leptiform impulse. (d.) Animal impulse. (e.) Dipso-mania. (f.) Pyromania. (g.) Kleptomania. (h.) Moral insanity.

(8.) The insane diathesis (*psychoneurosis, neurosis insana, neurosis spasmodica*).

No great advance, however, has been made in this branch of mental science, except in Germany, since the time of Griesinger, who, before he was thirty years of age, and while assistant in an insane asylum, wrote a treatise on insanity, which for twenty years remained the first in any language. The German mental pathologists have endeavored to combine in their classification the clinical history with the little that is known of its morbid anatomy. Meynert has gone so far in this direction as to have constructed an ideal mental pathology of great exactness, but, unfortunately, belonging to the sphere of brilliant speculation rather than exact science. Schüle, in his recent work, has well summarized our knowledge on these points, and has made the following classification, which keeps within the bounds of our definite knowledge, and at the same time recognizes all that is at present certain in the relations of pathological conditions to mental disease:—

I. States of mental defect or degeneration:—

(1.) States of mental defect:—

(a.) Microcephalism.

(b.) Idiocy.

(2.) States of mental degeneracy, chiefly as the result or further development of

(a.) Hereditary insanity.

Impulsive insanity.

Moral insanity.

(b.) Insanity from the severe neuroses.

Epileptic insanity.

Hysterical insanity.

Hypochondriacal insanity.

(c.) Periodic and circular insanity.

II. Insanity in persons of full mental and physical development:—

(A.) The cerebral neuroses causing mental disease, affecting primarily the intellect alone (*psychoneuroses*).

(1.) The acute or subacute typical cerebral neuroses in healthy neurotic persons, and with a vaso-motor origin.

(a.) Primary form:—

Melancholia.

Melancholia agitata.

Acute mania.

(b.) Secondary form:—

Chronic mania and monomania.

Dementia.

(2.) The chronic cerebral neuroses giving rise to mental disease, founded on degeneration, and of neurotic origin primarily (*delusional insanity*).

(a.) Primary mania of persecution, with a condition of pure depression, with exaggerated and exalted ideas.

(b.) Delusional insanity, strictly speaking, psychoconvulsive form (*maladie du doute*), psycho-cataleptic form (*delusional insanity attended with anomalies of sensation*).

(B.) The organic mental diseases affecting intellectual and psychic functions (*cerebro-psychoses*), differing from (A) chiefly in being deeper seated.

(1.) With motor symptoms of excitement (*acute mania*).

(a.) "Mania furiosa" (including "mania transitoria").

(b.) "Mania gravis."

(c.) Acute delirious mania.

(2.) With motor neuroses and symptoms resembling catalepsy, tetanus, and anergic stupor, or the various forms of *Spannungsneurosen*.

The states of mental stupor:—

(a.) "Melancholia attonita."

(b.) Delusional stupor.

(c.) Primary dementia (stupor).

Acute.

Chronic.

(3.) With progressive paralysis. The typical form of paralytic dementia.

(C.) The distinct lesions of the brain giving rise secondarily to psychical disturbances. The modified paralyzes, or cerebral diseases, in which dementia and paralysis are both observed clinically.

(a.) Meningo-periencephalitis, chronic and subacute.

(b.) Pachymeningitis and hæmatoma.

(c.) Diffuse encephalitis with sclerosis, without mental excitement; with mental excitement.

(d.) Diffuse encephalitis with local softening, apoplexy, capillary aneurisms in groups or singly; multiple sclerosis.

(e.) Diffuse encephalitis arising from foreign growths in the brain.

(f.) Chronic periencephalitis with previous *tubes dorsalis*; tabic paralysis.

(g.) Primary atrophy of the brain with accompanying spinal tubes; tabic dementia.

(h.) Syphilitic encephalitis with disturbances of the mind.

When we consider that in the early part of this century, two generations after John Hunter, Heinroth, then the first clinical instructor of mental disease in Germany, taught that insanity is the result of wrongdoing and sin; that a conscious neglect of God's will is its source; that the best treatment consists in a pious life, giving one's self up to God and all that is good; and that the only means of prevention of insanity is the Christian religion, it must be acknowledged that an immense advance has been made in the knowledge of mental diseases, perhaps not inferior to the progress in other branches of medical science.

Original Articles.

PYÆMIA OF DOUBTFUL ORIGIN; APPARENTLY "SPONTANEOUS."¹

BY CHARLES H. COOK, M. D., OF NATICK.

In the Transactions of the Pathological Society of London for the year 1879 is the report of the Committee appointed by the Society to investigate the Nature and Causes of those Infective Diseases known as Pyæmia, Septicæmia, and Purulent Infection.

One feature of the report is an Inquiry whether Pyæmia and Septicæmia can be sharply defined from Each Other.

The authorities cited under this head may be divided into three classes:—

(1.) Those who recognize no essential difference between septicæmia and pyæmia.

¹ Read before the Massachusetts Medical Society at its annual meeting, and recommended for publication by the society.

(2.) Those who distinguish between septicæmia and pyæmia, but recognize only one form of septicæmia; and even they differ among themselves as to whether septicæmia is or is not an infective disease.

(3.) Those who define sharply between septicæmia and pyæmia, and also recognize two separate and distinct conditions as existing, to which the term septicæmia is applied; to distinguish these two conditions they would employ the terms used by some of the German writers, and give to one the name of septic or putrid intoxication, and to the other septic or putrid infection.

Another feature is the careful study of the records of seven hundred and sixty-eight cases of pyæmia and septicæmia which occurred in the principal London hospitals during the ten years preceding.

As the results of the study of the records of these cases, together with an analysis of the views of the authorities cited, the committee present a "summary," from which I make the following extracts.

"It would seem probable that the diseases known clinically as pyæmia and septicæmia may be grouped as follows:—

(1.) "*Septic Intoxication*. The effects of poisoning by the chemical products of putrefaction. A non-infective disease.

(2.) "*Septic Infection*. A general infective process arising from the introduction of some peculiar constituent of putrid matter into the blood stream. It is supposed by some to be due to the multiplication of living organisms in the blood, and by others to the effect of a non-organized ferment. It terminates fatally without secondary inflammations.

(3.) "*Pyæmia* (for want of a better name). An infective process, probably similar in nature to septic infection, but differing from it in giving rise to local inflammations and suppurations, often complicated by thrombosis and embolism, possibly due to the blood condition. . . .

(9.) "A group of obscure cases, in which it is impossible to form any idea as to their exact nature, often called spontaneous septicæmia or pyæmia."

Of the seven hundred and sixty-eight cases before referred to, four are recorded under the head of Spontaneous Septicæmia and Spontaneous Pyæmia.

Concerning these cases the committee say: "Under these names have been described certain rare and obscure cases, in which symptoms analogous to those of septic infection and pyæmia have arisen without any discoverable local source of infection. Four such cases are briefly summarized in the appendix (Table XI). None of these occurred during the course of the present inquiry. They are merely appended as illustrations of the disease in question. They are not sufficient in number to justify any conclusions being drawn from them."

Before giving these cases I wish to read the history of a case which occurred in my own practice:—

On Thursday, December 26, 1878, I was called to see Mrs. H., aged thirty-three years, American, married, by occupation a bookkeeper, a lady of unusually fine physique and healthful appearance. Patient gave a history of general good health since childhood.

On the Saturday previous to my visit she felt symptoms of a severe cold, and on Saturday evening "took a sweat," which was repeated on Sunday evening. On Monday and Tuesday she went to her place of business, walking with great difficulty, because of lame-

ness involving the muscles of the hips, thighs, and legs, especially those of the right. Tuesday night had a severe rigor. Wednesday (Christmas day) remained indoors; lameness unimproved. Thursday morning, the time of my first visit, the patient, who was in bed, exclaimed, "Doctor, my right leg is practically paralyzed; I cannot move it." Examination revealed extreme tenderness of the muscles of the right hip, thigh, and leg, but passive motion produced no pain at the joints. There was no history of contusion nor injury, no discoloration of the skin, no swelling, no œdema. There was also tenderness, but in less degree, of the muscles of the left hip. Patient complained of pain and distress in the præcordial region, but physical examination revealed nothing abnormal about the heart. Pulse, 100; temperature, 102.5° F.; respiration, 34; was menstruating. On Saturday, December 28th, there were indications of disturbance in the right lung; no material change in other respects. On Monday, December 30th, the patient was able to move the right leg without difficulty; there was no tenderness on pressure except in the region of the right hip. Physical examination revealed dullness, bronchophony, a few subcrepitan râles, and increased vocal fremitus, over the lower lobe of the right lung. There was no cough, no expectoration, no pain in the right chest. The præcordial distress had disappeared. Since the previous Thursday the pulse had varied from 100 to 110, temperature from 101.5° to 103.5° F., respiration from 32 to 34. On Wednesday and Thursday, January 1 and 2, 1879, the pulse was 120, and the temperature 104° F. Patient unable to lie on either side since she was taken sick, because of the tenderness in region of the hips.

On the mornings of Friday and Saturday, January 3d and 4th, patient expectorated a small quantity of what seemed to be bright-red fresh blood. Pulse and temperature falling.

Menstruation ceased after ten days; was of longer duration than usual, in other respects normal.

On the mornings of Monday and Tuesday, January 6th and 7th, there were repetitions of the bloody expectoration. The pulse on Tuesday morning was 80; temperature normal.

Thursday, January 9th, pulse and temperature were the same as on Tuesday; tongue clean; patient sat up nearly an hour, and took solid food with relish. There was still tenderness in the region of the hips, especially of the right hip, but no fluctuation.

Saturday, January 11th, the pulse was 100, heat 100° F.; there was no relish for nourishment. Two spots, resembling erythema nodosum, had appeared on the middle third of the right thigh, external aspect. There were similar spots on the anterior and external aspects of the left thigh; one also below the knee, antero-internal aspect.

Tuesday, January 14th, the pulse was 110, temperature 101° F. No albumen in urine; no cough; no expectoration since Tuesday morning, January 7th.

Thursday afternoon, January 16th, patient had a severe chill, almost a rigor, followed by profuse perspiration.

Friday, January 17th, there were repeated chills and perspirations. On Friday evening I learned that extreme dysuria had been present for twenty-four hours, the nurse having kept silence at the urgent request of patient. Made investigations as to the possibility of any uterine disturbance sufficient to account

for chills, perspirations, and dysuria, but with negative results.

Saturday morning, January 18th, the condition of patient was but little changed, except that the dysuria had been almost entirely relieved. In the afternoon Dr. Ellis saw the patient in consultation. Dr. Ellis has very kindly furnished me with a copy of his notes of the case, made at the time:—

"Ill-defined dullness over the lower third of the right lung. Some subcrepitant as well as sonorous râles on full breath or coughing, but nothing very distinct. Complains mostly of pain in the hips, and says there is nothing wrong above the latter.

"Looks pretty well.

"Heart normal.

"The dark-red portions of skin on the thighs are hard as from infiltration, and in the left thigh is felt an induration beneath the skin, with no redness of the latter.

"Great hardness on pressure over the hip-joints.

"It seems probable that the soreness is owing to some deep-seated inflammation.

"The character of the pulmonary disease is such as to suggest embolism or pyæmia, but the source of this is not so clear.

"The dark-red or purplish spots are probably attributable to the same cause, and abscesses will be likely to form here.

"The case will probably terminate fatally."

Monday, January 20th, received the following report of examination, made by Dr. Townsend, of sample of urine voided the day before:—

"Specific gravity 1010; reaction feebly acid; pus abundant; one cast only seen; some doubtful fat corpuscles."

There was a gradual increase of unfavorable symptoms during the following week. Pulse varied from 100 to 130; temperature from 100° F. to 103° F.; chills and perspirations continued. The discolorations on the thighs assumed more of the aspect of tumors, becoming elevated above the surrounding tissues. There was fluctuation, the last of the week, in the tumor below the left knee.

On Friday, January 24th, I received a letter from Dr. Ellis, containing report of examination, by Dr. Cutler, of sample of urine. Dr. Ellis wrote as follows:—

"The examination of the urine does not prove much, but is suggestive as far as it goes. Specific gravity 1012; acid; urea deficient; a trace of albumen; pus corpuscles; vaginal and vesical epithelium. There is no more albumen than the pus would account for, but the low specific gravity and the diminution of urea make me suspect that, unless the quantity of urine were quite large, something more will be found later.

"The persistence of the symptoms makes me feel still more strongly that we may be correct in our diagnosis. I have not yet found an exactly parallel case, but as far as the evidence goes it confirms the view expressed."

On Sunday, January 26th, Dr. Hosmer was called in consultation, and found the general condition of patient much the same as when Dr. Ellis saw her. There was no fluctuation in region of right hip. Introduction of exploring needle in tumor below the left knee revealed pus. Dr. Hosmer's opinion as to the obscurity of the case fully coincided with that given by Dr. Ellis.

During the week following patient gradually failed. Pulse ranged from 120 to 140; temperature from 100° F. to 104° F. The last of the week there was pitting upon pressure in the region of the right hip, but no fluctuation.

Sunday, February 2d, Dr. Hosmer saw the patient again. It was decided that there were not sufficient indications of pus about the right hip to warrant the introduction of an exploring needle.

Two days later, Tuesday, February 4th, patient was seen in consultation by Dr. Patch, who concurred fully in the opinions of Drs. Ellis and Hosmer.

During the succeeding week the pulse ranged from 130 to 160; temperature from 100° F. to 105° F. There was slight delirium at times and occasional incoherence on first awaking from sleep. Patient died on Wednesday morning, February 12th, seven weeks from the time of my first visit.

The autopsy was made by Dr. E. G. Cutler, and the following are his notes:—

Autopsy, thirty-one hours after death. Rigor mortis was marked. The body was not emaciated. Miliary sudamina were found thickly scattered over the chest, not extending over the abdomen. The belly was much distended by gas. There was a slight icteric hue of skin, and the conjunctivæ were yellow. In the middle third of the left thigh, anteriorly, there was a tumor in the skin about the size of the fist, which, on being opened, was found to be an abscess involving the skin and burrowing between the muscles of the thigh. There were two or three similar but smaller tumors on the upper third and external side of the left thigh. A small circumscribed abscess was found at the junction of the fourth costal cartilage with the sternum on the left side, involving the cartilage and perichondrium.

The heart was of normal size, its color was somewhat pale; the right side was distended with dark, loosely coagulated blood, and the left side was fully contracted. The tissue was rather more friable than normal, and on section the muscle had a fatty appearance, more marked in the musculi papillares. A microscopic examination confirmed the gross appearances, the fibres being found to be markedly fatty. All the valves were healthy. The innermost sheath of the intima of the aorta contained numerous small spots of fatty degeneration.

There was an old pleural adhesion on the left side at the lower portion of the upper lobe. On section considerable fluid was found in the alveoli, having an acid odor and a brownish color; the bronchi were discolored posteriorly and stained of the same color as the alveoli, and it was evident that the fluid was part of the contents of the stomach pressed out by the gaseous distention of the intestines. In the right lung there was a recent pleuritic adhesion over the posterior and middle portion of the lower lobe; and on section of the lung at this point there was found to be a small abscess containing about a drachm and a half of pus. The boundaries of the abscess were a little obscured by softening dependent on the presence of fluid and consequent digestion, just as was seen in the other lung. On slitting up the pulmonary artery an embolus was found corresponding to the location of the abscess.

The spleen was of normal size, a trifle pale, and the pulp soft. The trabeculæ and Malpighian follicles were normally distinct.

The stomach and intestines were normal.

The left kidney contained a wedge-shaped abscess in the cortex at its upper extremity. The tubules were universally cloudy and the Malpighian bodies injected. There was an abscess in the right kidney near one of the pyramids considerably larger than the one in the other organ.

The liver was of average size; its color was yellow, and the acini appeared fatty. On microscopic examination there was found to be extreme fatty infiltration and some fatty degeneration of the hepatic cells.

The cervix uteri was found to be shortened and strongly anteflexed by old cicatrices; it was otherwise normal. There had been old pelvic peritonitis, which had bound the ovaries and Fallopian tubes into a confused mass.

The right buttock was found to be a bag of pus; the ilium was denuded over a space half the size of the palm of the hand, and the periosteum gone, though the bone was not roughened. The muscles were shreddy. No source of pus was found; there was neither caries nor necrosis of any of the bones, and there was no evidence of contusion.

Three of the cases reported by the committee of the London Pathological Society are in substance as follows:—

CASE I. Male, age forty-eight. Was taken with shivering on coming out of a hot room. Later on, cough, frequent rigors, night-sweats; bowels regular.

On three different dates was nearly well, but relapsed soon after. Was admitted about two months after first attack, with above symptoms and pain in back of head, neck, and calves; pulse 114; liver dullness slightly increased. There appeared an eruption like impetigo on legs; about twenty hard inflamed cutaneous lumps on each leg, size of peas; some suppurating, red raised patches, size of crown piece, on forearm; blood extravasated in some of suppurating points; constant delirium; glans penis apparently gangrenous. Died ten weeks after invasion.

Autopsy. Bullæ on face, legs, and arms, purple, with areola. Several small abscesses in the muscles of the forearm. Larynx: ulceration of membrane lining the ala of thyroid cartilage; patch made up of numerous minute purulent heads. Lungs intensely congested; contained numerous collections of minute abscesses, with distinct pyæmic characters; two or three larger accumulations of unhealthy pus, size of filbert. Glans penis infiltrated with pus.

CASE II. Female, age twenty-one. Good previous health. Was taken with headache and cough, with slight expectoration, followed by languid pain in chest and general aching; temperature high. Was admitted ten days after attack; a rigor; bowels regular. Next day two loose, dark-colored stools; twelve distinct rose spots; constant delirium; loud systolic murmur. The day following, vesicular eruptions on fingers and toes and forehead, in some places pustular; temperature 104.8° F. Died.

Autopsy. Purple hæmorrhagic spots at ends of fingers and toes; a few vesicles on front of legs, some becoming pustular; herpetic spots on scalp and forehead; slight ecchymosis under scalp, corresponding to the herpetic spots; small collections of pus in the brain under the visceral arachnoid, in the heart beneath endocardium chiefly at upper part of right ventricle, in the mucous membrane of the intestines (nothing like typhoid ulcerations), in the cortex of the kidneys, mostly immediately beneath the capsule; effusion of

blood into left hemisphere of brain and in cerebellum; two or three spots, mottled with yellow, beneath capsule of liver. Blood very fluid thirty-six hours after death.

I omit Case III., as there was no autopsy reported.

CASE IV. Male, age forty-eight. Cough three months. February 28th, severe rigors. Admitted March 3d. Jaundiced; liver dullness increased; temperature 103.8° F.; abdominal pains; purgatives; jaundice diminished; severe cough. No change for several days; jaundice then increased; emaciation. Four days before death sordes, profuse sweating; red flush on hands and wrists.

Autopsy. At the base of right lung was a small circumscribed area of "secondary pneumonia;" congestion of mucous membrane. Liver large; lobules distinctly marked out. Joints; pus in left sterno-clavicular and wrist joints.

In the *London Medical Record* for June 15, 1879, are epitomized the reports of a series of five cases of "spontaneous septicæmia" which have come under the observation of Leube, and which he published in a German medical journal.

The two most interesting of these reports I have copied:—

CASE III. A lad, aged nineteen, suddenly became unconscious. Slight excoriation on the nose; herpes of the left hand; the urine contained much albumen and numerous cylinders; both epididymides were enlarged, and felt hard and nodulous; the optic nerves and the veins of the retinae were hyperæmic; there were extravasations in both retinae. The temperature rose to 40.1° C. Later on Cheyne-Stokes's respiration set in, and the patient died in three days.

Necropsy. Ambilateral cheesy epididymitis; a softened thrombus in the left epididymis; miliary metastatic bacteritic foci in both kidneys, and cheesy degeneration of the apex of one of the pyramids; metastatic miliary foci in the myocardium; bacteritic growths on the bicuspid valves; metastatic miliary foci in the mucous membrane of the pharynx and larynx, the large intestine, the conjunctivæ palpebrarum, and the membranes of the brain; diphtheritic inflammation of the inner coat of the ileum; tumor of the spleen.

CASE V. A servant-girl, aged seventeen, was suddenly taken ill with rigor, subsequent fever, profuse perspiration, and pains in the right shoulder-joint. The latter was tender to pressure. A systolic murmur could be detected over the heart; the temperature was high. A few days later, she became comatose; some of the muscles of the eye were paralyzed; a bloody extravasation was seen, first in the left retina, later on in the right; the dullness of the heart was enlarged; death ensued a week after she had first felt ill.

Necropsy. The spleen was slightly enlarged; diffuse suppurative meningitis; pleuritis on the left side of the thorax; bacteric endocarditis of the central valve.

Leube states that "spontaneous septicæmia may easily be mistaken for uræmia, meningitis, or miliary tuberculosis, although neither of the latter affections entirely resemble it in every respect. Characteristic symptoms are the rigors and high temperature, which set in suddenly without any prodromi, as well as the profound alteration of the nervous centres. The eruptions on the skin are also very important diagnostically, especially as they occur constantly, which is not the case with the hæmorrhages in the retina."

In the *London Lancet* for March 20, 1880, is a clin-

ical lecture on Ulcerative Endocarditis with Embolism of Brain, by Henry Thompson, M. D., in which he says: "Its consequences are embolism or blood infection, or both together. . . . I am bound, however, to warn you that by many authorities ulcerative and infective endocarditis are regarded as commensurate and synonymous terms. Nor is this all. Pathologists have brought to light the so-called material of infection, the presumed blood poison itself, in the several shapes of micrococci, vibriones, bacteria, leptothrix, filaments and the like, — a motley assemblage of molecular organisms, which may be briefly designated microzymes. . . . Unfortunately no one can tell where these strange beings are born, whether *within* the heart or *behind* the heart in the course of the circulation, whether they are indigenous or exotic, central or peripheral, in origin. Cases are on record which one would unhesitatingly refer to an extraneous source. On the other hand, there are undoubted examples where no distant point of departure was *discovered*, but in this connection it must be borne in mind that the same thing is true of unequivocal pyæmia. Over and over again, you know, in pyæmia we find no aboriginal focus of infection, whether anything of the kind exist or not.

"In all my own more recent cases, three in number, post-mortem examination revealed nothing to warrant the assumption of an extraneous source."

I have given the records of certain cases of pyæmia and septicæmia which are classed by some authorities as "spontaneous" in their origin.

In my own case the possible causes, such as bad air, impure water, defective drainage, tainted food, previous poor health, were all thoroughly investigated, with negative results.

These histories seem to justify the belief that cases of pyæmia and septicæmia occur in which the cause cannot be traced. The word "spontaneous" indicates that the origin cannot be explained, but does not necessarily commit one to the belief that there was a "spontaneous generation."

Further than this I have no theory to offer in regard to these cases; they are still too few in number to warrant any conclusions being drawn from them.

My desire in the presentation of this paper is that it may elicit discussion now, and the publication, hereafter, of other cases similar in their history.

HUMAN GROWTH.

BY CHARLES SEDGWICK MINOT, M. D.

As Dr. Bowditch's researches on the growth of the school-children of Boston have excited a very widespread and general interest in the matter, it is desirable to call attention to the independent investigations of Professor Pagliani, of Turin, which have confirmed and supplemented Dr. Bowditch's results. Pagliani's last paper¹ gives a general *résumé* of the whole subject, based upon his own statistics and the observations of others. It is the chief object of the present article to give an abstract of this important memoir.

Formerly the principal authority on human growth was Quetelet,² who, having adopted a very arbitrary

method of research, arrived at results which are erroneous in important respects, as both Bowditch and Pagliani have pointed out. It is strange to find that even in the third edition of Foster's text-book of physiology, the best and most recent manual of this science, Quetelet's errors are still repeated. It is therefore desirable to report the new researches, since the general authorities are very incorrect.

Quetelet's error arose from his measuring twenty picked individuals for each age, ten of each sex, selecting those he supposed to be fully and symmetrically developed. In order to get at the real course of growth it is necessary to take the average of a very large number of measurements, excepting only individuals with positive deformity or disease, because the variations are both extensive and numerous, and the growth of an individual rarely, if ever, conforms exactly to the average.

The best measure of growth is unquestionably the weight, because it represents the total growth independently of its being principally in height or diameter. The stature shows some peculiarities, which the weight alone cannot bring out, namely, in the proportionate rate of increase of stature and bulk, which are subject to definite and different variations.

The time of growth may be divided into four tolerably distinct periods, as follows:—

(1.) *Formative period*, comprising the first two months of the foetal life, during which the tissues are differentiated, and the omphalo-mesaraic circulation is maintained.

(2.) *Period of embryonic completion*, comprising the rest of the foetal life, with placental circulation.

(3.) *Period of development*, from birth to puberty.

(4.) *Reproductive period*, from puberty onwards.

There is a sufficient distinction between the first and second as well as the second and third periods, but that between the third and fourth depends upon the determination of the age of puberty. No precise determination in the case of boys has yet been made, there being no readily recognizable sign. It is, however, to be hoped that valuable results may be obtained, as Bowditch has suggested, by accurately recording the time when the voice changes, and also when hairs are developed on the pubic region, both changes approximately coincident with puberty. In the case of girls, the first menstruation and also the enlargement of the mammæ, which usually somewhat precedes the first monthly flow, afford an obvious and sufficient indication of maturity. Numerous observations upon the first menstruation have been made. In Boston, according to Dr. Chadwick, the average age is fourteen years and five months. The exact epoch varies with race, climate, and circumstances of life. According to Joulin, in warm climates there is a larger number of first menstruations at twelve years than at any other age; in temperate climates at fifteen years; in cold climates at sixteen. But these data are very uncertain, as is shown by the fact that in Denmark Han-nover found from 2129 cases the average age to be 16.91 years, while Raun, from 3840 cases, found it to be 15.84.

The statistics must therefore be gathered before they will yield sufficiently accurate means. Menstruation begins in the majority of girls between the thirteenth and eighteenth year, both inclusive, a period of nearly six years, over three or four of which the cases are distributed about equally, so that there is not one year

¹ Luigi Pagliani, *Lo Sviluppo umano per Eta, Sesso, Condizione sociale ed etnica, studiato nel Peso, Statura, Circonferenza toracica, Capacità vitale e Sforzo muscolare*. Milan, 1879. 8vo, pp. 79, Tav. I.-IV.

² Quetelet, *Physique sociale*.