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Microscopic Examinations

OF

BLOOD;

AND

VEGETATIONS FOUND IN VARIOLA, VACCINA, AND TYPHOID FEVER.

BY J. H. SALISBURY, M.D.

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MICROSCOPIC EXAMINATION

OF

THE BLOOD.

What to look for in Blood Examinations. Proportion and Condition of the Cell Elements of the Blood, and the knowledge to be gained by observing carefully the manner in which they Arrange and Comport themselves between the Slides of the Microscope.

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It has now been over eight years since I commenced the microscopic examination of blood, with the view of arriving at positive pathological conditions, etc., in this fluid in disease. These examinations have been conducted with great care and patience; being often repeated at short intervals in the same case, in order to watch the successive changes brought about by treatment, and to confirm previous observations.

In this work of labor, I have already made over thirty-five thousand individual examinations. In all the more important of these, I have made careful drawings of the abnormal appearances and bodies present; and noted minutely the pathological conditions, and the attendant symptoms and lesions.

This paper is a brief summary of a portion of this labor. It is with much hesitation that it is presented in this incomplete condition. It was my intention, before saying publicly anything, to work quietly on, and spend much more time in labors so interesting to me, and that have aided me so much in treating disease; but a few learned gentlemen, who have taken great interest in the inquiries, have earnestly requested that they be published, so that others might commence and extend investigations in the same direction.

To obtain the blood, a clean puncture or cut is made, in any part of the body desired, the surface being previously carefully cleaned. The wound should be large enough to allow the free and immediate escape of a drop on slight pressure. The blood at once is transferred to the slide, then quickly covered with thin glass, and placed under the microscope. By a little experience, it may be under observation in one second from the time it leaves the blood stream.

WHAT TO LOOK FOR IN BLOOD EXAMINATIONS.

Blood examinations, to be of value in diagnosis, must be made with great care. There is not one microscope in fifty, of those in present use, that is suited for this kind of study. They lack in definition, and often in not being sufficiently achromatic.

A drop of blood may frequently be explored for an hour or more with profit. If the case is obscure, and the first drop examined fails to throw light, explore another carefully. If you still fail, continue the search till you are perfectly satisfied that the cause is to be sought for somewhere else. Often much may be learned by allowing the blood to stand for from a few hours to two or three days between the slides, watching from time to time the successive changes taking place during the process of drying. These changes, compared with those taking place, under similar circumstances, in healthy blood, often throw valuable light upon certain peculiarities of the case.

The following is a list in detail of some of the conditions, states, and pathological products to be sought for in blood:

1. Color of blood to the unaided eye and under the microscope.
2. Consistence of the blood.
3. Rapidity of clotting.
4. Serum in normal proportion.
5. Colored corpuscles in normal proportion.
6. Colorless corpuscles in normal proportion.
7. Fibrin in normal proportion.
8. Serum in too small quantity.
9. Colored corpuscles in too small quantity.
10. Colorless corpuscles in too small quantity.
11. Fibrin in too small quantity.
12. Serum in too large proportion.
13. Colored corpuscles in too large proportion.
14. Colorless corpuscles in too large proportion.
15. Fibrin in too large proportion.
16. Colored corpuscles of normal consistence.
17. Colored corpuscles too soft, plastic and sticky, adhering together and being drawn out into thread-like prolongations as they separate.
18. Colorless corpuscles, normal in quantity, but so sticky and plas-

tic that they adhere together in masses, endangering the formation of thrombi and emboli.

19. Fibrin meshes normal in size and arrangement, allowing blood cells to freely circulate through them.

20. Fibrin meshes too small to allow blood cells to freely flow through them, on account of which the blood cells arrange themselves in ropy rows, or ridges and masses, being held in the meshes of the partially clotted or contracted fibrin. In such cases the individual fibrin filaments are increased in diameter and opacity.

21. Colored corpuscles arrange themselves in nummulated piles.

22. Colored corpuscles have little or no tendency to arrange themselves in nummulated piles.

23. Colorless corpuscles, many of them ragged, partially broken down, and more or less curled and twisted and wrinkled.

24. No tendency of the blood discs to arrange themselves in nummulated piles; but remaining evenly and loosely scattered over the field.

25. The blood discs may exhibit a slight tendency to group themselves, having empty spaces between them.

26. The blood discs may arrange themselves in irregular compact masses, occupying but a small portion of the field.

27. The blood discs may arrange themselves in ridges, exhibiting a sticky stringiness and ropiness.

28. The blood discs may hold firmly the coloring matter, and be soft and plastic.

29. The blood discs may be high colored, smooth and even in outline, hard and rigid, and hold firmly and completely the coloring matter.

30. The blood discs may allow the coloring matter to escape readily, obscuring the individual outlines of the discs.

31. The discs may be mammellated.

32. The colorless corpuscles may be in excess or in too small quantity, and be normal in consistence.

33. The colorless corpuscles may be in excess, to a greater or less extent, and be sticky, plastic, and adhesive, having a tendency to stick together in groups and masses. These masses tend to hang in the meshes of the sticky fibrin. Under such circumstances there is great danger ahead from the liability to the formation of thrombi and emboli.

34. The colorless corpuscles may be in excess, and ragged and broken.

35. The colorless corpuscles may be in excess, and smooth and even n outline.

36. Minute grains and ragged masses of black, blue, brown, or yellow pigmentary matter may occur disseminated through the blood.

37. Globules and masses of fat may be present.

38. Amyloid matter may be present.

39. Masses of broken down and disintegrating parent cells may be present.

40. Emboli of fibrin may be present in greater or less quantity. These emboli may or may not be filled with granular and crystalline matters.

41. Emboli of algoid spores may be present.

42. Emboli of algoid filaments and spores may be present.

43. Algoid filaments and spores may be diffused or disseminated through the blood, without being aggregated in masses.

44. Fungoid spores may be present.

45. Fungoid spores and filaments may be present.

46. Granules and crystals of oxalate of lime may be present.

47. Granules and crystals of cystine may be present.

48. Granules and crystals of phosphates may be present.

49. Granules and crystals of stelline may be present.

50. Granules and crystals of stellurine may be present.

51. Granules and crystals of matters of a miscellaneous character may be present.

52. Conchoidine may be present.

53. Pigmentine may be present.

54. Leucine may be present.

55. Creatine may be present.

56. The lithates or lithic acid may be present.

57. Inosite may be present.

58. Both the serum and blood discs may contain brain fat or cholesterine.

59. The blood discs only may contain brain fat.

60. The Zymotosis regularis is present in the spore state.

61. The spores and filaments of Zymotosis regularis may be both present.

62. The spores of the Entophyticus hæmactus may be present.

63. The spores and filaments of the Entophyticus hæmactus may be both present.

64. The Penicillium quadrifidum may be present, both in the spore and filamentous states of development.

65. The spores and filaments of the Botrytis infestans may be present.

66. The colorless corpuscles may contain thin, bladder-like empty cells, of various sizes, that distend them.

67. The colorless corpuscles may contain algoid or fungoid spores, or both, which tend to destroy their normal contents and to distend the outside walls of the cells, so that they may be much larger than the healthy cell and appear like sporangia.

There are many other things to be sought for in pathological blood, which will be spoken of hereafter. I have given the foregoing list, in order to convey to the minds of those who have not conducted examinations in this direction, an idea of what to look for. The general impression is, that there is nothing to be found in the blood-stream, but the blood elements; and it has been considered that these elements are scarcely ever, to any great extent, pathological, and if they are, the microscope fails to throw much light upon the subject. This is a mistake. A good microscope and experience, and a little more patience and time devoted to blood examinations, will satisfy any physician that there is much more to be learned in this direction, than he has ever dreamed of. The work, however, must be patiently, carefully and honestly performed, and be most thorough. The more extended the knowledge of microscopic forms, of every conceivable variety, the more readily abnormal bodies are given their proper place and importance, and the more valuable in diagnosis are such labors to the observer.

Some pathological products and states are best studied immediately after the blood is drawn, while others are better made out after the blood has stood a longer or shorter time between the slides, and become stationary, uncovering crystalline and granular products that were at first too much enveloped in blood cells to be discoverable. Often after having worked over a drop of blood for half a day, I have discovered new forms on re-examination.

In the nicer microscopic explorations, we are very apt to see only those objects and conditions we are in search of, overlooking many interesting forms and features that after they have been pointed out to us, we are perfectly astonished, how, in the extreme care we have used, they could have been possibly overlooked. The truth of this remark will come home with peculiar force to those who have labored the most carefully in microscopic researches in new fields. The superficial observer cannot appreciate it, as he never studies out the nicer details of the individual features and forms under observation. His mind receives simply a vague impression of the general appearance, instead of grasping in detail well-defined pictures, which alone give positive and exact knowledge.

The symptoms and pathological consequences of the presence of stelline, stellurine, pigmentine, and conchoidine, are briefly set forth in my paper describing these substances, published in the New York Medical Record for February 1, 1868. The symptoms and pathological states excited by the presence in the blood and tissues of cystine, oxalate of lime, phosphates, and lithic acid, are described in my paper on Rheumatism, published in the American Journal of Medical Science, for July and October, 1867.

The symptoms and abnormal states excited by the presence of algoid and fungoid spores and filaments, have been briefly spoken of in several of my papers, and will be more fully set forth in a paper which is now nearly ready.

The presence of cholesterine in the blood disc of healthy blood, and in it and the serum in certain forms of disease, is the subject of a paper now ready, and which will soon appear.

Other pathological states produced by abnormal conditions of the blood cells, will constitute also the subject for a separate paper.

We will now present briefly some observations connected with the

CONDITION, APPEARANCE AND ARRANGEMENT OF THE FIBRIN FILAMENTS IN THE FRESHLY DRAWN BLOOD OF HEALTH AND DISEASE. A VALUABLE MEANS OF DIAGNOSTICATING CERTAIN PATHOLOGICAL STATES OF THE SYSTEM.

That the fibrin filaments exist ready formed in the blood stream, there is no possible doubt. By a little practice, the eye can begin to explore a drop of blood under the microscope, in one second after leaving the blood vessels. An experienced observer will immediately detect colorless corpuscles, masses of granules, and sporoid bodies, and sometimes crystals, that are fixed, or made almost stationary by some invisible means. If the eye watches these closely, while the balance of the blood is moving this way and that, and running in little currents in various directions, in a few moments will be noticed faintly delineated filaments, crossing and recrossing each other, forming a meshwork which holds fast these fixed cells, granules and spores. These are the fibrin filaments, which make up an almost invisible network in the freshly drawn blood. This network of organized fibrin gradually loses the almost perfect transparency it has in the blood stream, and becomes little by little more and more opaque and visible in outline, till in the course of five or ten minutes after it is drawn, the network of threads reaches its maximum opacity, the filaments being to the educated eye well defined.

The fibrin filaments are developed from the fibrin cells that are organized in the arterial extremities of the spleen and lacteal and lymphatic glands. These cells are mostly developed into filaments before they leave the glandular capillaries. The nucleus, or "yolk" of the fibrin cell forms the blood disc, while the portion of the cell outside of the nucleus is "spun" into a fine fibrin thread. This whole process is fully described in my paper on the "Histology and Functions of the Spleen and Lacteal and Lymphatic Glands," published in the American Journal of Medical Sciences for April, 1866.

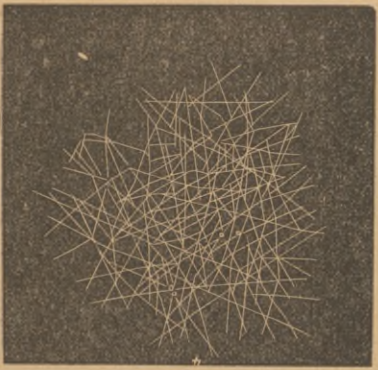
Upon the appearance and state of the filaments, and size of the meshes of this fibrin network, much depends. What might appear to be slight derangements in the parent cells that organize the fibrin cells, may result in grave pathological states.

The trouble, no doubt, starts primarily with defective or deranged alimentation, or with some disturbance of the digestive apparatus of the alimentary canal, by which improper, defective, irritating or poisonous food is transmitted to the parent fibrin cells of the spleen, lacteal and lymphatic glands. This imperfect food, little by little, deranges the digesting, assimilating, and organizing functions of these organisms, so that the fibrin cells they manufacture are in one or more ways pathological. These diseased cells produce fibrin filaments that are more or less abnormal. Now the causes that produce disturbance in the blood may be so far removed from the pathological results at the time we detect them in the blood, that they are entirely lost in the consideration of the subject. We only recognize, perhaps, the pathological products and conditions we find present in this fluid at the time of the examination. These we give the place of *causes* of the systemic disturbance. This may be to a great extent true, but the physician should be able to look back and beyond these specific excitants, to the primary or generic causes, which, perhaps, have been operating for years in deranging the functions of the mother cells. This knowledge he should have, that he may be able to impart such instructions to his patient, after specific or immediate causes are removed, as will enable him to live in such a way as to escape falling into the same pathological state again. Here is a field for much careful research and patient labor. It is in this direction that positive medicine may be greatly extended by close study, and honest, persevering investigation.

APPEARANCE AND ARRANGEMENT OF FIBRIN FILAMENTS IN HEALTH.

Where the system is in all respects healthy, where every part of the complicated machine is performing its functions normally, the colored and colorless corpuscles are distributed evenly throughout the serum, and the fibrin meshwork does not interfere with the free movement of the blood elements. As the natural process of clotting goes on, after the blood is removed from the system, the fibrin filaments contract, decreasing the size of the meshes of the network, so that the blood elements are to a considerable extent caught and held fast. If, however, the freshly drawn blood be stirred constantly with a rod, till the clotting process is over, the fibrin will be found adhering to the rod in white ropes and shreds, being almost perfectly free from the colored and colorless corpuscles. The reason of this is that the blood cells, by the motion kept up in the fibrin, are washed out from the network before the filaments have sufficiently contracted to hold the blood cells fast in the fibrin meshes. The filaments of fibrin

FIG. 1.



in the healthy blood are much smaller and less strongly marked than in rheumatic and tubercular states: and the meshes of the network are larger, allowing the blood cells to pass freely through them in all directions. Fig. 1 represents the fibrin network of healthy blood as it presents itself between the slides of the microscope, a few minutes after the blood leaves the blood stream, It will be seen that this network is free from spores, granules, colorless corpuscles, and crystals. There are no abnormal products adhering to the filaments, or fastened in the meshes. All the elements of the blood are normal.

APPEARANCE AND ARRANGMENT OF FIBRIN FILAMENTS IN RHEUMATISM.

In rheumatic conditions the filaments of the fibrin network of the blood are in a tonic state of contraction. This increases the size of the filaments, making them more plainly visible; and decreases the size of the meshes, so that the blood is in the premonitory stage of clotting; the meshes being so small that they interfere with the free passage of the blood elements,—they holding partially in their meshes the colored and colorless corpuscles. This makes the blood have a ropy, half clotted appearance between the slides.

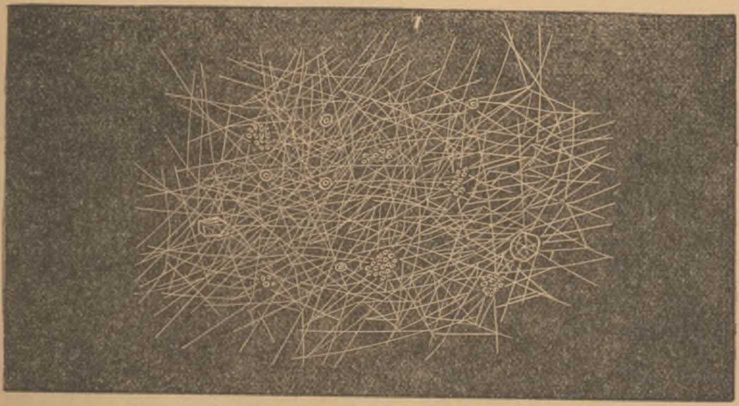
In a few minutes after rheumatic blood is placed between the slides, the colorless and colored corpuscles arrange themselves in ropy rows and masses, leaving large, irregular, clear spaces, in which may be distinctly traced the meshwork of fibrin filaments.

Frequently, for months before the patient has any idea that he is rheumatic, or in danger of being at any moment taken suddenly down with rheumatism, this condition may be positively diagnosticated by the appearance and condition of the blood. By this mode of working, the causes of this dreaded disease may be discovered and removed before the patient is aware he is in danger, thereby saving perhaps, severe suffering, and grave pathological disturbance.

In rheumatism, there appears to be a tendency to a tonic contraction in all the fibrin elements of the body. The whole muscular system is more or less stiffened and rigid. That suppleness and elasticity of the perfect physiological state is gone, and a heavy, non-elastic, more or less lame feeling pervades the organism. This tonic muscular rigidity no doubt extends to the muscular fibres of organic life; in the walls of all hollow vessels, as those of the blood apparatus and alimentary canal.

This condition, together with the tendency in the connective tissue to contract under the influence of cold, renders a rheumatic patient extremely sensitive to cold and exposure. His system usually indicates

Fig. 2.



meteorological changes with as much sensitiveness as a barometer.

Fig. 2 represents the appearance and condition of the fibrin network in the blood of rheumatism, as exhibited in the vacant spaces between the slides. It will be seen that the fibrin filaments are more contracted and larger, and the meshes of the network smaller than in healthy blood. This difference is really more strongly marked than is represented in the drawings.

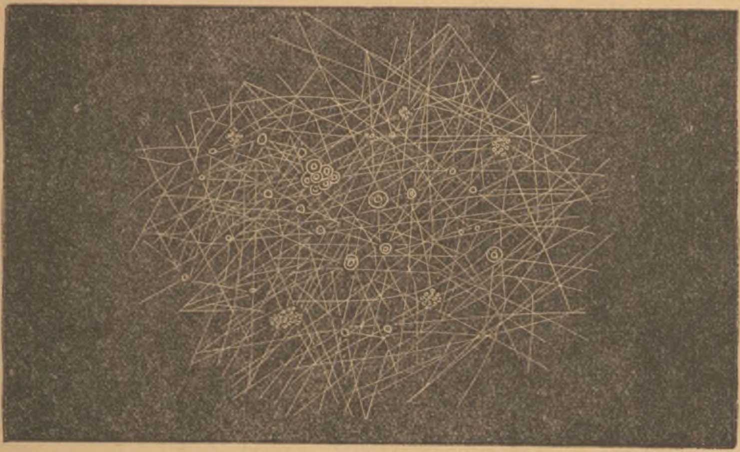
Spores, granules, colorless corpuscles, and crystals are seen fastened or caught in the meshwork. These bodies and conditions are pathological. They are never found present in healthy blood.

APPEARANCE AND ARRANGEMENT OF FIBRIN FILAMENTS IN PULMONARY TUBERCULOSIS.

In tubercular disease the blood has somewhat the appearance presented in rheumatic affections, save that there is less tendency for the colored and colorless corpuscles to become aggregated in ropy rows and masses; yet the resemblance in many cases is quite strong. In tubercular phthisis, there are almost always more or less flying rheumatic neuralgia pains. The fibrin filaments are sometimes almost as large and well defined, and the meshes as small, as in rheumatism. These pathological conditions are present, for the reason that this disease is almost always accompanied with more or less of the specific causes of rheumatism. This matter will be more fully presented in a paper now nearly ready on the primary and specific causes of pulmonary tuberculosis.

At Fig. 3 is represented the network of fibrin fila-

Fig. 3.

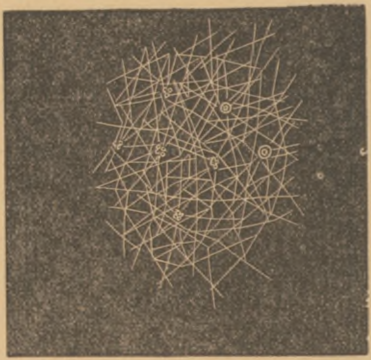


ments in pulmonary tuberculosis. The fibrin filaments are contracted and distinct, and the meshes much smaller than in health. In the meshes and sticking to the filaments are seen spores, granules, colorless corpuscles, etc. These bodies are fastened in the fibrin network, and the conditions present, that fix and hold them, are pathological.

APPEARANCE AND ARRANGEMENT OF THE FIBRIN FILAMENTS IN THE BLOOD OF ANÆMIA.

In pure cases of anæmia, that is, in states of the system where the organized histological elements of the blood are in the proper proportion, but where they are in by far too small quantity, the great mass of the blood being serum, the filaments of fibrin are small and faintly delineated, and the meshes of the network formed by them large, allowing the thinly scattered blood elements to float freely in all directions in the serum, between the slides, without any distinct evidence of clotting. In such cases, the red and white corpuscles are evenly distributed throughout the serum, there being but slight tendency in the fibrin filaments to contract, hence the meshes remain so large that they do not entangle the blood elements. When, however, the rheumatic or tubercular diathesis accompany anæmia, then the fibrin filaments assume all the characteristics peculiar to these pathological conditions.

FIG. 4.



At Fig. 4 is represented the network of fibrin in the blood of a pure case of anæmia.

APPEARANCE AND CONDITION OF THE FIBRIN AND OTHER BLOOD ELEMENTS WHERE THERE IS A TENDENCY TO THE FORMATION OF THROMBI AND EMBOLI.

Whenever there exists in the blood abnormal bodies that are insoluble in the serum, more or less irritation of the lining tissue of the blood apparatus, especially in the heart and vicinity, is the result. Sooner or later, the organic muscular fibres lose a part of their tonicity, and there are frequently tired feelings, and wandering pains and aches, which are more likely to hang about the cardiac region than elsewhere. The insoluble matters floating in the blood, have a tendency to fix themselves in or near the heart, to the epithelial lining, the secretions from which assume a more or less plastic and sticky condition from the irritation excited. These fixed particles become centres for the gradual accretion of fibrin, which applies itself slowly, layer upon layer, and finally little by little we have formed thrombi. These from time to time break loose from their points of attachment, and float as emboli in the blood stream.

There is also another condition of the blood elements, where there is great danger of thromboses and embolism, and which may be readily diagnosticated by means of the microscope, in time to avert the serious results which may await the patient. This is *stickiness* and *plasticity* of the fibrin filaments and colorless corpuscles. This stickiness often extends even to the blood discs. Whenever this state is present, the colorless corpuscles are found,—instead of being scattered about singly,—sticking to each other in groups of two, three, four, or more. The fibrin filaments are also sticky and plastic, and impede the free flow of the blood cells through their network. The result is a marked tendency to the formation of thrombi and emboli. Emboli, under such conditions, are produced frequently, simply by the sticking together of the colorless corpuscles, forming masses of greater or less size. They are also formed by the breaking loose of thrombi.

This sticky state of the blood is usually scorbutic, it arising mainly from deranged or defective alimentation.

In conclusion, I would say that this paper is but an imperfect brief of extended labors in this direction.

The Blood Disc.

THE BLOOD DISC,

A

VEHICLE FOR TRANSMITTING NERVE FOOD.

CHOLESTERINE AND OTHER CRYSTALLINE MATTERS IN THE HEALTHY BLOOD DISC, AND IN AND OUT OF IT IN CERTAIN FORMS OF DISEASE.—READY MEANS FOR DIAGNOSTICATING CHOLESTERÆMIC CONDITIONS. — CRYPTOGAMIC VEGETATIONS THAT ARE IN BOTH HEALTHY AND DISEASED BLOOD; WITH A BRIEF DESCRIPTION OF THE CRYPTA CARBUNCULATA AND ZYMOTOSIS ESCULARIS.

FOR several years I have been satisfied, from a variety of experiments, that the blood disc performed an important office in transmitting nerve food. In healthy blood, freshly drawn, the cholesterine or nerve fat is held by the blood disc, there not being enough in the serum to crystallize on drying between the slides of the microscope. If, however, the blood is allowed to stand in clean, well stoppered glass bottles for from one to three days, and then placed between the slides of the microscope and allowed to dry for a few hours, the cholesterine crystals make their appearance, it having escaped from the discs with the coloring matter and other crystalline products, and become dissolved in the serum.

This cholesterine is the fat of nerve tissue, and is largely present, it making up one of the principal constituents of the medullary matter that surrounds and insulates the ultimate central nerve threads, through which impressions are received and responses transmitted. This nerve fat has to be supplied through the medium of the blood. The only element of the blood that normally carries it is the blood disc, hence this disc may be considered a vehicle for transmitting to its destination nerve fat, and probably other nutrient products designed for nerve support. It can readily be conceived how defective alimentation and a great variety of other causes might derange this insulating covering, and how this derangement might disturb the normal mental functions and the nervous system generally, thereby producing a variety of distracting and strange results.

Here is a field open that offers tempting inducements to the careful and patient explorer.

In certain conditions of the system, when the freshly drawn blood is placed between the slides and allowed to dry for a few hours, cholesterine crystallizes around inside the edges of the thin glass. This is diagnostic of cholesteræmic states, and is pathological, and an important fact to determine.

Other matters held normally by the blood discs crystallize with the cholesterine. These will be briefly referred to further on.

CHOLESTERINE IN THE RED DISCS OF HEALTHY BLOOD, BUT NOT IN THE SERUM TILL AFTER THE BLOOD HAS BEEN STANDING FOR SEVERAL DAYS.

The following are a few of a series of experiments recently performed on the blood of persons in perfect health.

Experiment 1, *October* 13, 1867.—Drew two drams of blood from the arm of Dr. C. by opening a vein. Placed it in a clean glass-stoppered bottle, and set aside at a temperature ranging from 60° to 75° Fahrenheit.

On placing a drop of the freshly drawn blood between the slides of the microscope and allowing it to stand for twenty-four hours, no cholesterine crystals made their appearance.

Dr. C. is in perfect health.

October 16.—Shook up the bottle of blood well, and placed a drop between the slides of the microscope at 1 p. m. At 3 p. m., two hours after, cholesterine crystals had formed all around and just within the edges of the thin glass. These are represented at 12.

Experiment 2, *October* 13, 1867.—Drew a dram of blood from the arm of Dr. H., and placed it in a clean glass-stoppered bottle, and set aside at a temperature ranging from 60° to 75° Fahrenheit.

On placing a drop of the freshly drawn blood between the slides and allowing it to stand for twenty-four hours, no signs of cholesterine crystals made their appearance.

Dr. H. is enjoying excellent health. Age 26.

October 15.—Shook up the bottle well, and placed a drop of the blood between the slides of the microscope at 1 p. m. At 3½ p. m. cholesterine crystals had formed entirely around and just inside the edges of the thin glass, similar to those represented at 12.

Experiment 3, *October* 13, 1867.—Drew two drams of blood from the arm of Dr. D., who is in perfect health, and placed it in a clean glass-stoppered bottle, and set aside at a temperature ranging from 60° to 75° Fahrenheit.

A drop of this blood, freshly drawn, placed between the slides of the microscope and allowed to stand for twenty-four hours, afforded no crystals of cholesterine.

October 16.—At 12½ p. m., shook up the bottle well, and placed a drop of the blood between the glass slides and allowed to stand till 3 p. m., when it was examined. Found beautiful cholesterine crystals all around, just inside the edges of the thin glass.

Experiment 4, *October* 13, 1867.—Drew two drams of blood from the arm of Dr. S., who is in perfect health, and placed it in a clean glass-stoppered bottle, and set aside at a temperature ranging from 60° to 75° Fahrenheit.

A drop of this freshly drawn blood placed between the slides and allowed to stand for twenty-four hours, exhibited no signs of cholesterine crystals.

October 16.—At 1 p. m., shook up the bottle well, and placed a drop of the blood between the slides of the microscope and allowed to stand till 3 p. m., when, on examination, a beautiful row of crystalline plates of cholesterine was found just inside the edges of the thin glass.

Experiment 5, *October* 9, 1867.—Drew two drams of blood from the arm of Dr. G., who is laboring under severe rheumatic neuralgia in small of back and hips, with partial paralysis of lower extremities. Has had this trouble for the last three years. Pains at times very severe. Takes morphine hypodermically to relieve suffering. Has severe oxalæmia and cystinæmia. Placed the fresh blood in a clean glass-stoppered bottle, and set aside at a temperature ranging from 60° to 75° Fahrenheit.

Had a healthy appearance, save that it was rich in fibrin, and contained granules of cystine and oxalate of lime, also spores of the *Zymotosis regularis.*

A drop freshly drawn and placed between the slides of the microscope and allowed to stand for twenty-four hours, afforded no cholesterine crystals.

October 12.—The bottle of blood was well shaken, and a drop placed between the slides of the microscope. This was done at 1 p. m. At 4 p. m., three hours after, crystals of cholesterine had begun to appear all around inside the edges of the thin glass. The *Z. regularis* was rapidly developing into filaments.

Blood in bottle, which, when first drawn, was of a beautiful, clear red color, now had a bluish purple tinge. Coloring matter of the discs partially escaped and dissolved in the serum.

The fact that no cholesterine crystallizes in the freshly drawn healthy blood, while it does crystallize under similar circumstances, in the same blood, after it has stood for two or three days in clean, tightly corked glass-stoppered bottles, and the coloring matter of the discs partially escaped and dissolved in the serum, is interesting, and demonstrates the fact that the cholesterine is held by the blood disc in the freshly drawn healthy blood, and that it escapes from the disc with the coloring matter.

From the fact that the blood discs contain cholesterine, or nerve-fat, it would seem that they act as vehicles for transmitting nerve-food to its destination.

In all samples of healthy blood, the spores of the *Entophyticus hæmactus* and those of the *Zymotosis regularis* are found in small quantity, immediately after the escape of the blood from the blood vessels.

These spores are detected with difficulty, in the fresh blood, on account of their extreme transparency, and of being generally obscured by blood discs. After healthy blood has stood for from one to three days, at a temperature ranging from 60° to 75° Fah., the spores and embryonic filaments of the *Z. regularis*, are found in great numbers. The *E. hæmactus* is also always present in the filamentous and spore state of development, but in small quantity when compared with the large presence of the *Z. regularis*.

These vegetations are described further on.

CHOLESTERÆMIA.

There are two forms of this disease, each of which is well defined and may be readily diagnosed. In one, the cholesterine may exceed, may equal, or may be less than the normal quantity. In the other, it is always in excess. In one the blood discs are soft, yielding, plastic, and often sticky, and hold with feeble affinity their coloring matter and other products. The coloring and crystalline matters escape from the discs on the least provocation, and obscure their outlines and become mingled with and dissolved in the serum. In this pathological condition, the discs are unable to take up and hold the normal quantity of cholesterine and other crystalline products and coloring matter, and even when they are, the least disturbance liberates them.

In the other form, the blood discs are more firm and are able to hold their normal quantity of cholesterine and other products; but the cholesterine is always in excess in the blood, so much so, that a portion of it remains dissolved in the serum, the discs not being able to take it up.

In both forms of the disease, when the freshly drawn blood is placed between the slides of the microscope, and allowed to stand for a few hours, crystals of cholesterine and those of other bodies belonging normally to the discs, show themselves around inside the edges of the thin glass. If there is no cholesteræmia, the cholesterine crystals do not form between the slides, unless the blood has been previously allowed to stand for from one to three days, allowing the coloring matter to separate more or less from the discs.

By this simple means, cholesteræmia may be readily diagnosed. In all cases of cholesteræmia, or in all cases where there is more cholesterine in the blood than the discs can readily take up and firmly carry, there is a tendency to amyloid disease of some part of the blood apparatus. This takes place usually first, in some one of the following parts, to wit: the arterial extremities of the spleen, the arterial extremities of the lacteal and lymphatic glands, the liver, kidneys, or heart, and large vessels leading to it.

As soon as amyloid disease is ushered in, its existence may be determined simply by testing the blood for amyloid matter. Here a simple chemical reaction, under the microscope, settles another important question in positive medicine.

Whenever cholesteræmic states of the blood are present, to any extent, there seems to be much lassitude and depression, which are increased at irregular intervals. These spells are attended often with great sensitiveness and irritability, accompanied by peculiar mental impressions, and sometimes with paroxysms of an epileptic character.

The freshly-drawn blood of such patients is found to contain, in large quantity, the *Z. regularis*, both in the spore and embryonic filament states of development. The *E. hæmactus* is also present in both the spore and filamentous stages of growth.

Whenever amyloid disease of any part of the blood apparatus, or any of the blood glands, is thoroughly established, these vegetations appear in increased quantity.

Abundant crops of the crystalline matter, represented at 18, 14, and 15, are also formed between the slides, with the cholesterine plates. These crystalline forms have a strong affinity for the coloring matter of the blood. This matter is confined to the discs in freshly-drawn healthy blood. It is however found in the serum, in diseased blood where the discs do not hold firmly the coloring matter. It is also found in the serum of healthy blood, after it has stood for from one to three days after being drawn from the body. These are the crystalline matters, which have been studied and described by Funke, Kunde, Lehmann, Parkes, and Sieveking.

CRYPTOGAMIC VEGETATIONS IN BOTH HEALTHY AND DISEASED BLOOD.

There are two species of cryptogams, one fungoid and the other algoid, that are always present in both healthy and diseased blood. The spores, in an inactive state, exist in small quantity in healthy blood, when freshly drawn from the body. These are however few, and difficult always to demonstrate, on account of their great transparency, coupled with the fact that they are covered up and obscured by the blood elements. If the freshly drawn healthy blood however be placed in a clean, glass-stoppered bottle, and allowed to stand for from one to three days at a temperature ranging from 60° to 75° Fahrenheit, and then examined carefully under the microscope, the spores and filaments of the algoid vegetation will invariably be found in abundance, and spores and filaments of the fungoid growth will occur more rarely, but will always be found present.

In certain diseased states, where the vitality is depressed, and the machine in all its parts moving in a slow and labored manner, these vegetations in the filamentous and spore states are both found in the freshly-drawn blood. The algoid vegetation is always very much more abundant than the fungoid. That they produce grave disturbance in debilitated conditions, there can be no doubt.

The following are brief descriptions of these entophytic cryptogams.

Entophyticus hæmactus, (SALISBURY.)

This fungoid vegetation I have not yet developed to the stage of fruiting, and hence I am unable to give it its proper place. It is however very characteristic in the appearance and structure of its filaments. For convenience in designating it, until I am able to see it in fruit, I have given it the name *Entophyticus hæmactus*. The spores of this plant are represented at 16, and the filaments, as they usually appear in the blood, at 7 and 8. The inside tube of the filaments is rather opaque, giving to it a dark shade, and has interruptions of greater or less length, at irregular intervals. The filaments are usually irregularly and quite profusely branched, as represented in the figures.

These filaments are found often in freshly drawn diseased blood, and always in healthy blood after it has been standing in closely stoppered bottles for from one to three days, at a temperature ranging from 60° to 75° Fahrenheit. The spores always occur in an inactive state, sparsely scattered, in freshly drawn healthy blood.

Zymotosis regularis, (SALISBURY.)

This is a minute and most beautiful species of the genus Zymotosis. The spores are very minute, well defined in outline, and uniform in size and shape. They, under the proper conditions, multiply rapidly by duplicative segmentation, and develop into filaments with great rapidity. A single drop of blood may contain thousands of spores and hundreds of embryonic filaments. The filaments are well defined, uniform in diameter, and have cross markings or interruptions in the inside tubular membrane, at regular intervals, from which characteristic it derives its specific name.

At 1, is represented the spores and young filaments of this entophyte; at 2, are seen the embryonic filaments; and at 3, the mature filaments. These are all magnified about 350 diameters.

One peculiarity in the arrangement of the mature filament is, that it often returns on itself, the two portions maintaining in all their meanderings a uniform distance from each other of about the diameter of the filament, giving the space intervening the appearance of the central cavity of a tubular filament of larger growth. A careful examination, however, will always discover the truth. The filaments sometimes are arranged, several of them, side by side, forming regular ribbon-like bands, which cross and recross each other in various directions, producing a quite regular plaid appearance. At other times they are knotted, tangled, and irregularly woven together. This is a beautiful species, and is very characteristic in its appearance, so much so, that it need not be mistaken for any other vegetation.

VEGETATION THAT I HAVE UNIFORMLY MET WITH IN THOSE SUFFERING WITH CARBUNCLES, AND WHICH IS BELIEVED TO BE THE SPECIFIC CAUSE OF THIS DISEASE.

Crypta carbunculata, (SALISBURY.)

There is also an algoid vegetation that occurs in the blood in certain debilitated states of the system. It is however only occasionally met with. This plant is figured at 4, 5, 6. The spores and embryonic filaments are represented at 4 and 5, and the maturer filaments at 6.

I have given the specific name, Carbunculata, to this cryptogam. The uniform adaptation of the inside to the outside membrane of the filament is so characteristic in the mature plant, that there is scarcely ever a cross marking discoverable, unless the plants are partially dried. The embryonic filaments show usually a moniliform structure.

The filaments of this vegetation are about one half greater in diameter than those of the *Z. translucens*, and they run a much more zigzag or tortuous course.* Whenever I have found this plant in the blood, the patients have been afflicted more or less with carbuncles.

I have in several instances, in depressed states of the system, found it accompanying the *Z. regularis*. The fact that it is not always present with the regularis, shows that it has its own peculiar significance, as well as special conditions, under which it alone develops, and is no doubt indicative of certain pathological states of the system and blood.

The fact that wherever I have met with this plant, the patients have been afflicted with carbuncles; and also that the carbuncular sloughs contain the same kind of filaments in large quantity, would seem to point to this entophyte as the specific cause of this peculiar disease. If this should be true, it will explain why it

* Whenever the filaments of the carbunculata are allowed to dry partially between the slides of the microscope, they often show interruptions in the inside tube, as represented at 17. This figure is more highly magnified than those represented at 4, 5, and 6.

is that this affection sometimes seems to be transmitted from one person to another.

CHOLESTERÆMIC STATE OF, AND ALGOID VEGETATION IN THE FRESHLY DRAWN BLOOD OF THE HORSE, IN WHAT APPEARS TO BE A PECULIAR FATAL FORM OF REMITTENT FEVER IN THIS ANIMAL.

Zymotosis escularis, (SALISBURY.)

This is a vegetation found in the freshly drawn blood of the horse, in a peculiar fatal disease, affecting them in Cleveland and vicinity during the months of August and September, 1867. This plant in its various stages of growth is represented at 9, 10, 11.

The horses are taken suddenly with an uneasiness, which they manifest by pawing, lying down and getting up, and stepping about in a manner that indicates pain. Soon they break out in a profuse perspiration, which is followed by the appearance of very great shrinkage in bulk and condition. The skin is hot and feverish; the pulse somewhat rapid and intermittent; the mucous membrane rather dry; the breathing short and hurried, and the bowels so terribly constipated that it is almost impossible to procure a movement. During the day they seem to be easier than during the night. The exacerbations appear to come on about 7 o'clock p. m., and leave early in the morning. The remissions occur during the day. The disease rapidly prostrates, the breathing becomes more short and hurried, and death takes place usually from the second to the fourth or fifth day. If they survive beyond this period, there is hope of recovery. The horses are sensible to the last, and endeavor in the later stages to maintain an erect position till they fall from exhaustion, when they quickly expire.

Toward the last the extremities and nose become cold, the pulse slow and intermittent, and the breathing very short and hurried. The urine is scanty and high colored, and generally voided frequently.

On post-mortem, the lungs and heart are found healthy, the spleen and liver somewhat engorged, and usually impacted food and fæces are found in stomach and bowels. Bowels and stomach sometimes congested and slightly inflamed, but no organic lesions that are sufficient to cause any grave trouble.

Blood appears to be in much smaller quantity than normal. It contains the algoid vegetation represented at 9, 10, 11, to which I have given the name *Zymotosis escularis.*

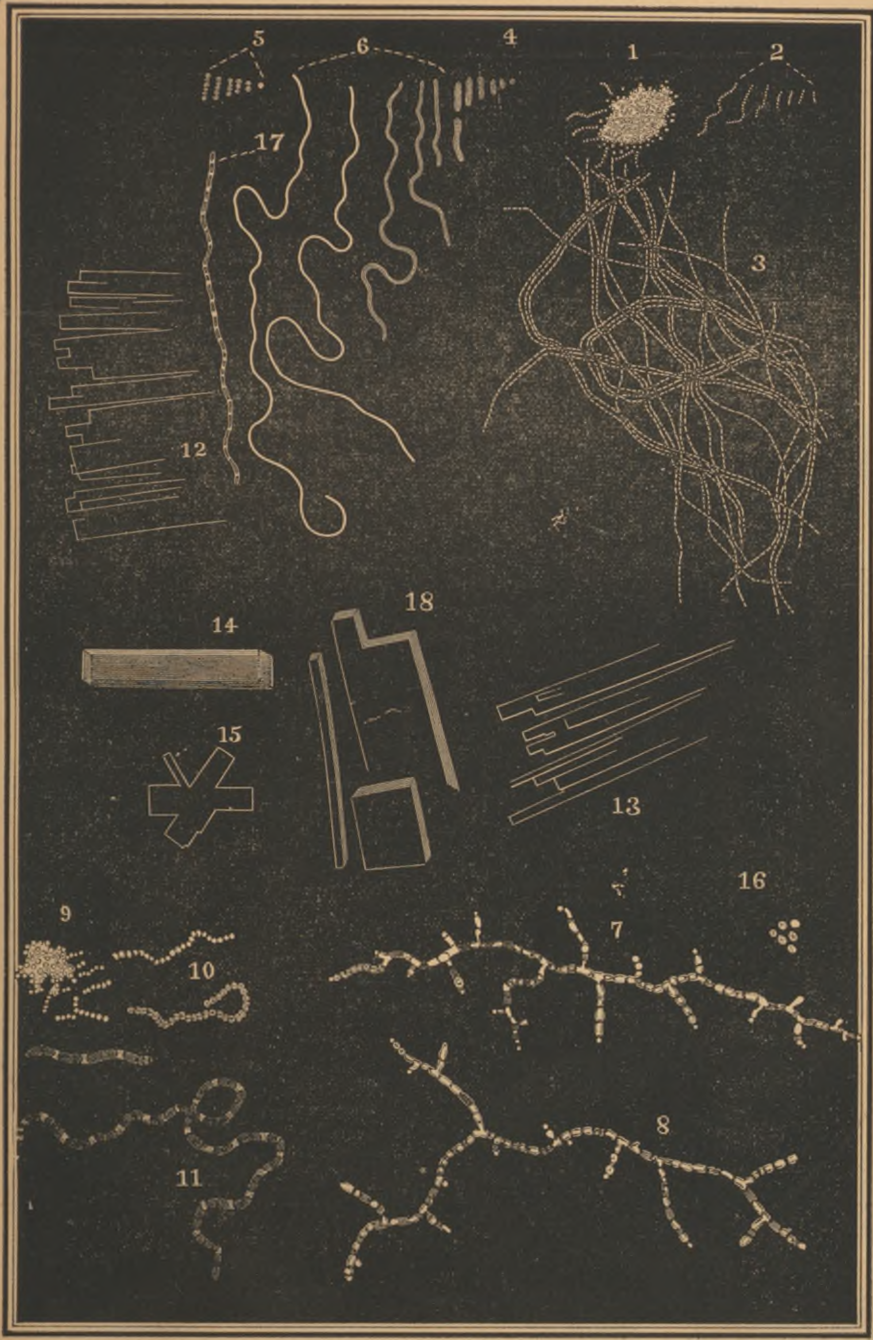
9 represents the spores, which are disseminated throughout the blood, singly and in groups.

10 represents the embryonic filaments, which are often moniliform in structure.

11 represents a filament further advanced in development.

This vegetation occurs in the freshly drawn blood. The filaments, in their early stages of development, are mostly moniliform in structure, as represented at 10. The more mature filaments have the outside tube continuous and uniform in diameter, while the inside membrane has not only interruptions at irregular intervals, but the interruptions are of variable length. Where the inside membrane occurs it affords a double wall to the tube and communicates greater opacity than have the intervening spaces. The filaments of this plant have about three times the diameter of the *Z. regularis*, represented at 3.

13 represents crystals of cholesterine, which form between the slides of the microscope, soon after the blood is drawn and placed between them. This shows the blood in this disease to be cholesteræmic.



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Vegetation of Variola.

DESCRIPTION OF A NEW VEGETATION,

HAVING FUNGOID AND ALGOID PHASES OF GROWTH; FOUND IN THE BLOOD AND ERUPTIONS OF

VARIOLA AND VACCINA,

AND WHICH APPEARS TO BE THE SPECIFIC CAUSE OF THESE DISEASES.

In 1862, I first commenced the study of the vegetation which appears to be the specific cause of small pox. Since that time I have taken advantage of every opportunity offered by the disease, to work up the various forms and phases of this entophytal cryptogam. It presented such different appearances, under different conditions, that it was not till within the last twelve months that I began to see clearly the place and significance of its various forms and phases of development. This paper is a brief summary of the results arrived at in this tedious and interesting labor.

Ios variolosa vacciola, (Salisbury.)

This is the plant which appears to be the specific cause of small pox. It is met with largely in the eruption of this disease, both in its spore and filamentous stages of growth. The spores are also found in the blood. It belongs to the mucedinous fungi. The spores are of two kinds, spores and zoospores. The spores (1, 2) develop into filaments, (3, 5, 6, 7, 8,) which when mature, constitute the perfect plant, that bears both kinds of spores (9, 10). The zoospores do not develop into filaments, but gradually expand and become filled with granules, (14, 15,) and finally these granules grow to be about $\frac{1}{4}$ or $\frac{1}{5}$ the size of a perfect spore. 1 represents a perfect spore, and 11 the granules from the mature zoospores. These granules from the zoospores we shall call algoid cells or spores, from the fact that they multiply by duplicative segmentation and develop into filaments under the proper conditions, precisely like the minute algæ, (20, 21, 22, 23, 24, 25;) this plant having both fungoid and algoid phases of development. The zoospores, when mature, are from the same to six times the diameter of the perfect spore, (14, 15, 18, 19.) Each contains a great number of algoid cells, or cells that comport themselves precisely like the spores of the minute entophytal algæ. When the zoospores are fully matured, they rupture, and the spores escape either *en masse*, or in a more or less gradual and scattered manner, (16, 17.) These minute cells occur in vast numbers in the eruption of small pox. Both the algoid sporules and the perfect spore multiply rapidly by duplicative segmentation.

I have given to the entire plant in all its phases of growth the name *Ios variolosa vacciola;* to the fungoid phase, *I. variolosa;* and to the algoid phase, *I. vacciola.* I have given these names to the two different phases of this vegetation, for reasons which will hereafter appear.

In small pox, this vegetation develops in all its phases. If the vegetation of a small pox pustule be inoculated into a person who has never had variola, the same contagious disease, in a modified form, and the same vegetation, is produced. This vegetation is the *Ios variolosa vacciola.* If, however, the matter of small pox be inoculated into the cow, a pustular disease is produced resembling that of variola, but the eruption will only be found to contain the algoid stage of the vegetation, on which account we have given to this stage of its development the name *Ios vacciola.* The fungoid phase of the plant is not produced in the cow.

If now we take the matter from the pustule of cow pox and inoculate it into the human subject, we produce a pustule like that of vaccina and variola, but it contains the stage of the vegetation only that is found in the cow pox sore.

Another interesting fact is noticed, namely, that the vaccine pustule does not transmit the disease from one person to another, except by inoculation. The vegetation in this stage seems to have no, or at least but little, power to penetrate the epithelial envelope that invests the body inside and out. The other form of the vegetation, however, which is developed in small pox, acts as an active contagion, and when the spores fall upon epithelial surfaces that have not had the impress of immunity stamped upon them by a previous invasion, they penetrate to the deeper tissues, and pervade the entire organism, the result of which is the pustular eruption called small pox.

These facts are extremely interesting, throwing a flood of light upon some singular features of the disease.

That the plant in its perfect state does not develop in the cow, while the algoid phase of growth finds in this animal a fertile soil, is highly instructive and significant, and may lead to interesting and valuable results in obtaining matter in other contagious and infectious diseases, that may impart without danger an impress of immunity by inoculation.

This whole field is one of the greatest possible interest, and is full of rich rewards for the patient and careful student.

The spores and filaments of the *Leptothrix buccalis* that develop in and on the epithelium of the tongue, and in and on the bronchial epithelium, in lung diseases, appear to be but the algoid phase of development of a species of fungus that finds a fertile nidus in the fermenting and vitiated condition of these surfaces. The algoid stage only of the plant is clearly determinable till the proper conditions arise in the later stages of disease, for the development of the fungoid phase, when the algoid spores are seen to grow and gradually take on the fungoid type, and finally to develop into branching mycelium.

The *Sphærotheca persica*, (Salisbury,) which causes the blister and curl in peach leaves and decay in the peach fruit, produces two kinds of spores and filaments. The perfect fungoid spore and filament are produced, in this climate, from about the 10th of May to the 15th of

June. During this period, the fungus is furnished abundant nourishment from the young, tender, and vigorously growing leaves and young twigs to which it is mainly confined, and the threads are mostly fertile, producing enormous numbers of sporidia. From the 15th of June to the 1st of September, the fertile threads are constantly decreasing and the sterile threads appear, taking their place. These sterile threads or filaments are longer and much more slender than the fertile ones, and are not moniliform. They resemble algoid filaments, and represent the sterile or algoid phase of development in this plant. From the 15th of June to the 1st of September may be denominated the period of sterile development in this fungus. The sterile or algoid growth begins as soon as the tissues of the leaves and twigs become so firm, and scant in nutritious juices, as to afford but imperfect nourishment to this parasite. The sterile growth exhausts the peach plant very much less than the fertile, or period of reproductive growth, which precedes it.

The fertile and sterile stages of development of the *S. persica* correspond to the fungoid and algoid phases of growth in the variola vegetation. Both the fertile and sterile (fungoid and algoid) phases, are produced in small pox; but in the cow, only the sterile vegetation thrives, on account of the tissues and fluids of this animal affording but a poor or imperfect soil for this entophyte.

All the mucedinous fungi, when developing under the proper conditions, seem to produce the two kinds of spores here described. These two forms may be beautifully studied in the yeast plant of fermenting milk. In this case the two kinds of spores are denominated spores and zoospores, or inactive and active spores. The inactive spores are those which develop into fungoid filaments, producing the perfect plant. The zoospores, during their organizing period, are moving in all directions. They have two motions, which go on at the same time, one a progressive zigzag movement, and the other a rotary at right angles to the progressive. During this compound movement, they organize and void at their posterior extremity, minute oblong cells, which have the appearance of minute algoid spores, in the manner in which they afterward arrange and comport themselves. After the zoospore has completed its organizing functions, it becomes quiet, shrinks gradually, dies, disintegrates, and disappears.

The zoospores of the milk fungus correspond to the algoid stage of the variola vegetation which we find in cow pox and in the vaccine pustule, and which we have designated as the *Ios vacciola*.

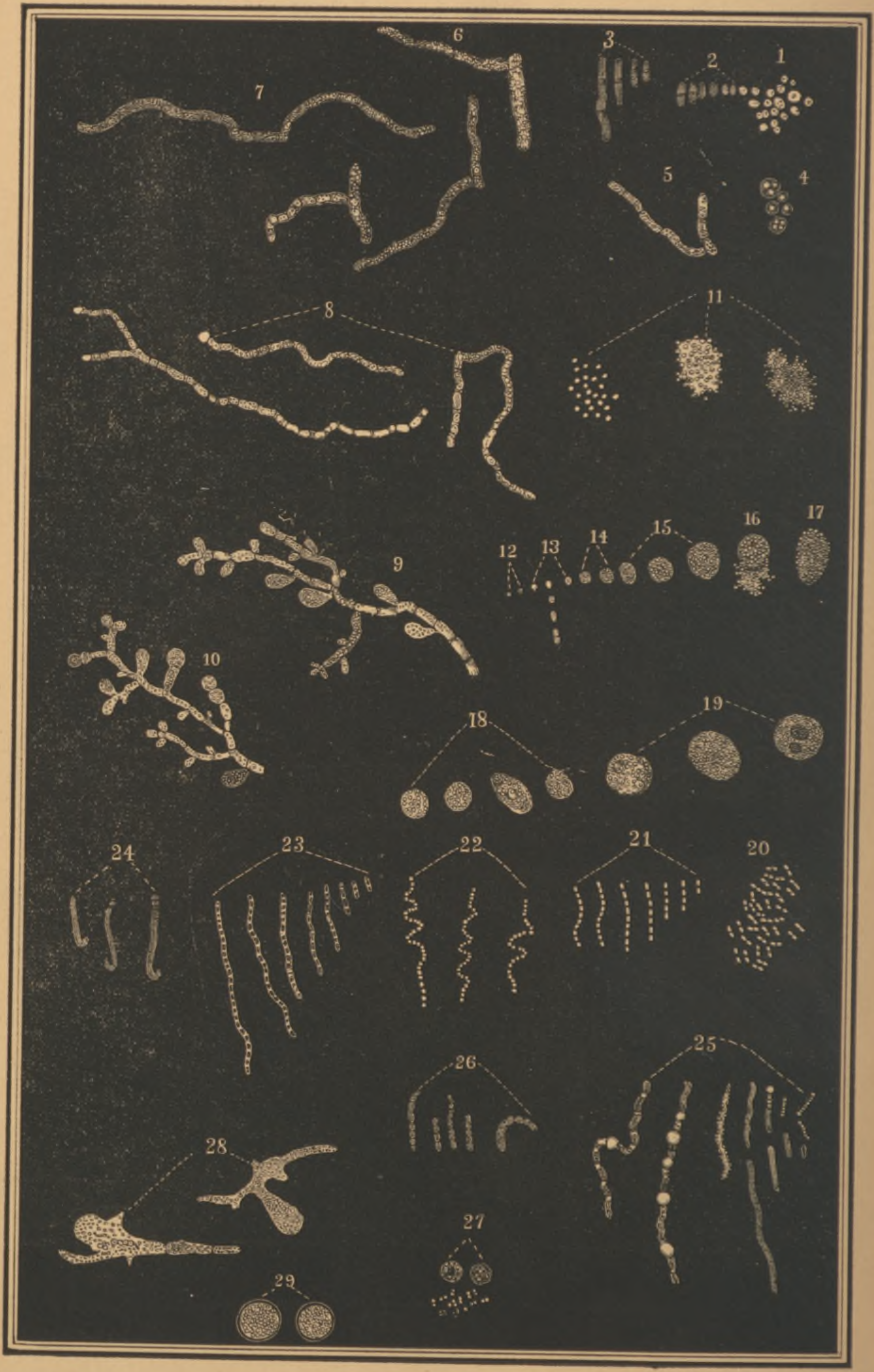
This peculiar variation or phase in the development of mucedinous cryptogams, may be denominated the *algoid*, to distinguish it from the fungoid phase or the perfect plant. It is very probable that under the proper conditions, most or all mucedinous growths have their algoid and fungoid phases. The algoid or minute spores develop into filaments (20, 21, 22, 23, 24, 25, 26) which have the peculiarities of algoid filaments in their structure and mode of growth. If this be as true as it now appears, it is highly probable that very many of the minute entophytal algæ are but special phases of development of parasitic mucedinous fungi. This is a field of labor where explorations have to be conducted with the greatest possible persistence and caution, or errors will everywhere creep in and links be lost in the chain of inquiry.

The cow pox is no more contagious than the vaccine pustule on the human subject. Both are only transmitted by inoculation. It is very doubtful whether the disease could be transmitted to the milkman or milkmaid, unless there were some abrasions through which the virus could reach the red and white blood apparatus and connective tissue. This is very fortunate, for otherwise we should often take the disease from the cow, as it no doubt is contracted by this animal from some of the fermenting matters of the barnyard.

It is also fortunate that when the matter of cow pox is transmitted to the human subject, it becomes a disease that is not transmissible from one to another except by direct inoculation.

The specific poison of vaccina does not seem to possess the power of passing through the epithelial envelope of the human body. If, however, we should take the disease from the same fermenting matters that give it often to the cow, no doubt it would be genuine small pox, a highly contagious disease, and would be readily transmissible from one to another, as this vegetation finds a rich soil in the human body for producing it in all its various phases of growth.

Quite a number of different figures are given of the fungoid and algoid filaments and zoospores, in order to give an idea of the various appearances they present in different cases and under different conditions. These figures will all be of service to those who are making microscopic examinations of the variola poison. These figures are briefly described in the following description of the plate.



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DESCRIPTION OF PLATE.

1. Spores of the Ios variolosa.
2. Spores of the Ios variolosa beginning to elongate.
3. Embryonic filaments of same.
4. Spores of the I. variolosa developing in pus cells.
5. Filament of I. variolosa, in its early stage of growth, sending off a branch.
6. A filament of same, with a branch, but presenting scarcely any appearance of cross markings.
7. Filaments of same, sending off branches, and presenting in internal structure, a somewhat different appearance from 5 or 6.
8. Filaments of I. variolosa, presenting a still different appearance from 5, 6, or 7.

9 and 10. The Ios variolosa in fruit. This stage of the plant is seldom met with. This is the most perfect appearance of fruiting that I have yet seen in all my examinations.

11. Spores of the Ios vacciola; or spores of the algoid phase of development of the small pox vegetation (Ios variolosa vacciola.) These are the spores of the vegetation of the cow pox and vaccine pustules. They occur in multitudes in the pustules of variola and vaccina.
12. The spores 11, or those from which the algoid filaments (20, 21, 22, 23, 24, 25) are developed.
13. The spores of the I. variolosa (1) or those which develop the fungoid filaments 5, 6, 7, 8, 9.
14. Zoospores, or those spores that grow into spore cases, inclosing the spores 11.
15. Mature zoospores, filled with the algoid spores 11. The spores 11 are also often found developing in epithelial and pus cells.
16. Spores escaping from a mature zoospore.
17. A group of algoid spores that have escaped *en masse* from a zoospore. Spores of the I. vacciola.

18 and 19. Mature zoospores of different shapes, that occur in the pustules of small pox and vaccina.

20. Algoid spores (11) multiplying by duplicative segmentation, and forming embryonic filaments.
21. Embryonic filaments of the I. vacciola, that present a moniliform structure.
22. Embryonic moniliform filaments of same, showing a tendency to run a spiral course, which is often seen.
23. Embryonic filaments of the I. vacciola, presenting less of the

moniliform appearance than 21 and 22. This form of the filament is frequently met with.

24. Filaments of the same vegetation presenting a more homogeneous structure, with usually a hooked extremity. This form is occasionally met with in the eruptions of small pox and vaccina.
25. This is the appearance of the filaments of the I. vacciola often in vaccine scabs, some little time after their removal. To have them show well the scabs should be dissolved in pure water and allowed to stand a short time, in order to allow the dried vegetation to expand by absorbing moisture.
26. This form of filament is also met with in the scabs.
27. Algoid spores (11) developing in pus cells.
28. Peculiar branched cells, that are occasionally met with in the eruptions of small pox and vaccina, and which resemble cancer cells.
29. Sporangia found occasionally in the fresh scabs of variola and vaccina. These are believed to be spore cases of the *Ios vacciola*. The minute spores inside are usually in active motion.

Vegetation in Typhoid Fever.

VEGETATION IN TYPHOID FEVER,

WHICH APPEARS TO BE THE SPECIFIC CAUSE OF THE DISEASE; WITH SOME GENERAL REMARKS ON THE TREATMENT OF

TYPHOID, INTERMITTENT, AND REMITTENT FEVERS.

In the course of the investigations connected with intermittent and remittent fevers, in 1863, I discovered a peculiar minute algoid vegetation, developing in and on the human body in typhoid fever. The first discovery was made in a highly malarious district, in a family all the members of which had, during the summer months, been affected with intermittent fever. During the early part of September, the husband and father was taken down with typhoid fever. The wife, who was constantly over the patient, in about two weeks was taken down with the same disease.

It was in these patients that I first discovered the vegetation. I found the spores developing in profusion over the whole body, inside and out.

Since that time I have seized upon every opportunity to work up the various stages in the growth of this plant.

It develops upon all the epidermic and mucous surfaces, extending from cell to cell, reaching the deepest part of the follicles and more complicated glands.

It penetrates the basement membrane, and extends to all portions of the blood apparatus and blood glands, and especially flourishes with great luxuriance in the agminated and solitary glandules of Peyer.

I have given to this vegetation the name *Biolysis typhoides*, (Salisbury.) It seems to grow only on and in animal matters. It so poisons the epithelial cells, in and on which it develops, that they eat, digest, assimilate, organize, and eliminate but imperfectly. In fact, these processes are so far checked, that the cells cease almost entirely to eliminate fluids, in consequence of which the surfaces become dry, hot, and parched, allowing nothing to escape save the gaseous products of decomposition. In this condition the system becomes surcharged with disintegrating, fermenting, and decaying animal matters, which seem for a time at least to increase the fertility of a soil already producing a prolific crop of vegetation. This process goes on till the organism finally becomes so poisoned and vitiated, that it seems to be no longer able to propagate the vegetation that has been the specific cause of all the trouble. A change now takes place in the condition of the epithelial surfaces and glands which is favorable to recovery, if the local lesions are not too great and the powers of life too far spent.

During the incubative stage, previous to the ushering in of the disease by the algoid and febrile paroxysms, the skin and mucous membranes are found to be covered more or less with the spores of the *B. typhoides* (1, 2, 3.) The algid paroxysm, terminating the incubative stage, is indicative of the vegetation having reached the more vital and highly animalized elements. During the period of high febrile excitement the vegetation multiplies with great rapidity, penetrating to every tissue of the organism.

The tendency to periodicity in all febrile diseases probably marks the periods of the successive crops of vegetation.

The spores multiply by duplicative segmentation (3,) and develop rapidly on and in the cells of the epidermic and mucous surfaces (2.) The filaments (10, 11) and spores (1, 5) are found developing in the glands of the red and white blood apparatus, and the spores are frequently met with in the blood, developing in the colorless corpuscles, (4, 6, 8, 7) destroying their contents and dilating their walls, so that the cells are often from two to four times the size of a normal colorless corpuscle (4, 6, 7, 8.) Especially is this vegetation found developing in Peyer's glands.

Since the discovery of the vegetations in febrile diseases, I have changed my treatment of these maladies materially and with marked benefit.

In intermittent, remittent, and typhoid fevers, I order the patients bathed thoroughly, morning and evening, with either sulphuric acid, a solution of bisulphites, chlorine water, or nitromuriatic acid. Of these I usually prefer the former. Sometimes a change from one to the other of these baths, from day to day, is found beneficial. I usually add to the baths a portion of quinia, on account of its fine tonic effects upon the skin and its marked tendency to check cryptogamic development.

For cheapness and convenience I have adopted the following formulæ and plan of bathing.

R. Acid sulphuric aromat., ℥iv ; Aquæ, ℥iv; quiniæ sulphate, ʒiij. S. Put a tablespoonful in half a pint of warm water, and wash the body and limbs all over thoroughly, morning and evening, and wipe dry after.

Or

R. Potass. chlorate, gr.xij ; Acid hydrochloric, ʒj ; quiniæ sulphate, ʒj ; Aquæ, ℥xv. M., adding the water, ounce by ounce, to the other ingredients in a pint bottle, shaking after the addition of each ounce. S. Put four ounces of this mixture with four ounces of warm water, and wash the body and limbs all over thoroughly, morning and evening, and wipe dry.

Or

R. Nichols's solution of bisulphite soda, ℥viij ; quiniæ sulph., ʒiss. M. S. Put two tablespoonfuls in half a pint of warm water, and bathe morning and evening as before mentioned.

Or

R. Acid nitromuriatic dil., ℥iij ; quiniæ sulph., ʒij. M. S. Put two teaspoonfuls in half a pint of warm water, and bathe thoroughly night and morning.

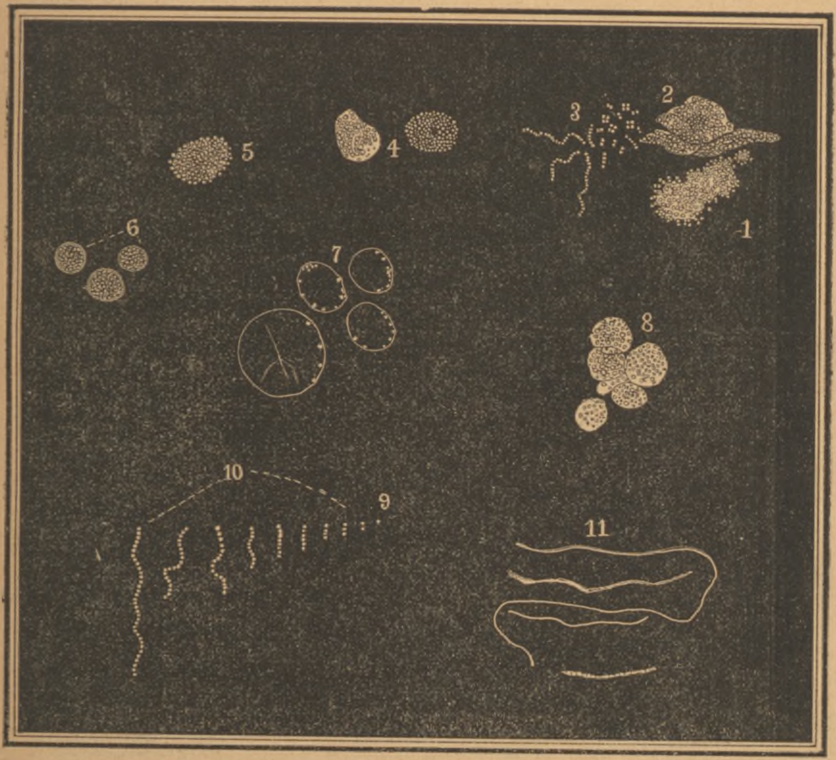
The object of the baths is to destroy the vegetation developing in and on the surface epithelium. Just in the proportion as this vegetation is destroyed, the patient brightens up, and the skin becomes soft, moist, and natural in feel, and the disease abates. As the skin improves, the mucous membranes, under the influence of similar internal remedies, take on a healthier and more natural appearance, the tongue becomes moist and clean, and the whole organism from hour to hour puts on more and more the vigor, glow, and suppleness of the physiological state.

The internal treatment is directed so as to check zymotic development as rapidly as possible. Quiniæ is invaluable. The bisulphites, chlorine water, tr. ferri chlorid., lactate of iron, strychnine, and the mineral acids are all highly useful.

A plenty of beef tea, and milk warm from the cow, aid much in the treatment. The clothing and bedding should be changed morning and evening, and the room should be well and constantly ventilated. By following out this plan the dangers and lingering sufferings may be much lessened, and these febrile diseases materially shortened in their course.

DESCRIPTIONS OF ILLUSTRATIONS.

1. Spores of the Biolysis typhoides, as they appear upon and in the epithelial cells of the epidermic and mucous surfaces in typhoid fever.
2. Epithelial cells filled with spores of the B. typhoides. These cells were scraped from the epidermis during the active stage of the disease. The cells of the epidermis and mucous surfaces are filled with these spores during the entire course of the fever.
3. Spores of the B. typhoides multiplying by duplicative segmentation. At the right are represented embryonic filaments.
4. Colorless corpuscles in the blood of typhoid fever expanded about four times their usual diameter, with their normal contents destroyed by the spores of the B. typhoides, which now fill the distended cells. These spore sacs are frequently met with in the blood of this disease.
5. Mass of spores of the B. typhoides from the blood of typhoid fever.
6. Colorless corpuscles of the blood in typhoid fever, with their normal contents destroyed and their place occupied by the spores of the B. typhoides.
7. Distended colorless corpuscles that have been filled with the spores of the B. typhoides, and which spores have escaped, leaving almost empty sacs. These empty sacs are quite abundant in the blood of typhoid fever.
8. Distended colorless corpuscles of typhoid fever filled with the spores of the B. typhoides.
9. Spore of the B. typhoides.
10. Embryonic filaments of the B. typhoides in various stages of development, that occur in the secretions, excretions, and glands of typhoid fever patients. These filaments in their earlier stages of growth are mostly moniliform.
11. One form of mature filaments of the B. typhoides which presents a quite homogeneous appearance throughout its entire length. Other filaments have cross markings at tolerably regular intervals. These are met with in the fæcal and urinary discharges in the later stages, and in the blood and glands after death.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