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ON THE

PHYSIOLOGY

OF

Syphilitic Infection.

BY

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SYPHILITIC INFECTION.*

SYPHILIS, as construed by the authorities of the present day, is a zymotic disease of the human organism, caused by the inoculation upon it of a virus hidden in certain specific venereal secretions, which, after a period of incubation, varying, in recorded cases, from thirty-six hours to seventy-two days, results in the appearance of the disease, at the point of inoculation, as an induration, or an indurated ulceration. This, which is known as the *Infecting or Syphilitic Chancre*, and termed the *Primary* stage of the disease, is accompanied or immediately followed by an enlargement and specific induration of the adjacent lymphatic glands : then the occurrence of a *Second* incubation, or period of rest, of several weeks' continuance, during which time no evidence of the disease is manifest except that already referred to.

The termination of the second period of incubation, in typical cases, and the commencement of the secondary stage or period, is announced by the enlargement and induration of lymphatic glands remote from the point of inoculation, and the occurrence of a specific fever, termed the syphilitic, ushering in a general roseolous eruption, which soon fades, leaving persistent copper-colored stains, which are considered diagnostic of syphilitic disease. Associated with the secondary period,

*Read before the New York County Medical Society, June 7th, 1871.

and following the above-named developments, are inflammations of the fauces, with ulcerations of the tonsils ; general and localized papular eruptions ; deposits of fibrin in the testes and in the tongue ; periosteal inflammations and osseous hypertrophy ; inoculability of the secretions of all the foregoing, and of the blood, which presents throughout this period a marked proportionate increase of the white corpuscular element. To the secondary or period of general eruption succeeds the *Tertiary* or *Gummy Period*, characterized by the development of unsymmetrical papular and tubercular eruptions and of local ulcerations—the latter often involving the osseous structures—of tumors throughout the connective tissues, of a peculiar gummy consistence, and termed by some authors *Syphiloma* (under the impression that they are made up of materials *sui generis*, produced by the syphilitic influence) ; the secretion and also the blood in this stage, non-inoculable ; and, finally, the *Fourth* stage, involving lesions of the viscera, with a general vitiation and degradation of the entire economy, under the title of *Syphilitic Cachexia*. This fearful category of ills is comprised in the brief term *Syphilis*.

The mysteries of its origin—of its nature—of the ways and means through and by which it produces its recognized effects upon the human economy, have been among the vexed questions of medical science, from the earliest mention of this disease, in any record, up to the present time.

The date of its original appearance has been a source of much controversy ; the weight of authority, until quite recently, claiming its advent in the latter part of the fifteenth century—while others have attempted to place it at a much more remote period. These last, however, recently exhuming alleged authentic Indian, Persian and Chinese records, describing the disease as existing several thousand years before the Christian era, have apparently settled the question in favor of the extreme antiquity of Syphilis.

Of its *nature*, opinions and theories have been almost as numerous as the writers on this subject since its affirmed European advent in 1492. At that period, Peter Pinctor, Grunbeck and others, taught that it was the result of astro-

nomical influences. NICHOLAS MASSA, about fifty years afterward, claimed that it had its source in a metastasis of bilious matter from the liver to the genital organs. PARACELSUS (in the same period) that a *venereal miasm* constituted the essential element of the disease. In pursuance of this view, Cardinal WOLSEY, in 1529, was publicly accused of having communicated syphilis to King HENRY the Eighth, by whispering in his ear. A little later, FERNEL discovered that this disease resulted only from contact. "The air and the breath cannot communicate it—contact with some of the matter which contains the poison, and serves as its vehicle, is necessary," wrote FERNEL, in 1548, and was thus first to enunciate the doctrine of a *virus*, which view, upheld by ASTRUC (physician to LOUIS XV.) in 1736, fifty years later was confirmed by the experiments of JOHN HUNTER upon his own person.

Toward the end of the last century, it was claimed by BRU, a syphilographer of some distinction, that the virus was not present before contact, but that it was developed, like a spark of electricity, during coition.

BRU was followed (1815) by BROUSSAIS, who wholly denied the presence of a *virus*, and claimed that the disease was only due to irritation of the genital organs, following excessive and impure coition.

In 1830, RICORD commenced a series of experimental inoculations with the secretions of venereal lesions, which resulted in promptly restoring the doctrine of virus, which has remained in almost undisputed possession of the field up to the present day.

The acceptance of the *virus* as a specific entity, lifted syphilis out of the list of miasmatic diseases, and connected it definitely and permanently with the results of venereal contact ; but the mystery of its origin was still unexplained, and although various and ingenious theories were advanced from time to time, chiefly associating it with bestial sexual commerce, the elucidation of the virulent principle was unaccomplished. It was only ascertained to reside in secretions which

differed in no appreciable way from similar products resulting from ordinary pathological changes, except that they originated in individuals suffering from syphilitic disease.

Likened by FERNEL to the poisons of hydrophobia and the plague, a mysterious power to enter and vitiate the blood was accorded to it, through which processes were established the various and distressing manifestations characteristic of the different stages of the disease.

ASTRUC, in 1745, wrote, "It is a *leaven*, which, if by any means it be conveyed into the blood, it does, for the most part, increase, multiply and gather strength, like the plague or leprosy; and frequently, when occasion favors, acts so as to produce fatal effects."

HUNTER, in 1786, after confirming by inoculations the existence of a specific virus, appears to have been the first to attempt an explanation of the physiological processes by which syphilitic infection takes place. Believing that the lymphatic vessels were the only absorbents, he asserted that the venereal matter was taken up by the absorbents (*i. e.* the lymphatics) of the part in which it was placed, and carried along these vessels to the common circulation: that it did not, however, communicate a contagious property to the blood, nor to the secondary lesions, but, as soon as it was introduced into the system at large, it gave rise to a disposition, in various parts of the body, to be attacked by certain affections. When this *disposition* was turned into *action*, secondary and tertiary symptoms were produced. He does not attempt to explain in what the susceptibility or *disposition* is supposed to consist.

BENJAMIN BELL, in 1793, taught that the virus of syphilis acted first on the blood alone, and then, by accumulation, came to irritate the solids, and in this manner to produce ulceration.

RICORD, in 1836, maintained that the secretion containing the virus set up a local action, which, for four or five days, was confined to the vicinity of the inoculated point; it was then absorbed into the system—by what manner he does not attempt to explain—and then produced its recognized constitutional effects. Since then, he has advanced no peculiar views in regard to the manner of syphilitic infection.

ERASMUS WILSON* wrote in 1852, that when the poison of syphilis is once admitted into the system, it has a tendency to accumulate until it attains a certain point, which he terms the point of saturation. "As soon as this saturation is reached, an outburst of fever, which results in the elimination of the excess of the collected poison, takes place, and the system returns to its wonted tranquillity. This process is repeated at intervals, until, after a while, the intervals lengthen, and the effects gradually diminish, and the poison is at last so thoroughly eliminated, that it ceases to accumulate in excessive quantities, and loses its power of exciting a febrile action in the blood of an infected person; but it still retains its power of infecting new blood, and it is difficult to ascertain how long this virulence continues."

VIDAL† (de Cassis), contemporary of WILSON, remarks that the syphilitic virus in substance cannot be detected—it is only manifest by its effects. "Brought into certain relations with the living tissues, and in certain conditions, the virus develops a morbid action, the result of which is its multiplication. There is a kind of germination; for the cause produces an effect, which becomes again itself the cause. It unites with the blood, and then undergoes certain modifications by which it becomes intimately blended with it. Once absorbed, the syphilitic virus may rest dormant, and remain a cause without effect; this is the period of incubation. Two conditions are necessary to the setting up of syphilis, viz., a virulent matter, and an organism with a certain susceptibility to the action of the virus."

ACTON,‡ in 1860, writes: "We must, however, frankly admit that in the present state of science, it is impossible to determine where, or under what circumstances the virus or its effects first appeared."

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"My own opinion is, that syphilis in the human race originally arose from some poison introduced into the economy

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* Erasmus Wilson on Syphilis, Am. Ed., 1852, page 48.

† Vidal on Venereal, Am. Ed., 1854, page 25.

‡ Acton on the Urinary and Generative Organs, London, 1860, pages 279 and 347.

from animals or decomposing animal matter, and that thus produced it has been transmitted from one individual to another." Of syphilitic infection he says: "Clinical observation only teaches the fact, the *modus operandi* remains undiscovered. We have no means of detecting the poison in the solids or in the liquids of the syphilitic sore. The blood taken from veins in the neighborhood contains no new or altered element that can be detected by chemical investigation; the only apparent difference is a greater proportion of albumen, and a diminution in the number of the red globules. Still, the system is contaminated; and our form of expression is, that a poison has been conveyed into the constitution, and that the first result is the local induration; but the real explanation of the matter we do not know."

Cullerier (the younger), 1866, speaks of syphilis as "quite unknown in its essential nature—appreciable by no physical characteristic, except its effects alone—the syphilitic virus is less a substance having a special existence than a property accidentally acquired by bodies not ordinarily virulent. The secretions of the infecting sore, subjected to the most rigorous chemical examination, are found not different from the most ordinary sore. The blood of syphilitic patients, under the field of the most skilfully handled microscope, reveals not the slightest distinguishing characteristic."

"The syphilitic virus does not act upon the system like those poisons the gravity of whose symptoms is in proportion to the dose of the deleterious principle: an infinitesimal quantity is sufficient to produce the syphilitic poisoning. Acting by a sort of germination; developing by two distinct impulses —that of the interior forces which compose it, that of the exterior forces which surround it—syphilis is a force unique in itself, and its degrees are only the result of the medium in which it is implanted. We have at the outset a period of incubation, which is in itself a proof of virulence. It is generally agreed that in every virulent affection the system is infected as soon as the virus has penetrated into the organism, and as soon even as contact has taken place."

VIRCHOW* compares the early manifestation of syphilis to that of malignant tumors—at first local in character, the nucleus of which, extending in depth and on the surface, implicating the lymphatic glands of connection ; and suggests that, as in cancer, the glands serve as depots for the virulent material, thus protecting for a time the rest of the system from its influence ; finally, after complete impregnation, acting from time to time, under favoring conditions, as new foci of infection for the general economy. The associated chlorosis he considers the result of glandular irritation, which is known to accelerate the development of the white blood corpuscles.

BILLROTH† says, that "the person inoculated with the syphilitic virus is syphilitic from the moment the virus takes effect—the entire organism is infected at once. A series of chronic inflammations occur in the most varied organs, which have at first a mere productive character, but soon lead to disintegration of the infiltrated tissue, and assume an ulcerative, destructive character."

BÄRENSPRUNG, that "the wound inoculated with the virus of syphilis heals as one not poisoned, but the virus is absorbed at once by the blood, and acts as a ferment."

SIGMUND thinks that "the syphilitic processes point in their origin directly to the blood, as the disease of the organism lies within the sphere of this plastic material ; that the diseased cell, implanted in the primary spot of inoculation, multiplies and grows partly into neighboring texture (skin and connective tissue), and partly into the lymph and blood vessels. In these channels once absorbed, it increases, and is deposited, together with the normal cells, in the various organs of the body. As a neoplasm at the spot of its first existence, it spreads by growth and division of the cells ; and, by the migratory character of the latter, into the vessels ; reaches the blood, circulates with it, and is deposited."

LANCEREAUX‡ says that "among the theories in regard to

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* Cellular Pathology, Am. Ed., page 221, et seq.

† Billroth's Surgical Pathology, Am. Ed., 1871, page 386.

‡ Lancereaux's Treatise on Syphilis, Sydenham Ed., London, 1869, vol. ii., page 211, et seq.

the nature of the syphilitic virus, it would be useless to pronounce a decided opinion until numerous and exact analyses shall have determined clearly the physical and destructive character of this agent. These researches have still to be made, but the method by which they should be undertaken is indicated in recent experiments (of BEALE and others) which have shown that the virulent principle of vaccine lymph resides in solid granulations, or rather in living organisms disseminated in the clear and transparent liquid which serves for inoculation. To produce syphilis there is evidently needed a predisposed organism. As regards the manner of absorption of the virus, *it is a question that ill bears discussion.* The *agents* of absorption of the syphilitic virus are those of other substances, viz., the *venous capillaries*, and, more especially perhaps, the *lymphatic* vessels" . . . "Is there not great reason to believe" (says LANCEREAUX) "that, like the vaccine and small-pox poisons, that of syphilis becomes disseminated in various parts of the body, not germinating in one place, and that the whole economy undergoes at once the impression which it is capable of receiving from it?" . . . "There can be no doubt but that the poison of syphilis at a given moment exists in the blood." . . . "If it be true that the poison becomes disseminated by attaching itself to one or other of the principles of the blood, with which does it combine?" . . . "It appears that it is to the globules rather than to the serum, for experimental inoculations with syphilitic blood were only successful when the globules were present. Thus it appears to attach itself to the globules, and, carried by these elements, goes to modify the tissues;" and, further, "we cannot admit a direct action of the syphilitic poison upon the blood. The poison is, in our opinion, like that of certain irritant poisons—like alcohol, which acts rather on the solid than on the liquid parts. In fact, like alcohol, the syphilitic poison contained in the blood acts upon the network of the organs, in which it occasions, at the same time with hyperæmia, the development of elements of new formation. Such is the period of the disease in which all the lesions which furnish a product of secretion are contagious and

inoculable. Things run this course during a certain time, that is, the period of chancre and secondary affections. After remaining a shorter or a longer time in the economy, the virulent agent is eliminated ; it is no longer in the blood, or in any of the products of physiological or pathological secretion, since the blood and those products have ceased to be inoculable, as is proved by experiments made on this subject. The disease, however, has not completed all its phases, and the organism continues to suffer. The evolution of the malady goes on, and fresh manifestations supervene, just as we see in a drinker who has long abstained from strong liquors, symptoms appear which it is impossible to ascribe to anything but alcoholism. In this state, which is really the chronic period of the disease, it becomes evident that the organism has undergone a modification, and retained a peculiar aptitude for producing at various points of the body derangements, which, anatomically, are characterized by a special hypergenesis of the connective tissues."

"To the simple *impression* made by the poison has succeeded impregnation, and there results from it a modification of the whole organism, which is so profound as to disappear with difficulty. The *individual affected* has acquired the *syphilitic constitution. He is no longer a normal being*, but an individual deviating from the type, *having undergone a kind of degeneration.*"

Henry Lee* says "constitutional syphilis depends upon an animal poison. The absorption of the poison of syphilis probably ensues immediately after its application. One attack gives immunity from another, quite as much as one attack of small-pox or scarlatina is protection against a second. The evolutions of the manifestations conform to the type of the contagious exanthemata, in being characterized by a period of incubation after exposure to contagion—a multiplication of the poison—a general outbreak or manifestation, frequently preceded by febrile commotion, and a more or less definite course. In both kinds of disease the symptoms are capable of

* Practical Pathology, Henry Lee, London Ed., 1870, vol. ii., page 32.

being grouped into varieties according to their degree of intensity—the severity of the manifestations is liable to be influenced by individual peculiarities—and the disease itself often induces such modification of nutrition, ill health, and cachexia as to induce various morbid changes and actions which are the offspring of a lowered health, a depressed power, and the action of a virus. It is much more in accordance with what is known to happen in the case of other poisons to suppose that, when the constitution becomes affected with syphilis, the disease is communicated directly to the blood circulating through the parts where the poison first gained access, and where morbid actions are afterwards manifested, than to refer the symptoms to the passage of the poison primarily through the absorbent system. Neither observation nor experiment, then, affords any proof that the syphilitic virus is conveyed, as such, through the absorbent glands. . . . Induration in the chancre and glands is an evidence that constitutional infection has already taken place. The syphilitic virus has, no doubt, exerted *some* influence on the tissues, otherwise the initial reaction would not ensue at the point where it first gained access to the system, but all observation goes to show that the induration in the chancre and glands is but the first link in the chain of constitutional manifestations."

Dr. J. H. SALISBURY (of Cleveland, Ohio) claims to have discovered the specific cause of syphilis in an algoid vegetation, which he terms the *crypta syphilitica*, a minute vegetable spore, which, received upon an abraded surface, enters the organism, and, germinating, permeates the tissues and the blood, until the entire system is contaminated. The spore of this microscopic fungus is delineated by Dr. SALISBURY with great definiteness, from the embryonic to the fully developed spore He also cites his own examination of the blood of several hundred syphilitics in which the *crypta syphilitica* was present.

Dr. LIONEL S. BEALE, of London, whose name is associated with most scientific and laborious investigations in regard to

the origin and nature of contagious diseases, announced, in 1863, his discovery of living animal disease germs in fresh vaccine lymph, with the declaration that its active properties, he believed, were entirely and solely due to these germs. They were described as consisting of extremely minute particles of bioplasm or germinal matter, readily seen under a microscopic power of from one to two thousand diameters; "and," says Beale, "I think they consist of a peculiar kind of living germinal matter, the smallest particle of which, when supplied with its proper pabulum, will grow and multiply, giving rise to millions of little particles like itself, each having similar properties and powers." *

M. CHAUVEAU, in 1868, verified Dr. Beale's discovery, and showed that the active particles in the vaccine lymph subsided after forty-eight hours, and that no effects were produced by inoculating the albuminous supernatant fluid, while the full effects were produced by vaccinating with the deposit. Like disease germs were shown to exist in the variolous virus, and; in 1866, BEALE announced their presence in the fluids of animals affected with the cattle plague, and *claimed a similar source of origin for syphilitic disease.*†

In reviewing this *résumé*, in which I have endeavored fairly to present the views and theories of leading syphilographers in regard to the origin and nature of syphilis, and the mode by which the human system is infected by it, a fair consideration for all, forces us to the conclusion :

1st. That in regard to *its origin*, the accumulated learning of centuries affords but the most unsatisfactory speculations.

2d. That nothing is yet positively known of its nature. Accepted as a virus, with a power to contaminate the blood, it is known only by its effects.

3d. That nothing is yet positively known of the mode by which the human system is infected by it.

Now, if it be required of a *theory* that it shall present a rational explanation of the subject to which it is applied,

* Disease Germs—their Real Nature, Lionel S. Beale, London, 1870, page 61.
† Ibid.

that through its application, mysterious or conflicting points may be harmonized or explained; that it shall lead to, and aid in, a systematic investigation and understanding of the subject in question—then it may be justly claimed that *no view* of syphilitic infection has yet been advanced which completely fulfils these necessary requirements. We find, in most cases, glittering generalities in place of logical statements and deductions, and the easy acceptance of mysteries, rather than an attempt toward their elucidation.

No information is afforded, by any of the numerous authorities, in regard to the pathology of the initial lesion, except that which is common to simple inflammatory processes. No connection is elucidated between the initial lesion and the subsequent manifestations of the disease. Each one stands separate and distinct from every other. The simple clinical fact, that the initial lesion appears first and has certain physical characteristics, is noted, and that enlargement and induration of the adjacent lymphatic glands soon follow—that after a variable interval, a cutaneous rash occurs, possibly ulceration of the tonsils—then, possibly, after another indefinite interval, a papular eruption—then, possibly, disease of the osseous structures, deposits of organized lymph in the testes and in the tongue—ulcerations, superficial and deep—gummy deposits in the tissues, viscera, etc., but nothing beyond a physical description of these different forms of disease—they are briefly summed up as *Syphilitic Manifestations*, each mysteriously related to the others by operations and processes of which an explanation is not even attempted.

As a rule, authors have not given us *theories*, but *their impressions* and *their opinions* in regard to the *modus operandi* of syphilitic infection, and the deductions from all may be formulated in the expression of LANCEREAUX, viz.: That "the agents of the absorption of the syphilitic poison are those of other substances, viz.—the venous capillaries, and more especially, perhaps, the lymphatic vessels." Accepting the virus of syphilis as a mysterious element, we are here certainly furnished with the channels through which it may be introduced into the human blood.

But can we afford thus summarily to dismiss a subject of so great practical moment? If the veins and lymphatics are both concerned in the absorptive process, we must of necessity conclude that through the *venous* capillaries the virus is carried at once into the general circulation, like the poisons of vaccine, small-pox, etc If, however, it can be shown that it is through the *lymphatics* alone that infection takes place, a possible interval between the occurrence of the inoculation and the constitutional infection may occur. Practically, this distinction has long been claimed as a result of clinical observation; but, resting upon no substantial basis, great differences of opinion prevail among modern authorities in regard to the matter. Thus, CAZENAVE, BEAUMÈS, VIDAL, BÄRENSPRUNG, DIDAY, BILLROTH, HENRY LEE, BUMSTEAD, MARTIUS, BASSEREAU, BAZIN, GIBERT, and many others, believe that the virus enters the circulation and infects the system at large at the moment of inoculation; while, on the contrary, RICORD, MICHAELIS, MELCHIOR-ROBERT, WALLACE, PUCHE, LINDWURM, SIGMUND, LANGSTON PARKER, BELHOMME, LANGLEBERT, LANCEREAUX, and many others, claim that the virus does *not* enter the blood at the moment of inoculation, but that a distinct interval—one of several days—always occurs between inoculation and constitutional infection.

The position of the advocates of instant constitutional infection, in view of the acknowledged fact that the *venous* capillaries are the absorbents proper of the cutaneous envelope, is most excellent. It is true, a limited power of absorption is also accorded to the *lymphatic* capillaries, but if the venous capillaries absorb *any* of the virus, practically, constitutional infection must occur at once, just the same as if no lymphatics existed. Unless, then, it can be shown that the venous capillaries do not absorb the syphilitic principle or virus *at all*, and that this office is always confined to the lymphatic capillaries, the theory of instant infection must prevail.

Since MAGENDIE deprived the lymphatics of their place as chief absorbents of the system, by proving that this office was delegated to the veins, there has been not a little speculation as to the actual uses of the lymphatic system in the human

economy. One of the most recent and apparently one of the most philosophical theories, in regard to the function of the lymphatics, appears to be that of Dr. ROBERT WILLIS,* of London (1867), who claims that the lymphatic system is chiefly an under-drainage system. "According to present physiological views, there is an acknowledged necessity for a difference in the density of the arterial and venous currents of the blood, in order that osmosis may be possible. It is well understood that 'the arteries exude and the veins imbibe.' Did not the blood, however, between its outward and inward course, lose something by which its quality was *altered*—by which its density especially was *augmented*, there would be no endosmosis into the returning channels, in the sense in which the word is understood in physiology, viz., *penetration, with increase in bulk of the body or liquid penetrated.*"

"Vessels, entitled lymphatics or absorbents, one essential function of which," says Dr. WILLIS, "I believe to be the abstraction of a certain quantity of the watery element of the blood, for the specific end of rendering the returning stream in the deeper seated parts of the body of greater density than the outgoing stream."

This view of the office of the lymphatic system is virtually confirmed (in 1869) by Professor F. VON RECKLINGHAUSEN† in the following terms :

"In consequence of the pressure under which the blood courses through the vessels of the several organs of the body, the tissues are constantly permeated with serous fluid, which partly furnishes the materials requisite for their nutrition, and is in part, also, subservient to the preparation of the secretions. This serous or tissue fluid requires constant renewal —a rapid exchange of material, without which it quickly alters the composition of the various tissue elements around which it plays. The passage of fresh fluid from the blood into the tissues would cease, however, as soon as the pressure of

* The Sudoriparous and Lymphatic Systems, by Robert Willis, M.D., London, 1867, page 32, et seq.

† "The Lymphatic System, by Prof. F. von Recklinghausen." Stricker's Human and Comparative Histology. Sydenham Ed., vol. i., page 297, et seq.

the latter approximated that under which the blood moves in the vessels, were not a constant escape of the fluid provided for by means of a canal system which is so far separate from the blood-vessels supplying the tissues, that the pressure of the blood is not transmitted directly into the canal system, that is to say, not with its full force. These canals, the lymph vessels, therefore, form a peculiar system, the rootlets of which are distributed through the tissues, and which only so far stands in connection with the blood-vessels in that it—

"*First*, indirectly withdraws from them the fluid they contain; and, *Second*, that it ultimately returns that fluid to the blood-vessels by its terminal trunks." According to these views, there is, then, a constant movement of the fluids bathing the tissues *toward the lymphatic canals.* Here, then, we take the first step in support of a syphilitic infection through the medium of the lymphatic system alone."

Let us now, for a moment, recall the statements of BEALE in regard to the nature of the disease germ of contagious diseases,* viz., that "it is a molecule of germinal matter, derived by direct descent from the living matter of man's organism—living matter which retains its life after the death of the organism in which it was produced—living matter which has descended from the living matter of health, but which has acquired the property of retaining its life under new conditions—living matter destroyed with difficulty, and possessing such wonderful energy that it will grow and multiply when removed from the seat of its development and transferred to another situation, provided only that it be supplied with suitable nutrient pabulum." This disease germ is, then, a living, moving entity—an amœboid cell, possessing, like the white corpuscle of the blood, the vital movement and a like power of multiplication. Demonstrated by BEALE and CHAUVEAU in the fluid of the vaccine virus, let us assume a similar disease germ to be the essential element of the syphilitic virus, as claimed, though not yet practically demonstrated, by BEALE; and, further, let us apply the secretion containing this living

* Disease Germs—their Real Nature, page 11.

syphilitic disease germ to the abraded cutaneous surface of a hypothetical subject. We have now two separate influences which may act separately or conjointly to carry this disease germ into the lymphatic circulation :—1st, the current of tissue fluid, which constantly sets towards the lymphatic vessels. 2d, the power of amœboid movement of the germ itself.

It is one of the few well settled points in regard to the syphilitic virus that, when free from extraneous matters, it is bland and unirritating in its character. Its application to a wound or an abrasion does not in any perceptible degree interfere with the natural, rapid and complete healing of the part ; and yet a tendency to the coagulation of albuminous materials —a separation of the fibrinous elements of the fluids brought within its influence—is universally accepted. It is reasonable, then, to suppose (as a very slight interference with the physiological processes of a given tissue will give rise to the coagulation of its albuminoid element) that this result occurs on application of the syphilitic disease germ to the abraded surface, and that this, while compatible with the natural and complete healing of the abrasion, would interfere to a greater or less degree with the movements of the disease germ. MIALHE* has shown that solutions which readily coagulate the albumen of the circulating fluids may yet be absorbed, *though very slowly*. Bearing this in mind, it now becomes necessary to consider the anatomical arrangements of the lymphatic capillary system in its relation to the *surface* of an abrasion of integument or mucous membrane. The statement is made by ROBIN, and supported by PANOZZA, SAPPEY, and other anatomists, that "the lymphatic system stands in no immediate relation with the blood vascular system;" on the contrary, as might be inferred from the office of the lymphatic system, as an under-drainage agent for the blood vascular system, "it holds its course as far as possible from the blood capillaries." Says RECKLINGHAUSEN,† "all fluids escaping from the blood capillaries must traverse tissue to reach the lymphatic capillaries." . . . ."In those

* MIALHE. Chimie, Appliquée a la Physiologie, Paris, 1856, page 200.

† The Lymphatic System, by F. von Recklinghausen. Human and Comparative Histology. STRICKER. Syd. Soc. Ed., vol. i., page 302.

membranes which present a free surface covered with an epithelium, as in the mucous and serous membranes and the skin, the lymphatic capillaries are found constantly occupying a deeper plane than the blood-vessels ; whilst the latter ascend till they lie just beneath the epithelium, the lymphatic capillaries do not reach the uppermost stratum of the connective tissue."

The relation of the lymphatic capillary system to the *surrounding tissue* is at present a subject of controversy, as to whether it is a system of closed canals, or whether they stand in open communication with the tissues with which they are in relation. KÖLLIKER, TEICHMAN, FREY, HIS, SANGER, BELAIEFF, ROBIN, DYBSKOUSKY and COHNHEIM, assert that they are closed at their origin ; while VIRCHOW, LEYDIG, CHRONSZCZEWSKY and DONDERS claim that they are in communication with a system of serous tubules, formed by the fusion of the membrane of connective tissue corpuscles ; and still a third party—RECKLINGHAUSEN and SCHWEIGGER-SEIDEL—that they are in open relation with the surrounding connective tissue by distinct interspaces or canals, which they term lymph paths.* To this last view STRICKER also evidently inclines, affording, as he says, a better explanation of what is at present known than any other. But whether we adopt the theory of a closed origin for the lymphatic capillaries, and with it the accepted accompanying view, that their walls are composed of a soft protoplasm ; or that they present numerous stomata or permanent openings ; or that of the open lymph paths of RECKLINGHAUSEN ; the passage of amœboid cells from the tissues into the interior of the lymphatic capillaries is made possible. In either case, tissue must be traversed—tissue bathed in albuminous fluid, the current of which is setting in the direction of the lymphatic canals.

Having, then, applied to the surface of the abrasion the living syphilitic disease germ of BEALE, $\frac{1}{100000}$ of an inch, or less, in diameter, with an amœboid power and a capacity to appropriate nutriment, and to generate its kind, what follows ? Its

* Human and Comparative Histology. STRICKER. Vol. i., page 297, et seq.

movement is with the *current*, and though its progress is retarded by a more or less complete coagulation of the tissue fluids, its tendency is still *toward a lymphatic canal*, and, aided possibly by its own vital movement, after a period more or less prolonged, dependent upon the difficulties in its path and the distance to be traversed, it is finally ushered into the interior of that vessel.

Again, if we fail to find sufficient evidence of the capacity of the independent amœboid disease germ to find its way into the lymphatic vessel, we have but to recall what has been advanced and proven by COHNHEIM and others, in regard to the nature and peculiar powers of the white blood corpuscle, which represents the germinal element of the animal organism.

Attracted by the occurrence of an irritation at any given point, this nomadic corpuscle, stretching out its processes, draws itself along through any and every tissue that may intervene, capable of seizing its nutriment by entrapping it in its undulating tentaculæ, and of enfolding and incorporating with its own elements, not germinal matter alone, but foreign substances, as proven by actual experiment. Attracted to the locality upon which a myriad of almost infinitesimal disease germs have been deposited, as will occur in a natural syphilitic inoculation, is it too much to believe that these molecules would not escape the omnivorous capacity of this wandering white blood corpuscle, or that, incorporated by it into its substance, the demands of this other and more active life, joined to and stimulating its own, should appropriate from the surrounding pabulum such undue proportion as would result in hastening to an abnormal degree the natural process of fission of the white corpuscle ?—and that myriads of new cells, thus hurried into being, incorporated with and impregnated by the proliferating molecules of the disease-germ, should be set loose in the tissue, sooner or later to find or force their way into the adjacent lymphatic capillaries ?

But why, you may possibly ask, in the presence of the open mouths of the *blood* capillaries, is not this infinitesimal disease-germ taken up and incorporated with *their* contents, and thus at once given access to the general circulation ? Simply,

as I apprehend, from the fact that it is not a *virus*, as ordinarily conceived, that constitutes the syphilitic influence, but *a living, abnormally active bioplast*, developing, multiplying, by appropriating as its pabulum the healthy bioplasm which goes to regenerate the fluids and solids of the healthy human organism; and hence, *formed material* cannot afford the proper pabulum for its nutrition. *Unformed* germinal matter *alone* can appropriate it or be appropriated by and combine with it. Not the *tissues* nor the *red blood corpuscles, which are formed matter*, but the *germinal* element of the blood and tissues *alone*, are affected by its power or influence, which would appear to be but to unduly stimulate and accelerate the normal processes of nutrition and development of the germinal element of the blood and tissues. The local action at the point of inoculation appears to me as follows:

1st. A coagulation of the superficial tissue fluids. A dilatation of the superficial blood-vessels. A consequent slowing of the circulation. The coincident attraction of a variable number of wandering white blood corpuscles—phenomena associated with any irritation of living tissue.

2d. An entrapment of the syphilitic disease-germ by the wandering white blood corpuscle (through its amœboid movement), and the incorporation of the disease-germ into the substance of the white corpuscle.

3d. An appropriation (as pabulum) by the disease-germ, of the substance of the white corpuscle, and the consequent development and multiplication of the disease-germ, *in* the white corpuscle.

4th. A consequent necessity of the white corpuscle for an increased supply of pabulum from the tissue fluids, the absorption of which, producing a rapid increase in size, and an abnormal tendency to fission or multiplication of the white corpuscle, through whose substance the multiplied disease-germs are now disseminated.

5th. Through the multiplication of the white corpuscle thus impregnated by the syphilitic disease-germs, the spread of the syphilitic influence at the point of inoculation, and from thence into the adjacent natural channels of the white cor-

puscle, viz., the *lymphatic canals*, through which, by aid of the lymphatic current, they are carried along until arrested in the substance of the nearest lymphatic gland.

While, however, certain of the wandering white corpuscles, incorporated with the syphilitic disease-germs, are stimulated to abnormal proliferation, and go on to spread their influence beyond the sphere of this immediate action, certain other, whose predestined office is that of connective tissue cells, become arrested in the coagulated albuminous medium at the point of inoculation, become fixed, and develop into connective tissue fibrillæ, after the manner described by BILLROTH* of the formation of normal cicatricial tissue, between which and the induration associated with and considered peculiar to the primary syphilitic lesion there appears to be but the difference of exaggerated formative power.

A corroboration of this view is found in the fact that the depth and extent of the induration of the initial syphilitic lesion, in like situations, is found to be decreased in some proportion to the decreased activity of the virus inoculated—having its maximum when originating from a typical initial lesion—modified in its extent and depth, if not its density, when occurring from secondary or degenerated sources of origin.

The influence of the disease germ, as it eventually comes to be felt in the lymphatic vessels underlying the inoculated point, is in accordance with its accepted power to separate and organize the fibrin contained in the lymph, and thus to add rapidly to the induration previously originated in the connective tissue corpuscles *outside* the lymphatic canals, and *underlying* the abraded surface.

I am aware of an impression, conveyed by authorities, that the induration associated with the initial lesion of syphilis is made up of a specific syphilitic material, and not of normal tissue elements; but microscopical examinations of recent normal cicatricial tissue, and of syphilitic induration-tissue, do not reveal any characteristics not compatible with the as-

* Billroth's Surgical Pathology, Am. Ed., 1871, page 98.

sumption of an identical origin, and a similar process of development in the two instances.

That differences ultimately arise cannot be denied ; but these differences are probably in *degree* of development, rather than of *kind*, and are, besides, in some measure dependent upon the different conditions of the parts in which the processes are carried on.

In the case of the normal cicatrix, we have a permanent useful tissue, in which vessels of nutrition are developed ; in point of fact, a new formation, supplying a want occurring from a previous loss of substance ; whereas the syphilitic induration is developed in and upon normal tissues in which vessels of nutrition *are present*—formed, under the unnatural stimulus or influence of the syphilitic disease-germs, into a denser tissue than the normal cicatricial tissue, and by which the included vessels of nutrition are embarrassed in their functions, and not seldom strangulated in its embrace ; producing, when the *lymphatic capillaries* alone are obstructed, a solution of continuity from lack of free passage from the returning tissue fluids, and thus setting up a process of disintegration which VIRCHOW terms a necrobiosis—"death brought on by altered life ;" or when the *blood-capillaries* are disabled, a positive necrosis is established ; in some cases even loss of the entire mass of induration by actual gangrene : all of which occurrences are observed and recognized as varieties of the infecting chancre, or initial lesion of syphilis.

It will, however, be observed that an important feature of syphilis, accepted and insisted on by all authorities, is entirely omitted, viz., *The Period of Incubation.*

This period of incubation is defined as "the interval of apparent rest," occurring between the inoculation of the syphilitic virus in a given subject, and the appearance of the specific local lesion at the inoculated point ; which lesion is stated to be the result of a local reaction consequent upon a general infection of the system—this occurring at the point of inoculation alone.

It may appear as an induration simply, or as an abrasion or ulceration, with or without induration, at first, but which,

after a variable period, *acquires* an induration considered *specific*, announcing the infection of the general system, and marking the termination of the incubative period.

In thirty-six well-authenticated experimental inoculations of the syphilitic virus, made and reported by BÄRENSPRUNG, CULLERIER, AUZIAS-TURENNE, WALLACE, WALLER, VIDAL, GALLIGO, RHINECKER, DANNIELSSEN, HEBRA, LINDWURM, KUSSMAUL, PELLIZARI, GIBERT, and the anonymous surgeon of the Palatinate, the earliest period transpiring from inoculation to the appearance of the local lesion was 10 days; the latest, 46 days; the mean, 24 days. Of these, four were inoculated with the secretion of an indurated chancre, resulting in one case in an incubative period of 10 days; another of 17 days; another of 39 days; another of 46 days.

Five were inoculated with the secretion from mucous tubercles, resulting in an incubation in one case of 28 days; one of 17 days; one of 25 days; one of 16 days; and one of 18 days.

Three inoculated with syphilitic blood, with an incubation in one of 34 days; in another of 25 days; in the third of 28 days.

DIDAY reports 28 cases having a mean of 14 days. AIME MARTIN, of Paris, reports the case of a girl, under surveillance in the St. Lazare Prison, where the period from exposure to the appearance of the local lesion was 72 days. M. FOURNIER, one with an apparent incubation of 70 days. Dr. BUMSTEAD* one of 50 days. Dr. HAMMOND† adduces an example, with a history circumstantially minute, where the period between the exposure and the appearance of the characteristic indurated syphilitic lesion was but 36 hours.

Thus we see that in the cases of experimental inoculation, where the quality of the virus was known and the time of its inoculation positively established—cases in which, if in any, we have a right to expect a certain degree of uniformity in results—a difference of 36 days between the extremes, and yet no note-

* Bumstead on Venereal, 3d Ed., Phila., page 417, 1870.
† Hammond on Venereal, Phila. Ed., 1864, page 66.

worthy difference appears to have occurred from the employment of different kinds of virus. In the four clinical cases subsequently quoted, there appears a difference of over 70 days in the periods of incubation From whence comes this remarkable lack of uniformity in processes apparently similar, under conditions practically the same? Shall it be referred to constitutional idiosyncrasy alone?

During the late civil war in this country, Dr. C. J., a distinguished surgeon of the Confederacy, was called upon to amputate the limb of a soldier who was at the time the subject of a secondary syphilitic eruption. During the operation the extremity of the right fore finger of the surgeon was accidentally pricked by a *spicula* of bone.

On the following day, a red line was observed, streaking from the wound, up the arm, and extending to the corresponding axilla. Swelling of the axillary glands followed within twenty-four hours from the occurrence of the accident. The wound of the finger healed quickly and naturally; the line of inflammation (evidently that of a lymphatic vessel), extending from the wound to the axilla, soon disappeared, but the axillary glands continued enlarged, though painless, until, at the end of the sixth week from the receipt of the wound of the finger, a distinct roseolous eruption appeared, thickly distributed over the breast, back and arms. The syphilitic character of the disease was recognized, and the doctor put himself at once upon a course of mercurial treatment.

Six months subsequent to the occurrence of the roseola, several nodes appeared on the doctor's tibiæ, and during the following year, spots of well characterized tertiary syphilitic impetigo made their appearance on his body, which finally disappeared under the administration of the iodide of potassium.

Two cases are reported to me by Dr. R. W. TAYLOR as occurring at the New York Dispensary during the past year, one in which the initial lesion made its appearance within twenty-four hours after connection, and in which a characteristic induration was developed within four days, followed in six weeks by a roseola, erythema of the fauces, etc.; a second where the in-

duration was discovered within a week from exposure, and which was followed by a well-pronounced secondary lesion at the end of the fifth week from the discovery of the induration. The local lesion was, in both these cases, situated just at the anterior junction of the frenum with the glans penis.*

In Dr. HAMMOND'S case, with an incubation of 36 hours, the lesion was described as at the frenum.

Now, it is at just this point that the superficial lymphatics of the glans penis approach nearest to the surface, rising in this especial locality, in some instances, according to BALAIEFF, to a point just underneath the epithelium.

Farther observations, which shall result in connecting a brief period of incubation with the occurrence of the initial lesion, in localities where the distribution of the lymphatic vessels is most superficial, as at the anterior and inferior extremity of the glans penis, or which shall show an *absence* of the initial lesion in cases where the syphilitic disease-germ has been introduced *directly* into a lymphatic vessel, as appears to have been shown in Dr. J.'s case, may yet be made, and afford a corroboration to my own view of the incubative period of syphilis, viz., that it is the period required for the syphilitic disease-germ to traverse the distance from the point of inoculation to the interior of a lymphatic vessel, by the processes described in a previous part of this paper. Consequently, according to this view, *syphilis is a local disease* up to the period of the entrance of the disease-germ into a lymphatic canal; and I am also of the opinion that, instead of infecting the system at large, even at this time, it passes on through the lymphatic vessel into the parenchyma of the lymphatic gland, with which it is connected, where it is retained by conditions arising from the character of the parenchyma of the gland, and the coagulation of its tissue fluids, for a period corresponding to the so-called *secondary incubation* of syphilis, recognized by all authorities as taking place before the constitutional evidences of the disease are ever manifested.

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* These cases minutely reported in the N. Y. Journal of Syphilography for July, 1871, page 244.

In conclusion, I would state my belief in the possibility of a satisfactory explanation of many, if not all, of the later manifestations of syphilis, through causes wholly dependent upon interference with the *lymphatic* circulation; and that further researches, in the direction I have indicated, will corroborate my claim, *that it is the germinal element of the blood and tissues alone that is primarily affected in syphilitic disease;* that it is through the *lymphatic* system *alone* that the syphilitic influence is propagated to parts remote from the point of inoculation; and, finally, that it is to deposits of fibrin, organized through the syphilitic influence in and around the *lymph*-vessels and *lymph*-sacs in the earlier stages of the disease, and its subsequent contraction, that the lymphatic obstructions resulting in various external and internal lesions in the later stages of the disease are chiefly due.

(NOTE.)

A copy of the London *Medical Times and Gazette*, of January 27, 1872, has just been received, containing an account of the recent discovery of a peculiar corpuscle in syphilitic blood, which is claimed to be characteristic of syphilis.

VIENNA, January 15, 1872.

At the last meeting of the Vienna Medical Society, Dr. Lostorfer read a paper containing the results of investigations into the nature of the microscopic appearance of the blood of syphilitic patients. The researches have been continued several months in Professor Stricker's laboratory, and, as will be seen, confirmed by no less an authority than that of Hebra, and if further confirmed they will, beyond any doubt, be one of the most important discoveries for practical medicine.

During the last few years several attempts have been made at explaining different diseases, and particularly infectious ones, by the presence of fungous growths in the blood, secretions, and excretions, as well as in the tissues of the human and animal body. In syphilis it was particularly the patients' blood which has been searched for organisms of a lower range. The results of these investigations, however, have been negative, with the single exception of Hallier, who describes a fungus, found in different infectious diseases, of that nature which has been called "micrococcus" by the same author. The micrococcus *per se* is not characteristic of any disease, but becomes so—according to Hallier's opinion—in the species produced by artificial cultivation. One of the greatest micrologists (De Bary) has objected in a most emphatic manner to Hallier's method of cultivation—so that it has been abandoned by almost all workers in that direction.

Dr. Lostorfer thinks that the negative results of blood investigation have been due to two causes, namely: 1. Hitherto nearly all researches have been made with too low powers; he is convinced that such investigations cannot be made with a less magnifying power than with Hartnack's eyepiece No. 3, and the immersion lens No. 10. 2. All researches have been made with fresh

blood, and the objects soon spoiled by an unfavorable method of preservation. The opinion has, unfortunately, always been prevalent, that what is to be seen in blood must be seen best in fresh blood, but it has been overlooked that things may be so minute as not to be viewed at first, but that they may grow to a visible size.

Under these considerations, Dr. Lostorfer commenced his researches in August, 1871, in Professor Zeissl's wards for syphilis. The method observed was excessively simple. A small drop of blood, taken from a syphilitic patient, was put as quickly as possible on a clean object glass, covered, the whole object conveyed to an exsiccatorium, arranged in a kind of Recklinghausen's moist camera, and daily carefully examined with the magnifying powers mentioned above. The result of the first four objects was already positive, and remained so afterwards in large numbers of objects, the blood having been taken from different patients suffering from various, yet unmistakable, forms of syphilis.

During the first two days of investigation nothing could be seen except vibriones, bacteria, and commencing forms of sarcina. In the third or fourth day, however, and, in exceptional cases, after the lapse of twenty-four hours, minute bright corpuscles became visible, some of which remained immovable, whilst others continued in a state of undulation. Some of these bodies exhibited a projection. On the fourth day (exceptionally on the third, fifth, or sixth day) the corpuscles were enlarged in bulk and in numbers. Of those enlarged, the majority had the projections just named, which were undoubtedly a kind of sprouts, which in some cases were larger in size than the corpuscle itself. In the following days the growing continued, so that some of these bodies became as big as, and even bigger than, red blood corpuscles. Besides these, there were numbers of smaller corpuscles visible, growing and sprouting, some exhibiting one projection, others three or more projections; the latter were sessile, or had a minute pedicle. The corpuscles were by no means all globular, but of different irregular shapes. After eight or ten days a vacuola was formed in the larger corpuscles, which extended over the whole corpuscle, and terminated the further development of the growth. Different fluids, as sugar, Pasteur's liquid, common salt, acetic acid, etc., were not able to arrest the shrivelling of the bodies and further retrograde development.

Concerning the number of corpuscles, it varies greatly in different cases. Whether this be dependent upon the different stage of the disease, cannot yet be said, and must be reserved for further investigation. Dr. Lostorfer has treated in a similar manner the blood of patients laboring under gonorrhœa, diphtheria, eczema, typhus, elephantiasis, and lupus, but never found anything to be compared with the appearance of syphilitic blood. Dr. Lostorfer is cautious enough not to give any opinion as to the relation of the "syphilis corpuscles," as he calls them, to the disease; whether they be the cause or the result of the latter he pretends not to know, but contents himself to state the facts he has found. After having alluded to a number of patients (and their histories) from whom he had procured blood for examination, he winds up with the statement that he is able in any case to form the diagnosis of syphilis by examining the blood microscopically.

After the paper was read, and received with great applause and encomiums by Skoda and Hebra, Professor Stricker confirmed, in addition, that the author of the paper had been tried seven times, viz., five times by Stricker, and twice by Hebra—in the following manner: In the first trial, twelve objects, numbered and registered, were given to Dr. Lostorfer; two (Nos. 8 and 9) were taken from healthy persons, the other ten from three patients suffering from different forms of syphilis. After a few days, Dr. Lostorfer responded: "Nos. 8 and 9 healthy, two objects spoiled, the rest syphilitic." Second trial, made with seven objects—"Nos. 1 and 3 syphilitic, the rest healthy." Third trial, with nine objects—"Nos. 3, 5, and 8 syphilitic, the rest healthy." In both trials, after four days the healthy objects were picked out from the syphilitic ones, with the exception of the two objects which were spoiled. Fourth trial, with twelve objects—four syphilitic, and eight healthy. (The objects by some accident having been exposed to a temperature of 12·15° C., previous to

their deliverance to Dr. Lostorfer, the latter replied that "Nothing abnormal could be detected.") Fifth trial, with four healthy and three syphilitic objects. The reply was corresponding to the registration made by Professor Hebra and kept himself secretly. In the sixth trial, one syphilitic object was given, and five healthy; in the seventh, two syphilitic and four healthy; and in both cases recognized accordingly.

By reference to page 13 it will be observed that the description of the disease germ of Beale and Chaveau is equally applicable to the syphilitic corpuscle of Dr. Lostorfer. That this *corpuscle* is an *amœboid cell*, "*retaining its life after the death of the organism in which it was produced, growing and multiplying when removed from the seat of its development and transferred to another situation.*" *Proliferating, like the white corpuscle of the blood* (and like all animal germinal matter), by *fission.*

Dr. Beale's disease germ was seen as a minute particle under a high microscopic power not capable of being distinguished from any other germinal matter, but its capacity for development was recognized and asserted.

Dr. Lostorfer has taken up the investigation of the development of the syphilitic disease germ where, by inference, Dr. Beale left it. He has pursued his observations until, through the natural growth of the disease germ, *outside the body*, it has come to be appreciable (under a comparatively low magnifying power) by distinct and well defined characteristics.

NEW YORK, February 18, 1872.