are soluble crystalline salts used in dose of 0.06-0.12 gm. (gr. i.-ij.) as uric-acid solvents. *W. A. Bastedo.*

**TETRA-IODO-DI-CHLOR-SALICYLIC ACID**, (C<sub>6</sub>H<sub>2</sub>-HCl.OH. COOH)<sub>2</sub>, is a reddish-yellow antiseptic dusting powder obtained by heating salicylic acid with sulphur chloride. It is soluble in alkaline solutions. *W. A. Bastedo.*

**TETRA-IODO-PHENOLPHTHALEIN.** See *Nosophen.*

**TETRONAL, POISONING BY.** See *Synthetic Products, Toxicology of.*

**TEXAS.**—The great extent of this State, its situation on the continent in relation to the surrounding land and water, and the diversity of its surface in mountain, plain, hill, and desert naturally produce a great variety of climatic conditions. The area of the State embraces 237,504 square miles, extending over eleven degrees of latitude and thirteen of longitude. It stretches "from a parallel very nearly coincident with the extreme southern portion of Florida to one touching the southern boundary of Virginia; while east and west it is bounded by the meridians coincident with Sedalia, Mo., and Leadville, Col." [Morse K. Taylor in the previous edition of the Handbook.] In the southern portion, on the gulf coast, we have the zone of tropical cyclones, as witness that of September 7th, 1900, at Galveston, which destroyed over six thousand lives and a considerable portion of the city; while on the northern border the arctic blizzards are experienced.

The eastern and southern portions of the State are at nearly sea-level, and, as one goes northwest, the elevation increases until an altitude of seven thousand feet is reached in the Chinanti Mountains. The intermediate country consists of "high, wide rolling prairies and river bottoms." The vegetation also varies greatly, according to the altitude and topography of the surface. The eastern border, for example, is heavily timbered, while in the west the land is barren of trees, and only the cacti and the stunted mesquite are found. In the extreme south we have a subtropical flora, and in the central portion are fertile agricultural lands where various cereals, fruits, and flowers of temperate latitudes are cultivated. The climate of such an extensive area, so diversified and so situated, cannot well be considered as a whole, except in the most general manner, and it is only by taking various portions of the State, each representing peculiar climatic characteristics, that one can obtain an adequate and intelligent idea of the climate, or rather climates, of the whole State. Taylor's division (*loc. cit.*) appears to be a serviceable one for this purpose. He divides the State into five districts: Eastern Texas, the gulf district, southwestern Texas, northwestern, and central Texas.

Only those districts which offer some claim as health resorts need occupy our attention to any great extent. The eastern district is comparatively level, has no elevations much above five hundred feet, and is heavily timbered throughout. Its climate is a moist, warm one, with a mean relative humidity of seventy-four per cent., and an annual rainfall of about forty-nine inches, with exacerbations in the form of heavy rains and floods. The annual mean temperature is about 66° F. Yellow-fever epidemics occur in this section. It is not a wholesome climate.

The gulf district has a coast line of about three hundred and seventy-five miles, and its surface is comparatively level. Its climate is of a subtropical nature—hot, moist, and windy. For a large portion of the year the winds are from the sea. The annual mean temperature

is 73.9° F.; the rainfall, 41 inches; and the relative humidity, 78.6 per cent. Away from the river bottoms it is said to be generally healthy, although malaria is prevalent. During the summer the gulf coast is said to offer a soft, equable temperature and excellent surf bathing, the heat being tempered by a pleasant sea breeze. The beach at Galveston is a fine one, and is a very popular resort; the accommodations are reported to be good.

Southwestern Texas is higher than either of the two previous districts, much of the northern portion being at an elevation of two thousand feet. This district is well drained, and is beyond the yellow-fever line. The climate is moderately dry, particularly so on the Rio Grande line. The annual mean temperature is 68.1° F.; the relative humidity, 67.3 per cent.; and the rainfall, 26.6 inches. "The possibility of outdoor employment," says Taylor, "during the whole year makes this portion better suited for those in delicate health who wish to remain a length of time, and, as they say, 'rough it,' than any other portion of the State. Life on the ranches, though lonely for many, is novel and interesting, and often beneficial." One should, however, bear in mind the wise advice of Hinsdale, that no invalid should go into the country districts unless he is able to endure positive hardships and to subsist on the coarsest food.

While, in general, the summers in Texas are hot (and the invalid from the North is advised not to go there at this season), yet in the southwestern portion "the heat is so tempered by the winds that its intensity is greatly modified . . . and the nights are always cool and dry. From May to October there is rarely any dew, so that persons may sleep in the draughts, on their porches, verandas, house-tops, or under the trees with perfect freedom from liability to take cold" [Taylor]. The same authority also avers "that the summer nights of southwestern Texas are more delightful than those of any interior region south of the great lakes." The two health resorts of Boerne and San Antonio are situated in this district, and the reader is referred to Vol. II, and to the first part of the present volume for a consideration of their climate and merits.

Central Texas, which contains the capital, Austin, in the southern portion, ranges from six hundred to two thousand feet above sea-level, and embraces the best agricultural land in the State. It is well settled, and contains several cities. The whole district has an annual mean temperature of 65.4° F., and an annual rainfall varying from 23 to 41 inches, and a relative humidity of from 59 to 67 per cent. The most desirable portions of central Texas for a winter residence are those centering about Dennison on the northern border, Corsicana about 120 miles directly south, and Austin 150 miles south of the latter town. "The general aspect of the country is pleasing," says Taylor; "it is productive and of easy cultivation, and for one seeking a home in a mild and healthful climate it offers advantages scarcely surpassed in the United States." The average maximum temperature at Austin is 99° F., and the average minimum 19°. The annual rainfall is about 33 to 35 inches. The "northers" are experienced throughout this district, especially in the northwestern portions.

The northwestern portion of the State is dry, more or less barren, and sparsely settled, and its climate is characterized by great dryness, small annual rainfall, low humidity, and almost continual sunshine. In the extreme northwestern portion of this district, not far from the boundary line between New and old Mexico, is the health resort of El Paso, a city of 15,000 inhabitants, with an elevation of 3,764 feet. The surrounding country is arid and barren, except as irrigation has been instituted; the city itself, however, is quite attractive. There are several hotels, one or more good boarding-houses, a modern hospital, and a sanatorium. There are various churches, good public schools, and a military fort—Fort Bliss—near by. A large majority of the exports from Mexico enter the United States by way of El Paso. From the middle of September to the middle of May the climate is suitable for tuberculous invalids; after that time it is too hot for