Howard says there is no shedding of mucous membrane,
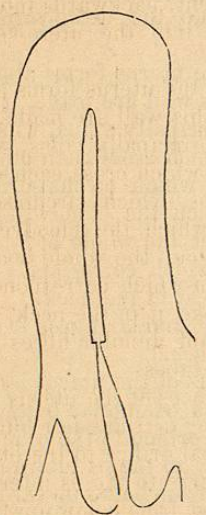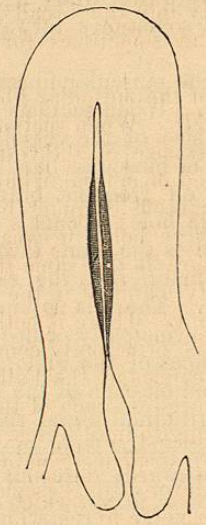
of the uterus was left bare, a sharp line of demarcation being observed at the os uteri internum. This I have had opportunities of verifying. John Williams has carefully described the changes through a fairly complete series of specimens. Fig. 27 represents the bare condition just
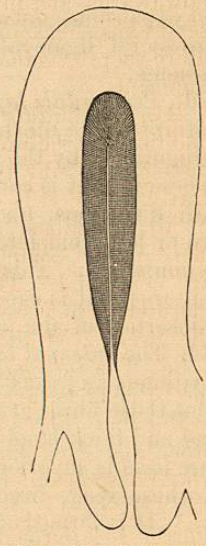
FIG. 27.   FIG. 28.   FIG. 29.

Menstruation just ended. Mucous membrane quite shed.   Three days after menstruation. Mucous membrane regenerated.   Just before menstruation. Mucous membrane at maximum development.
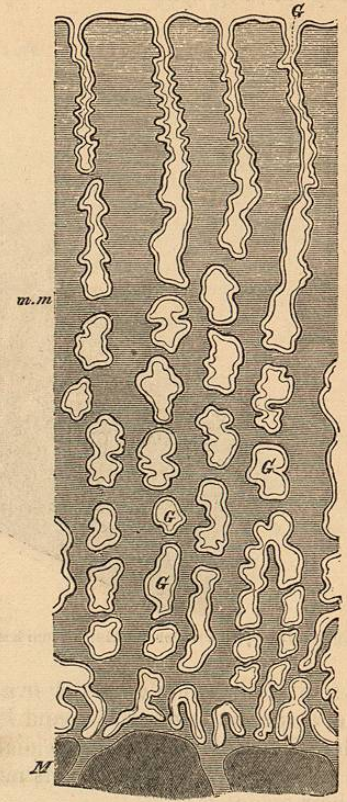
(After John Williams.)

after the shedding of the membrane under menstruation. Fig. 28 represents the uterus three days after menstruation, when the mucous membrane is in course of reformation. Fig. 29 represents the condition from a week after menstruation, when the membrane is still further developed.

The mucous membrane of the uterus proper, says Kundrat,[1] is distinguished by its peculiar connective tissue basement-layer rich in cells, and by the absence of a sub-mucous tissue. The tubular glands are also characteristic. These Kundrat and others describe as running more or less perpendicular to the free surface. Williams finds them more often variously oblique. They form culs-de-sac at their commencement, where they often divide, and dip in between the muscular fibres of the uterine wall. The narrowest portion of their canals is at the outlet on the free surface, where the openings are seen as little pits by the naked eye or magnifying glass. They are round or oval on cross-section. They are lined by columnar cells with cilia. The connective tissue of the mucous membrane spreads outwards into the muscular tissue, thus uniting the two. This description applies to the uterus from the time of its full development until the stage of climacteric atrophy.
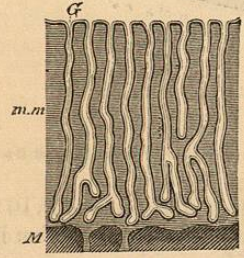
[1] Stricker's Jahrbücher, 1873.

The glands are imperfectly formed at four years old. They then form small depressions in groups. At ten these depressions have lengthened

FIG. 31.

FIG. 30.

Section through Mucous Membrane of Normal Virgin Uterus ✕ 40—(after Kundrat).

m, m, mucous membrane ; G, glands ; M, muscular coat, of which inner layer is shown.

Section of a Maiden Menstruating Uterus ✕40—(after Kundrat).
References as in Fig. 30.

out into tubes, but still they rarely reach the muscular wall. At twelve or thirteen the deep portions of the tubes are often divided and curled. At the climacteric the connective tissue becomes thicker, more fibrous, the cells smaller, the glands narrower, and in part disappear, or are changed into little cysts.

The difference, especially of size, of the mucous membrane during menstruation and in the intervals may be appreciated by contrasting Figs. 30, 31, from Kundrat.

The Neck of the Uterus.—Here the mucous membrane is much thicker than in the body ; it is whiter, denser, and less friable. It is 0.04 inch thick ; but this thickness is much increased at the level of the folds of the anterior and posterior walls. The mucous membrane of the neck is furnished in its lower third or half with warty or filiform papillæ, 0.08 inch to 0.25 inch high, and which are very numerous on the external surface of

the os tincæ. Formed of an amorphous substance, including a multitude of nuclei, they make no projection on the surface of the epithelium. They are, however, well seen when the epithelium is removed by maceration, as in Fig. 32, a preparation made by Dr. Hassall. Between these folds

FIG. 32.
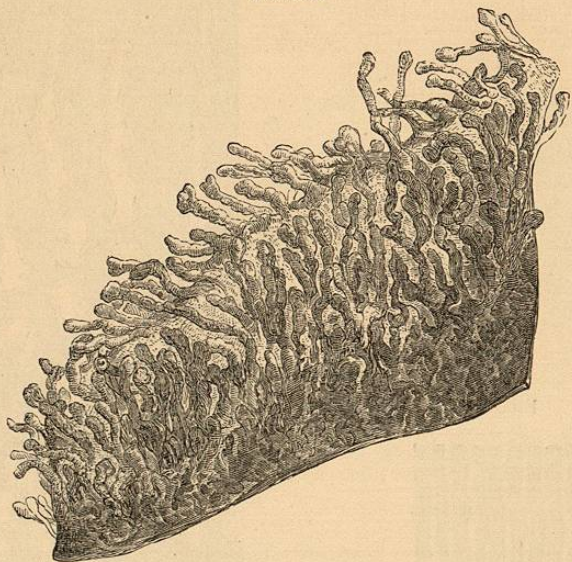
Villi of the Os Uteri, from which the Epithelium has been Removed—(after Tyler Smith and Hassall).

are seen a multitude of round or oval orifices from 0.12 inch to 0.16 inch wide, arranged in linear series and leading to the irregular cavities lined with cylindrical epithelium. The diameter of these cavities, which occupy the whole thickness of the mucous membrane, is scarcely larger than that of their openings.

According to Sappey the glands of the cervix are branched, not simple tubes or follicles. They are prolonged as far as the muscular tunic, and are far more complicated than is generally supposed. Each is formed of a duct which divides into two or more branches, which again subdivide, and terminate in a cul-de-sac. Their orifices open on the mucous membrane of the neck at the bottoms of the furrows of the arbor vitæ. They secrete the clear viscid mucus which is usually found filling the uterine neck; and which in the state of catarrh escapes abundantly.

The mucous membrane of the neck is composed of a mucous chorion formed almost exclusively of connective tissue, and of an epithelium formed of cylindrical cells in the upper two-thirds of the neck, and of pavement cells in the lower third.

We often meet, on the surface of the mucous membrane of the os uteri externum, with spherical translucent vesicles called *ovula Nabothi*. These are obstructed muciparous follicles which are found in the cavity of the body as well as in that of the neck, but which especially abound in the neighborhood of the os uteri. When small they remain buried in the

mucous membrane. They only become visible when the mucus accumulates in their cavities through the obliteration of their orifices. When

FIG. 33.
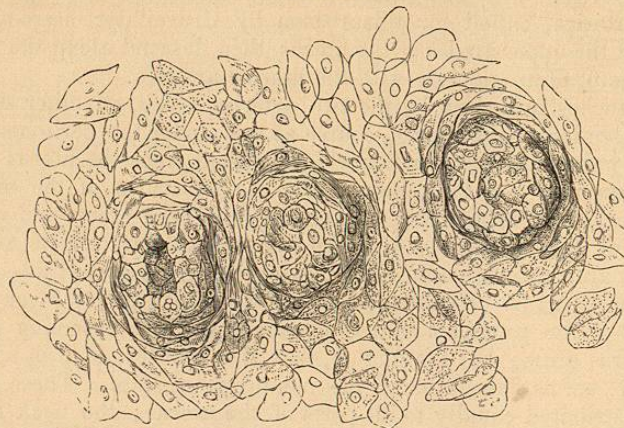
Extremities of Villi of Os Uteri, covered by Squamous Epithelium, showing their Central Depressions—(after Tyler Smith and Hassall).

very largely developed they have given rise to the suspicion of serious disease. They are formed of an investing membrane of connective tissue,

FIG. 34.
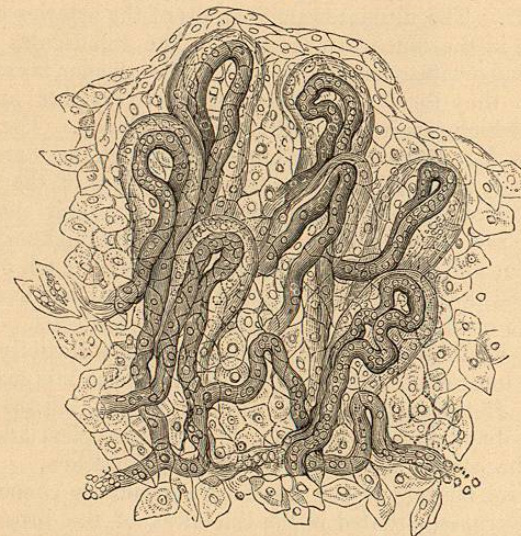
Villi of Os Uteri, covered by Pavement Epithelium and containing Looped Bloodvessels (after Tyler Smith and Hassall).

and of cylindrical epithelium; and contain a transparent, vitreous, or colloid liquid.

Vessels and Nerves.—1st. *Arteries.* The arteries of the uterus spring from two sources: (*a*) Some arise from the hypogastric, and take the

name of uterine arteries. Placed at first on the side of the vagina, they penetrate the broad ligaments in the neighborhood of the cervix uteri, ascend along the borders of the uterus, and anastomose with the utero-ovarian arteries. (b) The others, not less considerable, spring from the ovarian arteries, called for this reason by Cruveilhier, utero-ovarian; they reach the upper angles of the uterus, then descend along the borders of this organ, to anastomose with the uterine arteries.

The branches furnished by the two arteries which, on ether side, run along the border of the uterus, course at first under the peritoneum, surrounded by the muscular bundles which proceed from the uterus; then, after a certain course, they plunge into the substance of the muscular tissue, where they ramify and anastomose with each other, and with the branches of the opposite side. All these branches, which are very numerous, are remarkable for their cork-screw twistings. It was thought at one time that this helicine disposition was designed to favor the development of the pregnant uterus by uncurling, and becoming straight as the uterus grew; but the fact is, that the arteries, even in advanced pregnancy, are as flexous as in the non-pregnant state. These arteries are not distributed equally to all parts of the uterus; the neck receives but a small number; at the neigborhood of the upper angle of the uterus, on the other hand, the utero-ovarian artery supplies suddenly from twelve to eighteen tufts of arteries, spirally curled, which cover with their ramification the whole of this region. At the level of the furrow, which separates the body from the neck, M. Huguier has described an arterial circle formed by the anastomoses of the arteries of the right side with those of the left. The ultimate ramifications of the arteries of the uterus are distributed in the mucous membrane. The ramuscules in this membrane are of importance as to size only in the deeper layers; beneath the epithelium they form a capillary network, very fine and close, the interspaces of which receive the orifices of the glands. The coats of the arteries are, as Mr. Rainey pointed out, very thick, and are apt, unless care be observed, to be mistaken for the proper fibre of the uterus.

2d. *The veins* of the uterus are remarkable for their enormous development; they are large canals hollowed out of the thickness of the muscular substance, and frequently communicating with each other. They have been called the *uterine sinuses*, and M. Rouget has described them under the name of the *corpus spongiosum* of the uterus. The uterine sinuses occupy all the body of the uterus, and cease abruptly at the level of the os uteri internum. The neck itself has a much less marked venous development. Between the uterine sinuses, we find in the wall of the uterus venous ducts twisted spirally, like the arteries, and which are analogous to the *corpus spongiosum* of the male urethra.

On the lateral borders of the uterus these sinuses communicate with vast *venous plexuses*, situated in the thickness of the broad ligaments, and continuous below with the vaginal plexus, and above with the sub-ovarian plexus. They have received the name of the *pampiniform plexuses*. From these plexuses proceed below, the pudic veins; in the middle, the uterine veins; above, the ovarian veins. These last present but very few valves, and assume full development only after puberty.

3d. The *lymphatic vessels*, during pregnancy and after delivery, are,

like the veins, of considerable size. They form several planes in the thickness of the uterus; the superficial are the largest. They are divided into two groups; those of the neck, which run to the pelvic ganglia; those of the body, which terminate in the lumbar ganglia. These last accompany the utero-ovarian veins. Dr. Lucas-Championnière[1] describes a ganglion situated above the lateral vaginal cul-de-sac, closely applied at the union of the body and neck. When this ganglion is missing, its place is taken by close networks of lymphatics. Gallard thinks this ganglion or network plays an important part in pathology, as the starting-point of puerperal and other affections.

4th. The *nerves* proceed, some from the renal plexuses and inferior mesenteric, to reach the uterus, being closely bound to the utero-ovarian arteries; others, proceeding from the hypogastric plexus, are formed by some anterior branches of the sacral nerves, and by branches proceeding from the lumbar ganglia of the great sympathetic. These two plexuses anastomose in the thickness of the broad ligaments, and send off filaments over the two surfaces of the uterus which penetrate into the substance of the organ, keeping in intimate contact with the arteries, or coursing in the spaces between the arteries.

The following account by M. Boulard is adopted by Cruveilhier:—

1. The nerves of the uterus are very few in number.

2. They do not increase in size during pregnancy. The principal differences, observed during pregnancy and in the non-pregnant condition, bear more upon the state of the plexuses than on the volume of the nerves.

3. In the child, the elements of these plexuses, crowded together, seem to constitute a true nervous membrane; from these there proceed very delicate nerves, which run to the uterus and broad ligaments to give off their filaments, which are entirely capillary.

4. In woman whose uterus is developed, the plexus is carried higher up, its elements are separated, and form more or less considerable spaces; and as to the nerves issuing from it, they only differ in being longer, coinciding with greater tenuity if compared with those met with in the normal uterus of an adult woman.

5. These nerves issue from the hypogastric ganglion and plexus, as well as from the nervous ring or ganglion which surrounds the urethra at its entry into the bladder. They reach the sides of the uterus, and thence follow in part the distribution of the arteries. In every case they are accompanied by a very fine arteriole. Some, very fine, reach the anterior and posterior surfaces, as well as the fundus of the uterus.

6. As to the neck, imitating the prudent reserve of Longet, Boulard does not absolutely decide the question on account of the extreme difficulty of the dissection. He, however, believes that the uterine neck, that is the vaginal portion, is not completely deprived of nerves. He thinks he has traced a nervous filament ramifying in the anterior lip of the os tincæ. Sappey finds nerves in the neck.

7. M. Boulard has never seen uterine plexuses or ganglia. It is

[1] Lymphatiques utérins et lymphangite utérine. Bull. de la Soc. Méd. des hôpitaux de Paris, vol. vii.

enough, he says, to cast the eye upon the walls of a developed uterus, after having removed the peritoneum, to recognize how easy it is to fall into error, and how easy to represent as nerves and ganglia, muscular fibres, venulæ, lymphatic vessels, etc., especially after a prolonged submersion. The supra-vaginal portion is freely supplied, but the infra-vaginal portion is very scantily supplied with nerves. Hence excision, division, cautery, may cause little pain unless inflammation be present. The pain sometimes evoked on touch is often due to communicated pressure in parts beyond. In cancer there is little pain, so long as the disease is limited to the vaginal portion.

THE VAGINA.

The vagina is a musculo-membranous canal extending from the vulva to the uterus. It is at the same time the organ of copulation in woman, and the canal serving for the passage of the menstrual blood on the one hand, and of the product of conception on the other.

It is situated in the cavity of the pelvis, between the bladder and the rectum. Maintained in its position by intimate adhesions with the surrounding parts, the vagina is still not so fixed but that it may undergo an inversion upon itself like the finger of a glove or an invagination. This, in fact, is the true nature of most of the cases of so-called prolapsus with procidentia of the uterus. It is to be observed that the anterior wall of the vagina is shorter than the posterior wall; the difference being from 0.4 inch to 0.8 inch. Its direction is oblique from above downwards, and from before downwards. When the bladder is empty, its axis forms with that of the uterus a right angle. When the bladder is full, the angle of junction is obtuse, the open aspect of the angle looking upwards and forwards.

The vagina is not of equal width in all parts of its length. Its lower or vulvar orifice is the narrowest part; its upper extremity has much larger dimensions. In women who have had children, the fundus of the vagina forms a large bag, in which the speculum may be made to sweep freely, and in which also a large quantity of blood may accumulate in cases of uterine hemorrhage. Moreover, this canal is eminently dilatable, as is proved by parturition; it is, at the same time, elastic; and after labor it may return nearly to its original dimensions. The part which is most dilatable and the least elastic is certainly the upper part, to which the name of *vaginal bag* might well be given, whilst the lower orifice might be called the *vaginal strait*.

When not dilated by a foreign body, the walls of the vagina touch each other at every part, so that its cavity is completely closed. This may be clearly demonstrated by watching the behavior of the vagina during the withdrawal of the tubular or bivalve speculum. As the instrument retreats from the fundus, the walls of the vagina close up behind it, and even help to expel the speculum by its elasticity and contractile action. There are, however, cases in which the fundus of the vagina presents a true cavity, the walls not being in contact. This I have chiefly seen in women who were subject to prolapsus. It is also often remarkable during the process of abortion. If a horizontal section of the organ is

made, it exhibits a transverse slit not always of exactly similar shape. Generally this slit is slightly curvilinear, with anterior convexity, and each of the two extremities falls upon an antero-posterior slit, which gives to the whole the form of the letter H. This form is perfectly adapted to that of the neighboring parts; for the urethra is placed in the opening of the anterior branches, and the rectum is received into the posterior space. The transverse branch is generally about 0.25 inch long in the adult. In the child it is shorter, and the section takes rather the shape of a star. The calibre of the vagina is smaller in virgins. It is comparatively inextensile. Its muscular power seems greater than in married women, and especially than in those who have borne children. Hence the care that is necessary in the selection and use of instruments, as the speculum and pessaries, in single women. Still the walls of the vagina are generally easily extensible; but they would not be extensile enough to permit the child's head to pass in labor, if the vagina did not share during pregnancy in the hypertrophy of the uterus; and if in hypertrophying it did not dilate sufficiently to prepare it for this function of an excretory canal.

Relations.—1. The anterior aspect of the vagina, which presents a slight concavity in the transverse direction, answers above to the base of the bladder. To this organ the vagina is united by a dense filamentous cellular tissue. Lower down the vagina is united to the urethra, and the relation is so intimate that the urethra seems to be hollowed out of the anterior wall of the vagina. The urethra may thus be felt like a prominent cord running along the median line. It thus forms an excellent guide to the situation of the meatus, serving as a direct clue in passing the catheter. This intimate adhesion of the vagina with the bladder and urethra explains why these latter organs are constantly dragged down in displacements of the uterus.

2. The *posterior aspect* of the vagina answers to the rectum, through the peritoneum in its upper third or quarter, and immediately in its two lower thirds or three quarters. But I have shown that the peritoneum comes down lower on the left side of the vagina, than it does in the median line behind. This disposition of the peritoneum explains why, when the posterior wall of the vagina is torn in its upper third or fourth, the intestines may fall through the rent. The vagina adheres to the rectum by a cellular tissue much looser than that between the bladder and vagina, so that the rectum is not so liable to be dragged down in the displacement of the vagina.

The *recto-vaginal septum* is the septum formed by the apposition of the posterior wall of the vagina and of the anterior wall of the rectum. Inferiorly the rectum detaching itself from the vagina, there is formed a triangular space, whose base is below, and whose antero-posterior diameter defines the thickness of the perineum (see Fig. 1).

3. The lateral borders of the vagina give attachment above to the broad ligaments; below to the pelvic aponeurosis. They are crossed by the levatores ani muscles, which, however, take no insertion here.

The *inner surface*, or mucous membrane of the vagina, is smooth in its upper portion, and presents on its two walls flattened rounded tubercles, measuring from 0.04 inch to 0.12 inch in diameter, and pressed against each other; or else there are crests or transverse imbricated prominences