THE MICROSCOPE

IN

GYNÆCOLOGY.

BY

A. MEAD EDWARDS, M. D.,

NEWARK, N. J.

Extracted from the Transactions of the Medical Society of New Jersey.

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When the various and continually multiplying applications of the modern compound achromatic microscope, in its present almost perfected condition, to the various branches of biology are taken into consideration, it becomes a matter of some surprise that the practitioner of medicine has not more frequently availed himself of the assistance of that important instrument of research, in augmenting the limited powers with which he has been gifted, and thereby enabling him the more certainly to arrive at correct diagnoses in cases of disease. We ought hardly, however, to wonder that the already overburdened busy man of practice cannot steal a few more hours from his time of necessary rest, to look still deeper into the tissues of his patients. But there are always men, and they are perhaps to be found amongst the specialists, who do have the time to devote to researches of a scientific character. Many of these, doubtless, lack the desire or ability to use an instrument, such as the microscope, which requires for its intelligent employment a long period of schooling, of a severe and thorough description. To those who have not used its searching eye to assist and guide the labors of the mind, the microscope appears to be, doubtless, either a mere plaything, or, at best, an instrument the use of which is as easy as seeing with the eyes alone. To such the microscopist seems little better than an idler, or, even worse, a wild enthusiast. But they forget how many years it took them to learn to see as well as they can with their unassisted eyes; how many still longer years were required before they could interpret what they saw and thought they could comprehend. The manifold difficulties attendant upon microscopic research, are not known to such persons, and can only be appreciated from experience. It would be out of place to dwell upon them at the present time; but it will be my endeavor to call attention to a field of research which has been but little cultivated, but which would yield to the earnest student ample returns of interest and profit. The application of the microscope to practical medicine has been fully recognized by a few men, and treatises in English, German and French are to be found which treat more or less completely of the subject; but its use, as specially applied to Gynæcology, has not, as yet, been sufficiently set forth, although Gynæcology itself is rapidly becoming, if it has not already become, a science. There-

fore, it is my intention, in this paper, to present some suggestions pointing in the direction in which, I am of opinion, this means of physical research might be applied to investigations in this branch of medicine. Every day, more and more, the profession are coming to recognize and depend upon physical methods as applied to diagnosis. Instrumental observation and registration are so sure and reliable, so exact and ready, that the errors arising from the personal equation are almost, if not entirely, in many cases removed. The Stethoscope occupies a well-deserved position in the practitioner's tool-chest; the Thermometer is now loudly asserting its rights to recognition as an indispensable adjunct at the bed-side, and the Test-tube and Hydrometer have long since found a home on the office-table. Why, then, should not the more delicate, exact, and therefore valuable Microscope be more often appealed to for assistance in unravelling knotty points in pathology? It has been more for the purpose of claiming the right of the microscope to be called upon to do its part in scientific diagnosis, than to show what it has already done for medicine, that this paper has been written. Therefore it will necessarily be to a very great extent of a sketchy character, and, as I have just said, suggestive even if it does not convey any very valuable information to the readers.

Although the list of Gynæcologists is a long one, and many eminent names adorn it, yet those who have employed the microscope to assist them in their investigations are very few. Thus we find the names of Donné, Tyler, Smith, Köllicker and Scanzoni, Sims, Eichwald, Drysdale, Waldeyer and Martin as among the most prominent who have written much on the subject; whilst a few others have contributed scattered papers to the journals on matters relating to it. I shall make no attempt herein to review all that has been done by the investigators just enumerated, but shall merely allude to some of their discoveries, whilst I point out the direction in which I consider that future studies should be pushed. At the same time, I shall briefly describe a few observations of my own, illustrating them by means of drawings from nature made by means of the microscope. These are but samples of many, which I have made from time to time, and the results have been so promising that it is my intention to follow them up, as time and opportunity offers; at the same time, I would ask those who have the opportunity of so doing to follow out the hints I shall give, and see if the microscope, truthfully and conscientiously employed, will not yield fruit as profitable as that bestowed by the other instruments of physical research used by the practitioner of medicine.

At the outset, and before going any farther, I wish it to be distinctly under-

stood that I merely claim for the microscope the position of an assistant—a valuable and trustworthy assistant in diagnosis. That it is always reliable, I claim, as reliable in its place as the thermometer in its position; no more so. The careless observer, using the thermometer, may make absurd diagnoses; the unlearned owner of a microscope may easily do more. It is true that many accomplished diagnosticians do not depend upon any instruments of physical research to aid them in making their examinations. With them the practiced ear does not require the stethoscope; the sensitive finger can almost dispense with the thermometer; but no human eye, however practiced or sensitive, can unaided see what the microscope reveals. There are those who think that the microscope is not reliable, and point to the confused history of cancer-cells in justification of their doubts. But it must be remembered that in such cases it is not the instrument, but the observer that we are trusting, and it will be well, also, not to forget that the instrument does not see, but the eye which is behind it; that the instrument cannot misinterpret, but the uninformed user of it may do so. Therefore, if at any time erroneous deductions have been drawn from observations made by means of the microscope, the instrument should not be held responsible therefor, but they should rather be set down to the credit of the careless or unpracticed observer who employs it. Microscopists are plentiful, but students are rare; and to use the microscope intelligently requires that its possessor should be both an earnest and patient student.

To illustrate what I have to say, I shall, as I have already remarked, in the first place detail a few original observations which I have made, and which, although they may at first sight not appear to point to very immediate practical results in either pathology or therapeutics, yet to the scientific student of medicine they will, I trust, prove of interest as throwing some light upon the etiology of certain conditions of a portion of the human mucous-membrane. My attention was first called to this subject some few years since, when I was making a series of experiments connected with the life history of certain minute forms of vegetables belonging to the group Fungi, and which experiments I had undertaken in the expectation that they would assist in unravelling a few knotty points bearing upon the so-called spontaneous generation theory. And although it would perhaps be thought that this same spontaneous generation theory can have very little to do with practical medicine, yet when it is applied to the beginning of pathological conditions affecting the human economy and the origin of disease, spontaneous or otherwise, be looked for, it at once becomes interesting and extremely important to the working practitioner. To this end I shall

enumerate one or two cases in which I employed the microscope in the examination of discharges from the vaginal mucous-membrane of patients under treatment at that time; and, after pointing out what I found therein of interest, I shall briefly allude to the observations of others in this field. Thereafter, and in conclusion, I shall indicate the direction in which it appears to me that further observations of this character should be made.

The first case is that of a young married woman, afflicted apparently with no more serious disease than simple coryza. "A cold" having been caught, nothing was done for it, and seemingly it had passed off, without leaving any bad effects. This lady had always been remarkably healthy, and not subject to abnormal discharges of any kind from her genitals. When, therefore, she found that after the cold in the head had passed off, and the coryza of the catarrhal mucous-membrane had ceased, a discharge was occurring from the vagina, she became alarmed and applied for advice, fearing that something serious was the matter with her. I made a vaginal examination to see if there was any serious cause for alarm, and more for the purpose of allaying her anxiety, when I found that the leucorrhœa was, as I had supposed, mostly vaginal, but to a certain extent uterine likewise. This uterine leucorrhœa, as is usually the case, passing over the congested mucous-membrane of the lip of the os externum, had produced one or two slight so-called "ulcerations." For be it remembered that this uterine leucorrhœal discharge, more especially when it is for the most cervical, is with certain constitutions of a particularly icchorous character; so much so that when coming in contact with a membrane of the nature of that covering the lips of the uterus, it will abrade and remove the epithelium to a very great extent, and produce the condition known to the older practitioners as "ulceration." In persons of this type, a discharge from the nasal mucous membrane will in like manner produce similar abrasions of the cuticle, below the nostrils and covering the upper lip. To treat the ulcerations upon the uterine mouth alone, would be unscientific, and as unsatisfactory as to treat the solution of continuity found upon the face; and to cure either condition we must go to the root of the evil, and finding that, treat it.

It is not my intention, at the present time, to say anything in connection with the treatment of conditions, such as I found in this patient, as it is only my desire to detail what a microscopic observation revealed in the discharge itself. When examined by means of a sufficiently high power, it was found to present the appearance I have depicted in the first of the plates accompanying this paper. And here let me say how much I regret that I have been unable, as yet, to preserve specimens of vaginal discharges,

so as to be able to exhibit them at any length of time after they have been obtained. I do not, however, despair of succeeding in so doing, and am at present engaged in experimenting on this subject. In the drawing I have represented the squamous vaginal epithelial scales with their nuclei and nucleoli. I adopt these terms nucleus and nucleolus provisionally, as making the matter understandable to those who are not informed with regard to the later revelations of microscopic histology, as bearing upon the cell theory of the older observers, whilst at the same time I recognize the fact that our knowledge on this point is, at the present time, most markedly in a transition state, so much so that it becomes extremely difficult for a writer to express himself at the same time clearly and truthfully, without going into what would prove tedious details. In the plate will be seen certain fine filaments. These are of a mycelial character, resembling very closely what C. Robin has figured in his Histoire Naturelle des Végétaux Parasites (Planche I., Fig. 1 et 2) as *Leptothrix buccalis*. In fact, leaving out what he calls "globules purulents (globules muqueux)" and the curious organism to be presently described; my second plate which shows this organism more plainly and represents a specimen obtained at a later period from the same patient, and his fig. 1, are almost identical in appearance. This specimen was taken from the surface of the tongue and contains the squamous epithelium found there, and which is the same in all particulars as that occurring in the vagina along with the *Leptothrix* filaments and granular matter. As it may, at first sight, appear strange that we should find the same organism, namely, the *Leptothrix* in the mouth and in the vagina, it may be of interest to say something on this point at the present time. Al. Donné, in his Cours de Microscopie, 1844, when describing vaginal mucus, says thai under certain circumstances this secretion becomes so modified as to have disseminated amongst its epithelial scales, or "epidermic vesicles," as he calls them, numerous delicate filaments whose origin or meaning he is at loss to account for. The figure he gives in his Atlas of these organisms, is extremely crude, and by no means to be compared to that of Robin, just mentioned. In 1843, Kützing founded the genus *Leptothrix* with a large number of species; one of which, namely, *L. buccalis*, was founded by Ch. Robin in his Histoire Naturelle des Végétaux Parasites, 1853, page 345. He mentions it as being found upon the surface of the tongue, in the matter which accumulates between the teeth, or in the cavities of decayed teeth, from whence it passes into the liquids of the stomach and intestines, and makes its appearance in the dejections of diarrhœa. This plant was seen long before Robin's time, but he was the first one to make a scientific study of it and name it. He

nowhere mentions having found it in the mucous of the genital organs; but the form mentioned and figured by Donné is, without doubt, the same plant which I have found in that locality. Robin says that along with the filaments of *Leptothrix*, he always found *Vibrions* belonging to various species. This point it is important to bear in mind, as I intend to show presently the relation existing between the filaments and the *Vibrions*.

The most remarkable constituent of this particular specimen of lucorrhœal discharge was an organism which was in this particular specimen rather rare. I at once perceived that it was a member of the heterogenous group termed "Infusoria," and which contains both animals and plants, as well as things which are neither one nor the other. It is, in fact, the *Trico-monas vaginale* of Donné, which he first described and figured in 1837, in his "Recherches Microscopiques sur la nature des Mucus et la matiére des divers écoulemens des organes genito-urinaires." Since this time the orthography of the name of this creature has been remodelled so that we now know it as *Trichomonas Vaginalis*. The individuals I saw in this specimen were extremely lively in their motions, so much so that my attention was immediately attracted by them, and I was at once able to identify them as the organisms first seen by Donné, although I had never seen them before. Of course, I was naturally anxious to learn what their presence indicated. Donné, when he first saw them, did not believe them to be indicative of any pathological condition of the parts whereupon they were found, although later writers have fallen into the error of supposing that he considered them to be present only during disease. This mistake has, doubtless, arisen from Küchenmeister having stated in his Manual of Animal and Vegetable Parasites, (Eng. Ed., 1857, Vol. I., page 7,) that it "only occurs in women with gonorrhœal discharge, or with anabundant vaginal secretion mixed with mucous and pus-corpuscles; never in a normal and healthy secretion, but only in pathological secretions." Beale, who is singularly careless in his quotations, says (Kidney Diseases, 3d Ed., 1869, page 326), "it was found in the urine of females suffering from leucorrhœa," and he goes on to say that "they are probably ordinary monads, or pus-corpuscles with a projecting filament. I have met with both, but have never seen anything exactly resembling the figures of the so-called Trichomonas vaginæ." (It will be noticed that Donné does not call them "*Vaginæ*," but "*Vagin ale*." Now what Donné really does say (Cours de Microscopie, 1844, page 157) is that he found this creature "in the vaginal mucous of certain women, affected with a discharge sometimes of a suspicious character, sometimes resulting from want of cleanliness of the genitals." The fact would

seem to be that the *Trichomonas vaginalis* is the result of the retention of an abundant mucous discharge within the vaginal canal; for I shall show, farther on, that they may, at least, multiply outside the human body. As to how they originate in the vaginal mucous, either by "spontaneous generation" or otherwise, I leave for future investigation to decide.

As I have quoted Donné, an author whose investigations are, I think, insufficiently known or appreciated, it may be of interest to say that his inaugural thesis was on "Physiological and Chemico-Microscopical Researches on the Blood Globules, Pus, Mucus, and the Humors of the Eye," and that in it he makes the following remark: "The globules which are found in mucus or rather in saliva, have the same aspect as the last mentioned (pus globules), and I consider that they have the same origin." This was in 1831, and it is of interest, when considered in connection with the later observations of Waller, Conheim and others, which go to prove the identity of the leucocytes and pus and mucus corpuscles.

Two days after I had examined the specimen of vaginal mucus I have just been describing, I was enabled to procure another of a similar character from the same patient, who continued to have some leucorrhœa; and at that time, not knowing the import of either of the microscopic forms which I had detected, I had determined to keep her under observation. At this time, I found the *Trichomonas* and *Leptothrix* rarer than at first. Four days thereafter another specimen was taken and examined. In this no *Trichomonas* was seen, but the *Leptothrix* was in patches attached by one end of the filament to the epithelial plates. At the point of attachment was a mass of granular matter. Robin has well figured this mode of growth, in his Atlas, Planche I., fig. 1, of *Leptothrix buccalis* from the mouth. Separate filaments of this plant are shown in the drawing, as are filaments taking on the form and possessed of the movements of *Vibriones*. There are separate segments of the same, identical with what have been called *Bacteria*, both in form and movements. *Monads* were seen in active motion, and there was a form made up of three joints, one of which was bent, and showing one of the stages of transition, as was afterwards proved, from the *Vibrione* to the *Leptothrix*. The rest of the field of vision was filled up with minutely granular matter, as was the case with the first specimen.

From the observations which I had been engaged upon for some time, connected with the development of certain fungi, and which I have already alluded to, I was induced to seal some of this discharge up in what is known to microscopists as a "cell," where it was entirely excluded from the

air, and wherein it could be examined from time to time, or even watched under the microscope for hours at a time, and any changes which might take place in it be studied. It was thus watched carefully and observed frequently during the next three days. At the end of that period a marked change had occurred. The *Bacteria* forms and *Monads* had increased in numbers, whilst the filaments of *Leptothrix* had dropped off from the epithelial scales, showing that these shorter forms were derived from the longer ones. Chains made up of two and three *Monads* were also to be seen. Such chains, in which the bead-like portions number two to five, have had bestowed upon them the name of *Bacterium triloculare*, and where they are still more numerous and are arranged in the form of an open spiral they have been called *Spirillum*.

It was whilst watching this and other similar specimens, during severa, consecutive hours and days, that I saw certain changes actually take place which it will be well here to describe. The granular matter, which was always present in greater or less quantity, was at first immovable, and under a power of one thousand diameters did not appear to have any definite form, although, doubtless, if a still higher power had been used in its study it would have been seen to be globular. Soon its individual particles enlarged considerably, and taking upon themselves the spherical form, became true *Monads* with rapid trembling movements. These then attached themselves one to the other, until the chains constituting *Bacterium trilocalare* were formed. Gradually the little bead-like portions melted one into the other and rod-like *Bacteria* appeared. Now the *Bacteria* elongated into longer rods, which, in turn, would adhere end to end until chains of two or more rods were seen. At the point of union of these rods a certain amount of mobility often existed, and such zig-zag forms sailed about in a lively manner. These have been called *Vibriones*. But, at times, the contents of the long rods would grow out lengthwise, and *Leptothrix* filaments would be the result. It would seem that the granular matter adhering to epithelium might thus develop into groups of filaments like those I have depicted in the plate. But these filaments themselves undergo a change, either when attached and long, or free and short. Then their contents are transformed to such an extent that they refract light very strongly and appear almost opaque. Soon they enlarge in every direction, and growing rapidly, develop into a true fungoid mycelium. From this mycelium true sporangia—*i. e.*, seed-vessels—grew up into the air above the fluid. These I have drawn. One is a *Mucor*, whilst the other I cannot find described or figured anywhere. And to show its novelty, I may say that I sent a drawing of it to

Mr. M. C. Cooke, of London, the celebrated authority on fungi, and in reply he wrote me that he could not guess what my plant might be, and said, "are you sure that it is not an alga? It seems to me more of an algoid than a fungoid fruit." The *Mucors*, I may say for the information of those who are not up in fungi, are the moulds so common on animal and vegetable substances everywhere, and although numerous species and even genera have been described, there is good reason to believe that they are transmutable one into the other. Thus, Dr. Tilbury Fox has shown that many of the fungi peculiar to different skin diseases are thus transmutable; and he considers *Leptothrix* allied to *Torula* (yeast fungus), which he places in his diagram of the relations of these minute forms of life, as the centre around which are grouped *Aspergillus*, *Penicillium*, *Puccinia*, a fungus parasite found in the vagina by Dr. Bennett, and others. The mass of fungoid mycelium I speak of constituted a tough membrane closely resembling that developed on mucous and other surfaces in Diphtheria; in fact, there is good reason to believe that in this case there was developed exteriorly to the living body a true diphtheritic membrane. The reasons for this belief will be pointed out hereafter.

It may be as well to state here that Cohn has lately been investigating these minute forms of existence, and has cleared up the synonomy to such an extent, that we may hereafter be somewhat more clear as to what writers mean when they are speaking of them. Thus, the single spherical forms I have called *Monads*, he prefers to call *Micrococus;* the straight rod-like form he calls *Bacterium;* when it is jointed, *Bacillus;* when it is motile, *Vibrio;* and when it is corkscrew in form, *Spirillum*.

The second case to be mentioned in which the vaginal discharge was examined by means of the microscope, is that of a lady, forty years of age, and unmarried. This patient had been under treatment for some time, and came to me from another physician with the following history: For six or eight years she had had prolapsus in the first degree, accompanying, if not resulting from chronic endometritus, as well as ante-version, which, at times, was very marked. When I first saw her the uterus could be readily replaced, but as she was unable to wear a support of any kind, after a while it seemed to have formed adhesions, fixing it low in the pelvis, so that I could not, at the time I am speaking of, readily move it. At times she had considerable leucorrhœa accompanied by severe bearing-down pains and frequent and painful micturition. The urethra was slightly inflamed, and this condition continued until it was treated with a mixture of carbolic acid and glycerine, in the proportions of one to twenty, introduced on cotton

wool wrapped around a probe. The anterior wall of the vagina was very sensitive, referable to the urethral trouble. The cervix was difficult to engage for some time, until the uterus had been somewhat replaced. When she came under my care I found the endometritis existing in a very slight degree, but still there was sufficient to account for the leucorrhœa, which often produced redness and a stinging sensation of the external parts. The results of the examination, by means of the microscope, of the discharge from this patient, showed the presence, besides the vaginal epithelium, of nothing but innumerable *Monads* in extremely active motion. I fully expected, from my previous experience, that these *Monads* would develop into *Leptothrix*, or even still more complex vegetable forms. Therefore, five days after the first examination, another specimen was obtained and examined. Therein I found several specimens of *Trichomonas*, and, in fact, in the vaginal discharge, which was abundant at this time, they were plentiful. In the drawing, I have depicted a group of three individuals, as well as a single one with one of its extremities attached to an epithelial plate in the form of a stalk. There is also one with this stalk-like appendage drawn out into a fine filament. This individual was watched for a long time, and was seen to first fix itself to the epithelial plate, and, thereafter, move its body somewhat away, leaving a portion of its substance attached to the scale, constituting a stalk. Gradually this stalk became thinner and thinner as the creature moved farther away. Then it detached itself from the epithelial plate with a jerk and swam away, with a long stalk trailing after it like a tail. This was soon absorbed into the general substance and the individual presented the same character as its neighbors. I have also shown what has never been hitherto described—that is to say, a *Trichomonas* subdividing longitudinally into two new individuals; and this act I observed taking place on several occasions. I call this subdivision, although I am somewhat in doubt if it were that process or true copulation; but as no one has seen generative organs in *Trichomonas*, the matter must remain somewhat uncertain. It is true that since Balbiani's observation of copulation in hermaphrodite *Kolpoda*, the existence of fissiparous subdivision in these creatures is considered by many as doubtful. It would be hardly worth while for me to detail here all I have seen connected with the life-history of these creatures; but one fact had better be placed upon record. I have proved, to my own satisfaction at least, that it has no investing membrane, but consists merely of a mass of sarcode, differentiated at the point where something like a nucleus is seen, and where the cilliæ and terminal filament are found; but its structure is in every respect so extremely delicate, that

its study even with the high power that I used, which magnified it one thousand diameters, or one million times, and which was a fine one-tenth immersion lens, made by R. & J. Beck, of London, did not reveal any more than I have detailed. On several occasions the vaginal discharge from this patient was examined, and the same organism was always found in it, sometimes being present in enormous quantities, so that fifteen or twenty would be within the field of view of the microscope at one time. At no time was *Leptothrix* to be seen. On one occasion, when the discharge from this patient was examined, it was found to be very markedly changed in character. The epithelmium was smaller than that found previously, and rounder in outline. Hence, I judged that it could hardly be vaginal, or if it were, that it came from deeper layers. And this would seem to be confirmed by the presence of numerous pus corpuscles. Along with these elements were many large animals like *Trichomonas*, except that they were about three times as large as that creature and of almost spherical outline. They possessed cilliæ, which they kept in active motion, and terminal filaments exactly like the ordinary form of *Trichomonas*, but they did not change their position in the liquid.

This was the only time I ever saw these creatures. In another case of prolapsus *Leptothrix* filaments were found on more than one occasion, and they were observed in other cases; so that we must believe that as *Leptothrix buccalis* is certainly a normal inhabitant of the mouth, so the same form of vegetation is of common occurrence in the vagina. In fact, I found *Leptothrix* in the vaginal mucus of all women where that fluid was normal in quantity, and where no severe uterine disease existed or no washes had been used. It would seem, then, that *Leptothrix* is a normal inhabitant of vaginal mucus, and that when the mucus is secreted in extra quantity, and therefore accumulates in that canal, *Trichomonas* is apt to be developed. I cannot, as yet, persuade myself that the presence of this organism indicates any uterine or ovarian disease.

We come now to consider whether these facts, which I have detailed, possess anything more than a scientific interest; that is to say, whether they may, in any way, be made useful as applicable to practical gynæology. It was in the year 1860, that the eminent Professor of Medical Midwifery in the University of Berlin, first put forth the theory that that pathological condition which has commonly gone by the name of puerperal fever depends upon a diphtheritic process set up in the female genital organs, and which, in cases which prove fatal, spreads therefrom to more vital parts. Unfortunately, the views held by the different members of the medical profession

with regard to this condition, are extremely various, but this has most likely, in a considerable degree, arisen from the different amounts of thoroughness in diagnosis brought to bear upon the subject. At all events, the application of a new means of research, namely, the microscope, in the hands of Professor Martin, has brought forth facts of extreme value and interest, and the important bearings of which can hardly be over-estimated. In a late lecture on this subject, he points out that "febrile conditions may be met with in lying-in women as well as in pregnant women, whether as a consequence of inflammation in almost any organ, (but which has no connection with the puerperal condition, or in connection with various contagious diseases, as scarlatina, variola, &c. There may even be febrile affections consequent upon inflammatory action in the genitals of lying-in women, but which are not essentially different from puerperal fever in the alarming sense of the word. Entirely unconnected with this, lying-in women may have very severe fever from inflammation of the breasts or nipples, after contusion or laceration of the uterus or vagina, as well as consequent on abscesses or ulceration which may ensue from effusion of blood into the connective tissue. Such fever, neither in its course, symptoms or issue, resembles the puerperal fever as limited and distinguished by Prof. Martin. In fact, if fever can arise during the period of confinement, from these causes and from others, as is of course the case, we can readily understand, as Prof. Byford remarks, "the term puerperal fever has been applied by different authors and practitioners to almost every form of fever and inflammation incident to the puerperal condition." Prof. Martin shows that there is a distinct condition occurring in the lying-in women, which is characterized by the diphtheritic process, which he regards as essential to it. He then says, "what are we to understand by the diphtheritic process?" You are aware that recent investigations have thrown most important light on the nature of diphtheria affecting other organs, especially the pharynx, where it has been shown to consist of a fungus formation, the spores of which are seen under the microscope to penetrate not only into the tissues, but within the blood-vessels—producing in this way a generalized disease. In diphtheria of the genital organs investigations have as yet not been extended thus far, and it remains a question calling for further examination. Admitting, however, that the diphtheria is here due to a fungus formation, other questions arise. Is the fungus in question specifically different? Since we are familiar with various fungi which germinate in the vagina of both pregnant and non-pregnant women without giving rise to any dangerous affection—is the fungus the mere carrier of the contagion? or is the puerperal fever produced in consequence of the special

condition of lying-in women favoring the production of certain fungi, by reason of changes taking place in the organic substances and fluids?" What he calls "the microscopico-anatomical basis of puerperal fever" is found as a diphtheritic deposit covering those wounded spots on the external genitals, as well as the walls of the vagina, which, in the form of larger or smaller lacerations of the mucus membrane, so frequently occur during labor. This lesion is then a true traumatic diphtheria. "The circumference of these spots is more or less considerably swollen. In many cases the diphtheritic deposit is thus confined to the external genitals, and the disease pursues its course by casting off the deposit without any or with very little general disturbance. But in the majority of cases coming under medical recognition, the diphtheritis is not confined to the entrance of the vagina, but is found deep within the canal, covering the large or small lacerations of the os uteri, and within the cavity of the uterus itself. There it occupies both the site of the placenta and the upper parieties of the organ; and it is sometimes formed exclusively here, and in no places accessible to the eye." Without going further into the consideration of this condition it may be remarked, that the diphtheritic deposit, growing and increasing as fungi usually grow and increase, by means of its mycelium as well as by distribution of its spores, as a general rule is found to extend rapidly from the genital organs to the skin of the thigh, nates, &c. "These, then, exhibit an erythema (which has been well named puerperal scarlatina) or pass into ulceration." More frequently it spreads to and into the urethra and rectum, and still more commonly by means of the connective tissue and fallopian tubes, upwards and onwards to the peritoneum, or even to the great glandular organs of the abdomen, the kidneys, liver and spleen. Finally the lower lobes of the lungs may be implicated, and pleuritic adhesions be associated with those lesions found in the peritoneum. In conclusion, Prof. Martin recommends a symptomatic treatment along with the use of such substances as have been considered anti-zymotic, as creosote water, carbolic acid, chlorine, and nitrate of silver. The alkaline bromides he does not speak of, but their internal and local application in pharyngeal diphtheritis has been found to be so useful, that it would seem that in the puerperal form of the affection they would certainly prove of use. Sulphurous acid in the form of hot spray, I have found to answer so nicely in diphtheritic affections of external parts, that I think it worthy of trial in the puerperal diphtheritis. The alkaline permanganates might likewise be tried; but of all remedies that seem to promise the best results in affections of this character, Salicylic acid evidently stands preëminent, and I shall presently, in another paper, detail the results of the trials to which others, as well as myself, have put it.

In connection with this subject of the occurrence of a diphtheritic membrane, consisting of the mycelium of a fungus upon the mucus membrane of the female genital organs, it will be of importance to note that Dr. Tyler Smith, in his treatise on Leucorrhœa, calls attention to the resemblance of the mucus membrane in these situations to the cutaneous structures. He says that this is more markedly the case with this than with the mucus membrane of more internal parts. "This is particularly the case," he says, "with respect to the dense epithelial layer of the vagina and os uteri; and and the villi of the os uteri are perhaps more nearly allied to the papillæ of the skin than to the villi of the intestinal mucus membrane," and "these analogies are strongly confirmed by what is observed of the pathological lesions to which these parts are liable, and by the effects of therapeutical applications. Several of the common skin affections are closely imitated on the vaginal surface and the vaginal portion of the cervix uteri, and give way to treatment adapted for genuine skin disease." From this we can readily comprehend that, notwithstanding the dissimilarity existing between the mucus membrane of the vagina and the more internal parts, and, of course, of the serous membranes, that yet a mycosis which spread from the skin to the vagina would be liable to travel still farther and involve deeper tissues. Prof. Waldeyer, of Breslau, has examined the diphtheritic deposit found upon the mucous membrane of the uterus as well as the puriform mass from the lymphatics of that organ, and the broad ligament, and the peritoneal exudation, which is partially fluid and partially fluid and partially made up of whitish-yellow prominent fibrinous flakes, and in all of them the microscope has shown him Bacteria. Haussmann had formerly found these organisms along with Vibriones in the lochial discharge. Waldeyer tells us that in the diphtheritic exudation the Bacteria lie between the pus-cells and those of the partly decomposed tissue elements. The puriform contents of the lymphatics consist, besides the pus-cells, for the most part of Bacteriæ, and they are also found in the peritoneal exudations and flakes, mixed with pus-cells, young-cells, and masses of fibrin, and even in the interior of the pus-cells. In the main they were the globular Bacteria of Cohn, or what we would be disposed to call Monads, though in part they were the rod-like micro-bacteria. Orth, also, considers fungi to be the essence of puerperal fever. In the January (1875) number of the American Journal of the Medical Sciences, Dr. John S. Parry, of the Philadelphia Hospital, has published a paper on a form of Puerperal Fever, charcterized by diptheritic deposits on wounds of the genital passages, and by other peculiar phenomena, wherein he points out that "various affections

have been described under the general term puerperal fever." He considers that these various affections may be classified under three heads, as follows: Local inflammatory diseases, including Perimetritis, Parametritis and general Peritonitis; Septic diseases, including Pyæmia and Septicæmia, Diphtheria of wounds and Erysipelas of the genitals and internal organs in puerperal women, and idiopathic fevers in the puerperal female. All of which shows how hasty we have been in considering almost every febrile condition of a grave character, when occurring in the puerperal female, to belong to a distinct and distinguishable disease. The natural consequence has been that a mixture of many, if not all of the symptoms of these various forms of disease which have been mentioned, have been from time to time thrown together and called puerperal fever. It is not for me at the present time and in a paper of the character of this one, to consider the pros and cons of the question, as to whether there be a distinct disease entitled to the name puerperal fever; I have already said that Prof. Martin thinks that there is; but it would appear to me from my knowledge of the manner in which diphtheritic deposits, consisting of Bacteria and their resultant fungoid mycelium fibres make their appearance, that there must be a peculiar condition of the membrane upon which they appear, produced by some distinct pathological metamorphosis, honestly entitled to consideration when classifying disease. Bacteria and fungus mycelium may be the result of Diphtheria, but as certainly they will develop all of the conditions and symptons which go to make up the disease we call diphtheria. And if we do find diphtheritic membrane accompanying febrile conditions in puerperal women, the state which produces that Diphtheria must be present. As to whether Diphtheria, as commonly recognized, be a disease in itself, or only a condition resulting from a disease, is another question well worth considering, but not at the present time, as is likewise that question which has not sufficiently occupied the minds of scientific physicans—namely, are diseases, so-called, specifically distinct in the acceptance of the term as employed in modern scientific language? At some future day I may return to a consideration of this point.

To the practitioner who has not made himself acquainted with the laws governing the growth and reproduction of the more minute forms of existence, it is difficult to understand how it comes about that a disease like Diphtheria spreads with such rapidity as to involve large surfaces of mucous membrane, and endanger life in a few hours; but his wonder at perceiving such things to actually take place ceases when he is told that botanists have determined that some of the obscure fungi, and those forms which probably belong to the very groups whose mycelium constitutes the diphtheritic mem-

brane, multiply with the marvelous rapidity of ninety-six million in a single minute. In this connection, it will be well to note that Dr. L. Mayer, in 1862, published a memoir in which he considered the subject of vegetable parasites in relation to uterine and vaginal diseases; but his observations, as well as those of Prof. Martin, just referred to, do not seem to have attracted the attention they deserved, in this country, at least, or, at all events, their observations have not been availed of and applied by the profession at large. In short, perhaps we have no more striking illustration of the fact that it requires often many years before the results arrived at by scientific diagnosticians and pathologists, working with all the modern appliances of instruments for investigation are assimilated and made use of by the everyday working practitioner. In the paper in question, Dr. Mayer describes a species of fungus which he found spreading over the inner surface of the labia, the nymphæ, clitoris, along the vagina to the uppermost portion of the cervix uteri, in cases under his charge. He says that he never found this growth to extend beyond these limits, but as his observations were drawn from only six cases, and when the difficulty of exploring the uterine cavity is taken into consideration, we may believe that it might be found elsewhere, as in the cases mentioned by Prof. Martin, and the one presently to be described in England. In the six cases alluded to, there was usually observed spots in size varying from that of a pin's head to smaller, of a bright yellowish color, of a roundish or irregular outline, and generally loosely attached to the mucous membrane. More rarely, true diphtheritic-like membranes are formed, which, on removal, leave shallow ulcers. The basis on which these fungi grow is always hyperæmic, as we would expect to be the case, and an increased secretion is found to occur. This secretion is mucous, opalescent, and of a milky or creamy character, but sometimes of a still greater consistency, not unlike potato-paste. The six individuals thus affected with vaginal mycosis, were of various ages and of different conditions of health. Five of them suffered from diseases of the sexual organs, whilst the remaining one was pregnant at the time of the examination. In the first five there existed a more or less severe inflammatory condition of the mucous membrane of the genital organs, and all complained as soon as the mycosis was well established, of intense burning, itching and pricking in the vulva and vagina, which occurred paroxysmally, and destroyed rest and sleep. The pregnant woman, however, did not suffer from inflammation or the peculiar burning and itching of which the others complained. Frequent injections of water were used, by which the fungoid patches being removed, all the troublesome symptoms disappeared. There is one point of great interest and importance

connected with one of these cases, which Dr. Mayer unfortunately has failed to record, and that is whether the pregnant woman, during her subsequent confinement, suffered any return of the malady for which he had treated her. Neither are we told whether or not there were any abrasions of the mucous membrane in any of the cases; but it is not likely that there was, or we would have heard, if any of the cases were followed up, of more alarming symptoms like those to which Prof. Martin has called our attention.

In the London Lancet, for 1849, we have a paper entitled "Some remarks upon the development of Epiphytes, with the description of a new vegetable formation found in connection with the human uterus, by Dr. J. Stuart Wilkinson." Therein is described a case of a woman, who was suffering from a troublesome pruritis accompanied by considerable tumidity of the labia majora. Small sores were seen, caused, as she thought, by the friction employed to relieve the distressing sensations. Her attention was attracted to vaginal discharge of a yellow color and fœtid odor, which gradually increased in quantity. This discharge presented to the eye a very unusual appearance, such as might be produced by mixing up a large quantity of hairs of extreme tenuity and softness with purulent matter. Under the microscope this was found to consist of filaments of well-defined vegetable structure along with corpuscles, oval and spherical in form, some with and others apparently without nuclei, and granules and molecules. Robin mentions (page 366) and figures (Pl. V., fig. 1, a, b, c, d, e, f, g, h,) a vegetable from the human uterus, the drawings and particulars of occurrence of which were sent to him by Lebert, and which he considers an alga belonging to the genus *Leptomitus*. The figures he gives, however, would seem to prove it to be a fungus, or, at least, the mycelium of such a plant. It was taken from the mucous membrane of the cervix of a women in the Lourcine hospital, and Lebert thought it probable that the spores of the plant may have been introduced in vaginal injections which had been used. I have found still one more example of a vegetable within the human female genital organs recorded by Küchenmeister, in his Manual of Animal and Vegetable Parisites (Sydenham Society Edition, 1857. Vol. II., page 235). This case is as follows: "A case of diphtheritic inflammation of the intestines was observed at the Lying-in Hospital, at Dresden, in Professor Dr. Genser. A similar process occurred afterwards in the vagina, forming a membranous layer on the mucous membrane of the vagina, which was thrown off in single pieces. A slight improvement was noticed. Prosecutor Dr. F. A. Zenker recognized in these masses scanty pavement-epithelium, and entangled fungous filaments and spores, which were entirely surrounded by mucus cor-

puscles. Dr. Zenker was kind enough to send me some of these broken pieces, and I obtained, on addition of strong vinegar, the partly articulated filaments of which I have given an illustration in Tab. V., fig. 8. In order better to recognize the shape and articulations of the very diaphanous filaments, I added *Syrupus Rubi Idæi*, which answered its purpose, and which I would recommend for the purpose of examining vegetable parasites by means of ascetic acid. I use, however, a red ink when I employ potassa, since the *Syrupus Rubi Idæi* would change its color in alkalies. The above parasites remind us of those which Hannover found on the ulcerated mucus membrane of the œsophagus, and in cases of typhus. They very much resemble *Leptomitus Hannoveri* (Tab. I., fig. 8), and ought accordingly be classified with the algæ of Robin. This parasite resembles slightly the fungus given in Tab. V., fig. 2, which Bennett found in the lungs. It appears to me, however, that we have to deal with a *Leptomitus*." Küchenmeister tells us in his appendix, that Kölliker and Scanzoni also found spare, thin, and short ferment-fungi in the secretions of the cervix uteri." (Vol. II., page 256). He does not refer us, however, to the original account of this discovery. He also says that "first Donné and after him Kölliker and Scanzoni found in vaginal mucous fine, stiff threads, 0.04—0.06‴ in length, exactly resembling *Leptothrix buccalis*, from which they are only distinguished in that they are always isolated, are not bound together by a fine granular material, and are never situated on epithelial cells. Although often very numerous, they are still not so abundant as *Trichomonas vaginalis*, and are never met with like these without the coëxisting presence of mucus-corpuscles." (Page 256.) I cannot find that Donné says anything on this subject, at least in any of his writings that I have seen or heard of, and we are not told where Kölliker and Scanzoni's paper is to be found. If such observations have been made and recorded, it is of interest, for they accord in the main with what I had observed long before I had seen Küchenmeister's remarks, and which I have described in this communication. It would seem, then, that fungoid growths are found within the human female genital organs, both in health and in disease, and it is not difficult to believe that the apparently innocent *Leptothrix* of the healthy mucous membrane may become the dangerous diphtheritic membrane of puerperal fever. To prove this true or false farther investigations are needed, and it is my intention, as opportunity offers, to make them.

In this connection, and as assisting us in arriving at a somewhat more complete acquaintance with the condition of our knowledge of the connection of fungi with disease, it will be well to briefly glance at the following

facts: "Fuchs mentions having found a fungus in Bronchitis maligna, in the sputa and bronchi," (Küchenmeister, Vol. II., page 257). This he considered to be identical with *Leptomitus Hannoveri*, which Hannover found on the tongue and pharynx in various diseases, as typhus (typhoid ?) fever, pneumonia, pleuritis, phthisis, delirium tremens, apoplexy, diabetes and chronic gastritis (Muller Archiv., 1842, page 280: Valentin's Reportorium, 1843, page 84: Robin Hist. Nat. Veg. Par., page, 363.) These diseases are so different in character one from the other, that the fungus formed can hardly be believed to have any direct connection with any of them, and when we come to examine the figure of it given by Robin, we see that it is most likely an extension of growth of the form which goes by the name of *Leptothrix buccalis*, so common in the mouth and due to certain conditions of the mucus membrane in those parts incidental to the febrile state. For it will be seen that I have now a precisely similar form from *Leptothrix buccalis* in vaginal mucous, which was diluted with water, and kept from becoming dry by means of a cover, as I have described.

I might follow up this subject to a much greater length were I treating of the pathology of diseases in which so-called fungi make their appearance, and I might even continue this disquisition to its inevitable conclusion with regard to the abiogenetic origin of these minute forms, but I refrain, for this paper is merely meant as a sketch pointing the way in which those disposed and properly qualified must proceed if they are to solve the problem of what is disease and how is it to be arrested. Within the space of a composition of the character of the present this vast subject of the application of the microscope to the investigation of disease, cannot of course, have due justice done to it. Therefore I shall rest after recording one or two more facts of interest. Allusion must, at least, be made to the fact that this instrument has been called into requisition in the diagnosis of ovarian tumors. Thus Dr. Atlee in his treatise on the General and Differential Diagnosis of Ovarian Tumors, has a chapter contributed by Dr. Thomas M. Drysdale on this branch of the subject. This gentleman considers that in fluids drawn from ovarian cysts is to be found a peculiar structure of which he says "no matter what other cells may be present or absent, the cell which is almost invariably present in the fluids is the granular cell," (page 458.) So also Dr. Peaslee, in his treatise on Ovarian Tumors, when speaking of the application of the microscope to their diagnosis says, "a still more striking characteristic when met with of the ovarian cystomata is the ovarian glomerulus, or 'gorged granule,' spoken of by Mr. Nunn, though he does not attach much diagnostic importance to it, and which is recognized by Keberlé and

Dr. W. L. Atlee, and described as found in some of the ovarian cysts recently removed by the latter," (page 117.) He then goes on to describe and figure this glomerulus, but says that he has "not been able to detect them in the fluid of all cysts known to be ovarian," and he considers that "further observation is necessary in order to determine their precise diagnostic value." Eichwald has published in the Wurzburg Medicinische Zeitschrift for 1864, elaborate reports on the chemical composition and microscopic characters of the elements of ovarian cysts; and Spencer Wells, in his treatise on Diseases of the Ovaries, gives the results arrived at pretty fully. This investigator evidently does not think that the microsope detects anything markedly peculiar in this fluid, and points out that "chemical examination has proved these highly refracting granules which occur in all ovarian fluids to be fat globules or fatty granules." These refracting granules constitute the contents of the supposed "ovarian cell." Dr. H. F. Walker has contributed an article to the American Journal of Obstetrics, (Vol. III., 1870, page 120,) entitled "The Hypodermic Syringe a means of diagnosis in Ovarian Disease," wherein he says that he considers that "by the aid of the microscope, with never so small an amount of the fluid contents of the tumor, a diagnosis can be made in every case," and quotes a case in which, when a small portion of the fluid drawn by the means of the syringe from a tumor was examined "the microscope showed that it contained a multitude of the ovarian corpuscles." It would seem however that though we may find that the microscope will at some future time prove of value in the diagnosis of ovarian tumors, that those who have relied upon the "ovarian corpuscles," "globules," or "cells," as diagnostic, have been apparently led astray, for we are told by Dr. T. H. Green in his "Introduction to Pathology and Morbid Anatomy," that when fatty degeneration takes place and the albumenoid constituents of the tissues are transformed into fat, that the fat makes its appearance as minute granules and molecules within the cells, and, gradually increasing in number, at last fill the cell; "as they increase many of them coalesce, and so form distinct drops of fat; this, however, is not common, the fat usually remaining to the last in a granular form." These granules of fat may remain in a coherent form for some time after the cell wall and nucleus are destroyed; then these constitute the so-called "inflammatory," or "exudation corpuscles," or "corpuscles of Gluge," which are so common in chronic cerebral softening and in other forms of fatty degeneration." So the colostrum corpuscles are but such aggregations of minutely granular fatty matter, and "other examples are afforded by the formation of the sebaceous matter of the skin, the cerumen of the ear, and the corpus luteum

of the ovary." Under these circumstances it would seem that we must abandon the "corpuscles of Gluge," as diagnostic of cystic degeneration of the ovary, and find something more characteristic to rest our verdict upon, for they are the "ovarian corpuscles" so-called, or at least cannot be distinguished from them by chemical or microscopical means.

To make the microscope practically applicable, then to Gynæcology, or any other branch of medicine, a thorough knowledge of the optical principles involved in the construction of the instrument is necessary, that is to say, the observer must be a thorough microscopist, so that what is seen by means of it may be rightly interpreted; as well as an intimate acquaintance with the various tissues of the body in health and in disease, together with morbid growths and the results of acting upon them with various chemical reagents. To arrive at this amount of knowledge necessitates many hours labor and a vast deal of research, so that we can hardly expect that the practitioner of medicine will ever become an accomplished microscopist. But it is to be hoped that there will speedily spring up a sufficient number of skilled workers with the instrument, to whom the practitioner may go for assistance, and on whom he may with full confidence lean to aid him in making his diagnosis.

120 Belleville Avenue,
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