

schewsky states that these processes are most active at the period of maximum leucocytosis.

Just previous to the development of leucocytosis, there is usually a stage in which the leucocyte count is low. This is called by Löwit the *leucopenic phase*. Goldscheider and Jacob have proved that this is dependent purely upon an altered distribution of the cells in favor of the deeper vessels.

Pathological leucocytoses differ from the physiological in being usually of larger extent and of greater duration, and in being almost always accompanied by a relative and absolute increase in the poly(morpho)nuclear leucocytes. There is also a change in the cell structure in certain cells. A small percentage of the poly(morpho)nuclear cells resemble myelocytes, having a nucleus which is on the border line between the two cells. One to three per cent. of the cells have become so altered that they cannot be distinguished from myelocytes.

Post-Hemorrhagic.—Following a large hemorrhage there is usually within an hour a considerable leucocytosis—from 16,000 to 18,000. In hemorrhage from the stomach this disappears again in a day or two, while in ordinary traumatic hemorrhage it persists longer.

Inflammatory and Infectious.—To the clinician the determination of leucocytosis in the numerous infectious and inflammatory conditions is of more practical value from the standpoint of diagnosis and prognosis, than the leucocytosis in all other conditions.

In the consideration of this variety of leucocytosis and in the deductions to be drawn from it, it is well to keep in mind the following facts.

There is no direct connection between leucocytosis and fever, since many febrile processes—typhoid fever, for instance—run their entire course, if uncomplicated, without leucocytosis, even showing a hypoleucocytosis.

Purulent and gangrenous processes usually cause a higher leucocytosis than serous processes (compare empyema and pleurisy), but the amount of leucocytosis depends on the severity of the infection and the resisting power of the patient. A leucocytosis which increases from hour to hour suggests an acute spreading inflammatory process, and its detection is of great value in cases of acute appendicitis in influencing the surgeon regarding his operation and prognosis. Wright and Joy (*Medical News*, April 5th, 1902) come to the following conclusions from a study of one-hundred and twenty-four cases of appendicitis in which they have blood records, and about as many in which they have no records.

1. The leucocyte count is a valuable aid to prognosis in appendicitis.
2. This is distinct from its diagnostic value.
3. A high stationary, or an increasing count, indicates a morbid condition of increasing severity which demands operation no matter what the clinical symptoms may be.
4. A low stationary or decreasing count indicates that the severity of the case is abating and that an operation may be safely postponed. Cases in which a falling count is accompanied by unmistakable signs of a generally bad condition form the rare exception to this general principle, and in them there is no chance of error.
5. No arbitrary set of prognostic values to be assigned to various degrees of leucocytosis can be constructed. The important point is to follow any scheme in which one learns to have confidence, provided the essential principle be preserved.
6. The count indicates when operation should be performed for the best interests of the patient.
7. Circumstances often render it desirable to postpone operation in appendicitis. Study of the blood renders it possible to determine whether this may be done with safety and often renders such postponement permissible.

When appendicitis is walled off and stationary, leucocytosis is less than in the advancing process and does not increase from hour to hour.

Leucocytosis is present in the following inflammatory diseases (Cabot):

Asiatic cholera, relapsing fever, typhus fever (according to the majority of observers), scarlet fever, diphtheria

and follicular tonsillitis, syphilis (secondary stage), erysipelas, bubonic plague, yellow fever (some cases), pneumonia, smallpox (suppurative stage), malignant endocarditis, puerperal septicæmia, and all pyæmic and septicæmic conditions, actinomycosis, trichinosis, glanders, acute multiple neuritis (febrile stage), acute articular rheumatism, septic meningitis and cerebrospinal meningitis, cholangitis, cholecystitis, empyema of gall bladder, acute pancreatitis, endometritis, cystitis (some cases), gonorrhœa; abscesses of all kinds and situations,—felon, carbuncle, furunculosis, tonsillar and retropharyngeal abscess, appendicitis, phlebitis (some cases), pyonephrosis, perinephritic abscess, pyelonephritis, osteomyelitis, empyema, psoas and hip abscesses when not simply tuberculous, abscess of lung, liver, spleen, ovary, and prostate, salpingitis and pelvic peritonitis, epididymitis, pericarditis, peritonitis, arthritis (serous or purulent non-tuberculous), conjunctivitis, gangrenous inflammations of the appendix, lung, bowel, mouth (noma), many inflammatory diseases of the skin, such as dermatitis, pemphigus, pellagra, herpes zoster, prurigo, some cases of universal eczema. A miscellaneous class producing leucocytosis (toxic under Cabot's classification) includes that of illuminating-gas poisoning, quinine poisoning, rickets, uric-acid diathesis, gout, acute yellow atrophy of the liver, advanced cirrhosis of the liver (some cases), especially with jaundice, acute gastro-intestinal disorders (ptomaines?), chronic nephritis, usually in uræmia cases, after injections of tuberculin and thyroid extract and of normal salt solution (intravenous), after ingestion of salicylates, potassium chlorate, or phenacetin, during or after prolonged chloroform narcosis, ether narcosis (according to some observers).

Malignant Disease.—The position of the tumor, its size, rapidity of growth, the number, size, and position of its metastases, and the resisting power of the patient—all have a marked effect upon the number of leucocytes in malignant disease.

There may be a leucopenia in cancer of the œsophagus, due to the starvation which a new growth in that location causes. If the cancer is small and without metastases—as in the early epithelioma of the lip—the leucocyte count is normal. Excessively high counts are never found. In rapidly growing and extensive neoplasms of the lung, liver, and kidneys counts of 50,000, 40,000, and 28,000 have been made. Sarcoma usually produces a more frequent and larger leucocytosis than carcinoma. When all cases are considered, absence of leucocytosis is perhaps more common in malignant disease than is its presence.

Therapeutic and Experimental.—Pohl found that most of the so-called tonics and stomachics produce a slight leucocytosis in animals. Winternitz injected a large variety of substances subcutaneously, and found that the degree of leucocytosis was parallel to the degree of local reaction excited.

Lymphocytosis is an absolute and relative increase in the circulating lymphocytes. The ordinary white count cannot of course determine this fact, but resort must be had to the differential count of stained films. A moderate white count might show a lymphocytosis. If lymphocytosis is associated with an increase in the total white count it cannot be distinguished from lymphatic leucæmia except by the history and physical signs. If we take the adult blood as our standard, lymphocytosis is normal for healthy infants. Certain of the diseases of infancy increase the lymphocytes remarkably—such as cholera infantum, rickets, various intestinal troubles, scurvy, hereditary syphilis, and especially pertussis, which disease, according to Meunier, may quadruple the lymphocytes. There is no rule governing the size of the lymphocyte; sometimes it is the larger, sometimes the smaller, and often no division can be made between the two.

In many debilitated conditions in the adult, the percentage of lymphocytes is increased—due simply to a diminution in the number of polynuclear neutrophils. This must not be called a lymphocytosis.

The diagnostic value of lymphocytosis is seen chiefly in the diagnosis of lymphatic leucæmia, when associated with the presence of glandular tumors. Whooping-cough must first be proved absent. If associated with eosinophilia it may suggest obscure syphilitic disease.

Eosinophilia is an absolute increase in the number of eosinophiles in the circulating blood. There is a variation of from 25 to 500 per cubic millimetre in the healthy adult blood. Physiologically, eosinophilia occurs in young infants, and in women during the menstrual period and after coitus.

Pathologically, it has been reported in a large number of diseases, but from the standpoint of practical diagnosis is of more value in trichiniasis than in any other disease. The following list of diseases in which eosinophilia is found with the greatest regularity is taken from Da Costa:—

Diseases of the Skin.

Dermatitis herpetiformis.
Eczema.
Leprosy.
Lupus.
Pellagra.
Pemphigus.
Prurigo.
Psoriasis.
Scleroderma.
Urticaria.

Parasitic Diseases.

Helminthiasis.
Ankylostomiasis.
Ascaris lumbricoides infection.
Oxyuris vermicularis infection.
Tænia mediocanellata infection.
Trichiniasis.

Diseases of Bones.

Hypertrophy.
Osteomalacia.
Malignant neoplasms.

Post-febrile Conditions.

Malarial fever.
Pneumonia.
Rheumatic fever.
Scarlet fever.
Septicæmia.
Bronchial asthma.
Spleno-medullary leucæmia.

James Rae Arneill.

LEUCOPENIA.—An absolute reduction in the number of leucocytes in the circulating blood below the lowest normal limit is termed leucopenia, or hypoleucocytosis. It is the opposite of leucocytosis or hyperleucocytosis. The lowest normal limit is usually given as 5,000 per cubic millimetre. It is rather seldom in any condition that the leucocytes fall very much below 3,000 per cubic millimetre. Koblanck reports a remarkable case of leucopenia in an epileptic man twenty-five years of age. In a careful examination of twenty stained cover-glass preparations, he found only *one* leucocyte. Cabot refers to an unusual case of lymphatic leucæmia, in which the white count fell from 40,000 to 419 per cubic millimetre in the course of three weeks as the result of the development of an acute septicæmia. There are two classes of leucopenia—(1) physiological, (2) pathological.

Physiological leucopenia may occur after prolonged cold baths, short hot baths, and stimulation of sensory nerves. A change in the distribution of the leucocytes in the vessels takes place as a result of vaso-motor influences. Malnutrition and starvation are prominent factors in causing a reduction in the number of leucocytes. The faster Lucchi showed a decrease in his leucocytes from 14,530 to 861 per cubic millimetre after a seven days' fast. This number increased to 1,530 on the eighth day, and remained at about this figure during the remaining twenty-two days of the fast. If disease is excluded, the number of leucocytes—especially the polymorphonuclear—may be taken as an index of the patient's nutrition. A low leucocyte count indicates poor nutrition.

Pathological Leucopenia.—It is rather difficult to separate leucopenia and a simple absence of leucocytosis. The fact that some of our most important diseases (when devoid of complications) show an absence of leucocytosis, is a remarkable aid in diagnosis. The following diseases are included in this list: typhoid fever; tuberculosis, including incipient phthisis; miliary tuberculosis, tuberculous peritonitis, tuberculous ostitis and periostitis, tuberculous pleurisy, tuberculous pericarditis.

If, during the course of these diseases, a leucocytosis develops, it points to the presence of a new factor; in typhoid fever, for instance, one of its numerous compli-

cations should be suspected and looked for, such as phlebitis, perforation, hemorrhage, peritonitis, abscess, bronchitis, etc.

Pulmonary tuberculosis inevitably becomes a mixed infection as the lesions increase, with a resulting leucocytosis.

Da Costa states that leucopenia, or, at least, an absence of leucocytosis, may occur during the course of the following additional infectious diseases: measles, influenza, malarial fevers, Malta fever, and leprosy. A combination of an intense infection and feeble resisting power may result in a very low white count, as in certain cases of pneumonia and appendicitis.

A well-marked leucopenia may be expected in about one-fourth of the cases of chlorosis, and in about three-fourths of the cases of pernicious anæmia. In some very severe cases of secondary anæmia and in splenomegaly it is found. Chronic gastro-enteritis in infancy reduces the white count below the normal. An intercurrent infection may produce a leucopenia—as in Cabot's case referred to above. Various investigators have produced a decrease in the number of leucocytes by the administration of various substances hypodermically. Bohland found that it followed the injection of ergot, sulphonal, tannic acid, camphoric acid, atropine, agaricin, and picrotoxin. Delezené injected various anticoagulant substances, peptone, diastase, and eel serum, with a resulting marked leucopenia.

The leucopenic phase which precedes the development of leucocytosis has been referred to above, in the article on leucocytosis.

In typhoid fever there is a gradual decrease in the number of leucocytes after the first week, the lowest counts being found during the fifth and sixth weeks. This rule, according to Winter, does not hold good in all cases, but it is so constant that if in a given case of non-ruptive fever the number of leucocytes is normal or subnormal, it would be a strong point in favor of the diagnosis of typhoid fever. There is a progressive diminution in the percentage of the polymorphonuclear cells which continues into the stage of early convalescence. The percentage of lymphocytes is increased throughout the fever, the increase being most marked in the stage of convalescence. The degree of the leucopenia corresponds in a general way to the severity of the disease (not taking into account the effect of complications). Counts as low as 2,000 and 3,000 are not very rare. In pernicious anæmia the white count runs parallel with the red count and the hæmoglobin per cent. In some cases it is very low, falling to 1,000 per cubic millimetre. As stated above, leucopenia is found in about three-fourths of the cases of pernicious anæmia, which is in marked contrast to the tendency toward leucocytosis in secondary anæmias.

Ehrlich believes that in these conditions there is a lessened proliferative function of the bone marrow, which results in a diminution in the output of leucocytes by this organ.

James Rae Arneill.

LEUCOPLAKIA. See *Tongue, Diseases of.*

LEUCORRHEA.—This term furnishes another illustration of the very common error, in medical terminology, of confusing a symptom with the condition of which it forms but a part or a phenomenon. Current use, especially after the lapse of a long period of time, so fixes such errors that it is almost a hopeless task to make the correction which is necessary or at least desirable.

The term which is in common use as the synonym of leucorrhœa is "whites," which is sufficiently expressive, for leucorrhœa etymologically means a white discharge or flow. But there may be white discharges from various parts of the body, especially from mucous membranes; moreover the color of the leucorrhœal discharge is not always white, hence the correctness of the term is not at once evident.

The white discharge or flow which is to be considered proceeds from the mucous membrane of the female geni-

tal organs, and in common language any white discharge flowing from the vagina is referred to as leucorrhœa. In the majority of instances it is a glandular secretion, and may be discharged from the glands or epithelium of the vagina or uterus. Its color is by no means always white; it may be brown, green, or yellow when purulent, or red when mixed with blood.

It is composed of serum mingled with epithelial cells, with leucocytes, or with blood or mucous corpuscles, according as its color is brown, white, red, or yellow. Its reaction is acid when it is derived from the vagina, and alkaline if derived principally from the interior of the uterus. It may be bland and unirritating, or viscid, acrid, and excoriating.

It is odorless, if discharged very soon after it is secreted, but is more or less offensive if retained very long within the vagina or uterus. Its consistency is that of water, pus, or mucus, with a specific gravity which varies according to the admixture and weight of the various substances which may be combined with the watery basis. It may be thin and watery, thick like the white of egg, or semi-fluid like the pus from an abscess. A discharge of this character may always be considered abnormal, for the genital mucous membrane in health secretes only so much material as may be necessary for its lubrication; hence the more abundant the discharge or the more complex its character, the more it is an evidence of disease.

The quantity or volume of a leucorrhœal discharge varies within wide limits. There may be only an almost inappreciable moisture, which, however, may be sufficiently annoying on account of its irritating action and the staining and soiling of the garments, or there may be a continuous dripping which requires the use of a napkin.

Its effects and consequences vary greatly in different cases, and are not always commensurate with its quantity or even with its physical qualities. It may cause no great disturbance aside from an unpleasant sense of moisture and wetness, or it may produce the most profound irritation and corrosion, the epithelium of the vagina and vaginal portion of the cervix being macerated, with accompanying erosion and ulceration, and the skin being chafed, inflamed, or necrosed. The local condition may react unfavorably upon the system in general.

The debility produced by the constant abstraction of fluid from the blood, by the intense itching which is almost intolerable by day and worse by night, and by the absorption of more or less toxic material, shows the possible deleteriousness of a condition which under ordinary circumstances is hardly thought worthy the dignity of serious notice.

Pain is a not infrequent accompaniment. Under the ordinary conditions in which there is merely a milky or watery discharge there is no pain, but when the discharge is associated with acute inflammatory conditions very severe pain may be present. This symptom is quite distinct from the mere annoyance of the discharge or the irritation and itching which are caused by the chafing and excoriation of the skin. The other well-known symptoms of inflammatory conditions, swelling, heat, and redness, are, of course, present in greater or less degree.

There is probably no morbid condition to which the female genitals are susceptible which is of such frequent occurrence, in some form or other, as the leucorrhœal discharge. It may be present in infants, in young children, in young adults, in mature women, and in the aged. It is probable that it is for this reason that some gynecologists of wide experience have insisted that it is not necessarily an abnormality. With this sentiment I cannot agree, for, as already stated, the function of the mucous membrane is not to secrete a discharge which shall be appreciable and annoying, and if such a discharge is secreted the conclusion is only a logical one that it is due to some violation or fault of the natural law.

The grouping or classification of the various conditions in which leucorrhœa is present is not an easy matter.

The field is so large that it is difficult to treat it with satisfactory comprehensiveness. It must always be remembered that leucorrhœa in itself is a symptom and not a disease, and as it always has a cause we are hardly justified in applying to it that unfortunate term *idiopathic*, which has always seemed to me a subterfuge for ignorance.

We can certainly differentiate its presence in those diseases or morbid conditions which are acute and in those which are chronic. It is also perfectly apparent that it is a symptom both in those diseases which appertain almost exclusively to the genital organs, and in those which are general or constitutional. Of the diseases of the genital organs the acute infectious ones are the most common, especially those which are known as venereal diseases.

Syphilis is essentially a chronic disease, and leucorrhœa when occurring as one of its symptoms may be considered under this category.

Chancroid is an acute venereal disease but is not so frequent in women as in men. The ulcer or sore which is its essential characteristic may be located upon the opening of one or both of the vulvo-vaginal glands or upon any portion of the mucous membrane of the vagina or the portio vaginalis of the neck of the uterus. Inflammation attends the development of this disease and is accompanied by a leucorrhœal discharge which is at first purulent, then muco-purulent, sometimes streaked with blood, or merely mucous and viscid. It is more abundant in young than in mature women and seldom produces constitutional symptoms that are of importance.

The treatment consists in the use of astringent applications to the sore or ulcer, astringent vaginal douches, and a vaginal tampon of cotton wool properly medicated. I am accustomed to apply the solid nitrate of silver daily to the sore, followed by a vaginal douche of at least two quarts of very hot water and an injection of one or two ounces of peroxide of hydrogen, then applying a tampon moistened with a two-per-cent. mixture of ichthyol in glycerin.

By far the most common form of infectious disease of the genital organs giving rise to a leucorrhœal discharge is *gonorrhœa*. The part which is primarily infected may be the vulvo-vaginal glands or the mucous membrane of the vagina or vaginal portion of the cervix. The original focus of infection usually enlarges, whether in circles or in straight lines we do not know, attacking one portion of mucous membrane after another, until the entire mucous tract from the vulva to the junction of the mucous membrane of the Fallopian tubes with the peritoneum may be involved. The process may even extend to the peritoneum, and indeed we know that this actually occurs in not a few instances. After the period of congestion in such cases comes the period of discharge, and the vagina is constantly bathed with a fluid which is purulent, tinged with blood, muco-purulent, and then mucoid. It is always intensely infective, the period during which it continues being variable, depending upon the age and physical condition of the patient, the treatment which is given, etc. In young women the discharge is more abundant, more virulent, and more persistent than in those who are mature or aged. The tissues involved are extremely sensitive, and pain and swelling are pronounced and decisive.

During the first few days of the disease the tissues are so swollen and tender that little can be done except to keep the skin of the external genitals as clean as possible. A simple method of accomplishing this is to place a pad of absorbent cotton over the genitals, holding it in position by means of a snugly fitting napkin. It may be necessary to replace pad and napkin by clean ones five or six times daily. When the swelling and sensitiveness have somewhat subsided the patient should be placed in the Sims position, a large Sims speculum being introduced, and the secretion removed from the entire mucous surface with absorbent cotton and with the utmost care and gentleness. The entire surface may then be carefully swabbed with a strong solution of nitrate of silver

(two drachms to the ounce of water) and the vagina tamponed with cotton wool saturated with a two-per-cent. mixture of ichthyol in glycerin. This treatment must be repeated daily until the discharge has diminished, the intervals of application being then lengthened gradually, but it must not be discontinued until all discharge has ceased. It is absolutely imperative that this treatment be carried out regularly and systematically, as it may prevent the extension of the disease to the bladder, Fallopian tubes, and ovaries. I have also found it useful to administer internally an antiseptic, such as the salicylate or the benzoate of sodium, which may be given in ten-grain doses in an aromatic water before meals. The consequences of this disease may be so serious that too much care cannot be taken in giving it the most intelligent treatment which is possible.

The discharge which proceeds from the interior of the uterus cannot be treated so early as that which proceeds from the vagina, but as soon as the acute inflammation of the uterus has subsided it should be carefully removed from the canal with a cotton-wrapped probe or sound and the nitrate-of-silver solution then applied over the entire surface of the uterine mucous membrane. It must be remembered that violent treatment of the uterus during the acute period of inflammation will not only give intense pain but may excite metritis of a severe type, or even peritonitis. If the uterine discharge cannot be readily removed in the manner indicated it is better to wait a few days and then to scrape the entire endometrium with a dull curette.

The leucorrhœa which follows *abortion* is quite similar in its characteristics to that of *gonorrhœa*, indeed it is often of gonorrhœal origin. The discharge in such cases usually proceeds from the uterine canal and is purulent or muco-purulent in character. It may be thick and tenacious and is sometimes removed with difficulty. It is better that it be not removed at all than that violence be used in attempting to remove it. It proceeds from the entire surface of the endometrium and may come also from the mucous surface of the Fallopian tubes. The latter occurrence is rare, for the uterine ostium of the tubes in these cases is usually swollen and impervious and the material which is secreted is retained, forming a tumor of greater or smaller dimensions. The period during which an abundant discharge from the uterus occurs in this disease, the acute period, usually extends over one or two weeks. It then subsides under proper treatment or it may become chronic and continue indefinitely. The applications of the nitrate-of-silver solution and the cotton-wool tamponnade should be used for this disease in the same manner as for *gonorrhœa*, but it should be remembered of course that the disease is not always of gonorrhœal origin. If *gonorrhœa* is not present the discharge is neither so infective nor so virulent as that which accompanies the specific affection.

A leucorrhœal discharge is often a sequel of *parturition*, differing decidedly from the ordinary lochial discharge. It implies that inflammation has followed the parturient process, which may be the awakening of some latent focus of disease in some portion of the mucous tract of the genital apparatus. This discharge may be purulent or muco-purulent, and more or less profuse and irritating, and under ordinary conditions continues for from one to three or four weeks. It is unwise to disregard it, and it is usually treated effectively by morning and evening vaginal douches of hot water, which is made sufficiently astringent by the addition of alum or tannic acid, in the proportion of a tablespoonful to the quart of water.

During *pregnancy* a leucorrhœal discharge from the vagina is not unusual, resulting from the congested condition of the vessels. It is often very annoying from the irritation to the skin which it causes and the constant soiling of the clothing. It usually yields to the systematic use of astringent vaginal douches.

A discharge of a purulent character frequently follows *surgical operations* upon the genital organs, especially in those cases in which primary union has not taken place.

The treatment should consist in the use of astringent vaginal douches twice daily, and the constant application of a snugly fitting vulvar pad of absorbent cotton.

Injuries to the genital organs are usually followed by an abundant discharge from the vagina, constituting the customary discharge of an inflamed mucous membrane. Such injuries may be due to blows or thrusts with sticks or other substances, falls astride a chair or fence, brutality, rape, etc. They may be attended with great pain and swelling of the affected tissues. The chief considerations in their treatment are rest and cleanliness, the secretions being removed from the vagina with care and thoroughness at least once a day, and astringent vaginal douches being taken twice daily. The principle of treatment is that which applies to wounds in general, rest being an important factor in such treatment. Walking, working, or anything which causes motion of the diseased tissues tends to weaken the recuperative forces of nature.

Excessive coitus and *masturbation* are frequent causes of leucorrhœa. The repeated congestions of the mucous membrane in such cases furnish sufficient explanation of its mode of origin. The discharge is usually white or milky, and is often profuse, and irritating to the skin. It is the more troublesome as the individual is careless as to the conditions which provoke the discharge. The treatment is such as has already been indicated for similar conditions.

Little children are sometimes the subjects of leucorrhœa caused by the irritation of *worms*. Either the large round worms (lumbricoids), or the small seat or thread worms (ascarides) will produce this condition. The discharge is frequently profuse and annoying, irritating and excoriating the skin, and making the child's life miserable. It is usually brown in color and viscid in consistency. I have found it a most difficult condition to cure until the worms are discovered and destroyed. It will usually be necessary to examine the patient under anesthesia, dilating the entrance of the vagina with the finger if necessary. The vagina should be irrigated with a hot solution of boric or salicylic acid (one drachm to the quart of water), and the irrigation repeated daily until all congestion of the vaginal mucous membrane has disappeared. Of course a suitable cathartic must be given to dislodge the parasites from the rectum, and the ordinary rules of hygiene must be carefully regarded.

Of the *chronic* conditions and diseases of the genital organs which give rise to a leucorrhœal discharge it may be stated that they are the outcome of the acute diseases, and the failure to cure the latter implies that treatment has been defective. Such a result is by no means infrequent, especially with the venereal diseases. In syphilis, while the initial sore may be healed in a short time the constitutional derangement may be so great that a discharge from the vagina may continue indefinitely in spite of the most judicious local and general treatment. It is therefore necessary to be patient in our endeavors to check it, and not be too positive as to the prognosis, especially as to the time which may be required. In chancroid, which is entirely a local disease, the healing of the sore will be followed by the cessation of the leucorrhœa, if there is no other cause for its continuance. The leucorrhœal discharge which accompanies *gonorrhœa* is often very persistent. Especially is this the case when the ovaries and tubes become the seat of a chronic inflammatory process. If the ovaries and tubes are removed the leucorrhœal discharge will usually cease. The leucorrhœa which attends *abortion*, *pregnancy*, and *parturition* is usually quite amenable to treatment and seldom becomes chronic, unless there is such disease in the uterus and its appendages that severe surgical measures will be required to remove this fundamental cause.

The leucorrhœa which accompanies *dysmenorrhœa* is often prolonged and tedious. If it is due to a deformed and immature condition of the uterus it is usually remedied by *pregnancy*, but *pregnancy* does not often occur when such a condition of the uterus obtains. A surgical

operation will sometimes bring relief, but is not an infallible remedy.

The leucorrhœa in little children which is caused by worms is also one of the varieties which are often chronic and persistent, chiefly for the reason that the cause may fail to be discovered and removed. There is often very strong objection, on the part of parents, that their children should be subjected to the necessary examination and treatment, and it is frequently their fault that the condition remains obscure and uncured.

The leucorrhœa which occurs in aged women, technically known as *senile vaginitis*, is essentially a chronic disease. It sometimes proceeds from the vagina alone, and sometimes from the uterus as well. The discharge is usually a dirty, watery, acrid fluid which irritates the mucous membrane and skin, causing the most intense itching, and the rubbing and scratching to which it gives rise produce the most annoying and even painful results. The tissues become swollen and excoriated, and the patient is deprived of peace and comfort by day and by night. The general health is often as greatly deranged by this form of leucorrhœa as by any in the entire category. Nevertheless, I have seldom seen a case in which great relief could not be obtained by careful and persistent treatment. An examination must first be made, and if the source of trouble is found to be within the uterus, the endometrium must be thoroughly curetted. The uterus and vagina must be irrigated with an astringent solution (alum or tannic acid) and the vagina tamponed with cotton wool saturated with a mixture of subnitrate of bismuth and glycerin, enough of the former being added to the latter to make a rather thick paste. This paste must also be smeared over the swollen and inflamed external genitals. The treatment should be repeated every day or every second day until a cure has resulted. Many cases of this character have come under my observation and the treatment which has been alluded to has invariably brought relief.

The leucorrhœa which is an accompaniment of *malignant disease* of the uterus and vagina is susceptible only of palliative treatment. The discharge is profuse, watery, and very offensive. Curettage, irrigation with strong astringent solutions, and tamponade of the vagina will give a certain degree of relief, but the result will be uniform and uniformly fatal unless extirpation of the diseased organ is practised at a very early period.

We now come to the subject of leucorrhœa which occurs as a secondary phenomenon in the course of some constitutional or general disturbance. The list of diseases which may have this symptom is a long one, and the characteristics of the discharge are such as to make this the typical form of leucorrhœa as it is ordinarily considered. Foremost among these diseases may be mentioned those in which there is a chronic condition of malnutrition, the leucorrhœal discharge being one of the elements of its expression. The tissues are relaxed, the tension of the blood current is low, there are stasis of the venous circulation and transudation of serum and corpuscles in the vagina where the vessels are numerous and the resistance is slight. Diseases which at once suggest themselves as possessed of these conditions are tuberculosis, malaria, anæmia, chronic rheumatism, and the various forms of chronic, slowly progressing nervous disease. Those who suffer from excessive obesity, with its accompanying impairment of circulation, may also be placed in this category.

Another class of cases includes individuals who suffer with the infectious diseases, typhoid fever, scarlet fever, diphtheria, and measles. In such cases there is congestion of the genital organs, and the discharge sometimes continues long after all other symptoms of the disease have disappeared. Especially is this the case with children, and often, in addition to the leucorrhœa, an impression is produced upon the structure of the uterus—whether as the result of toxic influence or of interference with the circulation, is not known—which permanently affects its development and lays the foundation for future trouble which may prove of a serious nature.

Yet another class of cases includes those in which the causative influence is transient in character but may recur an indefinite number of times. Illustrations of such a cause are climatic variations, especially great heat and dampness, fatigue and emotion, particularly the extremes of emotion which are experienced by the hysterical and by those who are passing through the menopause. In all these varying forms of disease, if leucorrhœa is present as a symptom (and it frequently is present), there is one characteristic discharge which is usually observed, viz., the white watery variety, more or less abundant, more or less irritating, more or less persistent, and more or less pronounced in its debilitating and irritant effects.

The treatment for leucorrhœa in the three classes of cases last mentioned must consist primarily in the treatment of the cause. With such diseases as tuberculosis, syphilis, anæmia, etc., the local symptom is not usually removed by any form of local application or manipulation, however judicious or skilful, until the underlying cause is either removed or greatly ameliorated. If the discharge is due to an infectious general disease, such as one of the specific fevers, it will tend to self-limitation, but it may continue a long time after the fever has disappeared, and permanent lesions of the sexual organs, with leucorrhœa as one of their persistent accompaniments, are frequently attributable to such a cause. If the discharge is due to emotional causes, hysteria, etc., the removal of the cause is almost a hopeless task, for the changing of one's nature and characteristics is not a common occurrence. It is certainly proper in all these various cases to impress upon the patient's mind the necessity for the observance of a most careful personal hygiene, whether any medicinal or surgical treatment is employed or not. The constant use of the vulvar pad of absorbent cotton, the employment, morning and evening, of the vaginal douche with a hot astringent solution, and rigid attention to the skin, the bowels, the diet, the sleep, and the mode of occupation, may be more serviceable than any amount of professional attention.

The prognosis for this condition depends upon many factors. It is frequently entirely curable, recurring if the original cause is repeated, or it may be of a character which will preclude radically successful treatment, as in the case of malignant diseases. Its importance is sufficiently great to warrant careful study on the part of every physician who may be called upon to treat the disorders of the female sexual apparatus. *Andrew F. Currier.*

LEUKÆMIAS, THE.—(Synonym: Leucocythæmia.)

Definition.—The leukæmias are diseases of unknown causation (possibly varieties of the same disease), characterized anatomically by overgrowth of hematopoietic tissue, myeloid or lymphatic, infiltrations in the various organs of the corresponding leucocytes, myelocytes, or lymphocytes, and, when unmodified by treatment or intercurrent disease, accompanied by a great, usually an extreme increase of the circulating white cells of the same type.

HISTORICAL ACCOUNT.—This unusual and most interesting malady was first recognized and described in October, 1845, by Hughes Bennett and independently a few weeks later by Virchow. The former published the account of an autopsy upon the body of a man who died, with a much enlarged spleen and liver, and whose blood was filled with corpuscles which Dr. Bennett described as exactly resembling pus. In his discussion of the case he laid stress upon the absence of phlebitis and of the evidence of local suppuration in the body, which separated the condition clearly from pyæmia, or pus absorption, and he reached the conclusion that he was dealing with a new and distinct pathological process, in which pus corpuscles in great number originated within the blood itself. How far the hypertrophy of the liver and spleen was concerned with the change in the blood he was unwilling to say. Virchow, in his original publication, not only described independently a similar case, but came to the conclusion, which has been substantiated by all subsequent investigation, that the corpuscles in question

were not pus, but the white cells of the blood, present in many times their normal number. He also inclined to the view that there was some direct relation between the splenic enlargement and the diseased condition of the blood. Reviewing an older case of Rokitsky's, which had been diagnosed "general pyæmia," he correlated it with his own and proposed the name leukæmia, or white blood, for the disease. Upon this followed a prolonged controversy with Bennett—who now adopted the name leucocythæmia (white cell blood)—for the honor of priority in discovery and concerning the true nature of the newly recognized pathological condition. A few older cases, all included under pyæmia, were brought to light, and now that the attention of physicians everywhere was directed to the disease, reports of new cases were soon forthcoming. With this increasing material Virchow continued to elaborate his theories as to the real nature of the process, and in a series of articles made great additions to our knowledge of the leukæmias. He early described a case which differed from all preceding ones in presenting marked enlargement of the lymphatic glands throughout the body, accompanied by an increase in the small and not the large white cells of the blood. This he named lymphatic leukæmia, calling the previously described disease splenic.

Since the pioneer work of Virchow the study of leukæmia has been of marked interest to pathologists, and its true nature forms, even yet, a part of that great debatable territory of medicine into which theory and speculation press eagerly, while exact knowledge, by the slow acquisition of one fact after another, makes but gradual encroachment on its borders. The nature of the leukæmias is of course so intimately associated with the still unsolved problem of the physiology of the blood-making organs, of the normal mode of formation of blood, and especially of the white cells in the adult, that of late years it has been studied mostly by those who have devoted themselves to hæmatology. In this period of many theories and much valuable work it is hard to choose the most important, but Ehrlich's studies in staining and the introduction of his methods in the investigation of the blood during life, the recognition of acute leukemia by Ebstein and the study of its blood changes by Fränkel, and Neumann's work on the rôle of the bone marrow in the pathology of leukæmia, have been perhaps the most notable. Of the various theories which have played so large a part in the history of our knowledge of the disease, we shall treat later.

VARIETIES.—The older writers distinguished two forms of leukæmia on the basis of their gross anatomical features: the splenic type, in which the spleen is enormously enlarged, and the lymphatic, with a somewhat enlarged spleen but with general enlargement of the lymphatic glands. Later, when Neumann had demonstrated the constant presence of a characteristic change in the bone marrow in the splenic cases, these were called splenic-myelogenous—the term still most frequently employed. Since that time marrow changes of equal importance, but of a different type, have been found in lymphatic leukæmia and they probably exist in all cases, and very interesting cases of leukæmia without any anatomical changes outside of the bone marrow have been reported. The investigation and classification of the leucocytes, since the pioneer work of Ehrlich, have led to many changes in the theories held as to their derivation. The part which the spleen is known to play in their origin has been narrowed to insignificant dimensions. The bone marrow and the lymphoid tissues have been proved to be the great centres of leucocyte proliferation, and the distribution of lymphoid tissue has been found to be far wider than previously supposed, areas of it existing even in the bone marrow itself. Whether we follow Uskokoff, Löwit, and Gulland in regarding all forms of leucocytes as merely different stages in the development of a single cell, or believe with Ehrlich and Ribbert that they are so many distinct cell types, it is clear that a nomenclature which is based upon gross anatomical changes is misleading from the pathological standpoint, and, since

the spleen is enlarged in lymphatic leukæmia and the lymph nodes may be in the splenic variety, it is unsatisfactory clinically as well.

The subdivision made by Ehrlich and Lazarus fulfils all practical and theoretical requirements in the light of our present knowledge and will be adopted here. It distinguishes two forms: "1. Myelogenous leukæmia—leukæmic processes with growth of myeloid tissue; 2. Lymphatic leukæmia—leukæmic processes with growth of lymphoid tissue."

Under lymphatic leukæmia we may well consider acute leukæmia as a clinically distinct type; whether from theoretical considerations it should be regarded as a different process from chronic lymphæmia is perhaps an open question.

MYELOGENOUS LEUKÆMIA.

(Synonyms: Splenic-myelogenous, splenic, myelocytic and leucocytic leukæmia; myelæmia.)

Occurrence.—This, by far the most usual form of leukæmia, is still to the average practitioner a very rare disease. Bramwell, in the analysis of 141,777 consecutive medical cases, found only 5 of leukæmia. It would appear to be more prevalent in the United States than in England and is quite frequently met with in Russian Poland. In this country the highest percentage has been reported by Dock from the University Hospital, Ann Arbor, viz., 11.3 cases of leukæmia in 10,000 admissions.

Predisposing Conditions.—In a disease so infrequent, statistics are not to be relied upon. Men are said to be more commonly affected than women, and adults to show a larger preponderance of the myelogenous form over the lymphatic than children. It has been attempted to show that an antecedent malaria predisposes to the development of leukæmia. Injuries over the spleen have been followed by the disease; in one case which I have seen, only a short interval elapsed; but whether there was a direct connection between the two must be pure conjecture.

Onset, Course, and Termination.—The onset in the great majority of cases is gradual. The patient's attention will first be called to the slow failure of health, to the change in color, to the fulness and distress caused by the enlarged spleen, or to pain in the splenic region. In some cases a rise of temperature daily is an early symptom. Priapism occasionally is among the first complaints. The course of myelogenous leukæmia is essentially chronic. In most cases there are periods, sometimes of considerable length, when the disease remains stationary or even recedes. Some cases are more subacute, with fever and progressive anæmia. Rarely, sudden hemorrhage may be the initial symptom.

The termination is invariably fatal. That genuine leukæmia is ever recovered from must be doubted, for cases in which recovery has been recorded were probably of extreme leucocytosis, the report of the blood findings in older cases not sufficing to differentiate the two conditions. Bramwell reports a case of apparently acute myelogenous leukæmia with recovery under quinine; but here again the blood was examined only in the fresh state.

General Clinical Description.—During the early stages of the disease there is nothing in the appearance of the patients to suggest the existence of so grave a malady, and as a rule they do not seek medical advice until it has been established for some time. Before the custom of making examinations of the blood for diagnostic purposes was thought of, many cases were undoubtedly overlooked, either throughout their whole course or until a late stage. The apparent anæmia is usually but slight; there is some loss of weight and of strength; but apart from the examination of a stained blood specimen nothing may arouse the physician's suspicion until the enlargement of the spleen becomes prominent.

As the disease progresses this splenic tumor is usually the most conspicuous feature. It is associated with some and often considerable enlargement of the liver, so that the abdomen becomes quite prominent, in contrast with