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ORIGINAL COMMUNICATIONS.

HOW DO THE SPERMATOOZOA ENTER THE UTERUS ?

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(Read before the American Medical Association, June 2d, 1874.)

THE paper which I desire to present for the consideration of this section is a compilation of, first, a former paper on the same subject contributed by me, and published in the *St. Louis Medical and Surgical Journal*, in the number for September, 1872; second, some additional remarks in relation thereto, since added by myself, by way of interpolation of the original paper, but not published; third, a paper on the action of the os and cervix uteri during cohabitation, read by its author, Dr. Wernich, before the Berlin Medical Society, first published in the *Berliner klinische Wochenschrift*, in March, 1873, and kindly translated and republished in the same *St. Louis Journal* above referred to; and, fourth, a few additional remarks suggested by, and relative to the paper of Dr. Wernich. While I lay down as a foundation the division of this paper as above, I do not propose to so divide it practically. The first and second divisions, as named, will properly become but one in the discussion, while the rest may, for convenience, remain as they are. First and second, then:

The question which constitutes our subject is an old one, but one which has never been answered in a manner entirely satisfactory to my mind until now. Every author on gynæcology, obstetrics, physiology, anatomy, either normal or pathological, or in the department of medical jurisprudence, upon whose production I have been able to lay my hands, treats the matter in a vague and most unsatisfactory manner. Some pass by with remarks confined to two or three short sentences; while others take no notice of it at all; and thus, between indifference upon the one hand, and lack of knowledge on the other, we have not been making much headway in our endeavors to enter the secret penetralia of Nature, to unravel and wrest from her the intricate and mysterious process of procreation.

The reason for this apparent lack of attention on the part of the thinkers and observers in our profession, seems to me to be self-evident. It has heretofore been regarded as impossible, in the nature of circumstances, to ever be able to examine a vagina and uterus at the instant when the orgasm, which occurs during or just at the end of coition, affects these parts. This inability to observe must, of necessity, generally continue to exist; and we have heretofore been compelled to agree (though always under protest on my part), with the old idea that the spermatic fluid, upon being discharged in the neighborhood of the os uteri, remains thus situated a sufficient length of time to allow the spermatozoa to pass up through the external os, search the cavity of the uterus for the ovum, and even to penetrate to and through the Fallopian tubes in the prosecution of such search. In other words, a microscopic cell, with no internal construction that is fairly traceable, even under the highest attainable power of the microscope, possesses so much innate reasoning power, or, if you prefer the term, call it instinct, that immediately upon being deposited in the near proximity to its destination, it shall at once seem to become aware of the specific character of its mission, and, well knowing whither and in what manner to make its appointed journey, immediately bestirs itself in order to fulfil its destiny. In our days, many a spermatozoon must become disgusted at its unavailing efforts to find the object of its search, provided such a feeling is not incompatible with the very high grade of reasoning

power accorded to it by these old theories. I, at this time, regard any and all such explanations as exceedingly attenuated, as regards their thickness. After consulting the dictum of authority upon this matter, at least as much of it as is at this present writing attainable by me, I shall address myself to the demonstration of its utter absurdity, and undertake, in so far as I am able, after exposing its fallacy, to substitute therefor another and a very different theory, and one which I never saw broached anywhere until after the publication of my paper in 1872, which now constitutes part of this essay.

I take up first the line of demonstration followed by Gardner in explanation of this matter. Under the head of "*In what manner do these elements unite?*"<sup>1</sup> he states: "In the act of copulation the virile organ, in ordinary cases, penetrates into the vagina to the distance of from three to four inches, or to such a distance that the corona glandis, or extremity of the organ, is in immediate approximation with the opening of the uterine canal, the os uteri. Here the spermatic fluid is discharged.

"According to most physiologists, the active labors of the spermatozoon here commence, which accordingly, as if imbued with a knowledge of its duties, or pressed forward by instinct, commences to make its way through the patulous mouth of the uterus, into its cavity, and not finding the ovum there, prolonging its search through the length of the Fallopian tubes, even to the ovary itself. Some microscopists have recently asserted that they had seen the ovum just emerging from the ovary, already surrounded by the spermatozoa, rapidly moving round it and embracing it. . . .

"A popular opinion, but which has attained currency without foundation upon which to base it, that I am aware of, declares that in the act of copulation, at the time of the crisis, or height of venereal sensation on the part of the female, the mouth of the womb opens to receive the Danaëan shower, and the spermatic fluid is injected immediately into the cavity of the uterus.

"So little is known of the os and cervix uteri in its minute anatomy, and its physiological action and sympathies, either in a healthy or a diseased state, that there may be some truth in this opinion.

<sup>1</sup> On Sterility, page 47 *et seq.*

"We may also account for the arrival of the spermatic filament in the uterus in some other way—by its specific gravity, the fluids of the vagina flowing back towards the uterus, while the female is in the recumbent position, during and succeeding the act. That this may be the popular theory, that procreation cannot be effected in a standing position, and that violent dancing immediately after sexual intercourse will prevent pregnancy, is worthily considered in this connection. . . . . By whatever route the fecundating principle passes, it ultimately arrives at the ovary. Without much doubt, it is through the canal of the cervix, the uterus, and the Fallopian tubes. . . . . As neither argument, nor corroborating, nor contradictory hypothesis can settle this matter, I shall leave the question with the mere statement of the two sides of the subject."

Thus much Gardner; and, in my opinion, it would puzzle any one to explain upon which idea he places the most reliance. It would seem that he has a few, and those very grave doubts, as to which opinion he shall be regarded as an expounder of, and, in order to avoid any unpleasantness, he seats himself fairly (to use a common metaphor) on the top of the fence.

Again, note how emphatically Kölliker speaks, when he says: "As regards the movements of the uterus, they are, at all events during parturition, very energetic, but take place even at other times. . . . . It is probable that movements take place at the time of menstruation, and in the act of congress, but the fact has not been ascertained. In the latter case, an opening of the os uteri, and a dilatation of the canal of the cervix, are commonly supposed to take place. If this is to be regarded as a spontaneous action of the cervix, it would be justifiable, with Kiwisch, to refuse assent to the supposition, for the radiating fibres described by Kasper, which alone could effect anything of the kind, do not exist; the fact, nevertheless, is conceivable, if we assume a relaxation of the muscular element in the cervix and os, together with a contraction, especially of the longitudinal fibres in the fundus and body."

Kölliker, as you observe, assumes that any movement on the part of or by the cervix and os, must of necessity be directly

<sup>1</sup> On Microscopical Anatomy, page 658.

controlled by the action of certain muscles, which he has been unable to find. *Ergo*, there is no such movement. Please to observe, also, that there is not the slightest reference on the part of this eminent anatomist to any possible part which the contraction and dilatation of the blood-vessels of the os and cervix might take in such a movement. Further along in this investigation, we shall see how that this very omitted action plays a most important part.

One sentence from Byford, in which the italics are my own, will serve to illustrate his theory on this subject sufficiently for all practical purposes.<sup>1</sup> . . . . . Or the very thick, tenacious, albuminous fluid, which sometimes plugs up the os uteri and whole cervical cavity, may prevent the ingress of the spermatozoa, *which, by their independent motion, according to present belief, penetrate the uterus, meet the ovum somewhere on its passage to the os uteri, and produce their fructifying influence upon it.* . . . . .

Since Byford attempts no elucidation of this matter in any way, I pass the quotation by, with the single remark, that in a the uterus, work on we might have expected some information, no matter how erroneous, on the particular point now under consideration. Perhaps this is, after all, only another instance of a halt between two opinions.

Just here, and for the purpose of exhibiting the medico-legal idea of the physiology of this matter, and to instance upon what slender foundations the superstructure of Law is sometimes reared, I introduce a quotation from Beck:<sup>2</sup> . . . . . It was formerly supposed that a certain degree of enjoyment was necessary in order to cause conception, and accordingly the presence of pregnancy was deemed to exclude the idea of a rape. Late writers, however, urge that the functions of the uterine system are in a great degree independent of the will; and that there may be *physical constraint* on those organs sufficient to induce the required state, although the will itself is not consenting. We do not know, nor shall probably ever know, what is necessary to cause conception; but if we reason from analogy, we shall certainly find cases where females have con-

<sup>1</sup> On The Uterus, page 59.

<sup>2</sup> Medical Jurisprudence, volume 1, page 238 *et seq.*

ceived while under the influence of narcotics, of intoxication, and even of asphyxia, and consequently without knowing or partaking of the enjoyment that is insisted on."

The point to be noticed and insisted upon most of all in the quotation just given, is the admission as a fact, legal though it be, that the locally applied stimulus of coition will, at any rate at times, force the uterus to act independently of the will. How well this position is taken by our very eminent authority we shall see further on.

In quick succession we refer to Rokitsky, Dalton, Hodge, Meigs, West and Tyler Smith for some attempt at an explanation of the process we are considering, and we retire in confusion at finding no pabulum in their works which may satisfy the craving of our mental stomachs for this sort of a meal. Tyler Smith, indeed, discourses learnedly, eloquently, and in the most practical manner upon the possible destruction of the spermatozoa by a leucorrhœal discharge, but touches upon the point we are examining nowhere nearer than to say: "I have already referred to the normal mucous secretion of the canal of the cervix uteri, and which, in all probability, favors the ascent of the spermatozoa, or at all events permits them to move as freely as the mucus of the seminiferous tubes or the vesiculæ seminales. But in cases where a thick and highly viscid string of mucus is constantly exuding from the os uteri, we can easily understand that the ascent of the spermatie particles through the cervical canal may be impeded mechanically."

The fair deduction from this language seems to be, that the author quoted believes that the spermatie filament would pass up the channel of the cervical canal, and does so pass, of its own accord, provided that the resistance referred to is not very great, and that this filament has the power to overcome any ordinary obstruction which may be placed before it.

Carefully scanning Scanzoni's works, and finding nothing to reward us for our search, we pass on to notice what the pathologist Klob has to say in this connection. Those of you who have heretofore been disbelievers in the possession by the spermatozoon of peregrinating powers, which, but for want of a suitable arena, might rival a Weston, will be somewhat

<sup>1</sup> On Leucorrhœa, page 155.

astonished to hear our present author say :<sup>1</sup> "The rudimentary horn appended to the uterus unicornis may also become pregnant, even in cases where the junction with the normal one is solid, and therefore in those cases also where its canal neither communicates with the cavity of the uterus nor vagina ; consequently, in such cases, to produce conception the semen must have penetrated through the normal horn and oviduct to the ovary of the opposite side from which the ovum entered the rudimentary horn in the usual manner." This from Klob, and the matter, in fact, as to the emigration of the spermatic filaments, may be speculated upon as you choose.

Another instance of a non-committal, non-explaining author, we find in Tilt, as by a reference we shall notice that he says :<sup>2</sup> "The chances of pregnancy are proportionate to the amount of semen entering the womb ; and as, with well adapted organs, the orifice of the male urethra corresponds with the os uteri, the semen is, to a certain extent, injected into the cervical canal, and, whenever this occurs, the deadly collapse which follows connection may solve uterine spasm, and so dilate the os uteri as to facilitate the entrance of a portion of the semen in which it is bathed." . . . . . Certainly a most wonderfully constructed sentence. Not that I presume to criticise the language of the same, but merely state that if there ever was a single sentence written on any subject, which, by a fair inference, placed its author on both sides of the subject at once, then I have failed so far to meet with it. This is the way, of course, in which it presents itself to my mind.

Coming down now to the latest work comprehending the question which constitutes my subject, I am very properly surprised to find it dismissed from contemplation by as shrewd and careful an observer as Thomas, in a single paragraph, and in the following neutral style :<sup>3</sup> "In the act of coition, the male organ, being introduced into the vagina, projects into and against the cervix a fluid, consisting of a thick, watery portion, holding in suspension large numbers of ciliated cells which have the power of moving by ciliated action. The bulk of this fluid pours down into the vagina, but many of the cells which

<sup>1</sup> Pathology of the Female Sexual Organs, page 18.

<sup>2</sup> On Uterine Therapeutics, page 280.

<sup>3</sup> On Diseases of Women, page 618.



it contains pass upward into the body of the uterus." . . . . . Comment is deemed entirely out of place here, the more particularly so since there is nothing to comment upon. Perhaps, when the author revises his work for another edition, he may be disposed to elaborate this whole subject beyond the limits of a single sentence, and may even devote a whole chapter to the explanation of the how of the passage of these cells. We will hope so, at any rate.

But now, permitting our array of authorities, who have testified to so little effect thus far, to stand aside, we will call forward another witness; one who is positive in his opinions, and who, after clearly enunciating them, proceeds in their defence like a crusader of old, with the difference that his pen is a much readier and more trenchant weapon than was ever the sword of the warrior. The literature of this part of the subject, scant as it has necessarily heretofore been, is therefore most appropriately dismissed by a rather copious quotation from him whom I believe to be perhaps unequalled as a gynæcologist, and who is certainly the closest observer in this department that it has ever been my good fortune to read after. Indeed, words are powerless to express my admiration for his acuteness. So closely has he observed the physiology of this subject, *that he almost came upon the truth*; at any rate, very much nearer it than any other observer in the same premises, always excepting in all modesty your orator. Of course, I allude to and quote from Sims. Hear him!

<sup>1</sup> "We know very well that the semen, or rather its fructifying principle, the spermatozoa, must pass into the cavity of the uterus, if not further, in order to render conception possible. How is this done? Does it enter the canal of the cervix in the act of ejaculation? Or do the spermatozoa afterwards, by their locomotive powers, gradually wend their way up the canal of the cervix?

"I am not aware that any observations on the living subject have been before made upon this point. A few *post-mortem* examinations, made in cases of sudden death after coition, have demonstrated the presence of spermatozoa in the cavity of the uterus; but this does not settle the questions raised above.

<sup>1</sup> On Uterine Surgery, page 362, *et seq.*



The fact that pregnancy has frequently occurred without penetration, proves very conclusively that the spermatozoa can and do traverse the whole length of the vagina; that they then can and do enter the canal of the cervix, and passing along this narrow strait, that they can and do pass on until they reach the ovum and fertilize it. But this is not the usual way in which this is done.

"I have over and over again examined the condition of the uterus after coition, and often in four or five minutes after it; and I have usually found the state of things described on page 348. I have also frequently removed the mucus of the cervical canal immediately after sexual intercourse, first a drop from the os tincæ, and then a drop or two from an inch higher. If the neck of the womb is in a normal condition, with an open os tincæ filled with healthy mucus, we shall always find spermatozoa in it, in greater or less numbers, if we examine it immediately after coition.

"Thus we see that they enter the cervix, as it were, suddenly. My explanation of this physiological phenomenon is, that the cervix is pressed forcibly against the glans by a contraction of the superior constrictor vaginæ; that this pressure necessarily forces out the contents of the canal of the cervix; that the parts subsequently become relaxed, the uterus returns suddenly to its normal condition, and the seminal fluid filling the vagina, necessarily rushes into the canal of the cervix, by a process similar to that by which a fluid would pass into an india-rubber bottle slightly compressed so as to expel a portion of its contents before placing its mouth in a fluid of any sort.

"If the uterus is in a normal condition, we shall always, as a rule, find spermatozoa in the canal of the cervix immediately after coition. If the uterus is greatly retroverted, we shall not; and if it is greatly anteverted, we shall not. And why? Because in the first instance, the os tincæ will be too close to the symphysis pubis, and if it is subjected to any such pressure as that alluded to above, it will, for anatomical reasons, be such as to compress the posterior lip of the os tincæ up against the anterior, which will have no effect in exhausting the canal of the cervix; and in the second instance, where there is a complete anteversion, with the os looking in the direction of the hollow of the sacrum, the same act and the same pressure would only

force the anterior lip of the os tincæ up against the posterior, creating no vacuum, and making no room for the newly introduced fluid.

"From this it will be seen that I believe the cervix uteri to be shortened in the erethismal climax of coition, by pressure exerted upon it in the direction of its long axis, when its position is normal, which is impossible in any greatly abnormal position. I have spoken of a superior constrictor vaginæ, and attributed to it a certain office—that of compressing the glans forcibly against the os tincæ at a certain moment. I have made no dissections to prove the existence of such a special muscle; but that it does exist, and that some anatomist will dissect and describe it, I feel perfectly confident, for I have seen the manifestations of its presence hundreds of times. In uterine examinations, with the patient on the left side, and my speculum introduced, we may now and then see the posterior wall of the vagina, just opposite the os tincæ, gradually contracted and corrugated, till it is brought almost in contact with the cervix, evidently by circular bands of muscular fibres that occupy the superior portion of the vagina.

"We are more apt to see this in patients that are alarmed, and manifest some degree of general nervous agitation. I have witnessed this over and over again, and what one man sees another will be sure to discover when his attention is turned in the proper direction. It matters not whether this explanation is correct or not, *provided other observers establish the fact that the semen finds its way AT ONCE into the canal of the cervix.*"

The italics in the concluding sentence are my own again, emphasized for what purpose we shall see as we make further progress in the consideration of our subject. Coming as our last quotation does, from a work devoted professedly wholly to the special surgery of the uterine region, I am forcibly impressed with the fact that in the anatomical and physiological views set forth in the quotation just given, we have received most agreeably much more than we had a right to expect.

I now pass from mere statements of theory, to examine some of the arguments which, in my opinion, affix the stamp of puerility at least, if not that of absurdity, to all the theories which have so patiently been hereinbefore advanced on the part of their several authors. We premise this further examination by

a repetition of the remark made earlier in this paper, that the cause set forth to account for the extreme scantiness of literature on this point, is, for obvious reasons, quite a sufficient one, and one which will continue ever to be more or less of an obstacle to our rapid advancement in knowledge of this matter, by reason of want of opportunity for observation.

Coming, then, to the argument, we inquire, do the spermatozoa ever arrive in the cavity of the uterus by their own efforts, and entirely unaided by any force other than that generated within themselves? I do not believe that they do or can, and I base my unbelief upon, first, their entire want of either reasoning power or instinct. That they are animated by no such power in the least degree, seems to me to be evident from their very construction. They are simply ciliated cells, with no internal formation which can be made appreciable under the highest power of the microscope. Lacking, therefore, the physical construction necessary to generate reason or instinct, we are forced to the conclusion that any idea which is advocated as affirming my interrogatory, must, in the nature of the case, be absurd.

I am a disbeliever, secondly, by reason of the lack of physical power exhibited by the spermatozoa. Any one who has ever observed these cells under the microscope, it would seem to me, must have become impressed with the remarkably feeble power exhibited by them; not feeble when considered by themselves exactly, but very feeble when regarded in connection with their prospective journey in search of the ovum. The movement of each cell, while a lively one in appearance, is yet indicative of a want of power which, according to my mind, would seem to be required to propel it to its destination.

I am an unbeliever for the third, and by far the most cogent and forcible reason of all, which exists in the fact that to a certain extent great opposition has to be overcome during and by the passage of these spermatic cells to the uterus; or further, by reason of the peculiar anatomical construction of the vagina and the cervical canal, not to mention here that of the Fallopian tubes. I do not propose to make the broad statement here that the uterus has *only one action*, but desire to be understood as saying that the only action that it is susceptible of, *that we have been familiar with so far*, is that of its contraction upon any contents, and therefore an expulsion, or an *effort*

at expulsion of any material which may occupy its cavity. This effort is manifestly aided by the direction of the action of the villi lining the Fallopian tubes, covering the mucous membrane which lines the cavity of the uterus, and continuing on to and covering the external os uteri, *this direction being from within outward, and the villi being placed point downward.* Now, with these forces and natural obstructions arrayed to oppose their passage, it occurs to my mind that any one who could believe, or even imagine, that *large numbers* of spermatozoa could generally, or even exceptionally, *by the use of their own inherent power solely*, gain even the cervical canal, to say nothing of the cavity of the uterus or the Fallopian tubes, must be guilty of a grave inconsistency, to say the least.

That this view of the matter has been entertained by others, and has been examined before, and that it has attracted the serious attention of very eminent authors, I have only to instance, and refer as proof to Montgomery, from whose writings I have not deemed it inappropriate to make a selection, bearing somewhat upon the point immediately under consideration, namely, the third section in my creed of unbelief, as stated. In speaking of the point where conception occurs, he says: ' "It is much to be regretted that there should be in so many minds such a tendency to explain vital processes or functions by explanations based on mere physical or mechanical agencies, and, in fact, to be satisfied with no other; whereas all such modes of explanation are invariably found inadequate and unsatisfactory." This language contains an evident disapproval of all theories which do not admit that the process of conception is essentially a vital one, and that the function is in no respect purely physical. In this declaration—for reasons which will be made apparent hereinafter—I am glad to say I most heartily coincide.

But hear him further in this immediate connection: "It has been objected, and indeed it is one of Pouchet's principal arguments, that the natural peristaltic action of the Fallopian tube is from within outwards; and that, therefore, it cannot carry the semen from the uterus to the ovary. I think it would be equally just to say, *that as the natural peristaltic action of the*

<sup>1</sup> On Pregnancy, page 343.

*uterus and vagina is from within outwards, the semen deposited in the latter canal, or a portion, only at its entrance, could not be thence transferred inwards to the orifices of the Fallopian tubes.* Is not the natural action of the oesophagus to pass the food down to the stomach? But we know that in a large class of animals, it equally and as perfectly transfers it back again into the mouth for rumination. I know no reason why the Fallopian tube should not be equally capable of transmitting semen to the surface of the ovary, as of transferring an ovum to the uterus. . . . . Pouchet meets this unanswerable objection by saying that in extra-uterine pregnancy there is an aberration in the dispersion of the semen, which does not follow its natural course."

That a part of the above quotation contains matter that is irrelevant to the subject under consideration, I admit, and volunteer the statement that this matter was admitted in order to avoid any appearance of having made a garbled quotation. I have also italicized the concluding portion of the second sentence, merely to impress it upon your minds, as confirmative of the idea of the obstacles which are presented to oppose the entrance of the spermatozoa into the cavity of the uterus. Montgomery presupposes a reversal of action as the mode of carrying the semen up, and attempts to sustain his position by what I am pleased to denominate a very far-fetched comparison, and one which, even under the old *régime*, could not have been entertained for a moment by any competent anatomist, by reason of the vast difference in the anatomical construction of the two tubes thus ill-advisedly compared. Beside this, the returning action of the organs concerned in alimentation in the ruminantia, does not reside in the gullet solely, by any means; for Flourens ascribes the formation of the pellets which are thus returned, to the action of the muscular duct which connects the gullet with the reticulum and psalterium, and the power which the animal has of closing or opening at will the orifices of these cavities. Hence the term far-fetched is appropriately applied to Montgomery's comparison.

But returning and retracing our steps, we are led to ask, how, then, *may* the ascent of the spermatozoa be *aided* in exceptional cases, by the organs concerned in generation? It might be suggested as a partial reply to this question, that owing to the

intense excitement under which all of these organs are laboring during coition, and more especially at the height of the venereal orgasm, they *might* somehow *reverse* their action, and that under cover of this reversed action, a few spermatozoa might be *aided* in their journey to the cavity of the uterus. This theory would exactly coincide with that of Montgomery, in that it would be classed as a vital process, but surely there must some confusion ensue when the same author would class it with the purely physical function of rumination, as already mentioned.

This suggestion might cover some exceptional cases, and I do not propose to become so exceedingly illiberal as to entirely exclude the idea from all consideration, but will for tolerance sake admit the existence of a few such rare instances. I will even go further, and agree with Montgomery that this theory will patch out beautifully, and can be made to cover *all exceptional cases*; but, dealing as we are with rules and generalities, I beg to submit that the idea as above inculcated, *will not do for a rule, much less for a general explanation*. As the observant Sims has better said: "THIS IS NOT THE USUAL WAY."

But just here I may be met by the assertion, that the only way in which the persecuted spermatozoon could by any *possibility* obtain relief from all its troubles, and secure a conveyance into the uterus, *must of necessity* be elucidated by some one, or a combination of more than one of the ways and means which have already been discussed. To such an assertion, if made, I here submit a total denial. I am now, and have for a long time past been certain that no single one of the modes made mention of and advocated by any of the reputed authorities on the subject, nor any possible combination of them, ever has or ever can be made to explain that process in a perfectly rational manner.

The only way in which this subject can be positively set at rest, and determined for all time to come, is to observe the action of the os and cervix uteri *during the sexual orgasm*. I have made two such observations, and know beyond the peradventure of a doubt, that all the descriptions of the modes of entrance of the spermatic fluid into the uterus, heretofore or hereinbefore described, are totally and wholly, both in the main and in detail, theoretically and practically untrue. This may

be deemed to be a broad and sweeping denial, one which is very positive in its assertions, and which will admit of but one interpretation; nevertheless, gentlemen, I mean it just as it has been said in your hearing, and I am glad to be able to call attention hereinafter to Dr. Wernich's views as compared with mine, and am even better pleased to have this broad denial sustained in every particular, by as competent a gynæcological observer as my friend Dr. M. A. Pallen, of St. Louis. Of this, however, more anon.

What the *real* force and the *real* state of affairs is, which compasses the end which we are contemplating, remains yet to be described; and we find ourselves, if the truth has been spoken thus far, reduced to the extremity of again asking the question which stands as the subject of this paper: "How, then, do the spermatozoa enter the uterus?"

I answer this question in a positive manner, by a description of what I saw, and in what manner and under what circumstances I saw it. Since two observations, yielding each time the same results, were made within twenty-four hours of each other, a description of one will fairly represent the net results of both, give us as accurate details as a second one could, and spare me some trouble. I take from my case-book a *verbatim* description of the case as presented to me at the first consultation, and detail the observations which were made at the second examination.

"August 7th, 1872. Mrs. H. L——, married, living with her husband; aged 32 years; of very strongly marked nervous temperament; blonde, married eight years; has one child living, seven years of age; has had one abortion; last pregnancy was six years ago; commenced to menstruate in her fourteenth year; present illness has existed six years, dating evenly with abortion; symptoms which have been apparent during its course, were dragging and weight in pelvis, more or less pain in back and loins, some vesical and rectal irritation, inability to walk without great fatigue, inability to lift weight of any moment, some leucorrhœa, and a sinking sensation referred to the epigastric region; cause of all this trouble supposed by her to be a "falling of the womb;" present condition as regards menstruation, menstruates regularly every twenty-eight days, normal as to amount, and has no dysmenorrhœa; leucorrhœa slight as



to amount, is constantly present, is white, glairy, and unmistakably uterine in its character, and is nearly neutral in its reaction; pain is intermittent, by no means severe, and is principally referred to the back, loins, inguinal and sacral regions; locomotion is impeded to a considerable extent by the consequent fatigue; as to other symptoms she suffers severely from habitual constipation, and has had for four or five years a persistent eruption of acne upon her face; of physical signs, the touch shows the os uteri just inside the vulvæ, the speculum was not used, the probe shows the pelvi-uterine axis to be considerably changed, but no flexion of the uterus present, the probe entering the cavity two and one-half inches; diagnosis, prolapse of the uterus in the second stage; prognosis, a complete relief of all the symptoms, and in time a perfect cure; treatment, mechanical support to the uterus by means of a McIntosh stem pessary, and internally ferruginous and bark tonics, iodide of potassium, and Fowler's solution of arsenic."

Thus much for the history of the case as compiled from an office examination; and I desire to stop here long enough to remark that the result of the treatment was all that could have been desired; the prolapse is entirely relieved, although the supporter has been until very recently still worn during the day, and my latest advices from my patient, received while preparing this paper, was to the effect that she was then seven months advanced in her third pregnancy.

Returning from this digression, I continue my statement. In making my visit at the residence of the patient, next day, for the purpose of adjusting the supporter, I made a second examination by the touch, and upon introducing my finger between the pubic arch and the anterior lip of the prolapsed cervix, I was requested by the patient to be very careful in my manipulation of the parts, since she was very prone, by reason of her nervous temperament and passionate nature, to have the sexual orgasm induced by a slight contact of the finger, a fact which I believed had been manifested in my office examination of the previous day, and which she afterward admitted had been the case. Indeed, she stated further, that this had more than once before occurred to her while making digital investigation of herself. Here, then, was an opportunity presented me to make a second observation, under vastly more favorable circumstances

than had accompanied the first; an opportunity never before, in so far as I knew, afforded any one, and a chance for clearing up the hitherto regarded unknown and unknowable, which in my opinion was not to be lost under any consideration. Carefully, therefore, separating the labia with my left hand, so that the os uteri was brought clearly into view in the sunlight, I now swept my right forefinger quickly three or four times across the space between the cervix and the pubic arch, when almost immediately the orgasm occurred, and the following is what was presented to my view:

The os and cervix uteri had been about as firm as usual, moderately hard, and, generally speaking, in a natural and normal condition, with the external os closed to such an extent as to admit the uterine probe with some difficulty; but instantly that the height of the excitement was at hand, the os opened itself to the extent of fully an inch, as nearly as my eye could judge, made five or six successive gasps, as it were, drawing the external os into the cervix each time powerfully, and, it seemed to me, with a regular rhythmical action, at the same time losing its former density and hardness, and becoming quite soft to the touch. All these phenomena occurred within the space of twelve seconds of time certainly, and in an instant all was as before. At the near approach of the orgasmic excitement the os and cervix became intensely congested, assuming almost a livid purple color, but upon the cessation of the action, as related, the os suddenly closed, the cervix again hardened itself, the intense congestion was dissipated, the organs concerned resolved themselves into their normal condition, and their relations to each other became again as before the advent of the excitement.

In reflecting upon these facts, since the publication of my paper in 1872, the idea has taken possession of my mind that the application of my finger to the os, to determine its consistence during the crisis, exercised, perhaps, no small influence in abridging the duration of the orgasm. Particularly has this impressed me, by reason of the statements of the patient, which we shall presently notice. Another item which I have thought a great deal about since these events transpired, is the rhythm which marked the movements of the os and cervix. It now occurs to me that this rhythmical action might have been

synchronous with the action of a greatly excited heart, and this impression is especially deepened when the great attendant congestion is remembered; but as this idea is contemplated in the presence of a very lucid theory, I may be under the impress of the idea to too great an extent to be enabled to judge impartially. However, we will discuss this matter further along.

Returning from this apparent wandering, and resuming the thread of my narrative, I remark that I carefully questioned my patient as to the nature of the sensations experienced by her at this period of excitement, and she is very positive that they were identical in *quality* with those experienced by her during coition, even before the occurrence of the prolapse; but she admitted that they were not exactly the same in *quantity*, believing as she did that during coition the orgasm *had lasted longer*, although in no respect different as to the character of the sensation.

When in connection with these statements of the patient, who is a very intelligent and appreciative lady, I adduce the experience of her husband, who, since the preparation of my first paper, has assured me that prior to the observations of which I had written, he had, by frequent examinations, noticed what he now knows to have been the actions above described; and when to all this I add my own statement to the effect that there was no inflammation of any kind present anywhere, either in the os or cervix uteri, the vagina, bladder or rectum, and that the parts were in an entirely normal condition in every respect, except as to position, I am certain that no idea of presumption on my part will be entertained when I close this paragraph with the remark, that in the observations just described I then and there had exhibited before my eyes the phenomena which are always present during coition; and the passage of the spermatic fluid into the uterus is explained fully, satisfactorily, and in every way beyond the shadow of a doubt.

I do not doubt that many of you have at some time seen in small streams of water, a species of fresh-water fish, improperly denominated, in the United States, the "Sucker," but which in fact is not one of the Discoboli, but, on the contrary, comes under the class of *Cyprinus Carpio*, and is a member of the

family Cyprinidæ. The peculiarity of this fish is its long, pendulous upper lip, and small round mouth. When at rest in the water, they aerate their blood in the way common to all fish, with the additional peculiarity, when they pass the water through the mouth and out at the gills, of making a suction motion with their mouths, in or during which the overhanging lip is to a considerable extent inverted into itself. This action can be readily noticed when the fish is stationary under the shade in the water, and is peculiarly apparent on a very warm day. Precisely such a motion does the lower segment of the uterus make at the height of the sexual excitement.

The quarter from which my illustration is drawn, I feel stamps the comparison as a very homely one, but I am aware of no other operation in Nature, or in the movements of any of Nature's creation, which answers my purpose quite as well; and I may therefore be pardoned for having illustrated a vital action by a comparison with one essentially physical.

To condense the explanation of the passage of the spermatozoa to their destination, into a single sentence, we shall say that the act of coition, *purely mechanical in its nature*, arouses some special nervous action in the uterus, *entirely vital in its nature*, which causes that organ to act as already described. Perhaps we may properly amend this by saying, *forces that organ to act, etc.* I am now of the opinion that the movements of the os and cervix uteri herein delineated, are directly the result of the force exerted through the media of the nervous system, and that they are only indirectly promoted by the mechanical action of coition. I also believe that the great nerve centres have, to a greater or lesser degree, the control of the matter, ascribing to the nerves of volition a lesser degree of such power, but by no means denying to them *some agency* therein. This theory is not at this time demonstrable, and therefore is only suggested as an opinion. The views presented in connection with the facts throughout this paper are, of course, in a crude condition as yet, and will well bear discussion and further observation; but I feel sure that the facts stand for something, and that they offer to the profession the first and only reasonable solution of the question, "How do the spermatozoa enter the uterus?"

We shall now properly endeavor to cast as much light as possible upon that at present unknown power, which, by its direct action upon the os and cervix uteri, causes those movements by them which we have been considering. We have seen in what manner the os and cervix have been dilated, and how the process is continued to its completion by the admission of the spermatozoa into these cavities; but the desire is yet strong within us to go one step further, and investigate the character of the force or forces which have been chiefly instrumental in bringing this to pass. This brings me now to the consideration of the third division of my paper, namely, the monograph "ON THE ACTION OF THE OS AND CERVIX UTERI DURING COHABITATION," by Dr. A. Wernich, of Berlin, Prussia.

It is but proper to remark, as a preliminary to the introduction of this third section, that it is impossible for various reasons to give more than an abstract of the valuable points made by Dr. Wernich in this paper, since its complete rendition here would involve the extension of my paper to an immoderate and excessively tiresome degree; since all that is of real or comparative value is embodied in the abstract; since the paper in its entirety is of a nature rather metaphysical than practical; and finally, since the translator has not deemed it necessary, for a full understanding of the paper, to give more than an abstract. I reproduce this abstract, then, from the *St. Louis Medical and Surgical Journal*, for February, 1874.

"In considering this subject before the Berlin Medical Society, Dr. Wernich maintained that, although in late works upon the *cervix uteri* it is held that this portion of the uterus is almost without nerves, and, in the various activities of the organ, remains an inactive appendage, yet, on the other side, a series of investigations which have widened the older views makes it much more probable that just this portion of the uterus plays a very important rôle in certain phases of sexual life. Vallisneri and Haller directly observed the process of erection in the uteri of animals. Günther states that in the mare the uterus exercises an aspiratory activity during and after the ejaculations. Bischoff, after his experiments on dogs and rabbits, felt justified in assuming that the human uterus, at the moment of the highest excitation, presses down into the small basin, and that the mouth opens and draws the semen in by

suction. Still, there was generally little inclination to accept the analogy from the lower animals, even after Rouget published his investigations concerning the dilatable vessels of the human uterus, and Litzmann, and, soon after, Hohl, observed the erection of the uterus direct through touching, and Eichstedt, from these data and his own experience, framed a full erection and aspiration theory. According to this theory, the uterus, which is flattened antero-posteriorly in its usual state, assumes a roundish or pear shape during and especially after the sexual excitation in coition; so that an actual *cavum uteri* arises, and through this temporary widening the semen is drawn in.

"A year before the date of these remarks, in a full and detailed publication of two observations of uterus erection, Dr. Wernich took occasion to oppose this view, and especially supported by the results of Henle's anatomical investigations, he sought to establish the probability of a somewhat different process. He believed that as with man an erection of the penis, so in woman a similar erection of the *os and cervix uteri*, and of this only, takes place, and that at the time of the orgasm and almost simultaneously with the mutual ejaculation, the *cervix* becomes lax and soft, the *os* opens, and through this somewhat sudden cessation of the previous state, rendered possible by the peculiar arrangement of the vessels, the aspiration occurs. Furthermore, he had received friendly letters from Dr. Matthews Duncan, of Edinburgh, and from Professor Bischoff, of Munich, communicating statements in the literature of the subject overlooked by him, and remarks wholly in agreement with his views. Under these circumstances, he felt he might be pardoned for coming before the Society with a further confirmation of his views of normal conception, namely, the direct observation of these changes in the *portio vaginalis* by Dr. BECK, reported in the *St. Louis Medical and Surgical Journal*, September, 1872, under the title: '*How do the Spermatozoa enter the Uterus?*'"

Dr. Wernich was ready to retain doubts, as far as need be, in single observations; but aside from the fact that the author made the observation the second time, there was much in the report to contribute to its credibility. Dr. Beck was entirely unprejudiced with regard to what he saw. His *naïveté*

went so far that he knew nothing of the European literature, *pro et contra*, and held his observations not only as the first *per adspexit*, but as something absolutely new. However valuable though this absence of all preconceived opinion may be, it had, on the other hand, the disadvantage that the reporter had given no strict thought as to how the fact he saw came about. To Dr. Wernich, this initial hardness of the *cervix*, the congested state, and the rhythmus of the aspiratory movements, are certainly evidence in favor of the view that the confirmed phenomenon rests on a process of the vessels. There are peculiarly constructed vessels, capable of contraction and dilatation, found only in the *cervix*. Wholly at variance with Rouget and Ducelliez, who describe the whole uterus as capable of erection, and thereupon proceed from a somewhat hypothetical representation of the *arteriæ helicinæ*, and their functions, and who do not, in their whole works, describe a single vascular apparatus which, *stricto sensu*, merits the title erectile, Henle establishes beyond doubt the right of the vessels of the cervical and vaginal portion to this designation. Dr. Wernich had spoken in full concerning this matter in his publication alluded to, and to avoid repetition, he referred the Society to it and to Henle's "Hand-book of Anatomy."

Since the above abstract of his last paper has been incorporated into this essay, Dr. Wernich has kindly sent me his "former paper," etc., alluded to in the abstract; and I feel that the subject matter of the paper thus transmitted to me is of such an important nature that I have taken the liberty to transgress still further upon your time and patience, and have reproduced it in its entirety. The subject is by this paper very aptly and appropriately closed, in so far at least as I am able to carry it at the present time; and this paper would really be incomplete without the rendition of this last addition to the literature of the subject. It will be remembered that the paper, now about to be introduced, was read early in 1872, and about one year prior to that which we have just given, and thus claims precedence over my original paper of some few months at any rate. Deferring any remarks upon Dr. Wernich's theory for the present, I proceed to give you his paper "ON THE ERECTILE PROPERTIES OF THE LOWER SEGMENT OF THE UTERUS AND ITS SIGNIFICANCE."



"Among the many observers who have from time to time directed their attention to the erectile organs of the female, I may prominently mention the French anatomist Rouget, who, in an elaborate monograph on the subject,<sup>1</sup> has described not only the clitoris and the Fallopian tube, but also the whole uterus, as being possessed of erectile qualities. His investigations relative to this point, which originally had their origin in some other investigations having for *their* object the study of the helicine arteries, have evidently been held in higher estimation by anatomical authors than by the authors of works upon gynaecology. I thus conclude, from the fact that he is not referred to in any of the works upon the latter subject which are at present at my command, excepting in the volume on Sterility, by Marion Sims, and in that on Diseases of Women, by Dr. Grailly Hewitt; nor can I find that his discoveries have been made use of, in any of their peculiar phases, by the authors of any special papers having reference to this branch of the subject.

"The assertions of Rouget, in so far as they relate to the present subject, were to the effect that the uterus was, both as to its body and to its neck, an erectile organ, and that it exhibited its erectile property *only* during ovulation and menstruation. I believe that I shall be able to substantiate the fact, that while in one respect these views are correct, and capable of still further extension, they are in other respects more or less incorrect, and should be subjected to considerable restriction.

"I had endeavored for a long time to gain some light as to the *modus operandi* of the phenomena present during the erection of the uterus, but I have looked for it in vain in and during vaginal examinations, which I have made in large numbers upon the inmates of the extensive and numerous-attended wards of lying-in hospitals. The patients in these wards, upon whom the examinations were made, were, as a general thing, too far advanced in pregnancy to yield anything like a satisfactory result, and even in occasional cases, when the cervix uteri did seem to elongate and harden itself in response to the touch of the investigating finger, still the impressions received under these circumstances were of a very vague and indistinct character.

<sup>1</sup> Journal de la Physiologie, volume 1, page 320, *et seq.*

"During an investigation upon a case in which I was recently engaged, I made an observation which I briefly communicate here, which taught me, however, that such observations of the condition in question are possible even in pregnant women, and when carefully considered may become of practical importance. The case is as follows: Mrs. E——, 24 years of age, of very robust physique, and recently married, was suddenly attacked with very severe pains in the abdomen. In the opinion of the patient, she was about three months advanced in pregnancy, and volunteered the further statement that she had received a severe injury only a few days before. A careful exploration of the generative organs revealed the uterus in a normal position, and affairs generally in a proper condition in and about the genitalia; but I was surprised to notice a very remarkable action on the part of the cervix uteri while making my investigation. In the beginning of the exploration, while the abdominal pains seemed to be very severe, which I inferred was the case from the actions of the patient, yet as the examination progressed these pains seemed to lessen materially, both in degree and in duration. The cervix uteri, being that of a primipara, had, of course, not as yet lost its virginal shape and size, and it at first presented itself of a moderate length, easily movable laterally, and, on account of the moisture of the mucous membrane, quite soft to the touch. When, however, the pains ceased, and while I was yet engaged in interrogating the adjacent pelvic organs, the cervix suddenly became elongated and quite hard, and the mucous membrane covering it became distinctly movable upon or over a substratum of hard tissue; in short, the cervix was in a condition of erection.

"I cannot compare the impression I received from the cervix while in this condition, with anything else than the glans penis when in a state of erection. In this patient the change in condition from the soft to the hardened cervix could be produced at pleasure at every examination. Her opinion as to the existing state and time of her pregnancy, was in due course of time verified.

"I have for a long time been of the opinion that this phenomenon might be quite often noticed incidentally: yet a number of celebrated observers, especially noted for their shrewdness, have informed me that such action on the part of the cervix

uteri is not often developed to such a marked degree as to attract the attention of the observer, who being intent on other matters of detail, might easily pass such action by unnoticed. In my opinion, the explanation of this fact is principally to be found in the other fact, that the sexual excitement is in the generality of cases repressed as much as possible by the patient; nevertheless, if the patient be possessed of such an excitable temperament as to be unable to successfully repress these feelings, the changes in the erectile organs, which are now under consideration, are frequently produced by a mere sight by the patient of the preliminary preparations for an examination; so that it happens in the large majority of these excitable cases that the explorer finds the cervix uteri already in a state of erection.

"In Hohl's work<sup>1</sup> we find a statement made, according to the tenor of which we are given to understand that this process itself had been fully observed. The statement referred to is as follows: 'It, however, rests not indeed upon any error, but upon observations repeatedly made and often verified, when we make the statement, that in irritable females, especially quite plainly in those who have not as yet borne children, there occurs during the increased irritation ordinarily attending a vaginal examination, not only a material increase of the vaginal secretions, but also a momentary sinking down of the uterus, and an opening of the os, so that it does indeed become, to all intents and purposes, an os tincæ.' More than this, we find that Litzmann relates his experience in the following words:<sup>2</sup> 'I myself recently had occasion to observe, while examining a young and very excitable female, that the uterus suddenly took on a vertical position, and sank down into the cavity of the pelvis; that the mouth of the womb became of an equal length all around; that the os became rounded, softer, and more easily entered by the exploring finger; and that at the same time the high grade of sexual excitement under which the patient was laboring, manifested itself in her hurried respiration and tremulous voice.'

"In the case of Mrs. E., which I have detailed above, no other sign of sexual excitement was apparent except those already related.

<sup>1</sup> *Lehrbuch der Geburtshilfe*, page 125.

<sup>2</sup> *Wagner's Handwörterbuch der Physiologie*, volume 3, page 53.

"Just at this point I will relate an observation which, in its salient points, is quite in accordance with that made by Litzmann, and in which this phenomenon manifested itself quite plainly. It occurred in the case of a servant-girl, who was thirty-five years of age, who had borne one child when she was about nineteen years old, and who at the time of this examination was suffering from a slight retroflexion of the uterus. The uterus, after her labor, had undergone involution so fully and completely that the cervix uteri, with the single exception of a certain increase in volume, presented almost the form of that of a virgin. In the commencement of the examination I noticed that the patient, by the exercise of quite a strong effort, forcibly restrained her feelings, but as the investigation required to be extended over a considerable time, there eventually occurred, in addition to the other signs of strong sexual excitement, full and complete erections of the cervix uteri; so that while it was formerly soft and flabby, it now presented itself as a hard body, about as long and twice as thick as my thumb. Repeatedly, during the examination, the organ returned to its original condition, and again and again it re-erected itself as described.

"It has been the design, as must have been evident all through the statements set forth up to this time in this paper, to speak only of the erectile power of the lower segment of the uterus, for the specific reason here plainly stated, that I am firmly fixed in the opinion that the condition to which the term erectile can be rightfully applied, manifests itself, and indeed occurs in this lower segment *only*, and not in the whole uterus. This view, it seems to me, rests upon a very good anatomical basis. It is true that Rouget attempts to demonstrate that the uterine arteries, in their upward course, send or give off to the cervix only their first branches, and that these are of very insignificant calibre; and that when the trunks of the main arteries arrive at a point opposite the body of the uterus in their course, they directly give off from twelve to eighteen short branches, which, after a short, and it is said a spiral course, divide themselves again into an indefinite number of smaller branches. Reasoning from this fact alone as a basis, Rouget is of the opinion that the body of the uterus is the portion of that organ most profusely supplied with arterial blood; and he

further lays claim to have been enabled to follow these 'spirals' up to the point of their termination in the great sinuses of the uterine walls. That this description is correct in the main, and that the vessels so described are capable of supplying to the body of the uterus the great amount of blood so necessary to its general well-being under all circumstances, can and should be readily admitted. We miss, however, in these representations of Rouget the description of such a class of vessels as are absolutely characteristic of an erectile tissue. This, to my mind, fatal defect in the above author's description, I find fully and satisfactorily supplemented, especially with relation to the cervix uteri,<sup>1</sup> in Henle's larger "Anatomy," where he states:

"An arrangement quite peculiar to itself, and entirely different from those which may be found in the body of the uterus, is represented in those blood-vessels which supply the cervical and vaginal portions of that organ with blood. While the vessels situate in the soft superficial layer of the mucous membrane of the body of the uterus attract one's attention by reason of the attenuation of their walls, the arteries and capillaries of the cervix and os are especially noticeable for the great relative thickness of their walls. In the finer, or rather in the smaller vessels, whose transverse diameters do not exceed from one one-hundredth to four one-hundredths of a millimetre in diameter, we find that when uninjected and undilated they have a calibre of only one-third of that amount. In arteries measuring three-tenths of a millimetre in diameter, we find that the dimensions of their walls as to thickness are only six one-hundredths of a millimetre. In veins of fifteen one-hundredths of a millimetre in diameter, the walls are only two one-hundredths of a millimetre in thickness, and it is principally the circular muscular coat of these vessels which accounts for the major part of this thickness. Equally peculiar and striking with the structure of these vessels, is the course which they take in their distribution. In the muscular layer of the os uteri a number of small branches arise from the main arteries, and, pursuing a course parallel with each other and slightly serpentine in character, and almost equidistant from each other all around, run almost to the surface; and immediately beneath the surface a number of venous branches, which are

: <sup>1</sup> *Handbuch der systematischen Anatomie des Menschen*, page 463, *et seq.*

of a relatively large size, have their origin, and these vessels penetrate the walls in a course parallel with that of the arteries, and in the same regular order. The capillary vessels, through or by means of which the distal ends of the veins and arteries are brought into connection, are placed immediately beneath the epithelium, and penetrate the papillæ of the mucous membrane in loops. In the rugæ of the cervix the general course of the vessels is also vertically directed towards the surface. A horizontal section of the mucous membrane gives us a clear transverse view of the sinuses, surrounded by transverse sections of the vessels passing through the interspaces between these sinuses.'

"And further on, in remarks upon the physiology of the matter, we notice statements by the same author to the effect that: 'The reason why these vessels should be possessed of a relatively greater power of resistance is not readily apparent, inasmuch as they have no special amount of pressure to endure that I am aware of, and particularly inasmuch as they are fully and sufficiently protected from any undue or over-distension of their walls by the density of structure of the tissue in which they are situated. *Where, in order to produce contraction, unusual means are applied, there also we know that uncommon relaxation and dilatation is possible.*'

"In addition to the quotations already given, I desire further to notice a remark of the same author's, which has peculiar reference directly to the possible relation which might subsist between the curious construction of these blood-vessels and the mucous secretion: '*but the changeable degree of contraction in the smaller vessels might serve to furnish the cervical and vaginal portions of the uterus with a sort of erectile faculty, or a certain facility for congestions and swellings.*'

"I believe that I would be unable to plead for my own views with greater advantage, even by means of self-made investigations, than has been done just here, and in the already quoted words of the great anatomist. When, therefore, as has been demonstrated, we know that in the upper portion of the uterus the anatomical basis of a true erection is absent, it should, I believe, be readily admitted that in the physiological conditions which we will presently notice, an increase in the volume of the walls of the lower segment of this organ is not

only possible, but for the normal performance of certain functions is highly probable.

"To ascertain the condition of the upper portion of the uterus during an erection of its lower segment, either by pressing it down from above through the abdominal walls, or by the introduction of the uterine sound, or by means of both plans used in conjunction and at the same time, is, I think, very difficult.

"The explanations which I have just presented, had, of course, for their objective point the fixing of certain limits to the erectile powers of the uterus, and to restrict them to those certain portions of that organ which were determined by anatomical considerations. In a physiological point of view, however, the discoveries and observations of Rouget seem to require an essential extension of area. He claims that erections of the uterus occur during the period of ovulation only; but Grailly Hewitt goes one step further in making the statement that 'erections occur also during sexual intercourse.'<sup>1</sup> The examples which have occurred in my own cases, and in those of others, and which have already been related, seem to indicate clearly that the erection of the lower segment of the uterus is brought about in the same manner as that of the penis, by means of any considerable sexual excitement, even when cohabitation is not had; but under these circumstances it rarely attains a high degree, and recedes in common with the other symptoms of excitation, such as a peculiar sigh, a flushing of the face, a bright moist glittering of the eye, etc. While during ovulation this erection, as aforesaid, only accompanies the other menstrual processes by necessity, it is manifested during cohabitation not only in its highest degree, but, in my opinion, it is an essential, and in all probability the main factor in the process of impregnation.

"At first glance one might readily imagine that the cervix uteri might erect itself for the purpose of forming with the penis the so-called celebrated 'continuous canal' between the two sexual systems. It is well known that the contact of the glans penis with the os uteri is no very uncommon phenomenon; but it is also an equally well-known fact that this connection exists only in the form of short, jerking contacts, very

<sup>1</sup> On Diseases of Women, page 25.



similar, as to duration, to those made by successively opening and closing an electric circuit, owing to which fact a continuous contact, or one of considerable duration, is entirely out of the question. There exist, as I happen to know for a certainty, a number of happy husbands, with quite numerous progeny, who have never experienced even these transitory contacts with the os. The theory of the continuity of the canals of the two sexual systems, even as it is referred to and explained in some of the later text-books on Physiology, is rendered so extremely doubtful by the large number of both old and recent observations on the other side of the subject, that I desist from introducing any further evidence of their or its extreme improbability.

"We may now with the greatest propriety inquire for what purpose, then, has the lower segment of the uterus been endowed with erectility? I reply, in the first place, for the purpose of ejaculation. The fact that at the height of the orgasm there is ejaculated on the part of the female, and from the uterus, a fluid, has been known for a long time, and numerous observers have from time to time called attention thereto. This fluid is generally mucous in its character, small in quantity, of an alkaline reaction, and of a high temperature. I say generally, for the reason that there are exceptional cases, where, when the orgasm occurs in individuals who possess certain very voluptuous temperaments, this fluid is said to pour forth from the os uteri in quite considerable quantities. This fluid, as we all know, consists of the secretions of the cervical glands. As to the origin and the mode of manifestation of this secretion, I may be permitted to again quote from Henle. He says :<sup>1</sup>

"Inasmuch as the mucous membrane of the cervical portion of the uterus is the point where is secreted that transparent viscid mucus which fills that portion of the uterine cavity, as often as there exists a cavity by reason of a separation of the walls of the cervix, and since there is no other glandular structure found in this membrane, we are compelled to regard the sulci which exist in this membrane as a species of mucous follicles, although they differ considerably in structure from the ordinary secretory and glandular organs. Whether the muscular structure of the blood-vessels of the cervix is in any

<sup>1</sup> Loc. cit., p. 464.

way concerned in this function of the mucous membrane, is very difficult to establish. The formation of this secretion, however, depends, in all probability, upon a relaxation of the vessels just mentioned, and the contracted state of these vessels would in a certain degree fairly correspond to the period of inaction, during which the secretion is always suspended.<sup>1</sup>

"After the formation of an appropriate quantity of the cervical mucus, which is presumably effected by the dilatation of the cervical blood-vessels during erection, it is ejaculated from the cervix at the instant that the relaxation occurs which has been suggested by Henle, and which we propose to further discuss presently. This secretion of the cervical mucus may become chronic, and when such a state of affairs exists, there is formed an oblong or pyramidal plug of a viscid gelatiniform consistence, which protrudes from the os uteri in the form of a stringy and slimy mass (*ein Schleimstrang*). Kristeller, who is the originator of this term, has examined this pathological formation closely in an elaborate essay,<sup>2</sup> and has undertaken to establish for it an essential part in the processes of copulation and conception. Marion Sims also declares that the presence of this viscid mucus plug in the os uteri is by no means unknown to him. We must be careful, however, not to neglect to notice the fact that the large majority of Kristeller's investigations were made in and upon the bodies of invalids; and although one may with profit follow the ideas and reasonings of this author on a few special points, particularly those ideas having for their object the investigation of the conservative properties of this secretion in relation with the spermatozoa, yet his final hypothesis remains wide open to the imputation of improbability. This hypothesis assumes that the spermatozoa enter the cavity of the uterus through their own efforts and activity, and that the mucous plug above described affords very material aid and assistance to facilitate their entrance into the cervical canal, where indeed they may occasionally be found.

"That such a procedure is a common or even a frequent occurrence during conception, is, as I have already stated, highly improbable. On the contrary, C. Mayer<sup>3</sup> has well

<sup>1</sup> *Berliner klinische Wochenschrift*, 1871, Nos. 26 to 28.

<sup>2</sup> *Virchow's "Archiv,"* vol. x, p. 127.

stated the facts when he showed that, according to his experience, such a tough and almost impenetrable secretion as the mass spoken of above may constitute in itself a direct and perfect barrier to conception, by plugging up the cervical canal. The spermatozoa, or rather the intimate mixture of the semen and uterine mucus, is either carried to its proper field of action by some other force, or, missing its normal destination, it flows out of the vagina in its original intimately mixed condition. It is a popular theory, and one quite well known, that women who do not desire to become pregnant, and who, having been exposed by cohabitation, fear that they may become impregnated, endeavor in a variety of ways to remove this fluid from the genitals immediately after coition.

"In endeavoring to investigate into the means employed by nature to make the coitus fruitful, by transferring this mixture of semen and mucus from the organs immediately concerned in its elaboration into the cavity of the uterus, we shall call to mind the better known process which is exemplified by the erection of the male organ. The act of coition, in order to be perfectly satisfactory to both parties, is characterized by a contemporaneous erection of the organs immediately or rather principally concerned therein, and also by an ejaculation of a fluid material from both sides at the same instant. According to Johannes Mueller,<sup>1</sup> the penis retains its erect condition even after the ejaculation, and forces the semen into the orifice of the uterus by being itself repeatedly thrust into the depths of the cavity of the vagina, somewhat after the style of the piston of a syringe. This statement of Mueller's has been repeatedly and successfully attacked, by reason of its non-agreement with the facts. While, indeed, in some animals, as for instance the dog, the penis seems to be charged with the office of plugging up the vagina for a certain period of time after the ejaculation, yet it is the rule with the majority of the other mammalia, and more particularly man, that a complete relaxation of the male organ quickly follows the act of ejaculation. If, now, the lower segment of the uterus in woman has also been in a high state of erection, we only need go back for our premises to the anatomy of the parts and a few simple ideas, to be able to follow up my train of argument leading us clearly

<sup>1</sup> Handbook of Physiology, vol. ii., p. 648.

to the necessary consequences. The cervix uteri clearly shows, even in the virginal condition, a division into two erectile portions, which, however, are not placed side by side as are the corpora cavernosa of the penis, but as is manifested in the os uteri, one above the other. There exist evidences even in the virginal condition of such a circular arrangement, and this arrangement is apparently more fully developed during the involutions occurring after several pregnancies. If the strongly erected cervix uteri now suddenly relapses into the condition of relaxation, there is manifested a larger opening at the external os than had existed in its erected state, or even in its normal condition.

“The second process which manifests itself immediately after the sudden relaxation, and one which is to be necessarily inferred from both the physical and physiological relations of the parts, is aspiration. This is the means by which the mucous mass, including the spermatozoa, as above referred to, is drawn through the cervical canal into the uterus, and this latter organ, in all probability, aids in this movement, inasmuch as its congested and swollen walls also relapse into their normal condition immediately after the relaxation mentioned. This aspiration, or sucking-up movement, by the os and cervix uteri, by which the semen, mixed with the fluid which is ejaculated from the cervical canal, is brought into intimate mechanical contact with the cavity of the fundus of the uterus, is no new idea. It has been frequently mentioned in works on physiology and gynæcology, and it has also been observed in animals, for example in the rabbit, by means of vivisections. It is further well known to many women, who have been guided by former experiences, that certain sensations which peculiarly accompany the process of aspiration, taken in connection with the almost absolute absence of mucus from the vagina after cohabitation, constitute to them some of the surest signs of conception. This aspiration movement can also be frequently distinguished by the male during coitus, and in a word, the aspiration movement is a well-known fact; but it is only intelligible when viewed in connection with the rigid erection and the consecutive rapid relaxation of the lower segment of the uterus, as already described.

“A theory of aspiration which approaches the one under con-

sideration in a few of its essential points, has been carefully elaborated by Eichstedt,<sup>1</sup> in which he, however, conceives the action of the uterus, while under this influence, to be quite different from that advocated in this paper. According to his theory, the uterus, which in its normal unexcited condition is compressed or somewhat flattened in an antero-posterior direction, becomes during the period of excitement round, and more pear-shaped in its outline, by reason of the increased afflux of blood to the organ, during which, and by means of which change in its shape, a cavity is formed in its interior. This process commences at an early period in the coition, but it is only manifested in its highest degree of erection just after the ejaculation of the semen. This change in the shape of the body of the uterus, and this expansion of the cervical canal, remain for a considerable time after the completion of the coition, and thus the semen is aspirated by means of this comparatively permanent expansion. The points of variance between the views of Eichstedt and my own ideas on this subject are easily appreciated by all by means of the representations which have already been made by both of us. Inasmuch as the detailed description of observations in this region must of necessity be barren, owing to many reasons that cannot fail to be readily apparent to the observer, the principal of which is owing to the great difficulty with which such investigations are made. I refer for additional proof of the truth of my proposition to a simple experiment, designed to partially show the anatomical relations of the parts. If we take an ordinary colpeurynter, and remove from it the tube by which it is intended to be inflated, and traverse the long axis of this instrument with a rubber tube which shall enter the colpeurynter at its opening, pass through it lengthwise, and emerge from a perforation in the fundus of the bag, but attached to the mouth of the colpeurynter in such a manner as not to be easily separated from it, having the upper end of the tube hermetically sealed to the wall of the instrument, and having the lower end open, and not in any way communicating with the cavity of the bag; and now inflate the instrument itself to perfect transparency, we shall perceive how, during the process of inflation, the rubber tube is gradually extended as to its length, but at

<sup>1</sup> Zeugung, Geburtsmechanismus, etc. Griefswald, 1859.

the same time becomes thinner as to its walls, and materially narrowed as to its calibre. The expansion of an oblong cavity which traverses another expansible body in the direction of its long axis, is only conceivable when a special apparatus connects the walls of the first-named cavity with the outer walls of the erectile body. Further, we can render this experiment more conclusive by inserting another tube into the open end of the tube already described, connect them so that they shall be air-tight, and dip the open end of the last-mentioned tube into some liquid. You will now notice that even during the greatest expansion of the colpeurynter, not a single drop of the fluid is aspirated.

"Whenever a thrifty conception occurs, it would, at first sight, seem that the organs immediately concerned therein had fulfilled their proper and entire duties in the premises; for the cervix gradually closes itself, probably to shut out the remainder of the combined ejaculated mass which has not been utilized; and it would seem as if the erectility of the lower segment of the uterus might be dissipated. That it, nevertheless, is further excited and further employed, is reasonable, judging from the extensive requirements of married life. That this lower segment does respond to the sexual stimulus, even when in the pregnant condition, I have, I believe, fully demonstrated in my observations upon the first case related in this paper. It seems therefore, that some small concessions are made by nature to sexual enjoyment, even during pregnancy. It very often happens, however, that under these very circumstances an impetuous excitation of the erectile powers of the cervix, not having any higher purpose to serve, punishes itself by producing abortions.

"With regard to the anatomical relations of the vessels concerned in erection during pregnancy, Hyrtl<sup>1</sup> has defined and laid down certain premises. According to this author, the arteries of the cervix are only apparently dilated, and simulate this appearance by the thickness of their walls, which probably exceeds the thickness of the same walls when in a normal non-erectile condition. They are, therefore, in the first place, reduced in their calibre during pregnancy, and in addition to this, the arteriæ uterinæ proper, and a large proportion of

<sup>1</sup> Scanzoni on Chronic Metritis, page 8.

their smaller branches, now wind themselves spirally upward along the lateral portions of the uterus. The following observations were first made by Hyrtl, and he is confirmed therein by Briquet.<sup>1</sup> They are to the effect that these spiral twistings of the arteriæ uterinæ only take place during pregnancy; that they are wholly absent in virgins, and that this condition only remains after accouchement, in so far as that the 'wider and longer spirals' are reduced by the contraction of the uterus to shorter ones. In these facts we find, at the same time, an indication of the duties which attach to the erectile portions of the uterus during involution. In the re-formation of the short, wide spirals, and the restitution of the peculiar small arteries springing from them, as described by Henle, lies the possibility of being able to re-establish the erectile power for use in future conceptions. In the etiology of chronic metritis or chronic infarct, we find sufficient reasons supplied for the existence of these conditions in the frequent instances in which this object is not attained, or in which, at best, it is only incompletely fulfilled.

"Before concluding this essay with a glance at this pathological process, I beg to submit that I have arrived at a very defective section of this paper. The publication of this monograph was premature, owing to external untoward circumstances, and I therefore expressly ask that the point now to be considered be regarded in the light of a preliminary statement. I have, at every point in the preceding portion of this paper, placed the lower segment of the uterus in antagonism to the upper portion. I have done so not only because the erection is proven and palpable in the former, and because a similar process in the latter is only supposable, but also because I consider that these two segments receive their nervous supply from two different sources. Recent investigations make this latter statement very probable. If we consider the fact that the erection of one or both of the nipples, and that of the cervix uteri, are frequently observed to occur simultaneously, and further, when we consider the statements of careful and competent observers, such as Scanzoni, Grailly Hewitt, and others, on the connection of the process of contraction and involution of the uterus, in which, however, very probably the lower segment

<sup>1</sup> *Ibid.*, page 3.



only is concerned, with that of lactation, the theory of a common centre of innervation placed high up in the medulla spinalis, it seems to me can only exist in the imagination.

"I permit myself to add only a few words in relation to the pathological views, which would seem to be authorized by the adoption of my mode of explanation of the anatomy and physiology of the lower segment of the uterus. It may truthfully be stated that the uterus is an organ not only 'disposed to congestions, labors under very unfavorable circulatory arrangements, is exposed to hyperæmias, blood stases, etc.,' but which also fulfils with its circulatory apparatus the necessary and important functions of an erectile body. The most important of the pathological conditions which come under consideration is the so-called chronic metritis, with its many names, and its still more numerous theories of causation. Andral has already ceased to look upon this affection as an inflammation. More recent observers, especially Hughes Bennett, have followed in his wake, and have ably supported their positions by both arguments and facts. Assuredly the circumstances that the veins of the uterus are destitute of valves, the force of the heart's action weakened by reason of remoteness and the force of gravitation, certainly also the physiologically repeated congestions of menstruation, all play a conspicuous part in the origin of the blood stasis and induration found in this disease. Of just as much moment, however, is the consideration of the fact that while in the male unnatural and long-continued erections often constitute the causes of other diseases, so in the female, only probably more certainly and in a far higher degree than in the male, do the repeated and improperly-excited erections of the uterus also stimulate other diseases into action when latent, and also create new disorders.

"The unfavorable influence which insufficient involution after pregnancy exercises upon the re-establishment of the normal tone of the erectile portions of the uterus, has been pointed out in an earlier part of this paper.

"Upon the receipt of a copy of the paper just given, which I sent to Professor Bischoff, he replied in acknowledgment thereof, and further wrote me as follows: 'I cannot, I think, better express my thanks for the receipt of your essay than to call your attention to several observations and statements con-

tained in my work "On the Development of the Mammalia and Man," which I notice your views upon the processes attending conception closely follow. I have procured a copy of this well-known, but not readily accessible work, even here, and find the following ideas mentioned just after some older items by Valisneri, Dionis, and Haller, on pages 23 and 24: Günther has further made it appear to be very probable that in the mare, and also in other animals, the uterus exercises a sucking action upon the semen, as well at the moment of ejaculation as thereafter. If we further add that, as a rule, very few or no spermatozoa are found in the vaginas of bitches and rabbits after cohabitation, while I have always found them present in large numbers in the uterus; it seems to follow, with great probability, reasoning from all these facts, that at the time of a fruitful coition, very probably at the moment of the highest excitation and ejaculation, the uterus moves downward in the cavity of the pelvis, the os uteri opens itself to a certain extent, the semen is received into the os, and in this manner reaches the uterine cavity, partly in a direct manner, and partly through the suction action of the os and cervix uteri.'

"I deeply regret the fact that I had not at my command the work of Professor Bischoff's alluded to, while engaged in writing my essay. The precise and lucid description of the processes of ejaculation and aspiration just quoted, would have materially assisted me in the production of more convincing proof, and a better connection of that which is already known, with the fact of the erectility of the lower segment of the uterus, and the additional fact of the erection of this lower segment as anatomically established by Henle, and physiologically explained by me.

"With reference to the necessity of these functions, we find the following sentence in the 'History of the Development,' etc., just quoted, page 24: 'As both processes, the ejaculation of the semen as well as those movements of the uterus, very probably occur at the instant of the highest excitement, we might probably find one of the most frequent causes of the inefficiency of many cohabitations, in the fact that these crises do not, by any means, always coincide as to the precise instant of their occurrence in both parties, by means of which non-coincidence the seminal fluid may be prevented from entering the uterus.'

"In his letter above referred to, Professor Bischoff makes the following remark as additional upon this point: 'Nevertheless, I do not believe that we should overlook the fact that though in all probability these processes may and do favor conception, they should not by any means be regarded as absolutely necessary to the normal occurrence of this condition.'

"Although, as is self-evident, I place the greatest reliance upon Professor Bischoff's views in this department, yet I hope to be able, in some future paper on this subject, to support and fully establish my conviction of the absolute necessity of the mechanism just under consideration."

Gentlemen, we have reached the fourth division of this paper. I have already trespassed upon your time and patience to such an extent that the idea strikes me very forcibly that I will at this time add nothing more to the statements on this subject which have just been submitted to your mental inspection; but, following the example of the talented author of the last quoted paper, I hope to return to the charge at no very distant day, and hope then to be able to shed some additional light upon the as yet somewhat obscure points in this paper.

Although the processes to be investigated are exceedingly delicate in their nature, they will, in spite of this fact, surely at some time be made intelligible. There are many obscure points as yet to be found in these theories; but this fact should not be productive of surprise, when we remember that this inquiry is yet in its infancy.

Gentlemen, again I thank you for your interest and attention.

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## ON DEFORMITY OF THE UTERUS,

WITH SPECIAL REFERENCE TO ANTEFLEXION.

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IN the majority of standard works on the diseases of the uterus, prolapsus, ante- and retroversion, ante- and retroflexion, are all classed under the head of "displacements." This, I am satisfied, is an imperfect arrangement, as it groups together