

striking resemblance to the bacillus of tuberculosis, both morphologically and as regards its staining reactions. It was discovered by Hansen in 1874, and his observations were independently confirmed by Neisser in 1879. It is somewhat thinner but a little longer than the tubercle bacillus, though variations in size occur. Its average length is from 5 to 6  $\mu$ . Often in ordinary sections one finds the whole area crowded with bacilli. They frequently present a beaded appearance, which has led some observers to believe that they exhibit spore formation; this, however, is doubtful. They appear to be in groups, these usually being situated in large ovoid cells, which constitute the lepra cell. In the discharges from ulcers and diseased tissues, large numbers of bacilli are present, and the same tendency to grouping in ovoid

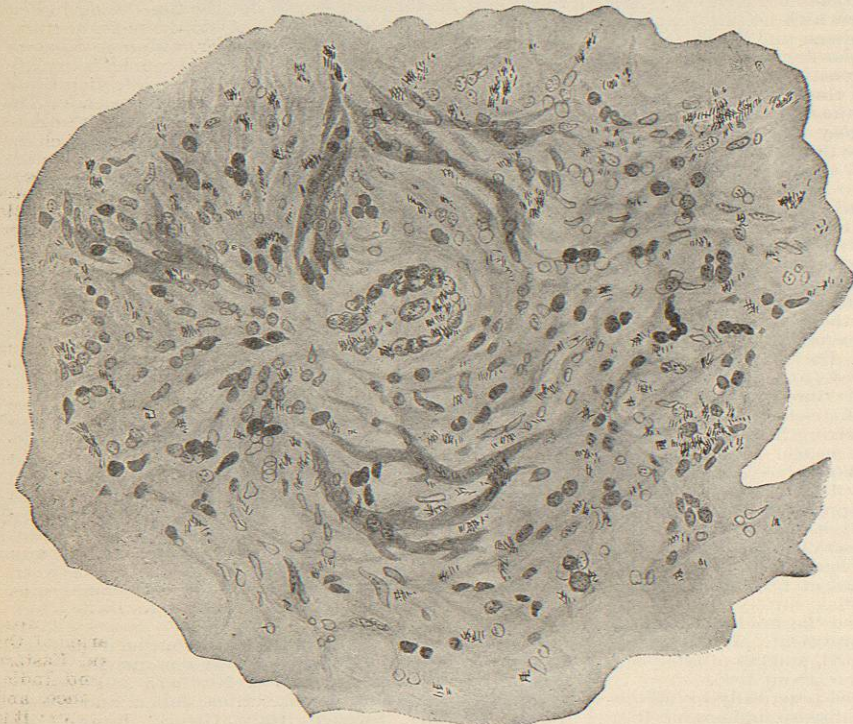


FIG. 3190.—Section of Leprous Nodule in Skin showing Lepra Bacilli and Giant Cell. (After Dom. Sauton.)

masses is often noticeable. Besides the two common locations, the skin and the peripheral nerves, these organisms have been found in greater or less abundance in the mucous membranes, cartilages, spleen, liver, lymphatic glands, hair follicles, cornea, testicle, spermatic cords, ovaries, blood-vessel walls, kidneys, and mammary gland. They are not found in the muscles, spinal cord, bones, or joints, nor in secondary lesions, such as bullæ; nor are they found in the urine or menstrual discharges, and they are absent from all physiological secretions unless pathologically contaminated. In the skin the bacilli are found in great numbers in the tuberculous variety, while in the macules of the maculo-anæsthetic variety they are present in very small numbers; but they are numerous in the connective-tissue sheaths of the peripheral nerves. Successful inoculations of the lower animals have not been made, nor has any one been able to grow the organism on artificial media outside of the human body. Campana (Rome) claims to have done so in

stab cultures on glucose agar, but his observations have not been confirmed.

In consequence of the poor supply of blood-vessels in the leprosy infiltrations, the nodules have low vitality and little power of organization, and therefore undergo absorptive and retrogressive changes slowly. As in the other granulomata, the principal changes are found in the corium, the process beginning about the vessels, glands, and follicles. There is cellular infiltration in, and hyperplasia of, the external and middle coats of the vessels, which by pressure narrow the lumen. The infiltration extends from these points upward to the epidermis and downward to the subcutaneous tissue. This infiltrate may be nodular or diffuse, and is composed of plasma cells, connective-tissue cells, occasional giant cells, and the lepra cells which are characteristic of this disease. These are large, ovoid cells, containing several clumps of bacilli, held together by mucoid material. Early in the process, the glands and follicles of the skin become infiltrated, and hyperplasia of the cells occurs. This is followed by degeneration and complete destruction and disappearance of these structures. The epidermal changes are purely secondary, and may consist, early in the process, in hypertrophy of the rete by pressure and irritation from below, which is followed later by atrophy; and when ulceration takes place complete destruction occurs. All throughout this infiltration, the bacilli are very numerous, and, although they are chiefly located within the lepra cell, some undoubtedly are intercellular in situation.

In the maculo-anæsthetic variety, nodules of proliferative connective tissue, containing bacilli, are present in the peripheral nerve sheaths, which by pressure early produce the pain and hyperæsthesia; later, as pressure increases, degeneration occurs and anæsthesia results. As some fibres escape the pressure, there are, in the anæsthetic spots, limited areas which still retain sensation. Voit,<sup>11</sup> whose sections and observations were confirmed by Schultz of Bonn and Strümpel of Erlangen, found that the skin filaments of the peripheral nerves were degenerated, while those supplying the muscles showed little or no degenerative changes; that ascending trophic degeneration of the sensory nerve branches was present; that the degenerative processes involving the nerves spread over the periphery; and that a central origin could be excluded. In the spinal cord, slight degeneration of the posterior columns was observed, but bacilli were never found. He believes with others that in the macules of true maculo-anæsthetic leprosy, either very few or no bacilli are present. Darier<sup>12</sup> says that all macules have a similar histological structure, and that they all contain bacilli, and are of the same nature as the nodules.

DIAGNOSIS.—In well-advanced and typical cases of either variety, the diagnosis of leprosy is not difficult, but in the early manifestations, especially of the maculo-

anæsthetic variety, its recognition is attended with the greatest difficulty, and numerous errors in diagnosis are recorded. In its prodromal stage, leprosy would prob-

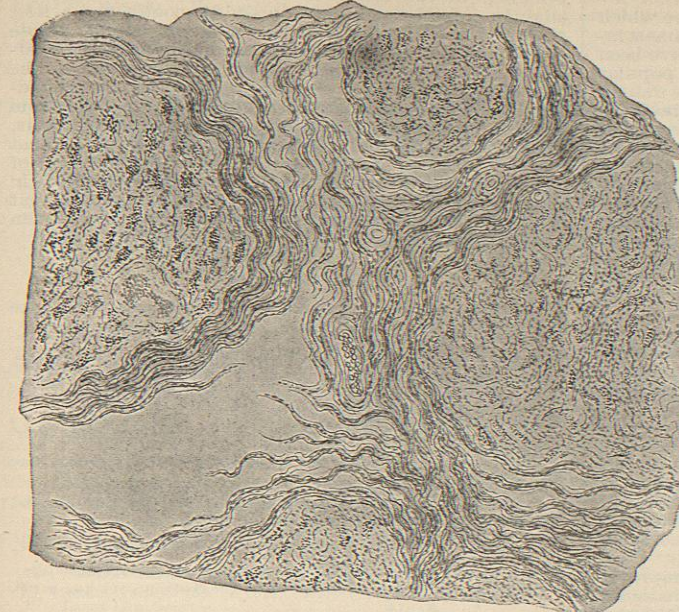


FIG. 3191.—Section of Nerve showing Lepra Bacilli. (After Jeanselme.)

ably never be suspected, unless it occurred in leprosy districts, or there was a history of exposure to one affected with the disease. It is chiefly to be differentiated from other members of the group of infectious granulomata, especially from syphilis and tuberculosis. In any doubtful case, the demonstration of the bacillus settles the diagnosis. Many of the individual lesions of the above disorders, if taken alone, could hardly be identified as belonging to the one or the other; but if the general picture, as well as the individual lesions, be taken into consideration, the difference between the diseases becomes apparent. Both the early and the late manifestations of syphilis might be mistaken for leprosy, but the early macular syphiloderm following a demonstrable initial sclerosis, accompanied by alopecia in the scalp and throat symptoms, should be readily recognized. The eruption is of shorter duration; the maculæ are smaller, less highly colored, and chiefly located on the trunk. The maculæ of tubercular leprosy are found on the face. There is no alopecia of the scalp, but the hair of the eyebrows falls. Further, the maculæ are larger, they may be diffuse and infiltrated, and are more persistent. The tubercular syphiloderm has a tendency to remain localized in certain regions, and breaks down and ulcerates in a much shorter period. The tubercles of leprosy are larger, brownish-yellow in color, and present a shiny appearance, as if oiled or varnished. This latter characteristic is never found in syphilis. The syphilitic ulcer progresses more rapidly, and possesses a serpiginous tendency not found in the leprosy ulcer. The bullæ of leprosy are not found in acquired syphilis.

Leprosy is to be distinguished from lupus vulgaris by the fact that the nodules in the latter disease occur in more circumscribed areas, and the individual lesions are smaller and unaccompanied by anæsthesia. The anæsthesia, hyperæsthesia, and constitutional disturbances of leprosy are not found in vitiligo and morphea. Leprosy is differentiated from pemphigus vulgaris by the presence, in the former, of anæsthesia in the spots, by the limited

number of the bullæ, and by the characteristic cicatrices. The presence of anæsthesia and hyperplasia distinguishes lepra from erythema multiforme.

In its later stages, anæsthetic leprosy may be confounded with syringomyelia. Hansen and Looft, in differentiating between these two, lay great stress on the fact that in leprosy a skin eruption is always present; or if not present at the same time, at least some evidence of its former existence will still be present.

PROGNOSIS.—The future of the unfortunate victim of leprosy is as dark to-day (so far as hope of complete eradication of his disease is concerned) as it has been during the many ages of its existence. Except in rare instances, the malady eventually ends fatally. Under favorable conditions, however, the disease, especially in the milder form, may cause the patient very little suffering for many years; and, were it not for the knowledge which he possesses, he might live in comparative comfort. Complete change of climate often arrests the progress of the disease for some time; but after a longer or shorter period it again becomes active. The tubercular form is much more rapidly fatal. In every country where leprosy is endemic, a few cases of apparent recovery are reported by competent authorities. These patients have complete cessation of symptoms and remain well until death ensues from other causes. Recovery may occur at any stage. Usually, however, it is in the advanced stages, after much mutilation has taken place. After a cure has occurred, Hansen and Looft<sup>13</sup> say: "We have occasionally a complete subject, with vigor and good health; but usually only a miserable rudiment of a human being, with more or less paralyzed hands and feet; with unclosable eyes, of which

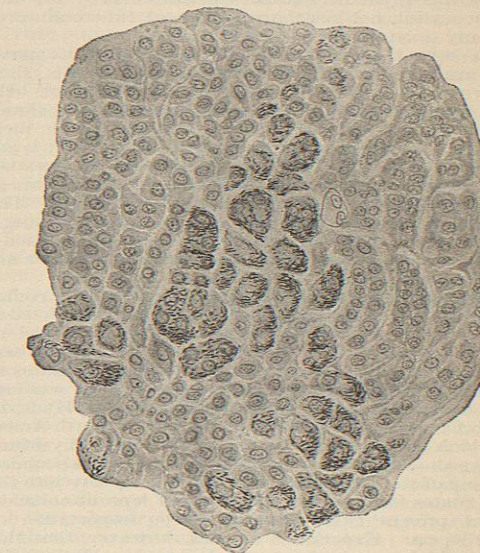


FIG. 3192.—Section of Leprous Spleen showing Lepra Bacilli. (After Jeanselme.)

the lower part of the cornea is opaque, and from which the tears roll down upon the cheeks; with paralyzed facial muscles, unable to close the mouth, so that the sa-

liva constantly dribbles from it. Such patients, however, may live long and reach great age, if under such circumstances this can be looked upon as an advantage. They die usually of some intercurrent disease."

TREATMENT.—During the long period of time which has elapsed since leprosy began making history, almost innumerable products and methods of treatment have been used for its relief or cure. Perhaps the most popular and largely used drug is chaulmoogra oil. This was introduced by Le Page, of Calcutta, and is used both externally and internally. Its dose is from five to seventy-five drops, three times a day, in capsules, emulsion, or milk. When the stomach will not tolerate the drug (which unfortunately often happens), Vidal recommends its active principle, gynocardic acid, in the form of gynocardate of sodium or magnesium, in capsules containing from 0.2-0.32 (gr. iij.-v.), from ten to twenty capsules being taken daily. Externally, it may be combined with olive oil, in the proportion of one part to from five to fifteen. When administered hypodermatically, it has proved irritating. Under its prolonged application, it is affirmed that ulcers heal, and the general nutrition improves, the patients gaining in weight, the anesthesia and hyperæsthesia being corrected; the tubercles undergoing involution, and general marked improvement taking place.

In South America and China, Hoang-nan is largely used with success. It is given in pill form, in doses of three grains three times daily. Arsenious acid, creosote, carbolic acid, chlorate of potassium, formalin, thyroïd extract, salol, mercury, and sodium salicylate have all been largely used. Crocker has obtained good results by the intramuscular injection of perchloride of mercury, one-quarter of a grain twice weekly.

Dyer,<sup>13</sup> of New Orleans, obtained marked improvement in four out of five cases by using hypodermatic injections of Calmette's antevenerne. From one to eleven cubic centimetres were first injected every other day; later, the injections were repeated daily, the sites being the gluteal and intrascapular regions. When the remedy was injected into nodules these disappeared. One of the patients was apparently cured. Serum-therapy has not been successful, nor has the injection of tuberculin produced any good effects.

Unna says that both the cutaneous and the nerve lesions are benefited by the use of reducing agents, such as chrysarobin, pyrogallol, resorcin, and ichthyol. He affirms that the action of these remedies is both local and constitutional, chiefly the former, and that under their influence marked improvement occurs. Electricity is advised for the relief of pain, anesthesia, and hyperæsthesia. Surgical measures are indicated in the treatment of tubercles, ulcers, bone necrosis, and gangrene. The condition of leprosy does not contraindicate any surgical operations which become necessary. Amputations, nerve-stretching, tracheotomy, and other operations are often demanded.

PROPHYLAXIS.—As leprosy is unquestionably contagious, the subject of the protection of the uninfected is important. In America attention was first directed to this by Dr. James C. White, of Boston. A number of years later he again called attention to and urged measures to check the evil. The importance of this subject was emphasized again, in 1894, by Dr. James Nevins Hyde, in his report "On the Distribution of Leprosy in North America," which was presented to the Congress of Physicians and Surgeons. Still more recently, Morrow<sup>14</sup> has sounded a warning of the possible introduction of leprosy into the United States from her newly acquired leprosy colonies. Laws at present exist prohibiting the importation of known lepers. Experience teaches, however, that this disease, which may be for years slow and insidious in its development, readily evades ordinary inspection. That great care should be taken to guard against the admission of it is shown by the fact that practically all the cases in the United States, except those in Louisiana, have been imported. Many plans for isolating these patients have been suggested and tried in various places, even to com-

pulsory detention. The latter has been very successful in Bombay and other places. The adoption of such measures in this country is at present out of the question. Numbers of the milder anæsthetic patients, being but slightly infectious, cannot justly be confined for life; while others suffering from the tuberos variety, whose ulcers and mucous discharges are highly infective, certainly should be isolated. Important measures in the care of leprosy patients concern their hygienic surroundings. A wholesome diet, warm clothing, protection from sudden changes of temperature, open-air exercise, baths, daily inunctions, and massage are all advised. That hygiene plays an important rôle in the management of leprosy is well illustrated by the immediate cessation in the spread of the disease, and by the great improvement in the individual cases themselves, among the Norwegian lepers in Minnesota. *Oliver S. Ormsby.*

BIBLIOGRAPHY.

<sup>1</sup> Danielsen and Boeck: Om Spedalskhed, Christiania, 1847—Traité de la Spedalskhed, Paris, 1848.  
<sup>2</sup> Hansen and Looft: Leprosy in its Clinical and Pathological Aspects. English translation by Walker, London, 1895.  
<sup>3</sup> Unna: The Histopathology of the Diseases of the Skin. Walker's English Translation, 1896.  
<sup>4</sup> G. Thin: Leprosy, London, 1891.  
<sup>5</sup> Hills: Leprosy in British Guiana, 1881.  
<sup>6</sup> Leloir: Quoted by Thin.  
<sup>7</sup> G. A. Hansen: A Rare Case of Leprosy. Lepra; Bibliotheca Internationalis, vol. 1, 1900.  
<sup>8</sup> Morrow: A System of Genito-Urinary Diseases: Syphilology and Dermatology, p. 56.  
<sup>9</sup> E. Besnier: Journ. des Mal. Cut. et Syph., No. 10, October, 1897.  
<sup>10</sup> Bracken: Leprosy in Minnesota, September 29th, 1898—Lepra; Bibliotheca Internationalis, vol. 1, 1900.  
<sup>11</sup> Oscar Voit: Lepra, 1900, vol. 1, Fasc. 1, 2, 3, 4.  
<sup>12</sup> J. Darier: Annales de Dermatologie et de Syphiligraphie, vol. viii., No. 12, December, 1897, p. 1229.  
<sup>13</sup> Dyer: New Orleans Medical and Surgical Journal, October, 1897.  
<sup>14</sup> Morrow: Twentieth Century Practice of Medicine, vol. xx., p. 463.

LEPTANDRA.—*Culver's Root, Culver's Physic.* The rhizome and roots of *Leptandra virginica* (L.) Nutt. (fam. *Scrophulariaceæ*). (The name *Leptandra* will doubtless replace that of "Veronica" of the present U. S. P. definition.) *Leptandra* grows very abundantly in rich open woodlands and copses through the Eastern and Central United States. It is a perennial herb, with simple, perfectly straight, erect, slender stems, from two to six feet high, whorled lanceolate leaves, and terminal panicles of long, slender, acute, white or pinkish, densely flowered spikes. The drug is gray-brown or gray-black, from four to six inches long, much branched and crooked, the rhizomes slightly flattened, about one-fourth inch thick. The internodes are characteristically narrowed downward and readily disarticulate. The roots are rather few, coarse, and unbranched. The drug has little odor, but a bitter, resinous, and slightly acrid taste.

The demand for *Leptandra* is chiefly American. It has, however, been recognized in the Pharmacopœia since its first edition and has of late increased greatly in favor, both here and abroad.

Its important constituent is six per cent. of an irritant resin, of the same general character as those of mandrake and jalap. It contains a little saponin, tannin and gum, and the peculiar bitter crystalline glucoside *leptandrin*, which is soluble in both water and alcohol, and which must not be mistaken for the commercial article so-called.

Our knowledge of the action of *leptandra* is purely clinical. It is a stimulating laxative or an irritant cathartic, according to its condition and dose. In the recent state it is drastic and even emetic, and poisonous, becoming milder with drying and keeping. It stimulates the intestinal mucous secretion and the defecation of bile, and also the intestinal movements, and is an excellent laxative in doses of 1 gm., and a purgative in doses of 2 to 4 gm. The long list of therapeutic properties attributed to it by the eclectics are not to be denied, but are the result of improved elimination and nutrition. The official preparations are the fluid extract, dose 1 to 4 c.c. (fl. ʒ ʒ-ʒ) and the extract, dose 0.06 to 0.2 gm. (gr. i.-ii.).

Each official vegetable cathartic pill contains 0.0015 gm. of this extract. Commercial "leptandrin" is the practical equivalent of this extract. *Henry H. Rausby.*

LESLIE WELL.—Ingham County, Michigan.  
Post-Office.—Leslie.

ACCESS.—From Jackson, via the Jackson, Lansing and Saginaw Railroad to Leslie, fifteen miles north. This is a very good calcic water, with sufficient iron to give it tonic properties. Analysis by Prof. R. C. Kedzie:

ONE UNITED STATES GALLON CONTAINS:	
Solids.	Grains.
Sodium bicarbonate	5.27
Potassium bicarbonate	4.55
Calcium bicarbonate	30.62
Magnesium bicarbonate	10.53
Iron bicarbonate	2.27
Calcium sulphate	7.04
Alumina	2.08
Silica	.65
Total	63.01
Carbonic acid gas,	13.05 cubic inches.

This water is very useful in anæmia and debilitated states of the system, especially in those affected with gastric and intestinal disorders. *James K. Crook.*

LEUCOCYTOSIS.—By leucocytosis is meant an increase of the number of leucocytes in the circulatory blood above that which is normal for the individual. This increase must affect chiefly the polynuclear leucocytes—or each variety in such a way that the relative proportions of the different leucocytes remain the same as in health.

NORMAL PERCENTAGE OF EACH VARIETY IN THE ADULT.	
(a) Small lymphocytes	20 to 50 per cent.
(b) Large lymphocytes	4 to 8 "
(c) Poly(morpho)nuclear neutrophiles	62 to 70 "
(d) Eosinophiles	4 to 4 "
(e) Mast cells	4 to 4 "

Myelocytes represent a pathological variety of leucocytes—hence an increase of leucocytes involving especially the myelocytes is not considered a leucocytosis, but represents a special blood disease which is considered under the heading *Leukæmia*.

Again, an increase of leucocytes involving especially the lymphocytes is not a leucocytosis—but is either a lymphocytosis or a lymphatic leukæmia.

Some authorities prefer the terms hyperleucocytosis and hypoleucocytosis to indicate an increase and decrease in the number of leucocytes, using the word leucocytosis to mean the normal number of leucocytes.

The normal number of leucocytes varies within quite a wide range in healthy adults (5,000 to 10,500). People in a poor condition of nutrition but with no special disease have a low leucocyte count, with a reduced percentage of polynuclear cells, while those in vigorous health have a high leucocyte count, even approaching a slight leucocytosis, with an increased percentage of polynuclear cells.

The estimation of the number of leucocytes is of great value in the diagnosis and prognosis of disease, and aids materially in operative decisions, when considered in connection with other diagnostic and prognostic data. Considered by itself, it is useless.

It is highly important to keep in mind the fact that a leucocytosis may be physiological.

VARIETIES OF PHYSIOLOGICAL LEUCOCYTOSIS.—(a) New-born, (b) digestion, (c) pregnancy, (d) post-partum, (e) after violent exercise, massage and cold baths, (f) moribund state.

In the *new-born* there is a leucocytosis, varying from 17,000 to 21,000, greatly increased by digestion. This gradually decreases as the child grows older, until about the sixth year, when it approaches the normal adult standard. It must be kept in mind that the leucocyte count of a child is greatly influenced by the backwardness or forwardness of its development.

Attention to *digestion leucocytosis* is often overlooked in the estimation of leucocytes and in the deductions drawn therefrom. After a meal rich in proteids the leucocyte count may increase in health about 33 per cent. A vigorous person whose fasting leucocyte count is 9,000 may have a count of 12,000 three to four hours after a meal. The best time for making a fasting leucocyte count is before breakfast, since during the day there is more or less digestion leucocytosis most of the time. In certain diseases other than those of the digestive tract, there may be quite a marked digestion leucocytosis. Cabot gives the following examples:

In a case of pneumonia the count before food was 10,400, after food 21,700; in neurasthenia, before food 7,500, after food 13,500.

Any disease of the gastro-intestinal tract, whether functional or organic, may prevent the appearance of the digestive leucocytosis. In chronic gastritis there may be an absence of digestion leucocytosis, or it may be slight and late in appearing. In dilatation of the stomach it may be absent. In the majority of cases of cancer of the stomach it does not occur.

Pregnancy.—Most primiparæ show a moderate degree of leucocytosis during the later months of pregnancy, averaging about 13,000. It is not so common in multiparæ. The fact that in this condition there is no digestion leucocytosis suggests that the whole process may be a digestive leucocytosis.

The fact that there is normally a moderate leucocytosis during the post-partum period is of value, because it might be taken as an evidence of sepsis.

Violent exercise, massage, and cold bathing, such as the typhoid bath, cause a moderate, temporary leucocytosis, comparable to the digestion leucocytosis.

Moribund, or terminal, leucocytosis, occurs during the terminal stages of different diseases, and in most cases is due to peripheral stasis. In some cases it is thought that the terminal infections may be responsible. The increase in white cells is moderate and is usually in the polymorphonuclear cells; the count seldom exceeds 20,000 or 30,000. Occasionally, as in the case of pernicious anemia reported by Cabot, the increase in the lymphocytes is so marked as to resemble lymphatic leukæmia.

PATHOLOGICAL LEUCOCYTOSIS.—Cabot makes the following classification: (1) Post-hemorrhagic; (2) inflammatory; (3) toxic; (4) malignant disease; (5) therapeutic and experimental.

Theory Explaining Pathological Leucocytosis.—Present evidence tends to show that this process is a general one, involving the entire circulatory system,—that a drop of blood from the finger or the ear may be taken as an index of the blood condition in the deeper vessels of the body.

Leucocytosis is symptomatic of an excessive output and rapid development of leucocytes by the bone marrow due to the influence of *chemotaxis*.

The chemotactic theory may be stated as follows: The presence in the blood of certain chemical substances, produced by infective agents, is capable of exerting both an attractive and a repellent influence upon the amoeboid leucocytes. If cells are attracted by such substances, the phenomenon is known as a positive chemotaxis; if they are repelled, it is called negative chemotaxis. This effect upon the cells of the blood may be produced by bacteria or their products,—necrotic tissue which has gained entrance to the circulation, and thermal and mechanical irritants. It would seem that different varieties of leucocytes—polynuclear neutrophiles, eosinophiles, lymphocytes—respond to different stimuli; in one instance we have an ordinary leucocytosis—as in pneumonia, in which the polymorphonuclear cells are chiefly increased; in another, as in trichiniasis, an eosinophilia; in a third, a lymphocytosis.

It seems reasonable to conclude that leucocytosis is a conservative process on the part of nature, and represents an attempt to destroy the infectious agent or its product by mechanical means, *i.e.*, phagocytosis; or by chemical means—the production of chemical substances (alexins) which act as bactericidal or antitoxic agents. Grabit-