A MEMOIR
ON THE
PATHOLOGY AND TREATMENT
OF
LEUCORRHOEA,
BASED UPON THE
MICROSCOPICAL ANATOMY OF THE OS AND CERVIX UTERI.

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VARIOUS authors, writing on the subject of Leucorrhœa, have described the external qualities of the different kinds of discharge met with in this affection. But their descriptions contain many discrepancies, which, it occurred to me, might be explained by a microscopical examination of the vaginal and uterine discharges in cases of leucorrhœa. I was not without hope that some light might in this way be thrown upon the pathological conditions on which these morbid secretions depend. Accordingly, I procured the examination of the leucorrhœal secretions in every suitable case which came under my care at St. Mary's Hospital during many months. But the results of this examination were hardly such as might have been anticipated. The opaque, curdy, and creamy discharge found lying upon the surface of the vagina and the external portion of the cervix uteri, seems to the naked eye widely different from the viscid, transparent secretion seen issuing from the cervix uteri. Yet, under the microscope, both were found to consist of nearly the same elements, namely,—mucus or pus globules and epithelial particles, involved in a thick tenacious plasma. The only

difference appeared to be in the relative quantity of squamous epithelium and mucous corpuscles. In the vaginal secretion the epithelium was in greatest abundance, while mucous corpuscles were in excess in the secretion from the canal of the cervix. It was evident, however, that the physical qualities of the discharges did not depend upon these variations, as the opaque, curdy, and the transparent viscid secretions were sometimes quite identical in their microscopical appearances. It became, therefore, an object to ascertain the precise structures which secreted these discharges, and the causes which modified their sensible and microscopical appearances. In this way I was led to examine the mucous surfaces of the vagina, the vaginal portion of the os and cervix, and the canal of the cervix uteri. But though I commenced the present investigation with an examination of the leucorrhœal secretions, and was only subsequently led to examine the tissues which produce them, I must beg leave to invert this order of proceeding, and direct the attention of the Society, in the first instance, to the minute anatomy of the os and cervix uteri. In this place I ought to mention, and I do so with the warmest thanks, that in the microscopical part of the investigation, I am under great obligations both to my friend Dr. A. H. Hassall, and to my colleague Dr. Handfield Jones. Without their valuable aid, it would have been impossible for me to have prosecuted the subject successfully. Dr. Hassall made with me an examination of the entire anatomy of the os and cervix uteri, to which, indeed, his attention had been directed before I applied to him for this purpose. To Dr. Handfield Jones I owe a large number of examinations of the leucorrhœal secretions made at the commencement of the present inquiry. I have also received much assistance, in the way of procuring healthy and morbid uteri, from Dr. J. W. Ogle, curator of the museum at St. George's Hospital; and from Messrs. Trotter and Bullock, the resident medical officers of St. Mary's Hospital.

Like the mucous membrane in other parts of the body, the mucous covering of the os and cervix uteri consists of—

1, epithelium; 2, primary or basement membrane; and, 3, fibrous tissue, blood-vessels, and nerves. But there are numerous points of special character belonging to the mucous membrane in this situation; and, for convenience of description, the os and cervix uteri may be divided into two parts, one comprising the mucous membrane of the os uteri and external portion of the cervix; the other the mucous lining of the cervical cavity or canal. In the first place, I proceed to describe the mucous membrane of the os uteri and external portion of the cervix,—that which lies between the junction of the cervix uteri with the vagina, and the margin at which the mucous membrane of the os uteri becomes continuous with the mucous lining of the canal of the cervix.

The epithelial layer found in this situation is tessellated or squamous, and is so arranged as to form a membrane of considerable thickness. After maceration in water for a few days, it can readily be raised from the surface of the mucous membrane. It closely resembles the epithelial covering of the vagina, with which it is continuous.

Immediately beneath the layer of epithelium the basement membrane is found, covering numerous villi or papillæ, which stud the whole of the surface. These villi are sufficiently large in some specimens to be seen with the naked eye, if a section is held to the light. When the villi are partially or wholly denuded of epithelium by maceration after death, or in certain diseased conditions, an uneven appearance is given to the os uteri. These villi are generally single, but occasionally two or three are united together upon one pedicle.

When examined by a high power in a recent specimen, each villus is found to contain a looped blood-vessel, which may be seen passing to the end of the villus, and returning to its base, where it inosculates with the blood-vessels of the neighbouring villi. These villi are everywhere covered by pavement epithelium, which also fills up the intervals between them, rendering the external surface smooth, as seen by the naked eye. (Fig. 1, plate II.)

The surface of the os uteri is generally described as containing numerous mucous follicles. But under the microscope it is difficult to make out any distinct follicular structure. On looking at a section taken from the os uteri, an appearance very similar to that presented by mucous follicles is observed; but on a closer examination it is found that the dark spots, although depressed in the centre, are slightly elevated, and contain dark-red points, which are the terminations of the looped blood-vessels of the villi. These appearances seem in fact to be nothing more than the villi obscured by their epithelial covering. In examining different parts of the same specimen, we may see that what at first appears to be depressions are, in reality, slight elevations. (Fig. 1, plate III.)

If a thin portion be sliced from the surface of the mucous membrane in this situation, and examined with a high power, the points of the villi appear nipple-shaped, and the whole surface is studded with eminences. Around the bases of the projections and immediately above them, the epithelial scales are more numerous, crowded, and narrow in shape, than in the interspaces. In the centre of each villus a slight depression is seen, which suggests the probability that the extremities of the villi may be more particularly concerned in the production of the vaginal mucus. (Fig. 1, plate I.)

The thick layer of scaly epithelium and the villi, with their looped vessels, are the principal anatomical features of the mucous membrane of the os uteri and external portion of the cervix; and it will be seen in the sequel that both villi and epithelium play an important part in the pathological changes which occur in the lower segment of the uterus in leucorrhœa.

On passing within the os uteri to examine the mucous lining of the cervical canal, a small tract of smooth surface is generally found between the margin of the lips of the os uteri and the commencement of the penniform rugæ. Sometimes, however, there is only a slight rim between the os uteri and the lower rugæ, and occasionally the rugæ

extend so low down, that they may be seen at the os uteri itself. Where this smooth surface exists, as it does in most specimens to some extent, the mucous membrane appears to the naked eye more delicate than the mucous membrane of the external portion of the os uteri. But whether rugose or smooth, the mucous membrane of this portion of the cervix consists of the same element, with the addition of mucous follicles, wherever rugæ are present. Examined by the microscope, the mucous membrane immediately within the os is found to be composed of cylinder epithelium arranged upon villi, somewhat after the manner of the epithelium covering the villi of the intestinal canal, of basement membrane, and of villi, three or four times larger than the villi of the external portion of the os uteri. Occasionally, the villi in this situation are compound, consisting of two or three, or even four villi, arising from a single stalk. They are covered, as well as the spaces between them, with cylinder epithelium, dentated in shape. They contain looped blood-vessels, and situated between the blood-vessels and the basement membrane, numerous oil globules, many of them of large size, are found, as well as an abundance of small granular cells. In some specimens, two of the vascular loops may be seen in a single villus, when the villi are of large size. At the bases of the villi, their blood-vessels inosculate everywhere freely, as in the case of the villi outside upon the os uteri.¹ (Fig. 2, plate II.)

¹ I first saw the villi or papillæ of the os and cervix uteri with Dr. Handfield Jones, but I afterwards found they had been observed previously, and a drawing made of them, by Dr. Hassall, (fig. 2, plate 1.) After the reading of my paper, Mr. Kiernan informed me that he had frequently seen them when examining the uterus. My attention has been directed, more recently, to a description of them in an able essay by the late Dr. Franz M. Kilian, of Bonn, on the structure of the uterus in animals, "*Die Structur des Uterus bei Thieren*," published in vol. ix of Henle and Pfeufer's '*Zeitschrift*,' 1850. In this article Dr. Kilian, after describing the sensitive papillæ of the vagina, gives a description of the papillæ of the os and cervix uteri and the cervical canal. These structures are spoken of as threadlike or filiform upon the os uteri, and are considered sensitive in function. The

Underneath the villi, both in the lower part of the cervical canal and upon the external surface of the os and cervix uteri, a dense fibrous and vascular tissue is found mixed with involuntary muscular fibres and nerve fibres ; the muscular fibre becoming more plentiful on descending deeply into the structure of the walls of the cervix.

The next division of the subject includes the description of the proper glandular structure of the canal of the cervix uteri.

When the cavity of a cervix uteri belonging to an organ which has never been impregnated is laid open by a longitudinal incision, so as to expose the whole of the cervical canal, the internal surface is generally found to contain four columns of rugæ, or folds of mucous membrane, arranged in an oblique, curved, or transverse direction. Between these columns of rugæ, four longitudinal grooves or ridges are sometimes observed. Of these, the two grooves in the median line anteriorly and posteriorly, are the most distinct. The other longitudinal channels are situated one on each side, between the anterior and posterior walls of the cervix, beginning at the angles dividing the anterior and posterior lips of the os uteri. The canal of the cervix is flattened in shape, and two of the rugous columns are arranged on the anterior surface corresponding to the anterior lip, and the other two upon the posterior, the posterior portion of the cervix being the largest, and containing the greatest number of rugæ. The sulcus, or division between the posterior rugous columns, is also generally more strongly marked than the anterior division. The rugæ, as seen in each column by the eye alone, vary from about ten to fifteen in number. In the intervals between the columns, small longitudinal folds can be seen, but these

sensitive papillæ within the os uteri are described as tuberculated in shape, and considerably larger than the filiform papillæ of the os uteri, and as being deeply sunk in the mucous membrane. At the upper part of the cervical canal the papillæ are said to approach again in shape and size to the papillæ of the os uteri. Rude lithographic figures of the papillæ, as seen by a low power, are given, but they do not exhibit, with any accuracy, the intimate structure of these bodies.

are less distinct than the transverse rugæ. In the normal state, the transverse rugæ with the fossæ between them, are filled with viscid semi-transparent mucus, and when this is drawn out or brushed away, a reticulated appearance, caused by numerous secondary rugæ, is visible in the mucous membrane beneath. At some points of the fossæ the mucous crypts are deeper than at others; and here and there minute openings are seen at the bottom of the pits, into which fine bristles may be readily passed to the distance of the twelfth of an inch. In some specimens, the rugæ are arranged closely together, as thin laminæ, with deep divisions between them. In all anatomical works, mucous follicles and lacunæ are mentioned as being numerous in the canal of the cervix uteri and between the penniform rugæ, but the subject is generally dismissed in a few words, and I am not aware that any minute description of the cavity of the cervix uteri, and the arrangements of its mucous membrane, even as they may be seen by the naked eye, has hitherto been given. Names too often hide the real significance of things, and the terms penniform rugæ, palmæ plicatæ, glandulæ Nabothi, and arbor vitæ uterinus, would seem in this instance to have been received in lieu of more accurate description.

Besides the four rugous columns and the furrows between them, other rugæ of irregular shape are seen, particularly at the upper and lower portions of the cervix where the regular transverse or oblique rugæ become indistinct. In the virgin state, these arrangements of the mucous membrane occur with tolerable regularity, but after child-bearing, they become to some extent confused and irregular, though the follicular structure of course remains. Probably, it is owing to the great extent of the reduplication of the mucous membrane of the cervix, that laceration of the mucous surface does not more frequently occur during parturition. In pregnant women, or in cases in which the cervix uteri is unusually developed, as in long-standing leucorrhœa, polypus, prolapsus, or procidentia, the rugæ or folds are considerably increased in size.

Although the columnar arrangement now described is generally met with in the cervix uteri in women who have not borne children, the disposition of the cervix is less regular, as I have stated, in multiparous women. Specimens of virgin uteri are also occasionally met with, in which the cervix presents a cribriform appearance, instead of having the transverse rugæ with fossæ between them; or there may be a less number of rugous columns than four, from the absence of some of the longitudinal sulci or ridges. When the follicles are disposed in a cribriform manner, they enter more deeply into the structure of the cervix, and are collected together in pouches instead of in furrows. (Fig. 2, plate vi.)

If we take a section of the cervix containing one of the longitudinal columns only, and magnify it nine diameters, we obtain a further insight into the glandular structure of this canal. The transverse ridges now stand out very prominently. Besides the primary rugæ, each fossa is subdivided by smaller rugæ from which curved septa, still more minute, take their origin, dividing the principal fossæ into a great number of crypts arranged like a piece of network. In each of the fossæ between the primary rugæ, as many as from forty to fifty crypts or lacunæ may be seen. A cervix of moderate size, magnified nine times, would show between the transverse rugæ of the four columns alone, from two to three thousand follicular pits. But besides the fossæ between the rugæ, the spaces between the rugous columns, and the longitudinal sulci themselves, are all seen to be covered by numerous follicles. Small plicæ are everywhere visible, and these are evidently only a repetition of the columnar rugæ, on a lesser scale. This is particularly the case with respect to the larger extremities of the transverse rugæ, all of which are closely studded with mucous pits. (Plate iv.)

If a portion of the cervix be magnified still further to the extent of eighteen diameters, so as to take only two or three of the primary ridges and fossæ into the field, it will be seen that the rugæ themselves, and even the secondary

septa, are covered in the greater part of their length with mucous follicles. The crypts in the furrows are still further divided and subdivided, so as to double or treble the number of follicles and lacunæ seen with the lower power. In a portion of the cervix, comprising only three rugæ and their two interspaces, upwards of 500 mucous follicles were easily counted, so that it is within the limits of moderation to say that a well-developed virgin cervix uteri must contain at least 10,000 mucous follicles. (Plate v.)

When a longitudinal section is made through one of the rugous columns, the fossæ are found to extend obliquely and deeply into the substance of the cervix, sometimes to the extent of the sixth of an inch, but occasionally mucous openings pass into the centre of the walls of the cervix, and may be seen filled with the tenacious mucus proper to the cervical canal. These irregular cavities are in some instances obstructed, and contain masses of inspissated mucus, the openings to the cervical mucous surface having become permanently closed.

Besides the arrangements already described, the superficial surface of this portion of the cervical canal is still further increased by the presence of villi similar to those found in the lower part of the cervix. These villi extend to the glandular surface of the canal, and are found in considerable numbers on the larger rugæ and other parts of the mucous membrane in this situation.

Thus the entire organisation and disposal of the mucous membrane lining the canal of the cervix uteri is such as to afford a very large extent of glandular surface for the purposes of secretion. In effect, the cervix uteri is an open gland; and in my opinion it is in this part of the utero-vaginal tract that the principal seat of leucorrhœa exists.

I may here refer to a point which should not be lost sight of, bearing as it does upon the pathology and treatment of leucorrhœal affections, namely, the great similarity which exists between the skin, and the mucous membrane of the vagina and the external portion of the os and cervix uteri. The resemblances of the mucous membrane in these situa-

tions are certainly much nearer to the cutaneous structures than to the mucous membranes of more internal parts. This is particularly the case with respect to the dense epithelial layer of the vagina and os uteri ; 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 mucous membrane. These analogies are strongly confirmed by what is observed of the pathological conditions to which these parts are liable, and by the effects of therapeutical applications. It is well known that when inversion of the vagina occurs, as in procidentia uteri, the secretion of mucus is arrested, and the epithelial layer of the vagina becomes hard and similar to epidermis.

The epithelium found upon the follicular surface of the canal of the cervix uteri is cylindrical or dentated, like the epithelium just within the os. It is also ciliated low down in the cervix, and this character is continued into the cavity of the fundus uteri. The villi found in this portion of the cervix are covered by the dentated epithelium, just as in the case of the villi of the lowest part of the cervix. Mixed with the epithelium of the follicular surface of the cervix, a considerable number of caudate corpuscles are frequently found, each of them having a distinct central nucleus.

Thus it appears that the epithelium of the os uteri and external portion of the cervix is constantly squamous ; that the epithelium just within the os uteri is cylindrical but not ciliated ; and that in the rugous portion of the cervical canal the cylindrical epithelium becomes ciliated. Various opinions have been held respecting the situation in which the squamous epithelium becomes changed for the cylindrical, and also respecting the point at which cilia are first found. The above is the result, however, of the examination of numerous uteri, made as early as possible after death, so as to anticipate the alteration of the cilia and epithelium by post-mortem changes.

The normal mucus secreted by the glandular portion of the cervix is extremely viscid and almost transparent. It adheres to the crypts and rugæ so as to fill the canal of the

cervix. It consists chiefly of mucous corpuscles, caudate corpuscles, minute oil globules, and occasionally dentated epithelium, all entangled in a thick tenacious plasma. The tenacity of the plasma is so great that the mucous corpuscles and epithelial debris are arranged in strings within the fluid, and even individual corpuscles may be elongated by pressure upon the plasma, under the microscope. (Fig. 2, plate III.) The mucus found at the lowest part of the canal of the cervix is thinner than that belonging to the glandular portion of the cervix, a circumstance which may perhaps be owing to the secretory action of the large number of villi within the margin of the os.

The mucus found in the upper part of the vagina, as the proper vaginal secretion, is no doubt chiefly secreted by the villi and epithelium of the upper extremity of the vagina and of the os uteri and external portion of the cervix.

The vaginal mucus, as first secreted, is pearly and semi-transparent, containing numerous curdy particles, which, when they accumulate to any considerable amount, give it a creamy appearance. Examined microscopically, the mucus of this situation possesses nearly the same characters as the mucus of the cervical canal, except that it contains, as already mentioned in a former part of the present Paper, larger quantities of squamous epithelium and epithelial debris. The only other essential difference is that the first is in the normal state invariably *acid*, while the second is always *alkaline*. It is to this chemical difference, and not to the preponderance of epithelium or mucous corpuscles, that we must look for the cause of the different outward appearances presented by vaginal and uterine mucus.

Mr. Whitehead, of Manchester, in his work on 'Abortion and Sterility,' made the observation that the mucus of the vagina always possesses acid qualities, and that the discharges from the interior of the uterus are as constantly alkaline. This point I have verified by numerous trials. In the ordinary state I find, moreover, that the secretion not only of the vagina but of the os and external surface of the cervix is acid, while it becomes alkaline within the labia uteri. If

a piece of litmus paper be applied to the surface of the os uteri, it is instantly reddened, but the blue colour is restored by passing it within the cervix. The margin of the cervical canal, and the limits of the villi covered by squamous epithelium, and the commencement of the villi covered by dentated epithelium, seem to mark the division between the acid and alkaline secretion. It is to the alkali that the secretion within the cervix owes its viscosity and transparency, while the curdled appearance of the vaginal mucus is owing to the presence of the vaginal acid. The acid of the vagina is quite sufficient to more than neutralise a moderate quantity of the alkaline secretion of the cervix, and when any secretion from the cervical canal enters the vagina, it becomes curdled from the coagulation of its albumen. The same thing may be imitated out of the body. On the addition of a little weak acetic acid, the thick viscid mucus of the cervix becomes after a time changed into the curdy mucus of the vagina. This fact is important; for in common with many other writers, Mr. Whitehead thinks a profuse secretion of the uterine mucus "extremely rare," whereas, it is remarkably common in leucorrhœa; but the fact has been masked by the circumstance of its becoming altered when it descends into the vagina, so as to resemble the strictly vaginal mucus; and its source has thus been attributed to the vagina instead of to the cervix uteri. Mr. Whitehead is of opinion that the acid mucus of the vagina is intended to prevent the coagulation of the catamenial fluid in this canal; but I believe that in addition to this, the different chemical conditions of the surface of the os uteri, and of the canal of the cervix, play an important part in the pathology of these structures. During the catamenial flow, the acid vaginal mucus probably has the effect attributed to it by Mr. Whitehead, that of preserving the fluidity of the catamenial discharge, a small quantity of this mucus having the effect of preventing its coagulation even out of the body. The immediate effect of the acid mucus upon the secretion of the cervix uteri, is to cause its coagulation in the way already pointed out.

The ordinary use of the acid vaginal mucus seems to be

the lubrication of the surfaces of the vagina, and the external surfaces of the os and cervix uteri. In the normal state only a sufficient amount of mucus for this purpose is secreted, there being little or no discharge issuing from the ostium vaginae. It will not escape observation that the portion of the mucous membrane of the uterus and vagina which resembles the skin, is the only part which, like the skin, furnishes an acid secretion.

The uterine cervical mucus has other uses to perform, besides the lubrication of the membrane by which it is secreted. When the cervix uteri is found perfectly healthy, little or no discharge is seen issuing from the cervical cavity, but when the labia uteri are separated; the canal of the cervix appears to be full of its peculiar secretion. In examinations after death, in cases in which the uterine organs are in a healthy condition, the mucous crypts and the canal of the cervix are found filled with viscid mucus, so as to entirely block up the passage from the vagina to the cavity of the fundus. This appears to be the normal condition of the cervical canal. At each catamenial period, the whole of the tenacious plug of mucus must be washed away by the menstrual fluid, as the latter may be seen escaping freely from the os uteri at these times. But in a few days after the completion of the period, the mucous plug is again formed. Thus it would seem to be the function of the glandular structure of the cervix, in the unimpregnated state, to secrete each month a sufficient quantity of viscid mucus to fill the channel of the cervix; the mucous follicles becoming comparatively inactive when this has been accomplished, until after its removal at the next flow of the catamenia. In healthy subjects, the canal of the cervix is always full in the intervals between the menstrual periods, though there certainly seems nothing like a constant flow of the cervical mucus into the vagina.

The use of the cervical mucus is probably two-fold. In the first place it closes the cervix uteri and defends the cavity of the fundus from external agencies as completely as though it were a shut sac. In the second, it probably affords

a suitable medium for the passage of the spermatozoa into the uterine cavity.

The last number of the 'Cyclopædia of Anatomy and Physiology' contains an article on the *Vesiculæ Seminales*, by Mr. Pittard, in which he suggests the hypothesis "that the office of the *vesiculæ* is to secrete and keep in store a mucus of such a nature as is congenial to spermatozoa." Now, the secretion of the *vesiculæ seminales*, like the secretion of the *cervix uteri*, is viscid, transparent, and alkaline. The spermatozoa are deposited at the *os uteri*, and there can be no doubt that where impregnation takes place some days after the completion of menstruation, the spermatozoa have to make their way through the plug of mucus filling the cervical canal, and it is a plain inference that this mucus must be adapted for their ascent to the cavity of the fundus uteri. In this progress, the movement of the spermatozoa themselves and the action of the cilia of the cervical canal no doubt contribute.

In pregnancy, the whole of the transverse rugæ and the follicular structures of the *cervix* are considerably enlarged, and a thick plug of viscid mucus is secreted in the early part of pregnancy, which continues to seal the *os uteri* during the whole of gestation, until it is removed at the beginning of labour. Sir Charles Clarke was of opinion that the cervical mucus was not secreted at any other time than during pregnancy, but this is clearly a misapprehension. In many cases there is, throughout pregnancy, a very considerable excess of the cervical secretion, which may occur at this time without any marked local or general derangement, while in other cases, the filling up of the cervical channel seems to be the measure of the healthy activity of the glandular surface, there being little or no discharge of mucus from the *cervix* into the vagina during the period of gestation. The profuse secretion of mucus, which lubricates the *os uteri* and the vagina, during parturition, is probably derived, not from the vagina, but from the follicles of the *cervix uteri*.

Objections may possibly be raised to some of the anatomical and physiological points which have been brought

forward in the present Paper, and it must be evident that much still remains for investigation, but I trust enough has been established to furnish the foundation for a new pathology of leucorrhœa. This was impossible without a microscopical examination of the tissues concerned. It would be easy to fill a volume with the discordant accounts which, in the absence of a knowledge of the minute anatomy of the parts involved, have been given of the nature and sources of leucorrhœal discharges.

One justly celebrated treatise was, it is well known, founded upon a classification of these discharges, the classification being made to depend upon mere outward and sensible qualities. I venture to submit, that no writer has hitherto formed anything like a just appreciation of the parts borne by the vagina and the os and cervix uteri respectively, in their production. Effects have been mistaken for causes; and secondary phenomena have received the importance due to those which are primary; while in treatment the most important structures have escaped attention altogether.

From a consideration of the structure of the different parts of the utero-vaginal mucous membrane, and the facts connected with leucorrhœa, it is impossible to do otherwise than form the conclusion, that the glandular portion of the cervix uteri is the chief source of the discharge in the most common form of this malady. This has often been suspected to be the case to a great extent; but it could not be asserted as a positive doctrine until the minute examination of the glandular structure of the cervical canal had been made, nor until the proof of the absence of any other follicular or secreting surface adequate to the pouring out of a profuse leucorrhœal discharge, had been obtained.

Leucorrhœa, in its most simple and uncomplicated form, is, then, the result of a morbid activity of the glandular portion of the cervix. A follicular organ, which should only take on an active condition at certain intervals, becomes, from a variety of causes, constantly engaged in secretion. Instead of the discharge of the plug of mucus at the catamenial period, an incessant discharge is set up. In

the first instance, the leucorrhœal discharge consists of nothing more than an unusual quantity of the elements found in the healthy mucus of the cervix. Quantities of mucous corpuscles and oily particles, with particles of epithelium entangled in the viscid alkaline plasma, which gives the mucus its clearness and consistence, are found. The mucus is seen at the os uteri, extending, in the form of a string, through the vagina to the os externum, and also adhering to the walls of the vagina in the curdy or creamy state, produced by the vaginal acid. This form of leucorrhœa is to the cervix uteri what menorrhagia is to the cavity of the fundus uteri. (Figs. 2, 3, plate VI.)

The quantity secreted daily is sufficient, in severe and continued cases, to prove a serious drain to the constitution; and the glandular cervix becomes, in some instances, so excitable, that any unusual stimulus provokes a sudden flow of mucus. The relation of mental emotion to the cervical follicles becomes almost as intimate as the connection between the mind and the lachrymal glands. Any sudden mental disturbance is, in such cases, followed by a sudden secretion and discharge of mucus into the vagina.

In some cases of leucorrhœa there is no discharge from the cervix uteri, and little or no implication of the glandular cervix; but the external surface of the os uteri and the upper part of the vagina secrete a copious discharge. When the surface remains unbroken, or the mucous membrane is only denuded of epithelium, the secretion consists of a plasma, containing multitudes of scaly epithelial particles in every stage of formation, from mere nuclei to the detritus of old epithelium. This may be called Epithelial Leucorrhœa of the vagina, as distinguished from the Mucous or Corpuscular Leucorrhœa of the cervical canal. This distinction is of use in practice, because it is in the epithelial form of leucorrhœa that astringent injections are most useful. When the morbid condition of the vagina extends deeper than the epithelium, the discharge is found to contain pus or mucous corpuscles in adundance, and it can hardly be distinguished by the microscope alone from the cervical form of leucorrhœa. (Fig. 2, plate VII.)

As regards the pathological condition of the mucous membrane of the os uteri and external portion of the cervix in chronic leucorrhœa, I may state that I have, with the aid of Dr. Hassall, examined microscopically many cases after death, in which abrasion or superficial ulceration, as it is termed, has existed; and the following is an abstract of the results.

The epithelium of the external portion of the os and cervix uteri and of the upper portion of the vagina may be partially or entirely removed; or there may be morbid patches in which the epithelium is here and there wanting. When, in analogous states, the epithelium has been removed in the living subject by diseased conditions, the mucous surface is of an intensely red colour from the presence of the naked villi with their vascular loops, and it conveys an impression of roughness and denudation upon examination by the speculum. To the touch the abraded surface feels erectile and "velvety," a term which has been very commonly applied to what has been considered ulceration of the cervix and os uteri. The villi do, indeed, in this condition stand out somewhat like the pile of velvet, and in some cases the villi themselves are considerably enlarged.

In other cases there is not merely loss of the dense epithelium, but the villi, both of the external surface of the os uteri and of the mucous surface within the labia uteri, are destroyed in patches. In that condition of the os uteri which, upon examination after death, would be pronounced to be undoubted superficial ulceration, the state which generally obtains is partial or entire loss of the epithelial layer in circumscribed patches, and here and there the loss or partial destruction of the villi. This gives an eaten, corroded appearance to the mucous surface. Such a condition of the os may be limited in extent, or it may be spread over the whole of the os and external cervix, and pass within the labia uteri. Sometimes small circumscribed ulcers are seen, in which the denuded, or partially denuded, villi are found surrounding the edge of the small ulcer, the area of the ulcer itself being bare of villi, or the ragged debris of villi and their vascular loops appearing at the bottom of the

ulcer. These little ulcers appear commonly in eruptive disorders of the os uteri; but they represent perfectly the loss of epithelium and villi, and to a more complete extent than is found in diffused patches of diseased surface. (Fig. 1, plate VII.)

In one case which I examined after death, not only the villi, but portions of the lower rugæ in the glandular portion of the cervix were eaten away.

The causes which produce these pathological conditions are various. They may arise from vaginitis; from mechanical injury, as in parturition; or from inflammatory states of the os uteri, having an independent type, though I think this is of comparatively rare occurrence; or, and which is more frequently the case, they may be caused by eruptive disorders of the mucous membrane, similar to herpes and eczema in the skin. The os uteri is frequently covered by small vesicles, which can hardly be distinguished from herpes or eczema. These eruptive conditions strongly mark the analogies between this tract of mucous surface and the skin. I have observed cases in which an occasional herpetic eruption upon the os uteri always produced herpes præputialis in the husband, showing very clearly the herpetic nature of the disorder. But by far the most common mode in which loss of epithelium takes place, is, I believe, as a secondary result of chronic irritation of, and discharge from, the glandular surface of the cervix. In my experience, it has been rare to find a morbid state of the os uteri, without the exudation of a gummy albuminous discharge from the canal of the cervix. In the case of wax models of the so-called ulceration of the os uteri, submitted to the Society on a former occasion by Dr. Murphy, I observed that in nearly all of them the artist had correctly represented the viscid cervical mucus as issuing from the os uteri. When the discharge from the cervix uteri coexists with lesion of the os uteri, it appears to me that the *alkaline* discharge lying upon the surface of the os and external portion of the cervix, irritates these surfaces, accustomed to the presence of an *acid* secretion, and occasions the rapid shedding and loss

of the epithelium, and ultimately the injury or destruction of the villi beneath. I believe this to be the true pathology of the greater part of what has been called inflammatory ulceration of the os and cervix uteri.

The loss of portions of the epithelium is so common in cases of confirmed leucorrhœa, that there must be some frequent and common cause which produces it; and it appears to me that it is more reasonably accounted for in this way than in any other. We know that the mucous surfaces, accustomed to acid secretions, are irritated by the continued presence of alkaline states, as, for instance, the stomach under the constant use of alkalies, the bladder in the secretion and retention of alkaline urine, or the urethra in spermatorrhœa. Many other facts might be urged to show that the diseased states of the os uteri in leucorrhœa are secondary to the morbid condition of the cervical canal.

The secondary character of the so-called ulcerations of the os uteri, and their dependence upon uterine catarrh, has been suspected by several writers upon uterine disease. But in the absence of a definite knowledge of the structure of the parts concerned, it was objected that uterine catarrh is not invariably accompanied by lesion of the os uteri, and that ulceration might exist without any catarrhal flux from the uterus. These reasons, advanced by Duparcque, were thought so valid and unanswerable by Dr. Evory Kennedy, that he relinquished the idea as preposterous. But I submit, that if the excessive cervical secretion be a general cause of abrasion of the os uteri, it would not be extraordinary to meet with some case in which, notwithstanding the leucorrhœal flow, the epithelium remained healthy, from the existence of greater thickness or vitality, or from the un-irritant nature of the discharge, in a certain proportion of cases. I have carefully observed a large number of cases, and although I have sometimes found cervical leucorrhœa without any marked derangement of the os uteri, I have very rarely found the os uteri abraded without the existence of disease of the glandular portion of the cervix, unless in cases of eruptive disease. I have also found in treatment, that the

best way to restore the os uteri is by restraining the cervical secretion; but that the morbid state of the os uteri may be remedied again and again, with a tolerable certainty of the recurrence of the disorder, unless the cervical secretion be brought back to the healthy condition.

When the changes of structure above described have taken place in the os and external surface of the cervix, the nature of the leucorrhœal secretion is, as I have already observed, materially altered. The morbid os and cervix now secrete mucus and pus in abundance, blood globules escape from the vessels, and large quantities of scaly epithelium in every form, from mere nuclei to the perfect scales and epithelial detritus, become mixed with the secretions of the cervical glandular structure. But one circumstance is somewhat remarkable. As the epithelium of the cervical canal is cylindrical, it might have been expected that cylindrical epithelium would constantly be found in the discharge issuing from the cervix. Yet the presence of the debris of cylinder epithelium in this discharge is comparatively rare. More than this, scaly epithelium is frequently found mixed with the viscid secretion coming from the canal of the cervix. I have frequently drawn out a string of mucus from the cervix with a long forceps, and it has almost invariably contained scaly epithelium. Whether this arises from the difficulty of obtaining any of the cervical secretion perfectly pure or not, or whether the cervix uteri has the power of imbibing particles of scaly epithelium from the os, I am not prepared to say, but the fact is as I have stated it. (Fig. 2, plate vi.)

I should fear to weary the Society by detailing the numerous microscopical examinations of leucorrhœal discharges kindly made for me by Dr. Handfield Jones and Dr. Hassall, in cases of every intensity and complication. The above are the results of these microscopical analyses. The chemical condition of the discharges has varied with the amount of cervical secretion, blood and pus globules, and vaginal mucus. Every care was taken always to exclude extraneous matter, the portions kept for examination being

always taken up by a pair of long forceps, and preserved in glass tubes.

The pathological results of the preceding investigation may be stated as follows:—If any division of leucorrhœa be attempted, we must recognise two principal forms of this disorder. Of these, the first and by far the most frequent is the *mucous* variety, consisting chiefly of mucous corpuscles, and secreted by the follicular canal of the cervix. The second is the *epithelial* variety, in which the discharge is vaginal, or is secreted by the external surface of the os and cervix, and consists for the most part of scaly epithelial debris. These two varieties may of course exist in various degrees of combination. As regards the morbid changes occurring upon the os and cervix uteri (the so-called ulcerations) two grades of alteration are found; one of which, and by far the most common, may be called *epithelial abrasion*. In this, the epithelium is the only structure deficient. In the second grade, the villi, and occasionally the base from which they spring, are affected by a superficial ulcerative process, which may be designated as *villous abrasion*, *erosion*, or *ulceration*.

I have already referred to the occurrence of eruptions upon the os uteri, a circumstance which has often been observed by uterine pathologists. But there is one state of the os and cervix uteri which is deserving of particular attention, namely, that in which the so-called ovules of Naboth occur.¹ The vesicles which have received these absurd designations are generally considered to be obstructed

¹ The first volume of the 'Mémoires de la Société de Chirurgie de Paris,' 1847, contains a Paper by M. Huguier, entitled 'Mémoire sur les Kystes Folliculaires du Vagin,' in which the ovula Nabothi and their transformations are elaborately described. M. Huguier considers them to be obstructed mucous follicles of the cervix uteri; but it is not a little singular that, in the figured representations of these cysts, they appear to extend far beyond the limits of the cervical follicles; and in one instance the cavity of the cervix, the muscular walls of the uterus, and the broad ligaments, are all studded with vesicles or cysts, presenting apparently the same character. This subject is certainly one requiring further investigation.

mucous follicles, but they are often found in situations where mucous follicles cannot be detected; and after a careful examination of several of these cases, they appear to be rather a form of vesicular disease, having its first seat in the deeper structures of the mucous membrane. This affection is generally attended by profuse discharge from the cervix, with a patulous and engorged state of the os uteri. These vesicles are found in the upper part of the vagina, upon the os uteri and external portion of the cervix, within the os, and upon the penniform rugæ, as high up as the summit of the rugous columns. The vesicles mature and rupture one after another, leaving ulcerated spots, which may either heal or spread over the mucous surface. They reach their greatest size at the os uteri. Sometimes they enlarge without discharging their contents, and I suspect it is in this way that vesicular polypi of the os and cervix uteri are formed. I may mention, that Dr. Hassall suggests, that the solid polypi found attached to the cervix take their rise in enlarged villi of the cervix uteri.

The covering of these transparent vesicles is a thin fibrous membrane. Their contents are a white pearly coagulated matter, in which numerous granular corpuscles, mucous corpuscles, and minute points of oily matter are found.¹ (Fig. 1, plate VIII.)

In the middle of the walls of the cervix, what appears to be undoubtedly obstructed mucous follicles are sometimes seen. But the appearance and contents of these are very

¹ M. Robin has published in the 'Archives Générales de Médecine,' tome xvii, xviii, 1848, a 'Mémoire pour servir à l'Histoire Anatomique et Pathologique de la Membrane Muqueuse Uterine, de son mucus, de la caduque, et des œufs ou mieux glands de Naboth.' The greater part of the very able memoir of M. Robin is occupied by a minute description of the state of the mucous membrane during pregnancy; but he is, like other writers, of opinion that the ovula Nabothi are nothing more than obstructed Nabothian glands, meaning by the latter the whole of the mucous follicles of the cervix uteri. He considers the mucus secreted by the glands of the cervix identical with the contents of the ovula Nabothi; he is so convinced of this, that he describes the latter, but thinks it unnecessary to describe the former.

different from the Nabothian bodies. They have the appearance and consistence of curd, and under the microscope contain myriads of mucous corpuscles, with abundance of single fat globules, and occasionally large agglomerations of oily matter. (Fig. 2, plate VIII.)

There is another state of the os and cervix uteri in leucorrhœa of considerable importance, but which has hitherto, as far as I am aware, escaped attention. In long-continued irritation of the canal of the cervix, partial inversion of the lower part of the cervical canal may take place, causing increased pain and distress, and an aggravation of the leucorrhœal symptoms. The lower part of the canal of the cervix is frequently so inverted that it comes into contact with the vagina, and the penniform rugæ may be sometimes seen upon examination. (Plate IX.)

When the os uteri is open, and the cervix partially everted, so as to bring the penniform rugæ into view, an appearance is produced which has been considered a form of ulceration, called the "cock's comb" granulation; the serrated edges of the so-called ulcer being, in reality, the penniform rugæ presenting at the os uteri, denuded of epithelium, and with the villi florid and enlarged. The villous surface of the partially inverted cervix very much resembles the granulations of an ulcer to the naked eye, and has, no doubt, been frequently mistaken for them.

The simply open state of the os uteri, generally found in leucorrhœa, appears to me to depend, not upon muscular dilatation, as commonly supposed, but upon a development of the os and cervix caused by local irritation, and to be somewhat similar to the development of these parts in the early months of gestation.

It remains to make a few remarks on the practical deductions which may be drawn from the present investigation. The demonstration of the extensive glandular structure existing within the os uteri, at once points to the influence of constitutional causes in the production of leucorrhœa, and shows the true reason why this affection should be so common in women of strumous habit and leuco-phlegmatic

temperament. It also explains the effect of the excessive glandular secretion upon the constitution; and, above all, it vindicates the importance of constitutional treatment in this malady. It further directs attention to the more rational application of topical remedies. If, as I believe, the morbid conditions of the os uteri either depend in most cases upon eruptive disorders, having their cause in the condition of the constitution, or are secondary to the morbid flow of alkaline mucus from the cervical canal, it is evident that the profuse application of caustics, as recommended in the French school of uterine pathology, is unnecessary and unscientific. We ought not to use these measures in eruptive conditions of the os uteri, any more than we should use them in similar diseases affecting the skin. Nor should we use them in cases of secondary abrasion, from the irritation of the cervical discharge, as we should only be dealing with an effect, while the cause of mischief remained. This would leave comparatively few cases for their application. I admit that leucorrhœa of the cervical canal is sometimes cured by the use of caustics to the os uteri, but, in these cases, they seem to act as counter-irritants to the glandular structure, and thus to effect a cure indirectly. I believe I have seen cases cured by blistering the cervix with acetum cantharidis more readily than by caustic, and on the same principle. It is of little use to direct attention to the os uteri if the interior of the cervix be neglected. Any abrasion or other lesion of the os uteri may be relieved by topical treatment; but if the cervical discharge continue, the os uteri is seen to renew its morbid state again and again.

The indications of treatment which I have proved to a considerable extent in practice, arising from the minute anatomy of the knowledge of the os and cervix uteri, and the study of its pathology in leucorrhœa, appear to me to be the combination of constitutional medicines and regimen, with local applications. But it is obvious that, in the majority of cases, local measures, to be of use, must be applied, not to the vagina nor the os uteri, but to the canal of the cervix. With respect to the common method of treatment by injec-

tions, these are of great service in vaginal or epithelial leucorrhœa, where the walls of the vagina and the external surface of the os and cervix uteri are the seat of disorder; but in cervical or mucous leucorrhœa, little good is obtained unless some portion of the injection is passed into the cervix. As the os uteri is frequently patulous to some extent, this may occur in their common use, but only to a limited extent. To make the entrance of injections into the cervical cavity more certain, I generally recommend the injection of plain water, in the first instance, to clear away the mucous plug from the os uteri, and then the use of medicinal injection. Or, as nearly all the injections used in leucorrhœa coagulate the cervical mucus, and diminish the size of the cervical plug, I direct a first injection to be used with this view, to be followed, in a short time, by a second quantity of injection, to act upon the mucous membrane of the os uteri and cervical canal. It is singular that, almost without exception, the substances used for injections in leucorrhœa have an acid reaction. In intractable cases I apply astringent solutions, such as a concentrated solution of tannin, or a solution of the nitrate of silver, or a solution of iodine, applying them directly to the canal of the cervix by a camel-hair pencil. But I am at present engaged in the attempt to determine the best methods of local and general treatment.

I will not further trespass on the Society, except to state that that which I have now submitted, with much deference to the consideration of the Fellows, is but the commencement of an extensive field of investigation, the prosecution of which may, I trust, prove serviceable, by rendering a troublesome class of maladies more intelligible than they have hitherto been, by correcting errors of practice, and by indicating the just value and kinds of constitutional and topical remedies.

The drawings which accompany the present Paper were executed by Mr. Miller, under the careful superintendence of Dr. Hassall. In all, which are above the size of nature, the camera lucida was employed, to ensure fidelity.

Fig. 1

Extremities of Villi of Os Uteri, covered by Squamous Epithelium,
showing their central depressions.

220 diam.

Fig 2.

Villi of the Os Uteri, from which the Epithelium has been removed,
from preparation of D^r Hassall.

24. diam

Fig. 1.

Villi of Os Uteri, covered by pavement Epithelium
& containing looped Blood vessels.
220 diam.

Fig. 2

Villi of Cervix Uteri covered by Cylindrical Epithelium,
& containing looped Blood vessels, &c.
100 diam.

One of the Columns of Fugæ in the Virgin Cervix.
from preparation of Dr Hassall.

9 diam.

Three of the Rugae and two of the Fossae of the Cervix Uteri.

18 diam.

Fig. 2.

Mucus and Pus corpuscles, Epithelial particles,
& Blood discs from Cervical Leucorrhoea.
220 diam.

Fig. 1.

Interior of Cervix Uteri.
Natural size.

Fig. 3.

Mucus Corpuscles, Epithelial particles, &
Oil granules from Cervical Leucorrhoea.
220 diam.

Epithelium, from Vaginal Leucorrhœa
220. diam

Fig. 1

Circumscribed Ulcer of Os Uteri, showing the removal of the Epithelium,
the erosion of the Villi, and surrounded by a fringe of enlarged Villi.
20 diam.

Fig. 1.

Contents of Nabothian Cyst.
220. diam.

Fig. 2.

Contents of Obstructed Mucous Follicle.
420 diam.

Os, and Cervix Uteri partially inverted and shewing the
Rugæ and Nabothian Ovules
Natural Size.