THE FEMALE INTERNAL GENITALIA

THE URINARY BLADDER

THE URETHRA

THE HYPOGASTRIC ARTERY

Lecture 10
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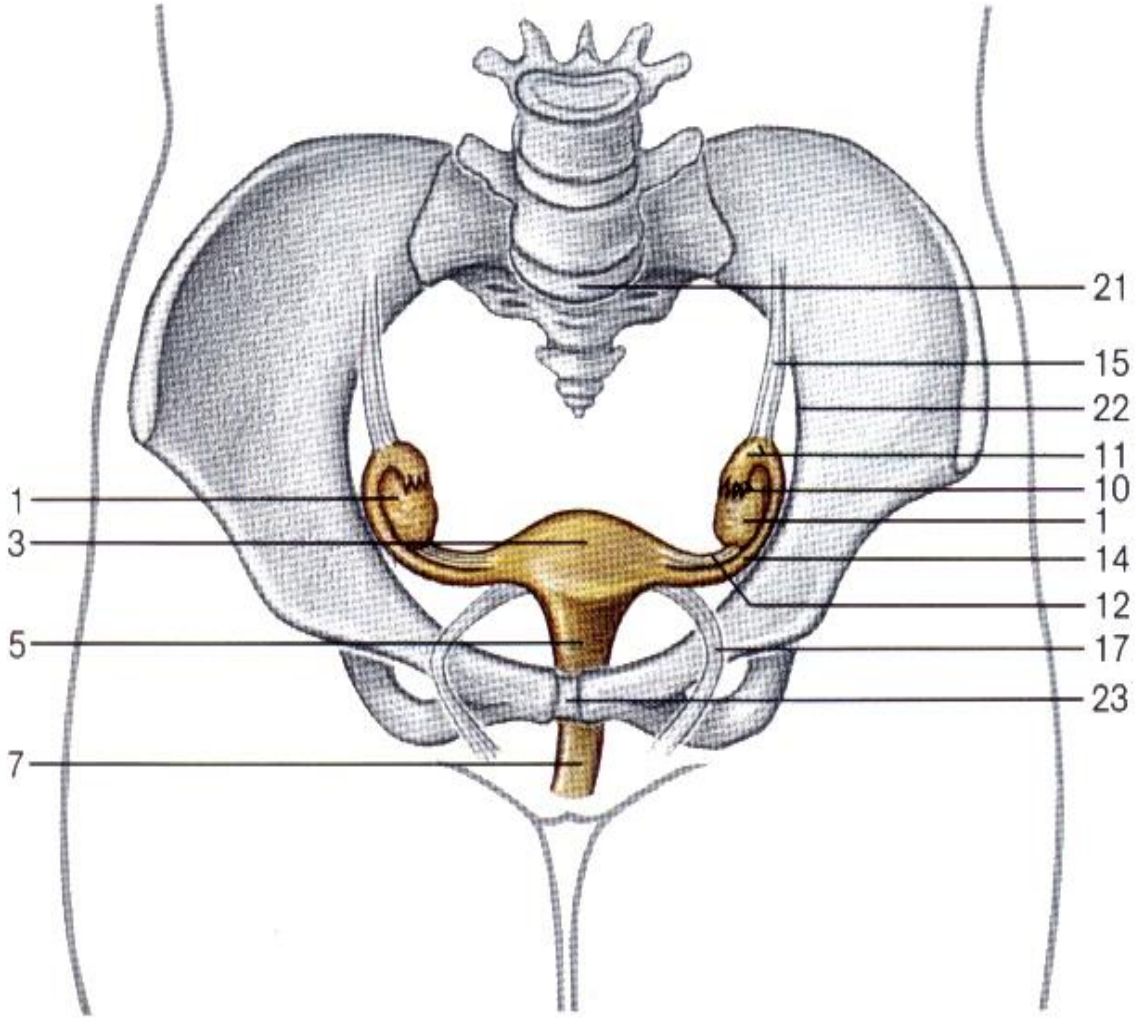
The Female Genital Organs *(Organa Genitalia Muliebria)*

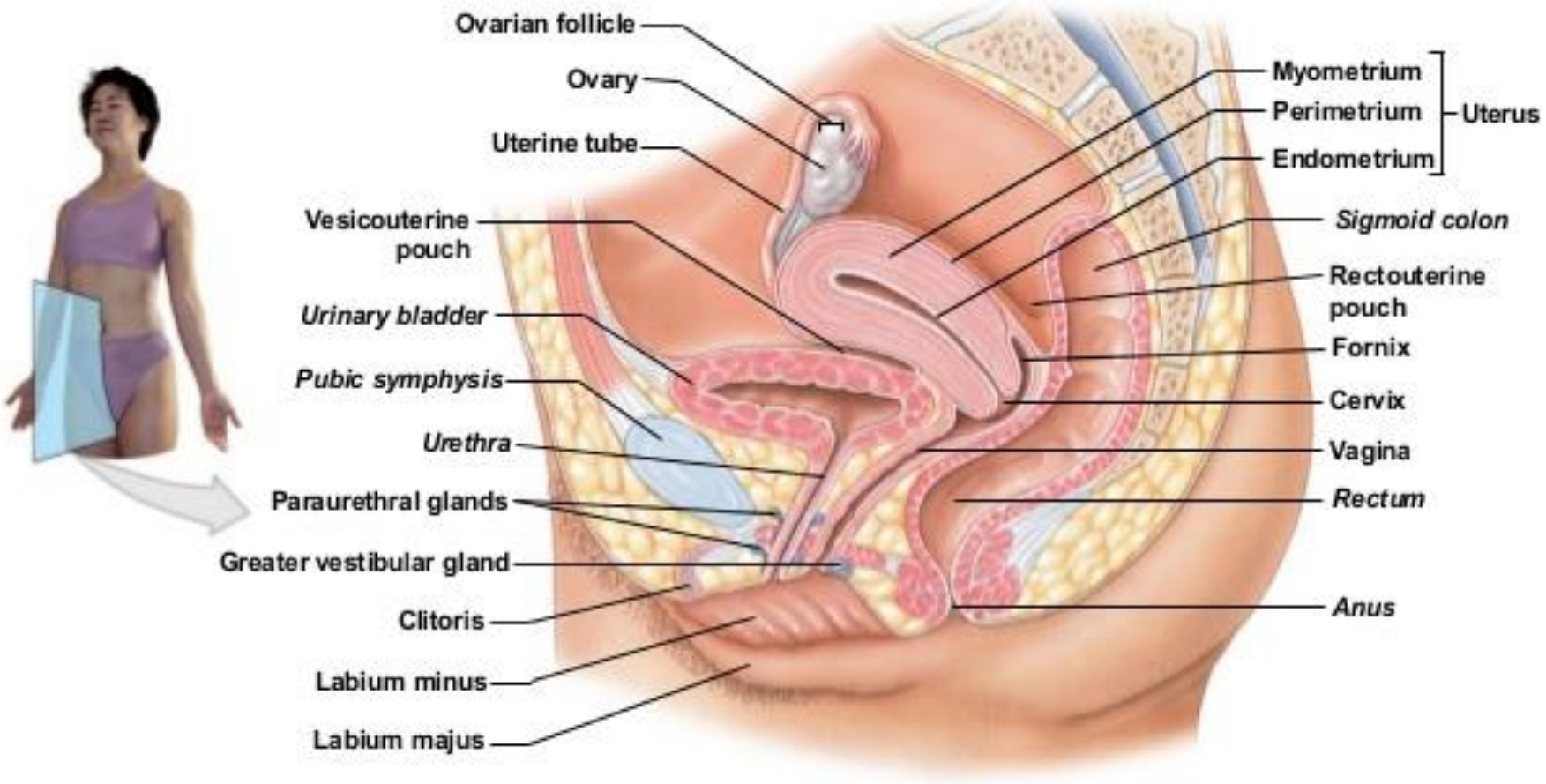
- The female genital organs consist of an internal and an external group.
- The **internal organs** are situated within the pelvis, and consist of the **ovaries,** the **uterine tubes**, the **uterus**, and the **vagina**.
- The **external organs** are placed below the urogenital diaphragm and below and in front of the pubic arch.
- They comprise the **mons pubis,**
- the **labia majora et minora pudendi,**
- the **clitoris,**
- the **bulbus vestibuli,**
- and the **greater vestibular glands.**



Female internal genital organs. (Schematic drawing.)

1 **Ovary**
2 Mesovarium
3 **Fundus of uterus**
4 Uterovesical pouch
5 **Cervix of uterus**
6 Vaginal portion of cervix
7 **Vagina**
8 Crus of clitoris
9 Labium minus
10 Fimbriae of uterine tube
11 Infundibulum of uterine tube
12 Ligament of the ovary
13 Mesosalpinx
14 Uterine tube
15 Suspensory ligament of ovary (caudally displaced)
16 Broad ligament of uterus
17 Round ligament of uterus
18 Corpus cavernosum of clitoris
19 Glans of clitoris
20 **Hymen, vaginal orifice**
21 Promontory
22 Linea terminalis of pelvis
23 Pubic symphysis

Figure 27.10 The Female Reproductive System (Part 1 of 2)



The Ovaries *(Ovaria)*

- The **ovaries** are homologous with the testes in the male.
- They are two nodular bodies, situated one on either side of the uterus in relation to the lateral wall of the pelvis, and attached to the back of the broad ligament of the uterus, behind and below the uterine tubes .
- The ovaries are of a grayish-pink color, and present either a smooth or a puckered uneven surface.
- Each ovary presents a lateral and a medial surface, an upper or tubal and a lower or uterine extremity, and an anterior or mesovarion and a posterior free border.
- It lies in a shallow depression, named the **ovarian fossa,** on the lateral wall of the pelvis; this fossa is bounded above by the external iliac vessels, in front by the obliterated umbilical artery, and behind by the ureter.
- The exact position of the ovary has been the subject of considerable difference of opinion, and the description here given applies to the ovary of the nulliparous woman.
- The ovary becomes displaced during the first pregnancy, and probably never again returns to its original position.
- In the erect posture the long axis of the ovary is vertical.

The *tubal extremity* is near the external iliac vein; to it are attached the ovarian fimbria of the uterine tube and a fold of peritoneum, the **suspensory ligament of the ovary,** which is directed upward over the iliac vessels and contains the ovarian vessels.

The *uterine end* is directed downward toward the pelvic floor, it is usually narrower than the tubal, and is attached to the lateral angle of the uterus, immediately behind the uterine tube, by a rounded cord termed the **ligament of the ovary,** which lies within the broad ligament and contains some non-striped, muscular fibers.

The *lateral surface* is in contact with the parietal peritoneum, which lines the ovarian fossa; the *medial surface* is to a large extent covered by the fimbriated extremity of the uterine tube.

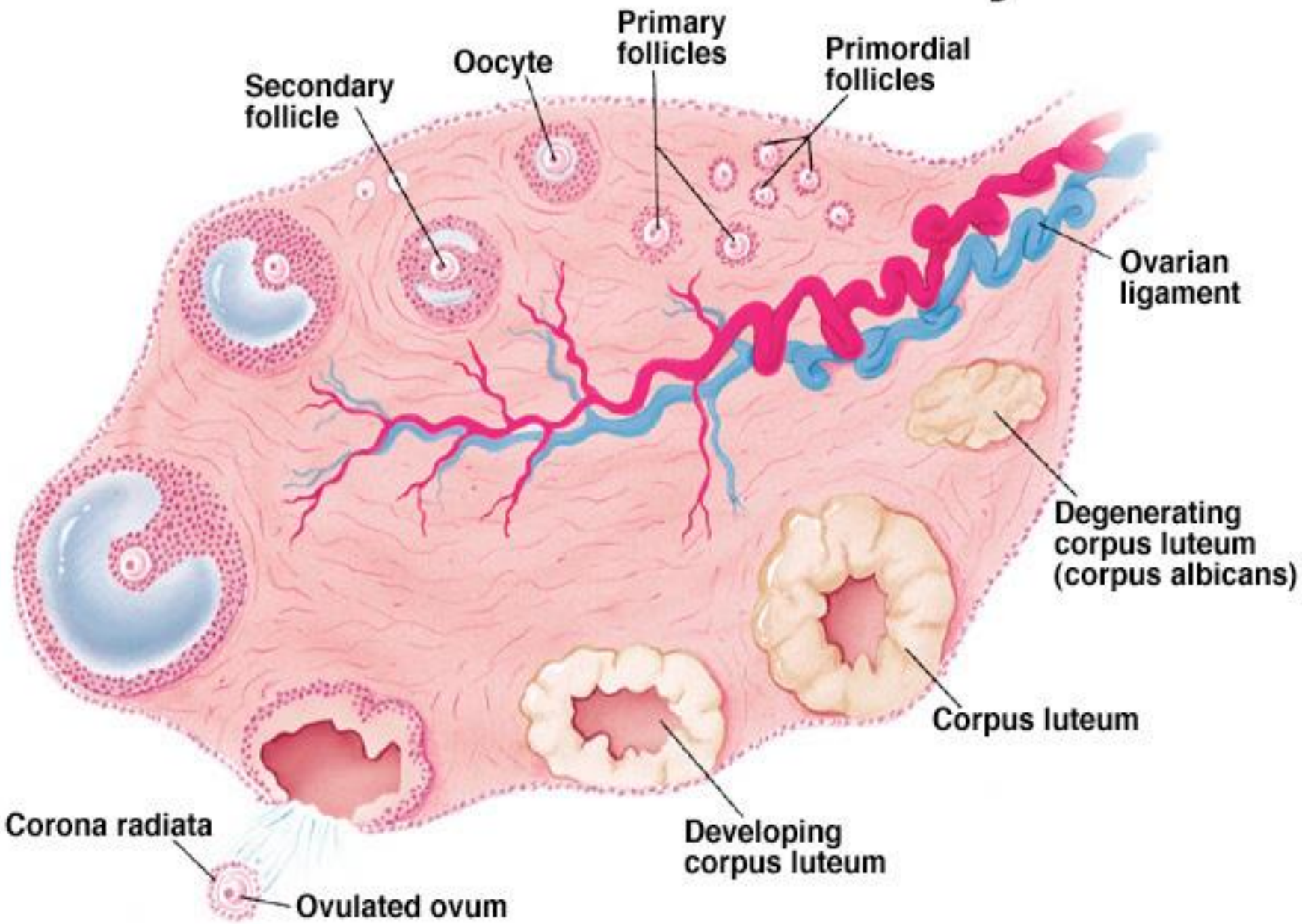
The *mesovarian border* is straight and is directed toward the obliterated umbilical artery, and is attached to the back of the broad ligament by a short fold named the **mesovarium.**

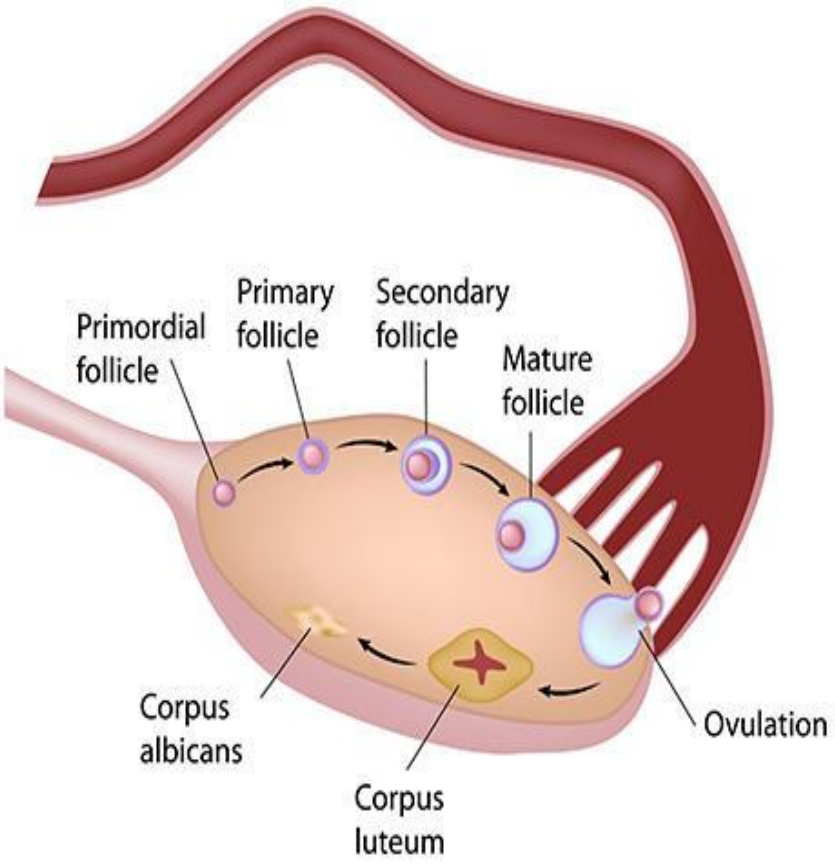
Between the two layers of this fold the bloodvessels and nerves pass to reach the hilum of the ovary.

The *free border* is convex, and is directed toward the ureter.

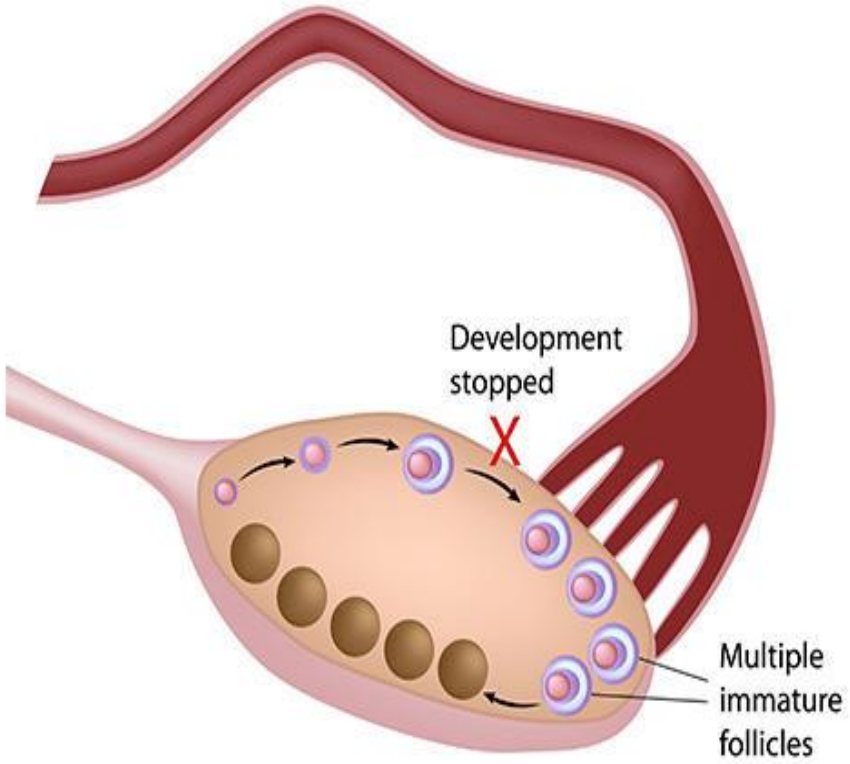
The uterine tube arches over the ovary, running upward in relation to its mesovarian border, then curving over its tubal pole, and finally passing downward on its free border and medial surface.

Structure of an Ovary



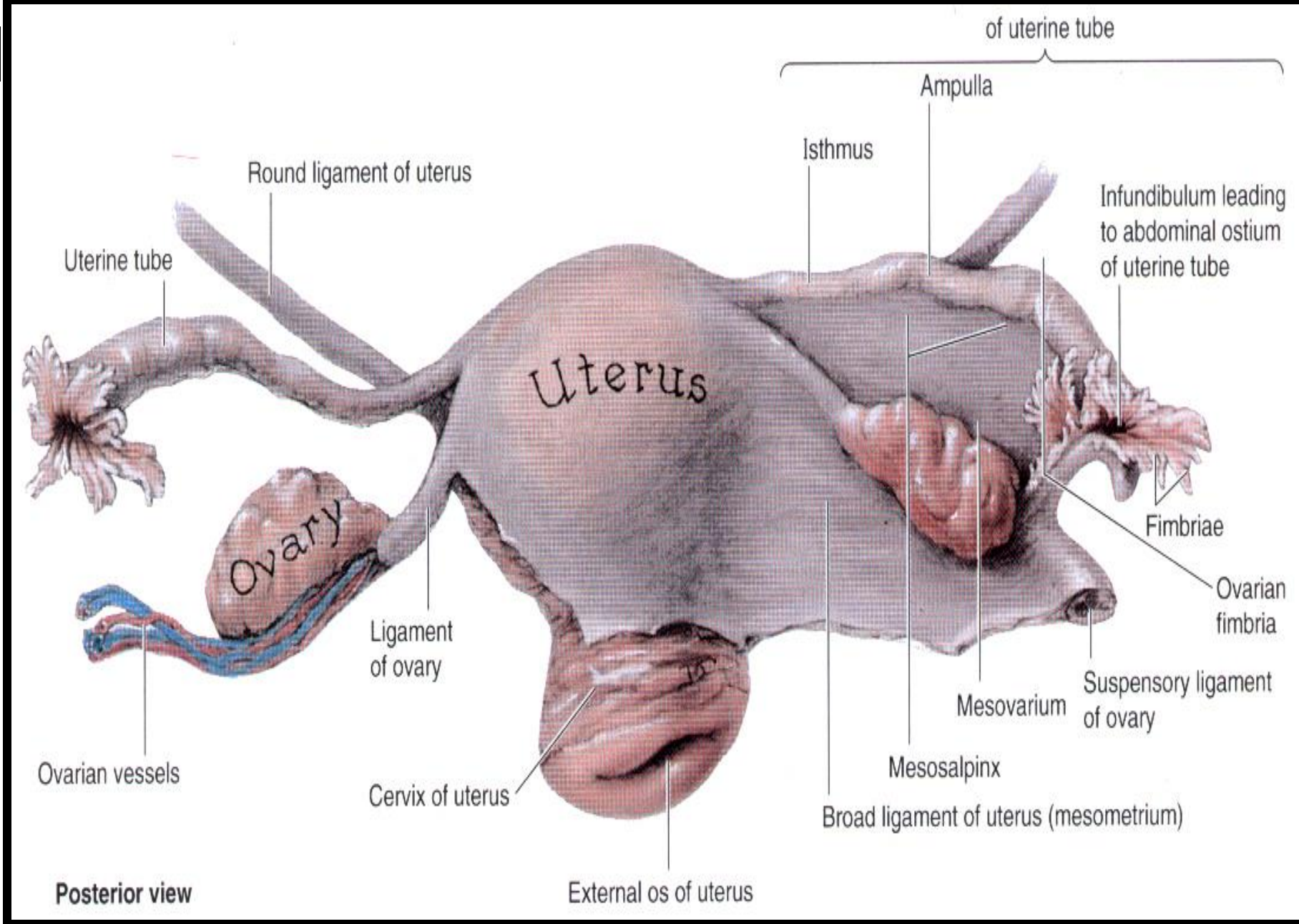


Normal Ovary



Polycystic Ovary

- **Situated one on each side of the uterus close to the lateral pelvic wall, they are attached to the posterior aspect of the broad uterine ligament of the uterus near its upper limit by a double fold of peritoneum, the *mesovarium,* behind and mainly below the lateral part of the uterine tube.**
- **In the living they are greyish-pink and present a smooth exterior before regular ovulation begins, but thereafter their surfaces are distorted by the scarring which follows the degeneration of successive *corpora lutea*.**
- **Each ovary is classically described as almond-shaped (amygdaloid), about 3 cm long, 1.5 cm wide and 1cm thick.**


of uterine tube
Ampulla
Isthmus
Round ligament of uterus
Infundibulum leading to abdominal ostium of uterine tube
Uterine tube
Uterus
Ovary
Fimbriae
Ligament of ovary
Ovarian fimbria
Suspensory ligament of ovary
Mesovarium
Ovarian vessels
Mesosalpinx
Cervix of uterus
Broad ligament of uterus (mesometrium)
External os of uterus
Posterior view

Ovarian cortex

- **After puberty the cortex forms the major part of the ovary, enclosing the medulla except at the hilum.**
- **It contains the *ovarian follicles* of various sizes and *corpora lutea* (and their degenerative remnants), depending on the stage of menstrual cycle or age.**
- **The follicles and their products are embedded in a dense fibrocellular *stroma* composed of interwoven, thin, collagen fibres and many fusiform, fibroblast-like or mesenchymal cells arranged in characteristic swirls.**
- **Other tissue components include *interstitial cells,* these are common in the human ovary in the early period of life, and in many other mammalian species, but are said to persist in women after puberty only in the thecae of atretic follicles; their significance is uncertain.**

Tertiary follicle

- Although a number of follicles may progress to the secondary stage by about the first week of a menstrual cycle, only one follicle from the two ovaries proceeds to the tertiary stage, the remainder becoming atretic.
- The 'chosen' follicle now increases in size considerably as the follicular antrum takes up fluid from the surrounding tissues and expands to a diameter of about 2 mm.
- The term Graafian follicle is often used of this stage (though sometimes also applied to the late secondary follicle).
- The oocyte and its surrounding ring of cells *(corona radiata)* breaks away from the wall and now floats freely in the follicular fluid.
- At this stage, the primary oocyte, which has remained in the first meiotic prophase since fetal life, completes its first meiotic division to produce the almost equally large *secondary oocyte* and a relatively minute *first polar body',* both of them now haploid.

- During this step the first meiotic spindle is orientated perpendicular to the oocyte surface, which it approaches closely, so that the polar body is separated at the periphery of the oocyte (still beneath the zona pellucida), with a nucleus and a minimal amount of cytoplasm.
- The secondary oocyte now immediately begins its second meiotic division, but when it reaches metaphase, this process is once again arrested, and the chromosome remains in this condition until fertilization has occurred, when it completes the divisional stage as a response to penetration by a sperm head, throwing off a second polar body during this process.
- The follicle now moves to the surface of the cortex, causing the surface of the ovary to bulge.

- On release into the peritoneal cavity, the secondary oocyte is still surrounded by its zona pellucida and corona radiata of granulosa cells.
- Ovulation is now complete, and the oocyte is ready for transport to the uterine tube.
- During maturation the oocyte grows from 25 μm in the primordial follicle to 100 μm in the mature follicle, as the numbers of organelles within it increase, including mitochondria, ribosomes, Golgic complexes, yolk platelets and, in its peripheral cytoplasm, cortical granules important in the fertilization process.
- If the oocyte is not fertilized, it begins to degenerate after 24-48 hours.
- Ovulation usually occurs 12-16 days before the expected onset of a menstrual cycle.

Atretic follicles

- the degeneration of pre-tertiary stage follicles is a major factor influencing the development of the ovary.
- Atresia occurs at all stages of oocyte development, from the embryonic period onwards.
- the numbers of human oocytes are reduced from a maximum of nearly 7 million at 5 months gestation to about 1 million at birth.
- Postnatally, further degeneration occurs so that by puberty only about 400000 oocytes remain.
- Oocyte degeneration between birth and menarche is caused mainly by recruitment of oocytes from the pool of primordial follicles, destined of course for atresia since there are no ovulations before puberty.
- Of the 40000 oocytes remaining at puberty only about 400 undergo ovulation during the reproductive years.

Corpus luteum

- **After ovulation, the walls of the empty follicle collapse and fold extensively; the cells of the membrana granulosa increase in size and synthesize a cytoplasmic carotenoid pigment (lutein) giving them a yellowish colour (hence corpus luteum).**
- **These large *(30-50* µm) cells, often termed *granulosa lutein cells* because of their origins, form most of the corpus luteum.**
- **The basal lamina surrounding the follicle breaks down, allowing rather smaller (20 µm) though more numerous cells, to infiltrate into the cellular mass, accompanied by capillaries and connective tissue.**
- **If the oocyte is not fertilized, the corpus luteum functions for about 12-14 days after ovulation, then atrophies into a *corpus luteum of menstruation,* the lutein cells undergoing fatty degeneration, autolysis, removal by macrophages and gradual replacement with fibrous tissue; eventually, after about 2 months, a small scar-like *corpus albicans* is all that remains.**

Medulla

- This central zone is highly vascular, consisting of numerous veins and spiral arteries set in a looser connective tissue stroma, with many elastin fibres, pericytes and some smooth muscle which enter the hilum from the mesovarium.
- The medulla is much more vascular than the cortex.
- Small numbers of cells with characteristics similar to interstitial (Leydig) cells in the testis also occur in the medulla.
- These are known as *chromaffin cells:* they may be a source of androgens.

Ovarian follicles

Primordial follicles

- **The formation of the female gamete is a complex process with many different phases.**
- **At birth, the cortex contains a superficial zone of primordial follicles; these consist of primary oocytes about *25* m in diameter, each surrounded by a single layer of flat *follicular cells* derived from somatic tissue (their precise origins at present uncertain).**
- **Many degenerate during childhood, some in situ, others developing briefly then undergoing atresia, as also occurs each month during the child-bearing period of life.**
- **Their remnants are visible as *atretic follicles* which gradually disperse, but whose remains accumulate throughout the ovary's active life.**

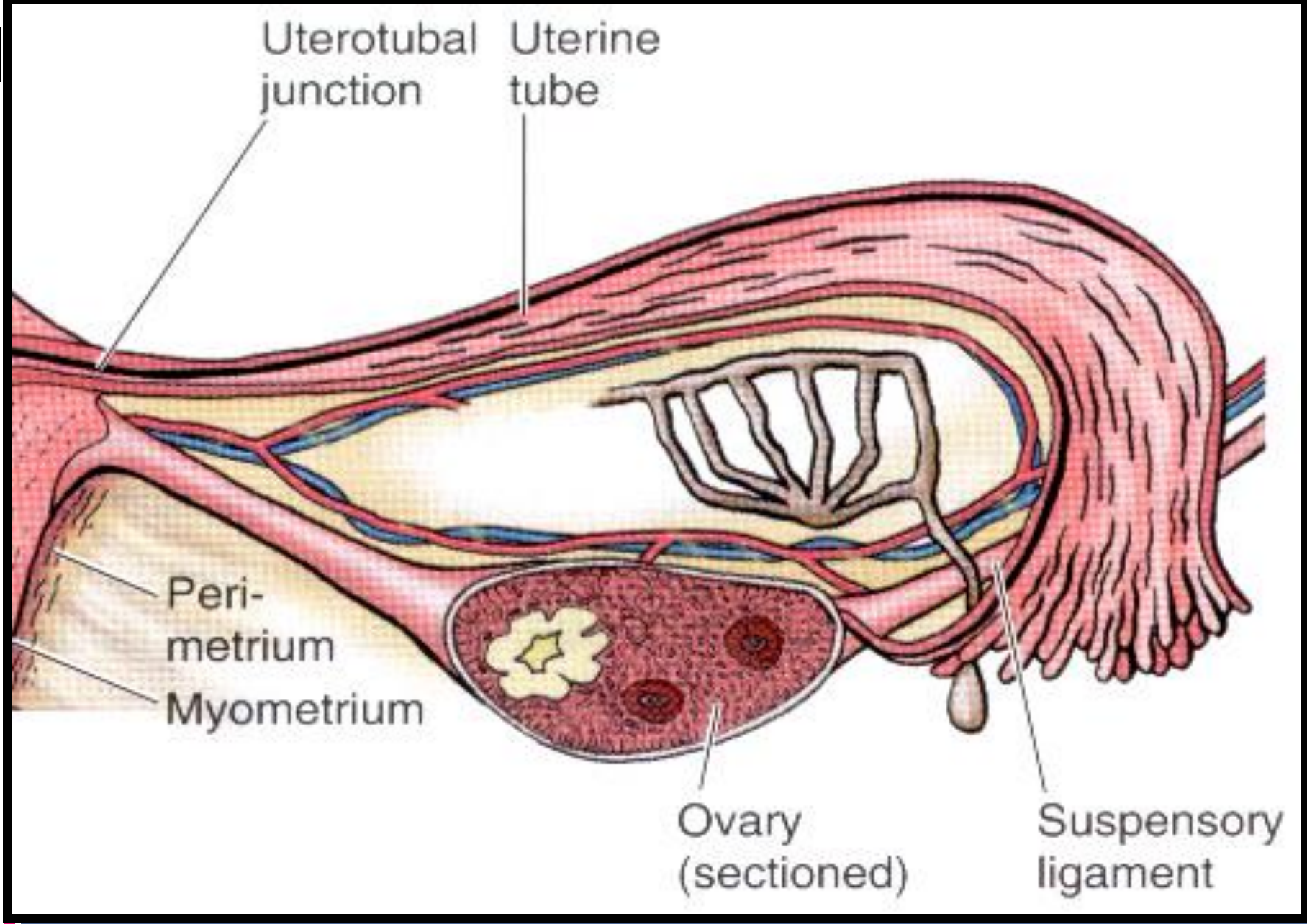
Primary follicle

- The first sign of follicular activation is the growth of the follicle cells from squamous to cuboidal, followed by their multiplication to form a multilayered mass, the membrana granulosa, surrounded by a thick basal lamina (membrana limitans externa).
- Stromal cells immediately surrounding the follicle begin to differentiate into spindle-shaped cells constituting the *internal theca,* and are later accompanied by another, more fibrous *external theca.*
- At the same time the oocyte increases in size and a thick layer of extracellular proteoglycan-rich material, the *zona pellucida,* is secreted by the oocyte between its surface and the surrounding granulosa cells.
- This is important for the process of fertilization.
- The follicular cells continue to multiply, the small rounded products of division being termed *granulosa cells.*

Secondary (antral) follicle

- As the mass of follicular cells continues to increase, fluid-filled cavities begin to form between them, containing a clear fluid *(liquor folliculi)* containing, amongst other components, hyaluran, growth factors and the hormonal secretions of the granulosa cells.
- The follicle is now about 200 μm.
- These cavities fuse to form one large fluid-filled space (the *antrum folliculi)* surrounded by a thin layer of granulosa cells, thickened at one pole of the follicle to encompass the oocyte in a mound of cells, the *cumulus ovaricus (cumulus oophorus)*.
- Among the granulosa cells are small numbers of various other cell types, including macrophages, which are a source of growth factors, and lymphocytes.
- As follicles mature, the theca interna becomes more prominent ('thecal gland').

- **It occupies the *ovarian fossa,* on the lateral pelvic wall, bounded anteriorly by the obliterated umbilical artery and posteriorly by the ureter and internal iliac artery.**
- **Attached to its upper, *tubal extremity,* near the external iliac vein, are the ovarian fimbria of the uterine tube and a peritoneal *suspensory ligament of the ovary,* which contains the ovarian vessels and nerves and passes superiorly over the external iliac vessels to join the peritoneum on psoas major, posterior to the caecum or descending colon (depending on whether it is right or left).**
- **The *uterine* (inferior) *extremity* is directed downwards towards the pelvic floor; it is usually narrower than the tubal extremity and is attached to the lateral angle of the uterus, postero-inferior to the uterine tube, by a rounded *ovarian ligament,* which lies in the broad ligament and contains some smooth muscle cells.**

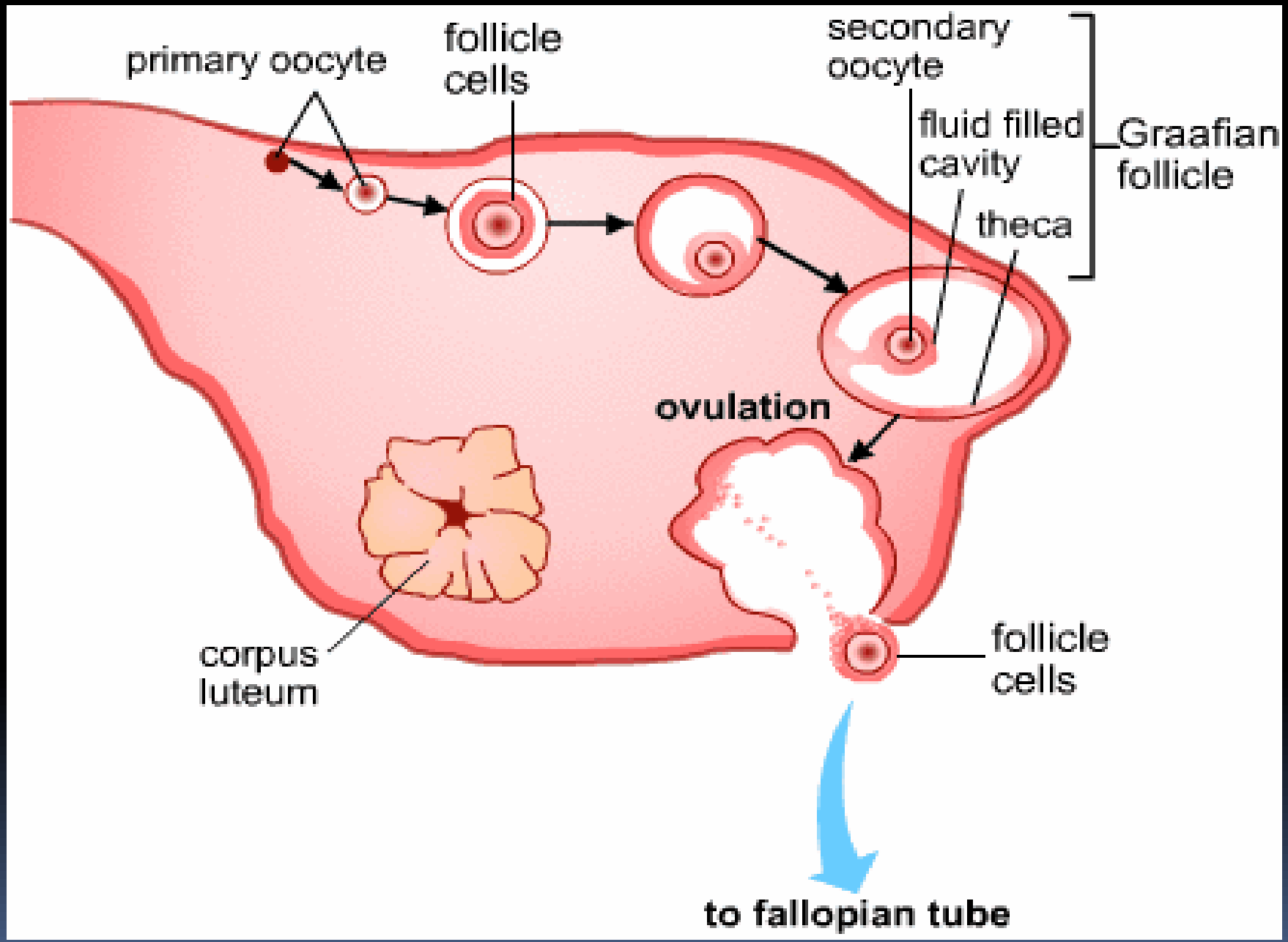

Uterotubal junction
Uterine tube
Peri-metrium
Myometrium
Ovary (sectioned)
Suspensory ligament

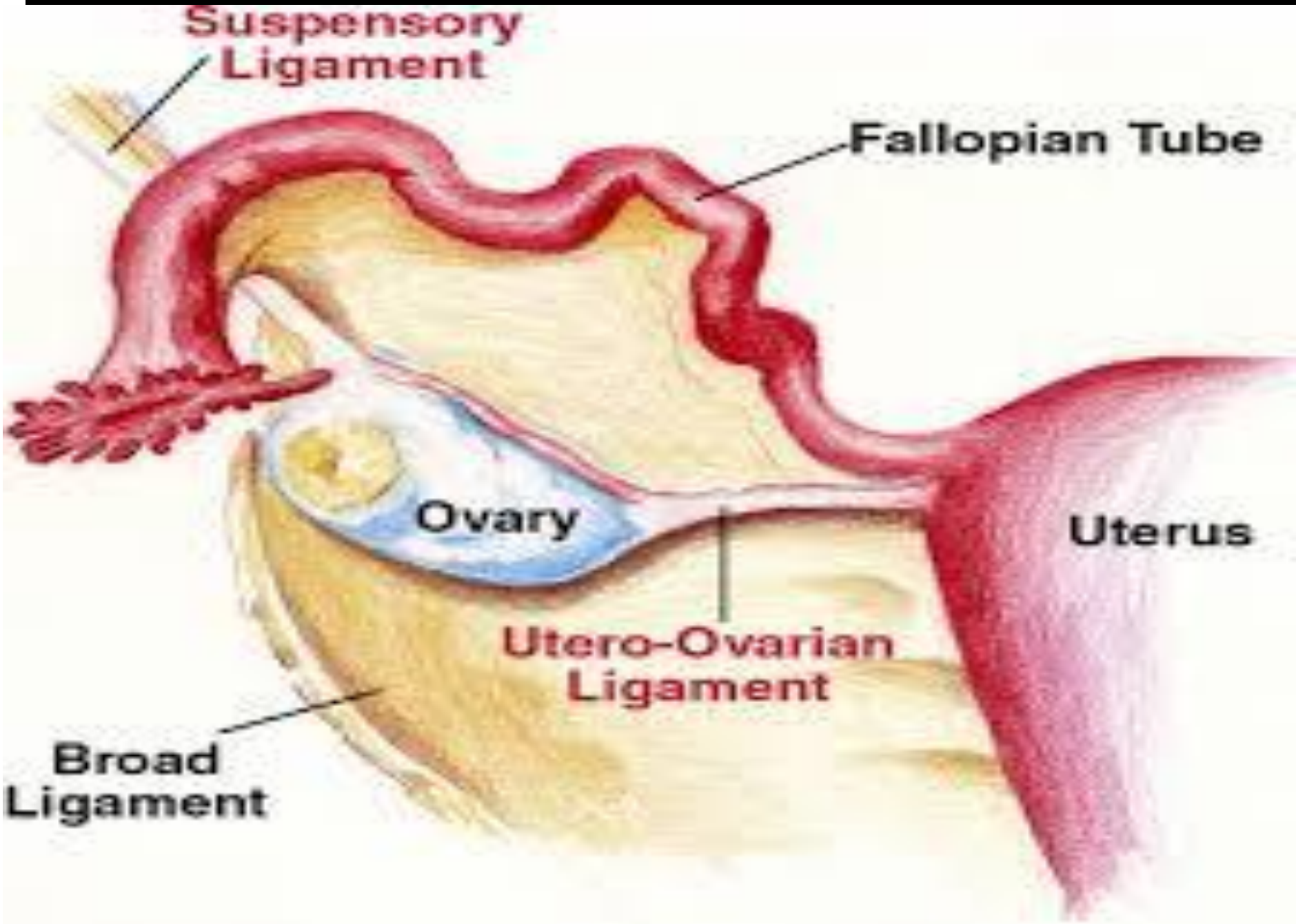
- The *lateral surface* of the ovary contacts parietal peritoneum in the ovarian fossa, behind which are extraperitoneal tissue and the obturator vessels and nerve.
- The uterine tube largely covers the *medial surface;* the peritoneal recess here, between the ovary and overlapping mesosalpinx, is termed the *ovarian bursa.*
- The mesovarian border is straight and is directed towards the obliterated umbilical artery.
- It is attached to the back of the broad ligament by a short peritoneal fold, the mesovarium, in which blood vessels and nerves reach the ovarian hilum.
- The convex *free border* of the ovary faces the ureter.
- The uterine tube arches over the ovary, ascending in relation to its mesovarian border, to curve over its tubal end and pass down on its posterior, free border and medial surface.

MICROSTRUCTURE OF THE OVARY

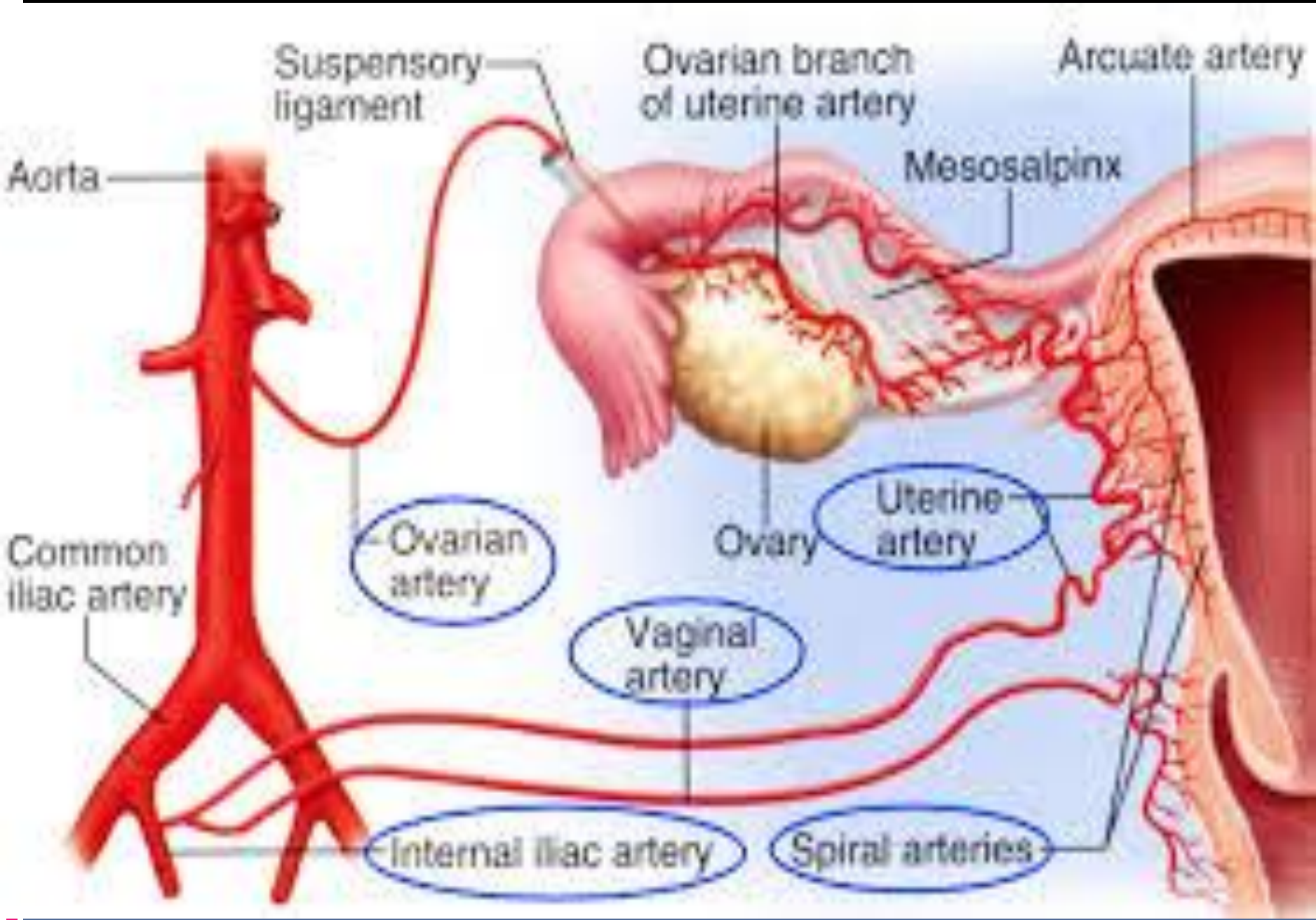
- **The surface is covered, in young females, by a layer of *ovarian surface epithelium* consisting of a single layer of cuboidal and some flatter cells.**
- **This gives the ovary a dull grey surface, contrasting with the shining, smooth peritoneum of the mesovarium; the transition between peritoneum and ovarian epithelium is usually marked by a white line around the anterior, mesovarian border.**
- **Immediately beneath the epithelium, the ovary is invested by a tough collagenous coat, the *tunica albuginea,* bounding the mass of the ovary; this is divisible into a *cortex* containing the ovarian follicles, and a *medulla* which receives the vessels and nerves at the hilum.**

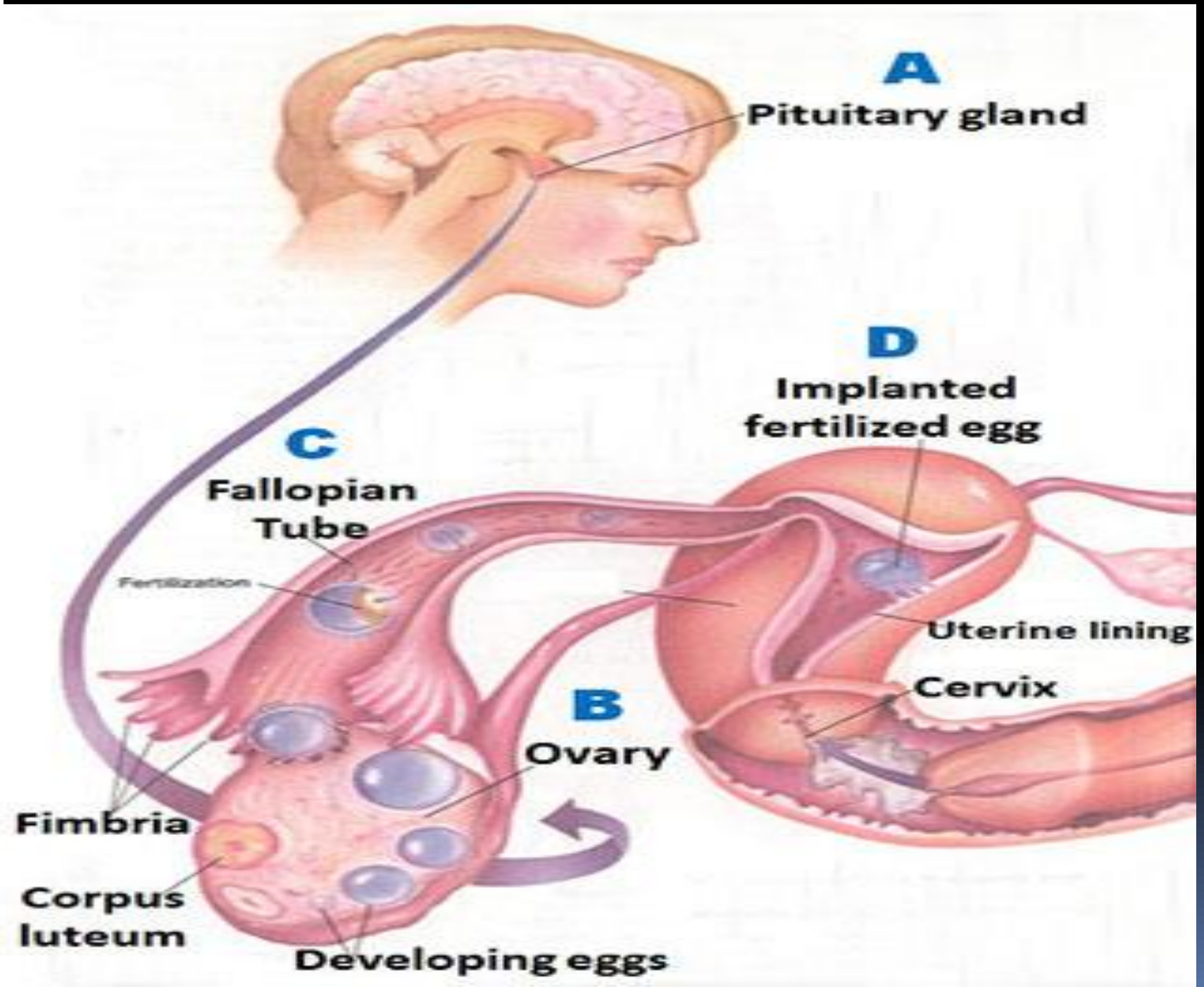
- **Structure**
- The surface of the ovary is covered by a layer of columnar cells which constitutes the **germinal epithelium of Waldeyer.**
- This epithelium gives to the ovary a dull gray color as compared with the shining smoothness of the peritoneum; and the transition between the squamous epithelium of the peritoneum and the columnar cells which cover the ovary is usually marked by a line around the anterior border of the ovary.
- The ovary consists of a number of vesicular ovarian follicles imbedded in the meshes of a stroma or frame-work.


primary oocyte
follicle cells
secondary oocyte
fluid filled cavity
Graafian follicle
theca
ovulation
corpus luteum
follicle cells
to fallopian tube


Suspensory Ligament
Fallopian Tube
Ovary
Uterus
Utero-Ovarian Ligament
Broad Ligament

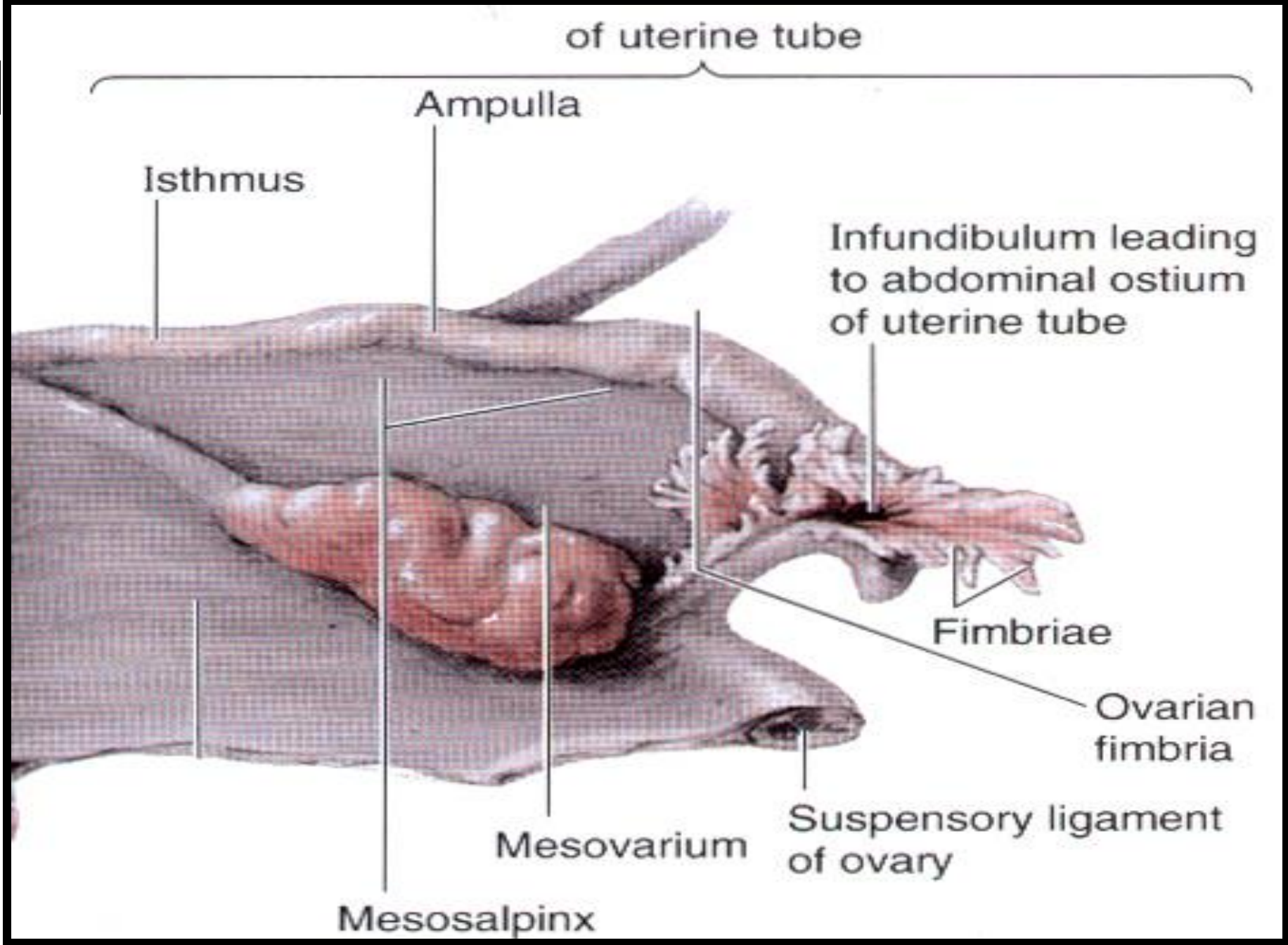
- **Vessels and Nerves**
- The **arteries** of the ovaries and uterine tubes are the ovarian from the aorta.
- Each anastomoses freely in the mesosalpinx, with the uterine artery, giving some branches to the uterine tube, and others which traverse the mesovarium and enter the hilum of the ovary.
- The **veins** emerge from the hilum in the form of a plexus, the **pampiniform plexus;** the ovarian vein is formed from this plexus, and leaves the pelvis in company with the artery.
- The **nerves** are derived from the hypogastric or pelvic plexus, and from the ovarian plexus, the uterine tube receiving a branch from one of the uterine nerves.


Suspensory ligament
Ovarian branch of uterine artery
Arcuate artery
Aorta
Mesosalpinx
Common iliac artery
Ovarian artery
Ovary
Uterine artery
Vaginal artery
Internal iliac artery
Spiral arteries


A
Pituitary gland
D
Implanted fertilized egg
C
Fallopian Tube
Fertilization
Uterine lining
Cervix
B
Ovary
Fimbria
Corpus luteum
Developing eggs

The Uterine Tube (*Tuba Uterina [Fallopii]*; Fallopian Tube; Oviduct)

- The **uterine tubes** convey the *ova* from the ovaries to the cavity of the uterus.
- They are two in number, one on either side, situated in the upper margin of the broad ligament, and extending from the superior angle of the uterus to the side of the pelvis.
- Each tube is about 10 cm. long, and is described as consisting of three portions:
- (1) the **isthmus,** or medial constricted third;
- (2) the **ampulla,** or intermediate dilated portion, which curves over the ovary; and
- (3) the **infundibulum** with its **abdominal ostium,** surrounded by **fimbriæ,** one of which, the **ovarian fimbria** is attached to the ovary.
- The uterine tube is directed lateralward as far as the uterine pole of the ovary, and then ascends along the mesovarian border of the ovary to the tubal pole, over which it arches; finally it turns downward and ends in relation to the free border and medial surface of the ovary.
- The uterine opening is minute, and will only admit a fine bristle; the abdominal opening is somewhat larger.
- In connection with the fimbriæ of the uterine tube, or with the broad ligament close to them, there are frequently one or more small pedunculated vesicles.


of uterine tube
Ampulla
Isthmus
Infundibulum leading to abdominal ostium of uterine tube
Fimbriae
Ovarian fimbria
Suspensory ligament of ovary
Mesovarium
Mesosalpinx

- **Structure**
- The uterine tube consists of three coats: **serous, muscular,** and **mucous.**
- The **external** or **serous coat** is peritoneal. The **middle** or **muscular coat** consists of an external longitudinal and an internal circular layer of non-striped muscular fibers continuous with those of the uterus.
- The **internal** or **mucous coat** is continuous with the mucous lining of the uterus, and, at the abdominal ostium of the tube, with the peritoneum.

- **If fertilization does occur, implantation of the blastocyst into the uterine endometrium usually begins on the seventh day after that event; the embryonic trophoblast then starts to produce FSH, LH, progesterone and oestradiol.**
- **The chorionic gonadotropins (FSH and LH) stimulate the corpus luteum of menstruation to grow, becoming then a *corpus luteum of pregnancy.***
- **During that process it increases from about 10 mm in diameter to 25 mm (secreting progesterone, oestrogen and relaxin), and persists actively until parturition, although it gradually regresses as its endocrine functions are largely superseded by the placenta after about 2 months' gestation.**
- **By the end of pregnancy its diameter is reduced to about 1 cm, and in the next few months it degenerates, like the corpus luteum of menstruation, to a corpus albicans.**

Ovarian surface epithelium

- This covering of the ovary is composed mainly of cuboidal cells bearing modest numbers of microvilli, although there is also a scattered group of flatter epithelial cells with fewer microvilli, which may represent cells reacting to epithelial injury caused by ovulation.
- Amongst other organelles, these cells contain cytokeratin filaments and vimentin.
- The epithelium appears to take an active part in the repair of the ovarian surface after that event by reforming the epithelial barrier and reconstituting the underlying matrix.
- It is very delicate and easily damaged by manipulation.
- About *85%* of ovarian cancers arise from neoplastic changes in the surface epithelium.

- **The two uterine (Fallopian) tubes lie on each side of the uterus in the upper margin (mesosalpinx) of the broad ligament.**
- **Each tube is about 10 cm long and opens medially by an aperture, the *uterine os,* into the uterine cavity's superior angle and laterally by the *abdominal os* into the peritoneal cavity near the ovary.**
- **In the nulliparous state, followed from the uterus to the fimbriae the uterine tube extends laterally as far as the inferior (uterine) pole of the ovary, and then ascends over its anterior (mesovarian) surface to the tubal pole over which it arches, turns downwards and ends in relation to the free border and medial surface of the ovary .**
- **The tube is divisible into four parts, from lateral to medial: fimbriated end (infundibulum), ampulla, isthmus, intrauterine or intramural portion.**

Fimbriated end

- This is formed by a funnel-like expansion of the uterine tube, the *infundibulum,* its circumference prolonged into a variable number of finger-like processes, the *fimbriae;* one of these, the *ovarian fimbria* is longer and more deeply grooved than the others, and is typically applied to the tubal pole of the ovary.
- All fimbriae are lined by ciliated mucosa which, in the larger of them, has longitudinal folds continuous with those in the infundibulum.
- The cilia beat towards the ampulla.
- The fimbriae help to capture the unfertilised ovum after its release from the ovary, and conduct it into the lumen of the uterine tube through the abdominal Os, an aperture deeply situated within the infundibulum and about 3 mm wide when relaxed.

Ampulla

- **This is a somewhat expanded region of the tube forming rather more than the lateral half of its length. It has a thin wall and a tortuously folded luminal surface marked by ~5 major plicae (longitudinal ridges) on which lie large numbers of secondary plicae, creating an extensive surface area.**

Isthmus

- **This part of the tube is rounded, muscular and firm, and forms approximately its medial third.**

Intramural part

- **Lying within the wall of the uterus, this is about 1 cm long. It opens into the main cavity of the uterus near its upper end at the uterine cornu, through the uterine os, which is minute.**

Vessels

- The arteries of the ovaries and uterine tubes are the ovarian arteries which are branches of the abdominal aorta.
- The veins emerge from the ovarian hila as a pampiniform plexus, drained by the ovarian veins.

- Lymph vessels drain primarily to the lumbo-aortic and pelvic lymph nodes, although it is reported that after the meno~a use the flow of lymph is reduced and it drains mainly to the aortolumbar nodes.

Nerves

- The innervation, derived from the ovarian plexuses, consist of postganglionic sympathetic, parasympathetic and autonomic afferent fibres.

Muscular layer

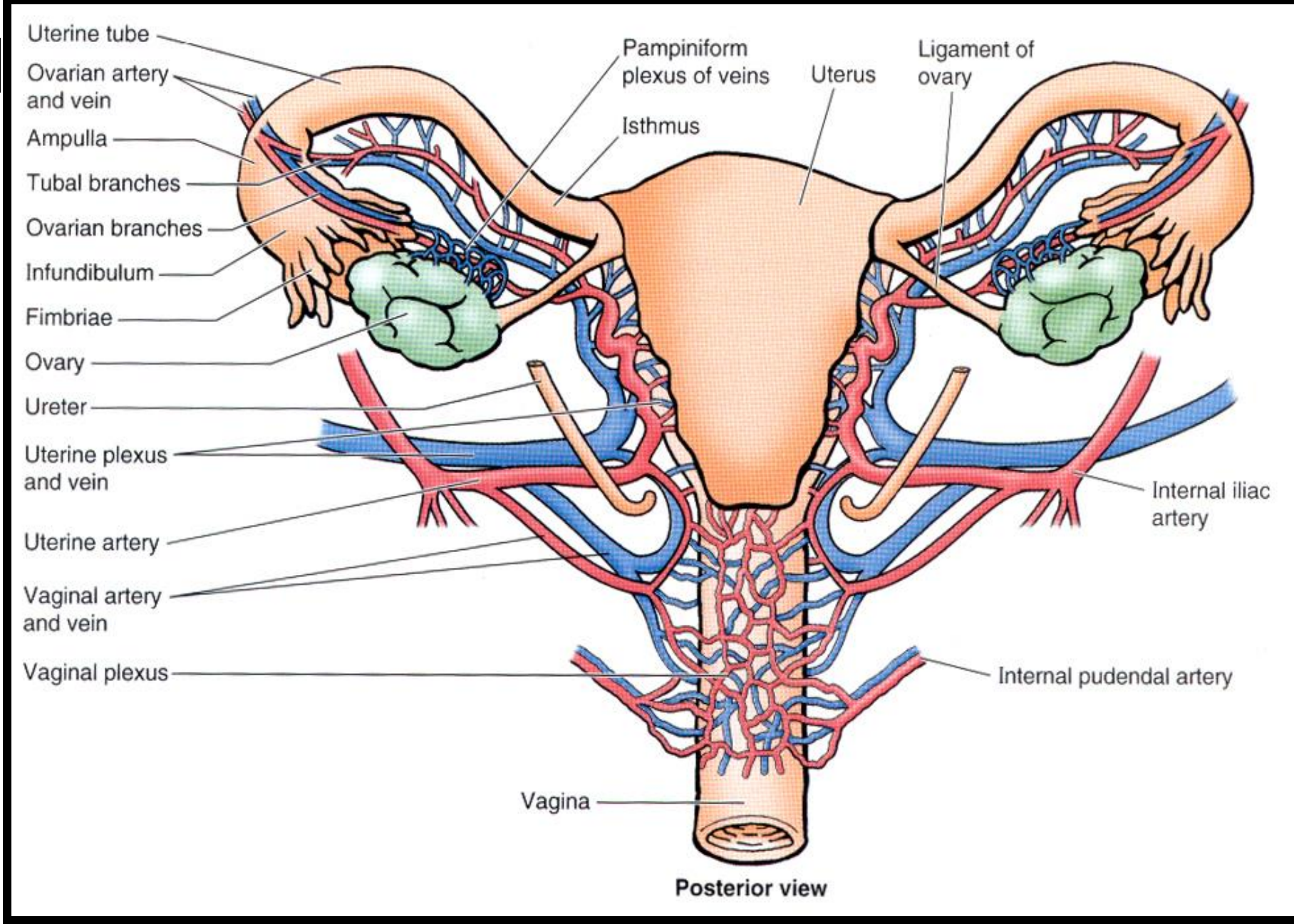
- **This is composed of external longitudinal and internal circular layers of smooth muscle; additional internal longitudinal fibres appear in some parts of the tube.**
- **The circular muscle is thickest in the wall of the isthmus, becoming reduced where the isthmus joins the ampulla.**
- **In the ampulla, internal longitudinal muscle is absent and the external longitudinal and circular are intermingled; the infundibular function, particularly in humans.**

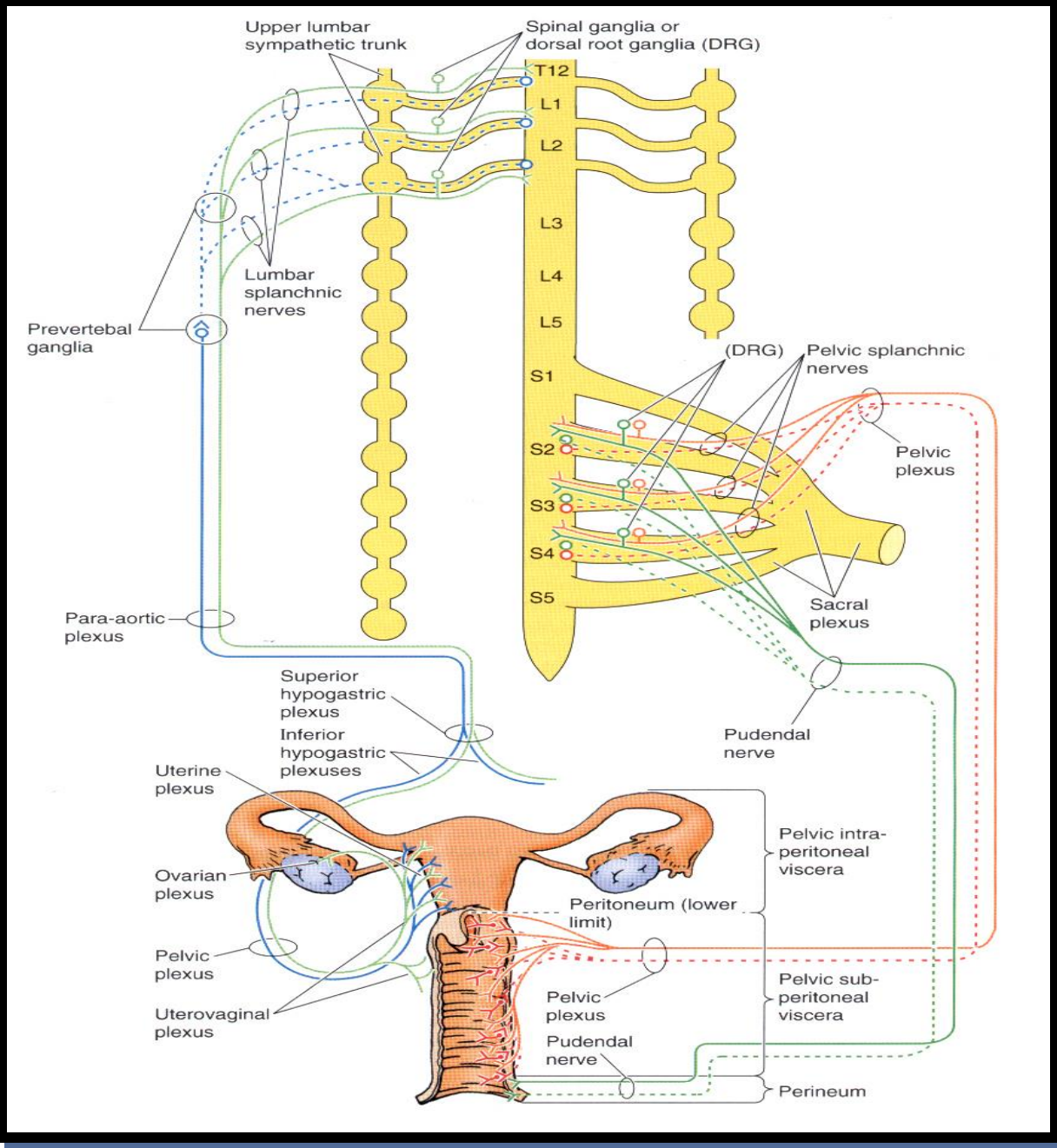
Tubal transport

- **The tube conveys ova, zygotes, the pre-implantation morulae and blastocytes to the uterus, and spermatozoa from the uterus to the ampulla for fertilization.**

Vessels

- The vessels of the uterine tube arise from ovarian and uterine stems.
- Arteries: arteriographic evidence shows that the uterine artery usually supplies the medial two-thirds of the tube, the ovarian the remainder, the partition between the two (which in any case anastomose) being variable.
- Veins are arranged similarly to the arteries, and intrinsic mucosal, muscular and subserous networks have been described.
- Lymphatics follow the veins.


Uterine tube
Ovarian artery and vein
Ampulla
Tubal branches
Ovarian branches
Infundibulum
Fimbriae
Ovary
Ureter
Uterine plexus and vein
Uterine artery
Vaginal artery and vein
Vaginal plexus
Pampiniform plexus of veins
Isthmus
Uterus
Ligament of ovary
Internal iliac artery
Internal pudendal artery
Vagina
Posterior view



Key (B)

- Visceral afferents running with parasympathetic fibers
- Presynaptic } Parasympathetic
- Postsynaptic } Parasympathetic
- Presynaptic } Sympathetic
- Postsynaptic } Sympathetic
- Visceral afferents running with sympathetic fibers
- Somatic motor
- Somatic afferrent

Nerves

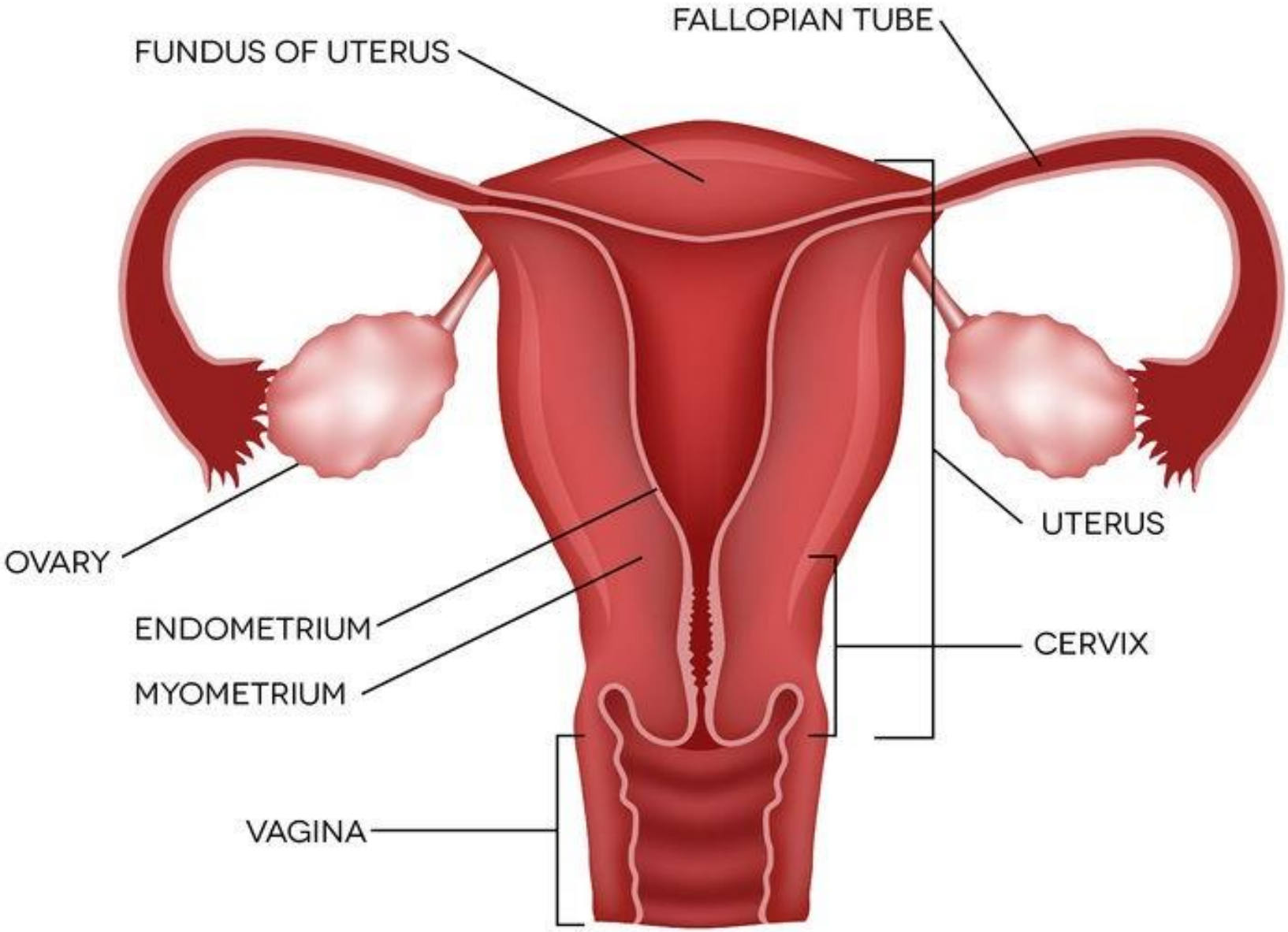
- Nerve fibres enter and distribute largely with the ovarian and uterine arteries.
- Most of the tube has sympathetic and parasympathetic supplies.
- *Parasympathetic* fibres are from the vagus for the lateral half of the tube, and pelvic splanchnic nerves for the medial half.
- *Sympathetic supply* is from the tenth thoracic to the second lumbar spinal segments.

The Uterus *(Womb)*

The **uterus** is a hollow, thick-walled, muscular organ situated deeply in the pelvic cavity between the bladder and rectum. Into its upper part the uterine tubes open, one on either side, while below, its cavity communicates with that of the vagina.

- When the ova are discharged from the ovaries they are carried to the uterine cavity through the uterine tubes.
- After parturition the uterus returns almost to its former condition, but certain traces of its enlargement remains.
- It is necessary, therefore, to describe as the type-form the adult virgin uterus, and then to consider the modifications which are effected as a result of pregnancy.

- It is divisible into two portions.
- On the surface, about midway between the apex and base, is a slight constriction, known as the **isthmus,** and corresponding to this in the interior is a narrowing of the uterine cavity, the **internal orifice** of the uterus.
- The portion above the isthmus is termed the **body,** and that below, the **cervix.**
- The part of the body which lies above a plane passing through the points of entrance of the uterine tubes is known as the **fundus.**


FALLOPIAN TUBE
FUNDUS OF UTERUS
UTERUS
OVARY
ENDOMETRIUM
CERVIX
MYOMETRIUM
VAGINA

Body (*corpus uteri*)

The body gradually narrows from the fundus to the isthmus.

The **vesical** or **anterior surface** (*facies vesicalis*) is flattened and covered by peritoneum, which is reflected on to the bladder to form the vesicouterine excavation. The surface lies in apposition with the bladder.

The **intestinal** or **posterior surface** (*facies intestinalis*) is convex transversely and is covered by peritoneum, which is continued down on to the cervix and vagina. It is in relation with the sigmoid colon, from which it is usually separated by some coils of small intestine.

The **fundus** (*fundus uteri*) is convex in all directions, and covered by peritoneum continuous with that on the vesical and intestinal surfaces. On it rest some coils of small intestine, and occasionally the distended sigmoid colon.

The **lateral margins** (*margo lateralis*) are slightly convex.

At the upper end of each the uterine tube pierces the uterine wall. Below and in front of this point the round ligament of the uterus is fixed, while behind it is the attachment of the ligament of the ovary.

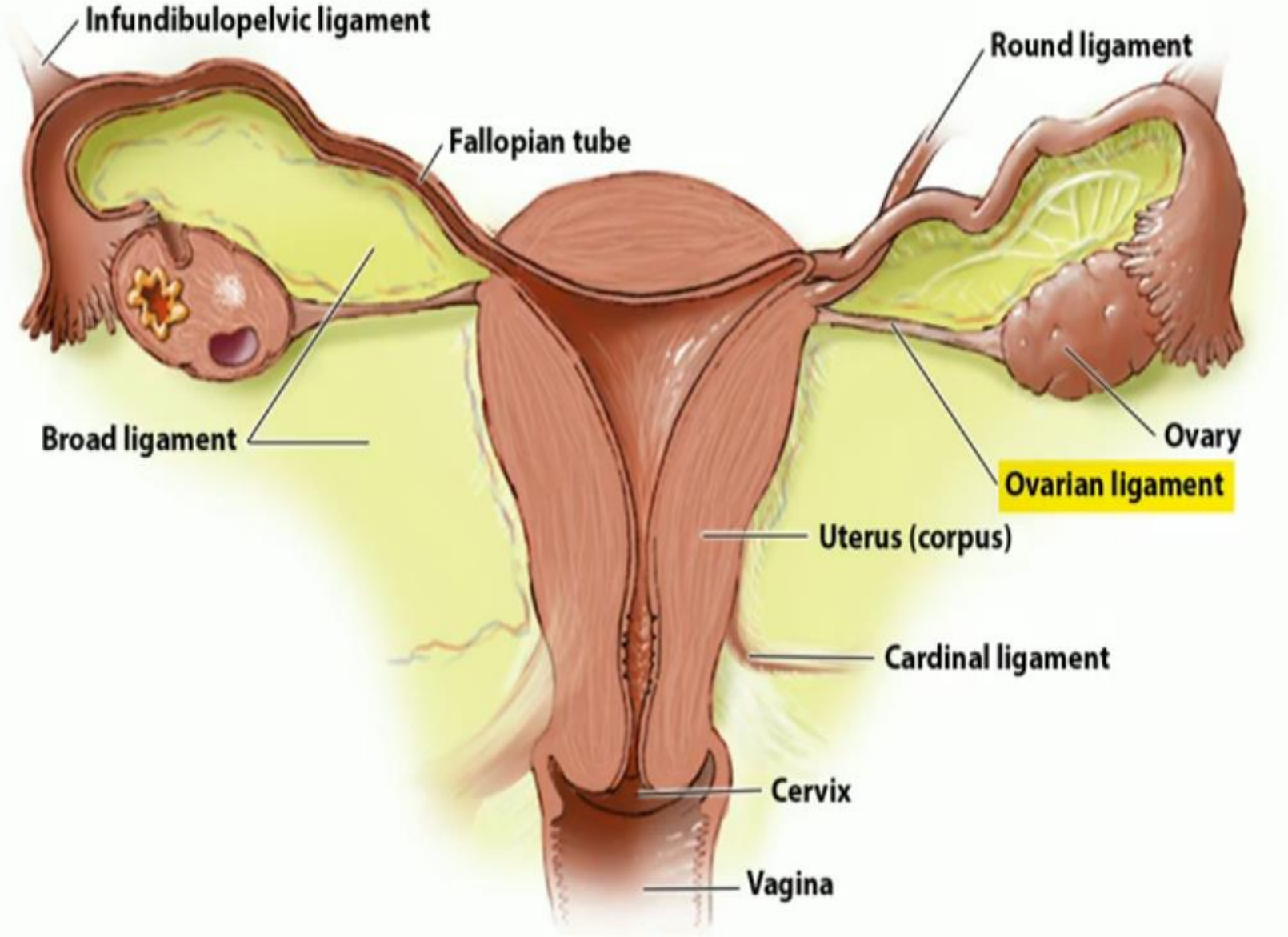
These three structures lie within a fold of peritoneum which is reflected from the margin of the uterus to the wall of the pelvis, and is named the **broad ligament.**

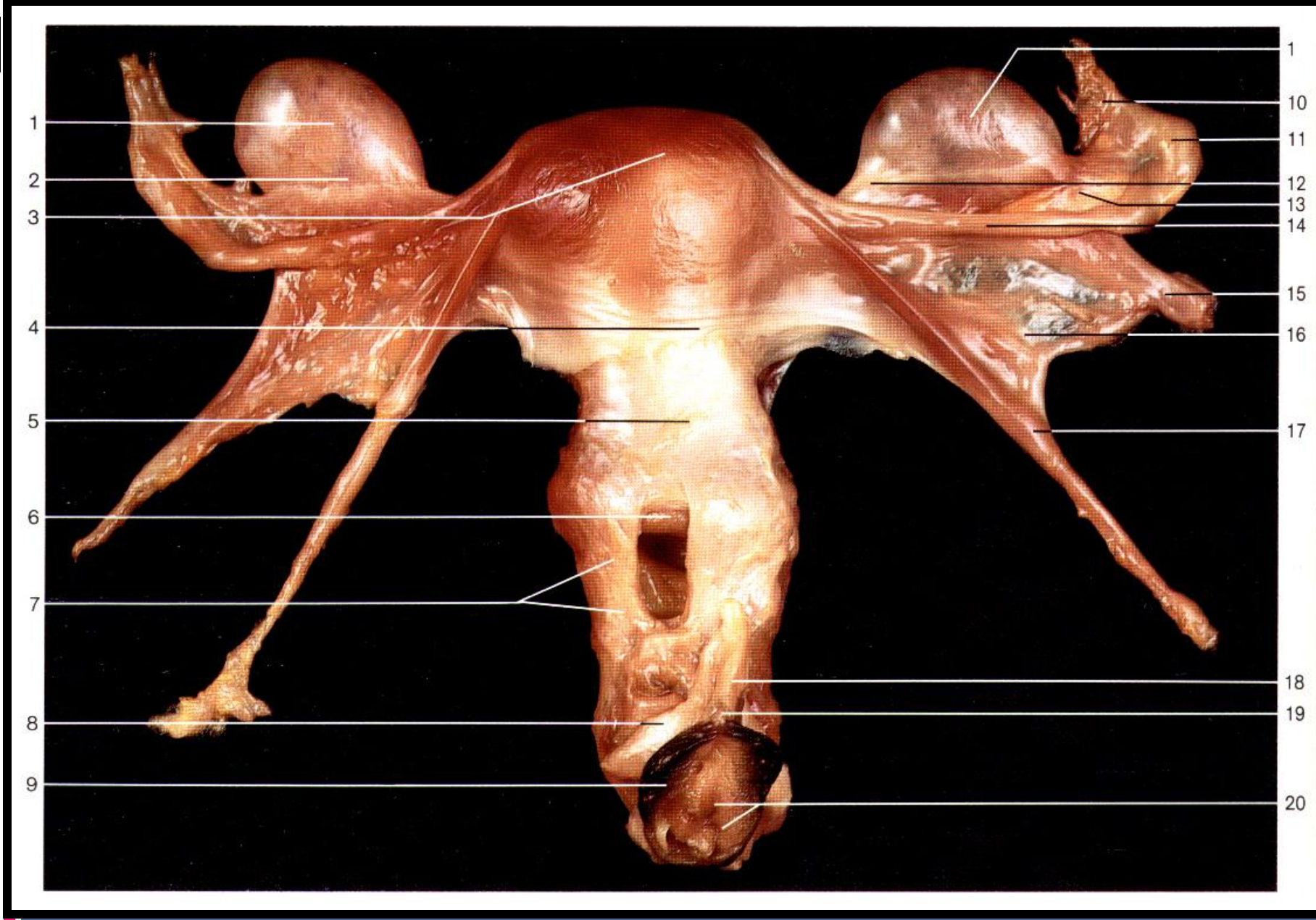
Cervix (*cervix uteri; neck*)

- The cervix is the lower constricted segment of the uterus.
- It is somewhat conical in shape, with its truncated apex directed downward and backward, but is slightly wider in the middle than either above or below.
- Owing to its relationships, it is less freely movable than the body, so that the latter may bend on it.
- The long axis of the cervix is therefore seldom in the same straight line as the long axis of the body.
- The long axis of the uterus as a whole presents the form of a curved line with its concavity forward, or in extreme cases may present an angular bend at the region of the isthmus.

- The cervix projects through the anterior wall of the vagina, which divides it into an upper, supravaginal portion, and a lower, vaginal portion.
- The **supravaginal portion** (*portio supravaginalis* [*cervicis*]) is separated *in front* from the bladder by fibrous tissue (**parametrium**), which extends also on to its *sides* and lateralward between the layers of the broad ligaments.
- The uterine arteries reach the margins of the cervix in this fibrous tissue, while on either side the ureter runs downward and forward in it at a distance of about 2 cm. from the cervix.
- *Posteriorly,* the supravaginal cervix is covered by peritoneum, which is prolonged below on to the posterior vaginal wall, when it is reflected on to the rectum, forming the rectouterine excavation.
- It is in relation with the rectum, from which it may be separated by coils of small intestine.

- The **vaginal portion** (*portio vaginalis* [*cervicis*]) of the cervix projects free into the anterior wall of the vagina between the anterior and posterior fornices.
- On its rounded extremity is a small, depressed, somewhat circular aperture, the **external orifice of the uterus,** through which the cavity of the cervix communicates with that of the vagina.
- The external orifice is bounded by two lips, an anterior and a posterior, of which the anterior is the shorter and thicker, although, on account of the slope of the cervix, it projects lower than the posterior.
- Normally, both lips are in contact with the posterior vaginal wall.


Infundibulopelvic ligament
Round ligament
Fallopian tube
Broad ligament
Ovary
Ovarian ligament
Uterus (corpus)
Cardinal ligament
Cervix
Vagina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Interior of the Uterus

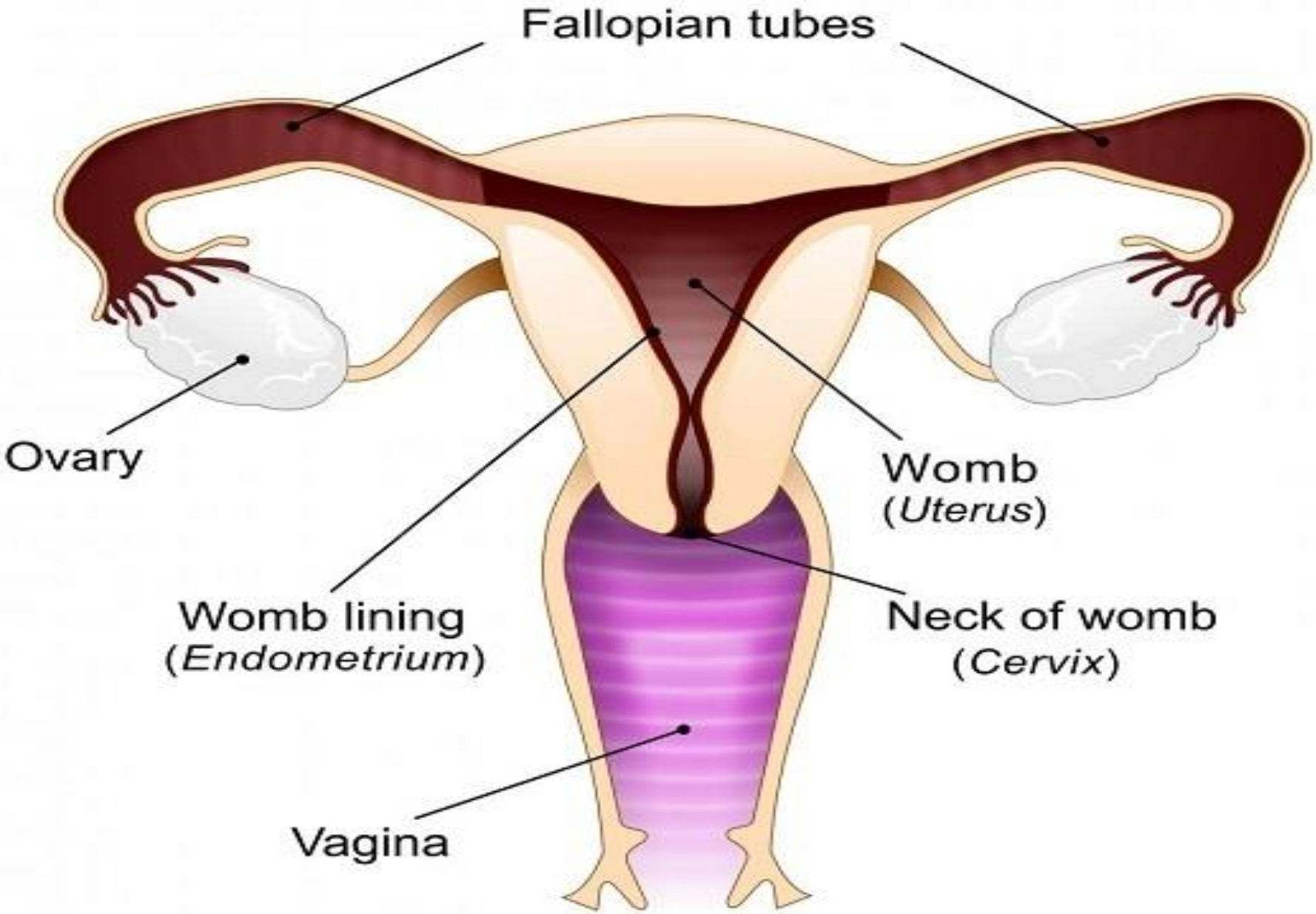
The cavity of the uterus is small in comparison with the size of the organ.

The **Cavity of the Body** (*cavum uteri*) is a mere slit, flattened antero-posteriorly.

It is triangular in shape, the base being formed by the internal surface of the fundus between the orifices of the uterine tubes, the apex by the internal orifice of the uterus through which the cavity of the body communicates with the canal of the cervix.

The **Canal of the Cervix** (*canalis cervicis uteri*) is somewhat fusiform, flattened from before backward, and broader at the middle than at either extremity.

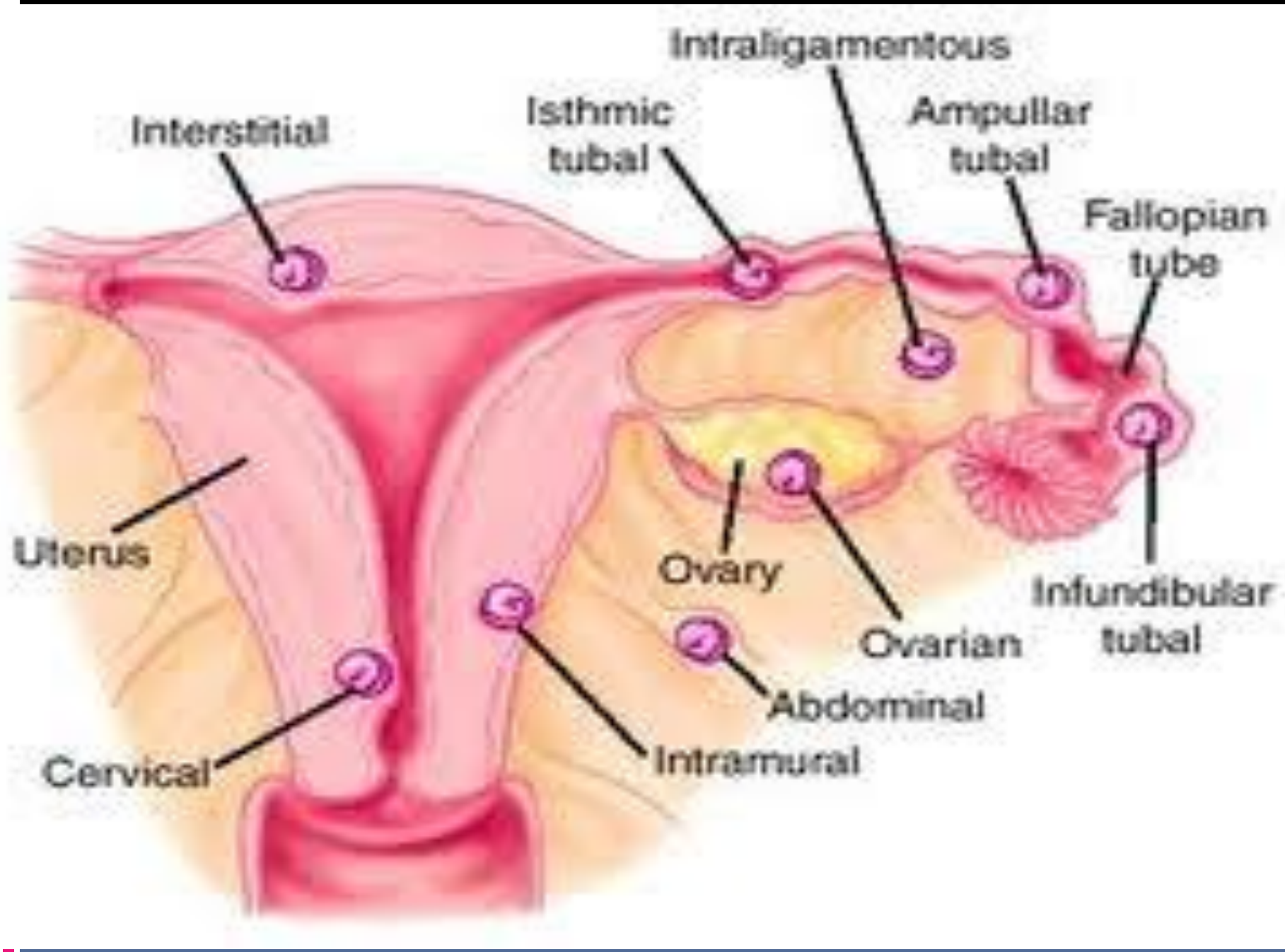
It communicates above through the internal orifice with the cavity of the body, and below through the external orifice with the vaginal cavity.


Fallopian tubes
Ovary
Womb
(Uterus)
Womb lining
(Endometrium)
Neck of womb
(Cervix)
Vagina

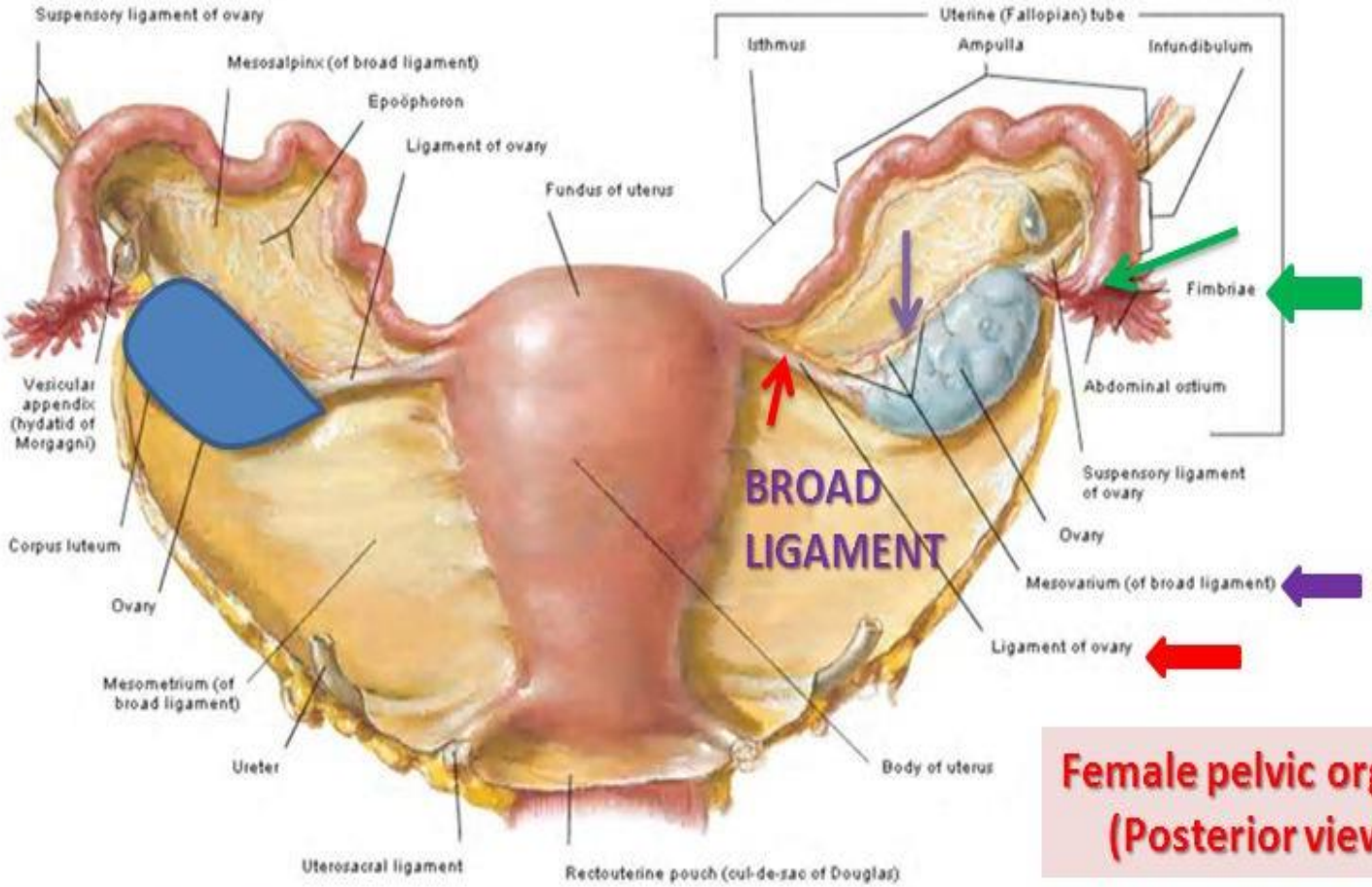
Ligaments

The ligaments of the uterus are:
one **anterior;** one **posterior**; two **lateral** or **broad**; two **cardinal**; and two **round ligaments.**

- The **anterior ligament** consists of the vesicouterine fold of peritoneum, which is reflected on to the bladder from the front of the uterus, at the junction of the cervix and body.
- The **posterior ligament** consists of the rectovaginal fold of peritoneum, which is reflected from the back of the posterior fornix of the vagina on to the front of the rectum.
- It forms the bottom of a deep pouch called the **rectouterine excavation,** which is bounded in front by the posterior wall of the uterus, the supravaginal cervix, and the posterior fornix of the vagina; behind, by the rectum; and laterally by two crescentic folds of peritoneum which pass backward from the cervix uteri on either side of the rectum to the posterior wall of the pelvis.
- These folds are named the **sacrogenital** or **rectouterine folds.**


Intraligamentous
Isthmic tubal
Ampullar tubal
Interstitial
Fallopian tube
Uterus
Ovary
Infundibular tubal
Ovarian
Abdominal
Intramural
Cervical

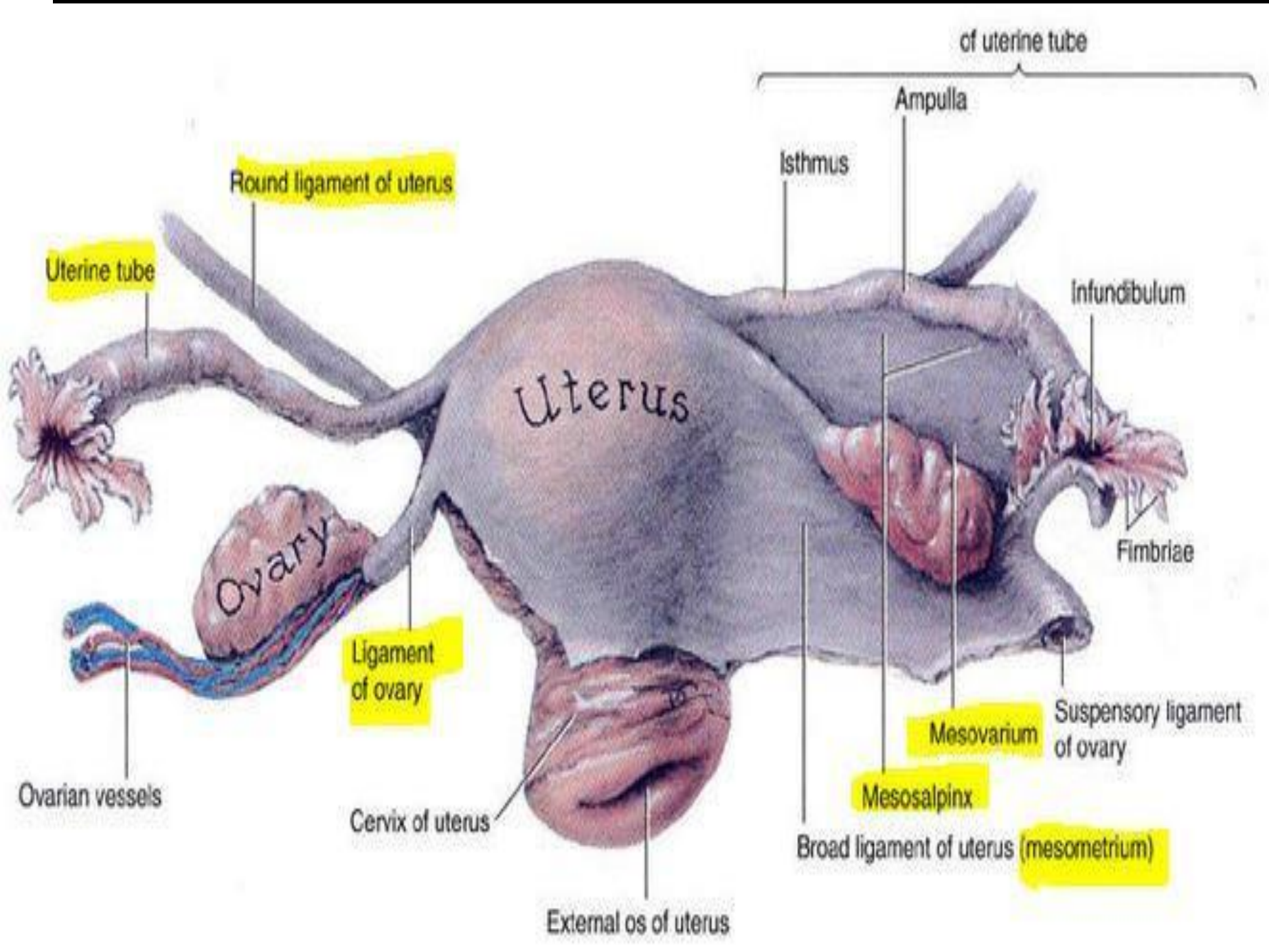
- The **two lateral** or **broad ligaments** (*ligamentum latum uteri*) pass from the sides of the uterus to the lateral walls of the pelvis.
- Together with the uterus they form a septum across the female pelvis, dividing that cavity into two portions.
- In the anterior part is contained the bladder; in the posterior part the rectum, and in certain conditions some coils of the small intestine and a part of the sigmoid colon.
- Between the two layers of each broad ligament are contained:
- (1) the uterine tube superiorly;
- (2) the round ligament of the uterus;
- (3) the ovary and its ligament;
- (4) the epoophoron and paroophoron;
- (5) connective tissue;
- (6) unstriped muscular fibers;
- (7) bloodvessels
- (8) nerves.
- The portion of the broad ligament which stretches from the uterine tube to the level of the ovary is known by the name of the **mesosalpinx.**



Female pelvic organs (Posterior view)

- It is an **almond-shaped** organ.
- It is attached to the back of the broad ligament by a peritoneal fold **(mesovarium)**
- **Its medial end** is attached to uterus by **ligament of ovary.**
- **Its lateral end** is related to **the fimbriae of the uterine tube.**

- The **round ligaments** (*ligamentum teres uteri*) situated between the layers of the broad ligament in front of and below the uterine tubes.
- Commencing on either side at the lateral angle of the uterus, this ligament is directed forward, upward, and lateralward over the external iliac vessels. It then passes through the abdominal inguinal ring and along the inguinal canal to the *labium majus*, in which it becomes lost.
- The round ligaments consists principally of muscular tissue, prolonged from the uterus; also of some fibrous and areolar tissue, besides bloodvessels, lymphatics; and nerves, enclosed in a duplicature of peritoneum, which, in the fetus, is prolonged in the form of a tubular process for a short distance into the inguinal canal.


of uterine tube
Ampulla
Isthmus
Round ligament of uterus
Uterine tube
Infundibulum
Uterus
Ovary
Fimbriae
Ligament of ovary
Suspensory ligament of ovary
Mesovarium
Ovarian vessels
Mesosalpinx
Cervix of uterus
Broad ligament of uterus (mesometrium)
External os of uterus

Structure

The uterus is composed of three coats: an **external** or **serous,** a **middle** or **muscular,** and an **internal** or **mucous.**

The **serous coat** (*tunica serosa*) is derived from the peritoneum; it invests the fundus and the whole of the intestinal surface of the uterus; but covers the vesical surface only as far as the junction of the body and cervix. In the lower fourth of the intestinal surface the peritoneum, though covering the uterus, is not closely connected with it.

The **muscular coat** (*tunica muscularis*) forms the chief bulk of the substance of the uterus. In the virgin it is dense, firm, of a grayish color, and cuts almost like cartilage.

It is thick opposite the middle of the body and fundus, and thin at the orifices of the uterine tubes. It consists of bundles of unstriped muscular fibers, disposed in layers, intermixed with areolar tissue, bloodvessels, lymphatic vessels, and nerves.

The layers are three in number: external, middle, and internal.

The external and middle layers constitute the muscular coat proper, while the inner layer is a greatly hypertrophied muscularis mucosæ.

The external layer, placed beneath the peritoneum, is disposed as a thin plane on the vesical and intestinal surfaces.

It consists of fibers which pass transversely across the fundus, and, converging at each lateral angle of the uterus, are continued on to the uterine tube, the round ligament, and the ligament of the ovary: some passing at each side into the broad ligament, and others running backward from the cervix into the sacrouterine ligaments.

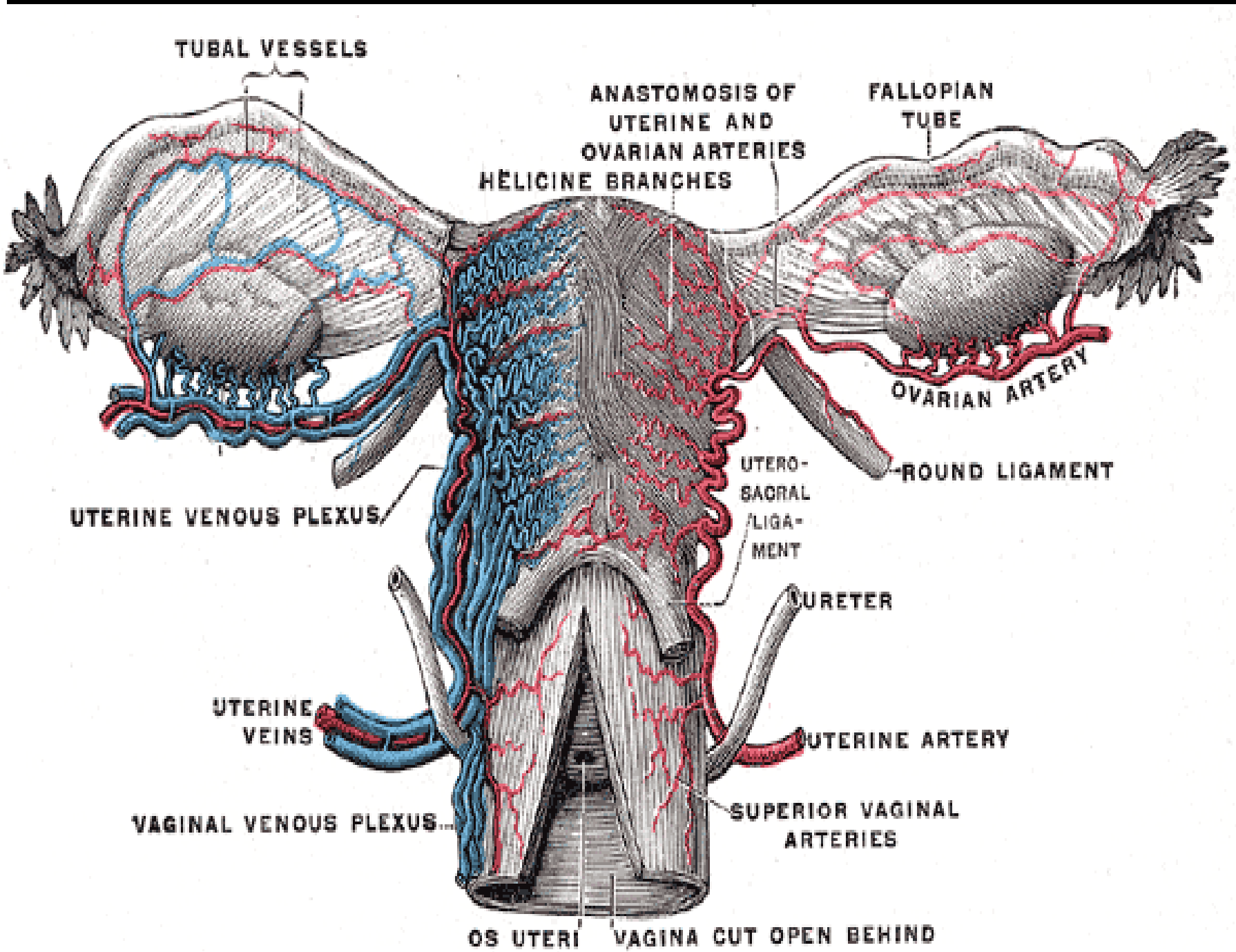
The middle layer of fibers presents no regularity in its arrangement, being disposed longitudinally, obliquely, and transversely.

It contains more bloodvessels than either of the other two layers.

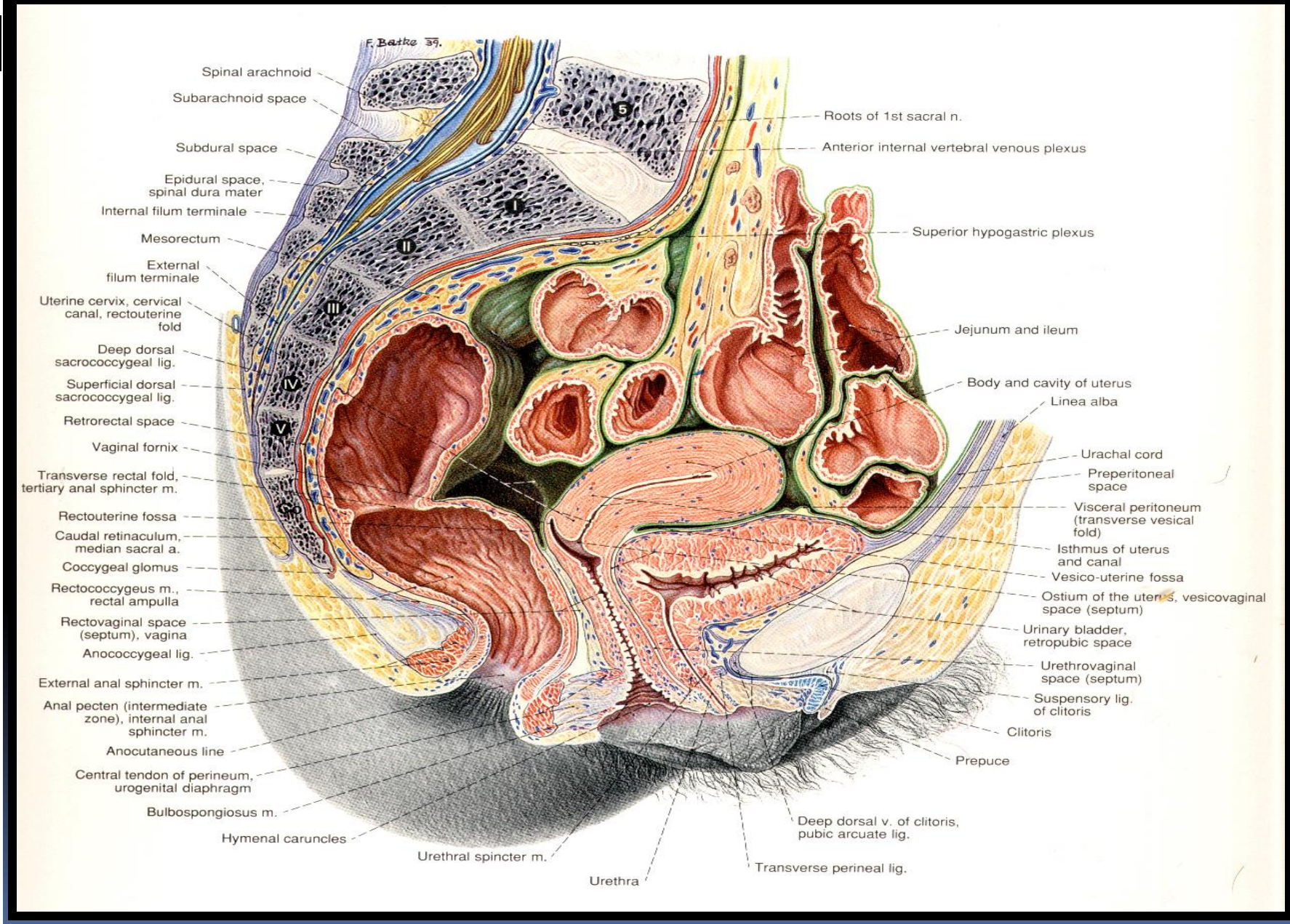
The internal or deep layer consists of circular fibers arranged in the form of two hollow cones, the apices of which surround the orifices of the uterine tubes, their bases intermingling with one another on the middle of the body of the uterus.

- The **mucous membrane** (*tunica mucosa*) is smooth, and closely adherent to the subjacent tissue.
- It is continuous through the fimbriated extremity of the uterine tubes, with the peritoneum; and, through the external uterine orifice, with the lining of the vagina.
- In the body of the uterus the mucous membrane is smooth, soft, of a pale red color, lined by columnar ciliated epithelium, and presents, when viewed with a lens, the orifices of numerous tubular follicles, arranged perpendicularly to the surface.
- The structure of the corium differs from that of ordinary mucous membranes, and consists of an embryonic nucleated and highly cellular form of connective tissue in which run numerous large lymphatics.

- **Vessels and Nerves**
- The **arteries** of the uterus are the uterine, from the hypogastric; and the ovarian, from the abdominal aorta. They are remarkable for their tortuous course in the substance of the organ, and for their frequent anastomoses.
- The termination of the ovarian artery meets that of the uterine artery, and forms an anastomotic trunk from which branches are given off to supply the uterus, their disposition being circular.
- The **veins** are of large size, and correspond with the arteries.
- They end in the uterine plexuses.
- The **nerves** are derived from the hypogastric and ovarian plexuses, and from the third and fourth sacral nerves.


TUBAL VESSELS
ANASTOMOSIS OF UTERINE AND OVARIAN ARTERIES
FALLOPIAN TUBE
HELICINE BRANCHES
OVARIAN ARTERY
ROUND LIGAMENT
UTERO-SACRAL LIGA-MENT
URETER
UTERINE VENOUS PLEXUS
UTERINE VEINS
UTERINE ARTERY
VAGINAL VENOUS PLEXUS
SUPERIOR VAGINAL ARTERIES
OS UTERI
VAGINA CUT OPEN BEHIND

- The uterus is a hollow, thick-walled and muscular organ, normally situated in the lesser pelvis between the urinary bladder and rectum.
- Into its upper part open the uterine tubes, one on each side; below, it continues into the vagina.
- If fertilization has occurred. the developing blastocyst conveyed to the uterine cavity by the uterine tubes embeds in the uterine lining and is normally retained until development is complete.
- The uterus adapting in size and structure to the needs of the growing embryo and fetus.
- After parturition it returns almost to its former condition, though somewhat larger than in its nulliparous state.
- In the adult nulliparous state it is pear shaped. though somewhat flattened anteroposteriorly and its long axis tilted superiorly forwards.


F. Batke 39.
Spinal arachnoid
Subarachnoid space
Subdural space
Epidural space, spinal dura mater
Internal filum terminale
Mesorectum
External filum terminale
Uterine cervix, cervical canal, rectouterine fold
Deep dorsal sacrococcygeal lig.
Superficial dorsal sacrococcygeal lig.
Retrorectal space
Vaginal fornix
Transverse rectal fold, tertiary anal sphincter m.
Rectouterine fossa
Caudal retinaculum, median sacral a.
Coccygeal glomus
Rectococcygeus m., rectal ampulla
Rectovaginal space (septum), vagina
Anococcygeal lig.
External anal sphincter m.
Anal pecten (intermediate zone), internal anal sphincter m.
Anocutaneous line
Central tendon of perineum, urogenital diaphragm
Bulbospongiosus m.
Hymenal caruncles
Urethral spincter m.
Urethra
Transverse perineal lig.
Deep dorsal v. of clitoris, pubic arcuate lig.
Prepuce
Clitoris
Suspensory lig. of clitoris
Urethrovaginal space (septum)
Urinary bladder, retropubic space
Ostium of the uterus, vesicovaginal space (septum)
Vesico-uterine fossa
Isthmus of uterus and canal
Visceral peritoneum (transverse vesical fold)
Preperitoneal space
Urachal cord
Linea alba
Body and cavity of uterus
Jejunum and ileum
Superior hypogastric plexus
Anterior internal vertebral venous plexus
Roots of 1st sacral n.
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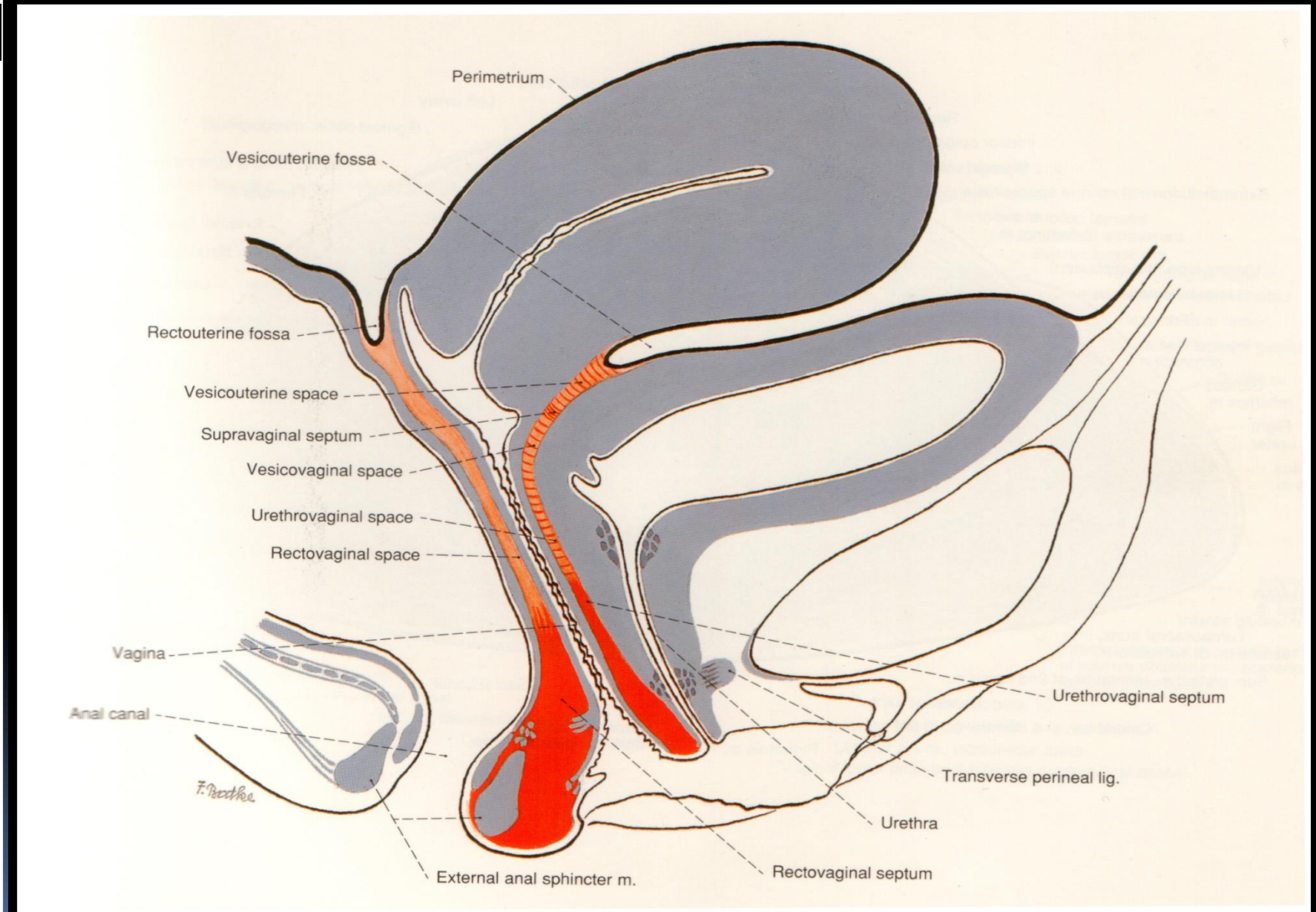
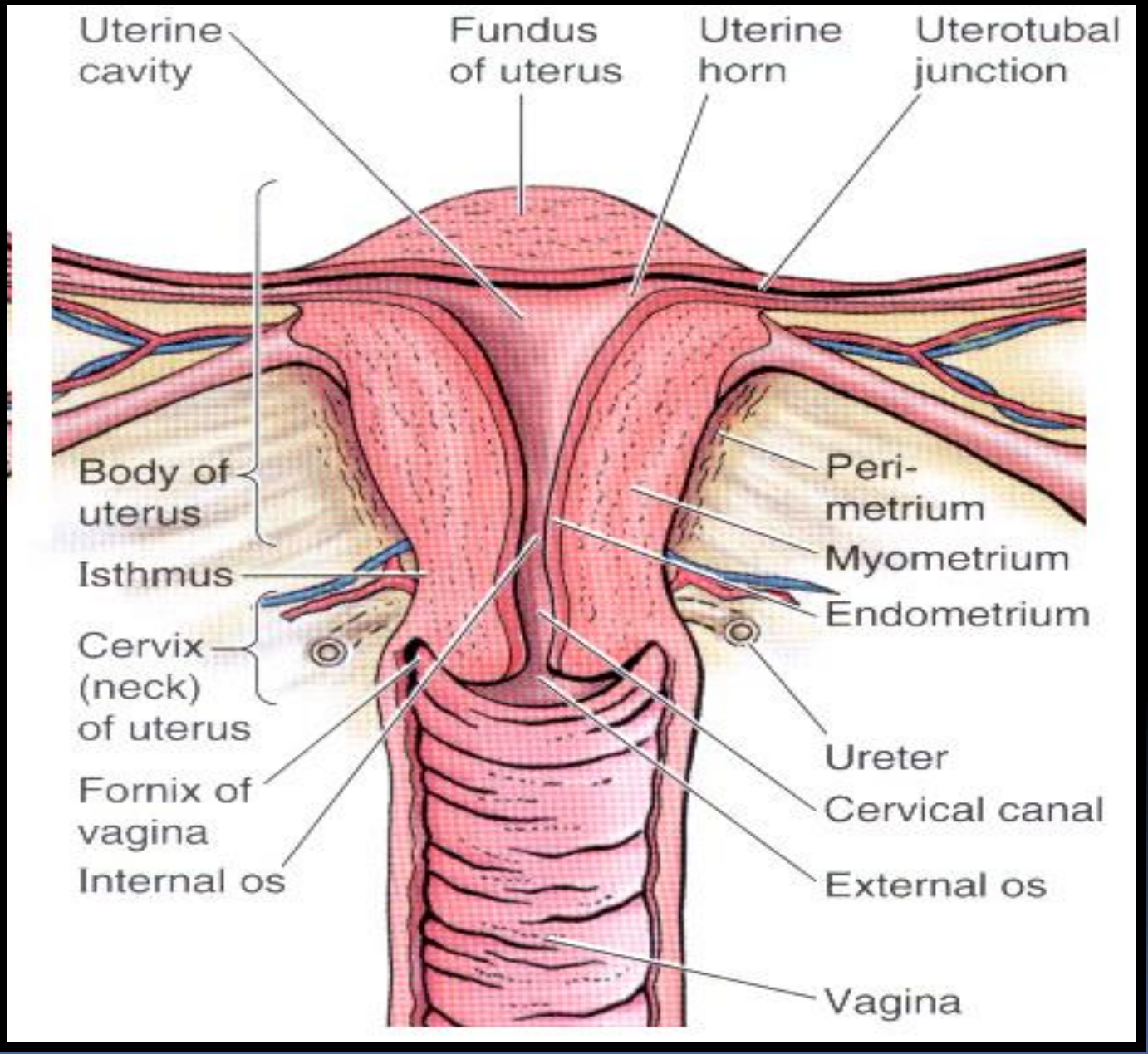
III
IV
V
Co

- Its narrow end is therefore posteroinferior in position.
- The uterus lies behind the bladder and (unless the bladder is full) bent forward above it. It is situated inferior to the sigmoid colon and in front of the rectum and completely below the pelvic inlet.
- The long axis usually lies approximately along the axis of the pelvic inlet, but since the uterus is movable, its position varies with the distension of the bladder and rectum.
- Except when displaced by a much distended bladder, the long axis of the uterus is nearly at right angles to that of the vagina, the latter's axis corresponding to the axis of the pelvic outlet.
- In size, the adult non-pregnant uterus is about 7.5 cm long, 5 cm in breadth at its widest, and nearly *2.5* cm thick; it weighs 30-40 g.


Perimetrium
Vesicouterine fossa
Rectouterine fossa
Vesicouterine space
Supravaginal septum
Vesicovaginal space
Urethrovaginal space
Rectovaginal space
Vagina
Anal canal
Urethrovaginal septum
Transverse perineal lig.
Urethra
Rectovaginal septum
External anal sphincter m.

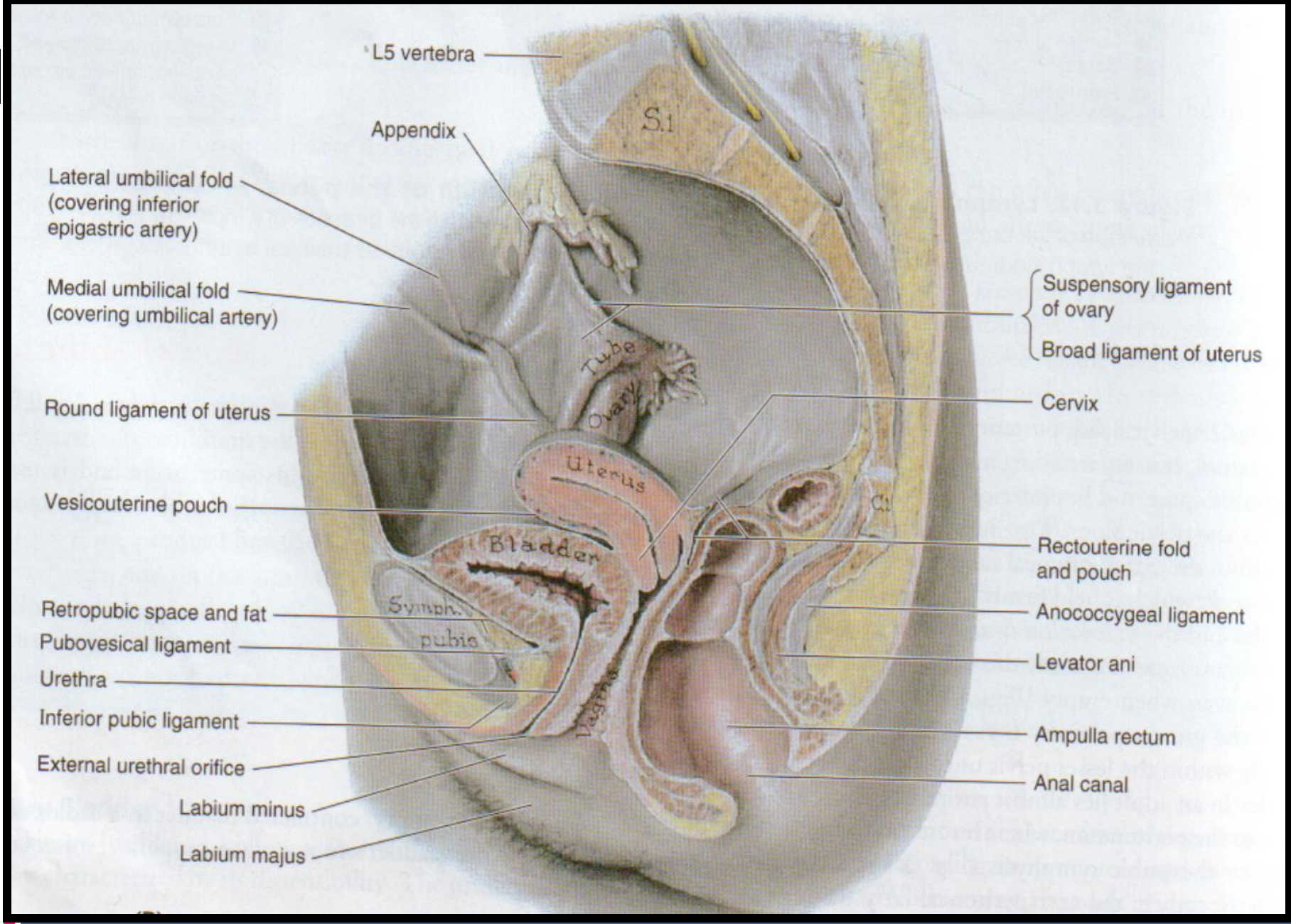
DIVISIONS OF THE UTERUS

- The uterus is divisible into two main regions, the *body of the uterus* (corpus uteri) forming its upper two-thirds, and a narrower, more cylindrical cervix (cervix uteri), demarcated by a slight constriction.
- The rounded upper part of the corpus above the entry-points of the uterine tubes is the *fundus;* (this is the highest part but the deepest when approached via the cervix).
- The lumen of the corpus is flat anteroposteriorly, but that of the cervix is round in section and quite narrow, its upper end communicating with the corpus by an aperture, the *internal os,* and its lower end opening into the vagina by an *external os* (see below).

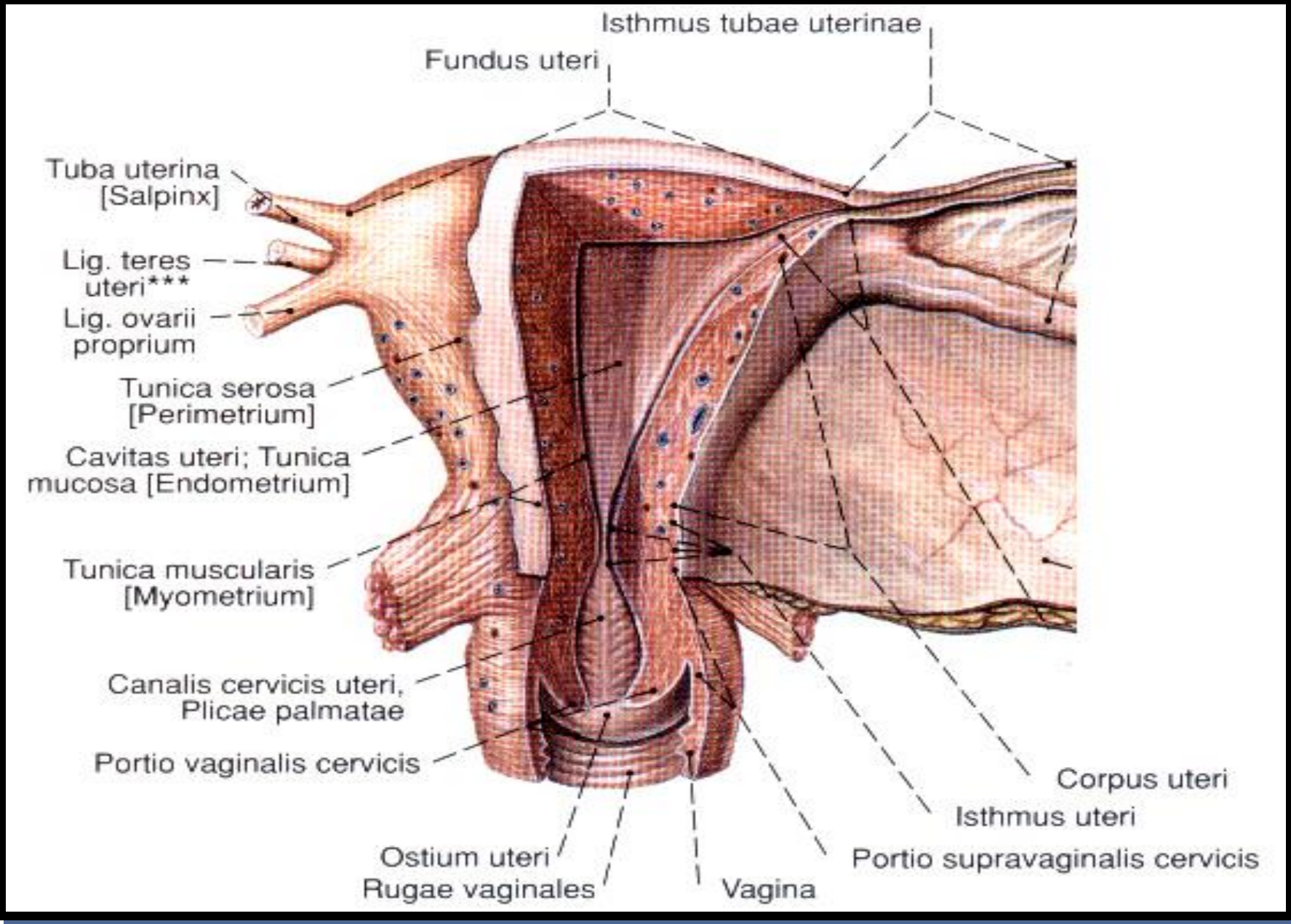

Uterine cavity
Fundus of uterus
Uterine horn
Uterotubal junction
Body of uterus
Isthmus
Cervix (neck) of uterus
Fornix of vagina
Internal os
Peri-metrium
Myometrium
Endometrium
Ureter
Cervical canal
External os
Vagina

Uterine body *(corpus uteri)*

- **The pear-shaped uterine body gradually narrows from the fundus down to the internal os.**
- **Its anterior (vesical) surface, apposed to the urinary bladder, is flattened and covered by peritoneum, reflected on to the bladder as the *uterovesical fold,* level with the internal os.**
- **Between the bladder and uterus is the vesicouterine *pouch,* usually empty but sometimes occupied by part of the small intestine.**
- **The posterior (intestinal) surface of the uterus is convex transversely.**
- **Its peritoneal covering continues down to the cervix and upper vagina and is then reflected back to the rectum along the surface of the *recto-uterine pouch* (of Douglas) which lies posterior to the uterus.**
- **Posterior to the uterus is the sigmoid colon, though the two are usually separated by the terminal ileal coil.**


L5 vertebra
Appendix
Lateral umbilical fold (covering inferior epigastric artery)
Medial umbilical fold (covering umbilical artery)
Round ligament of uterus
Vesicouterine pouch
Retropubic space and fat
Pubovesical ligament
Urethra
Inferior pubic ligament
External urethral orifice
Labium minus
Labium majus
S.1
Tube
Ovary
Uterus
Bladder
Symph. pubis
Vagina
Suspensory ligament of ovary
Broad ligament of uterus
Cervix
Rectouterine fold and pouch
Anococcygeal ligament
Levator ani
Ampulla rectum
Anal canal

- **The dome-like fundus is covered by peritoneum continuous with that of neighbouring surfaces.**
- **Coils of small intestine and occasionally distended sigmoid colon contact it.**
- **The lateral margins of the body are convex, and on each side their peritoneum is reflected laterally to form the *broad ligament,* extending as a flat sheet to the pelvic wall.**
- **Near its upper end, the body receives a uterine tube on either side, the point of fusion of each being a uterine *cornu.***
- **Below the cornu, and slightly in front is attached the round ligament and posteroinferior to it the ligament of the ovary, both running in the broad ligament and stretching from the lateral uterine margin to the lateral pelvic wall.**

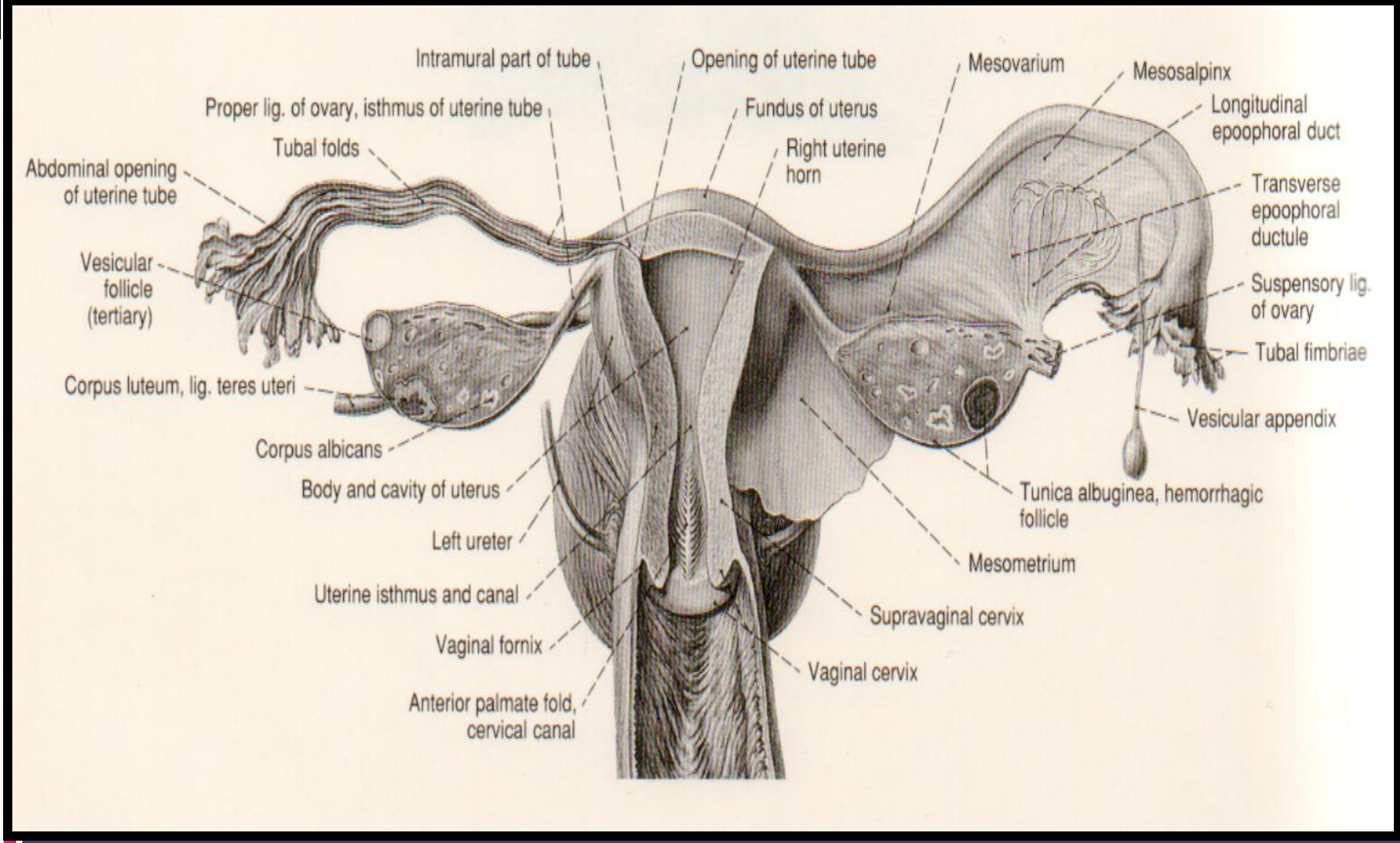

Isthmus tubae uterinae
Fundus uteri
Tuba uterina [Salpinx]
Lig. teres uteri***
Lig. ovarii proprium
Tunica serosa [Perimetrium]
Cavitas uteri; Tunica mucosa [Endometrium]
Tunica muscularis [Myometrium]
Canalis cervicis uteri, Plicae palmatae
Portio vaginalis cervicis
Ostium uteri
Rugae vaginales
Vagina
Corpus uteri
Isthmus uteri
Portio supravaginalis cervicis

Uterine cavity

- In length, it measures about 6 cm from the external os to the wall of the fundus.
- The lumen is small in comparison with its thick wall.
- In the uterine body it is very flat anteroposteriorly, being a mere transverse slit in sagittal or transverse section, with the anterior and posterior walls almost in contact.
- In coronal section it is triangular, broad above where the two uterine tubes join the uterus, and narrow below at the internal os of the cervix.

Cervix *(cervix uteri)*

- **This part of the uterus is about 2.5cm long in the adult, non pregnant state; it is narrower and more cylindrical than the corpus, and is widest at its midlevel; it is also less mobile than the body of the uterus, so that their axes are seldom in line.**
- **The uterine long axis is usually curved forwards, concave below, a state described as *ante flexed;* occasionally there is an angular bend at the level of the internal os *(acute anteflexion).***
- **With the bladder empty the whole uterus leans forwards at an angle to the vagina, and in this position is said to be *anteverted.***
- **The external end of the cervix bulges into the anterior wall of the vagina, which divides it into *supravaginal* and *vaginal* regions.**

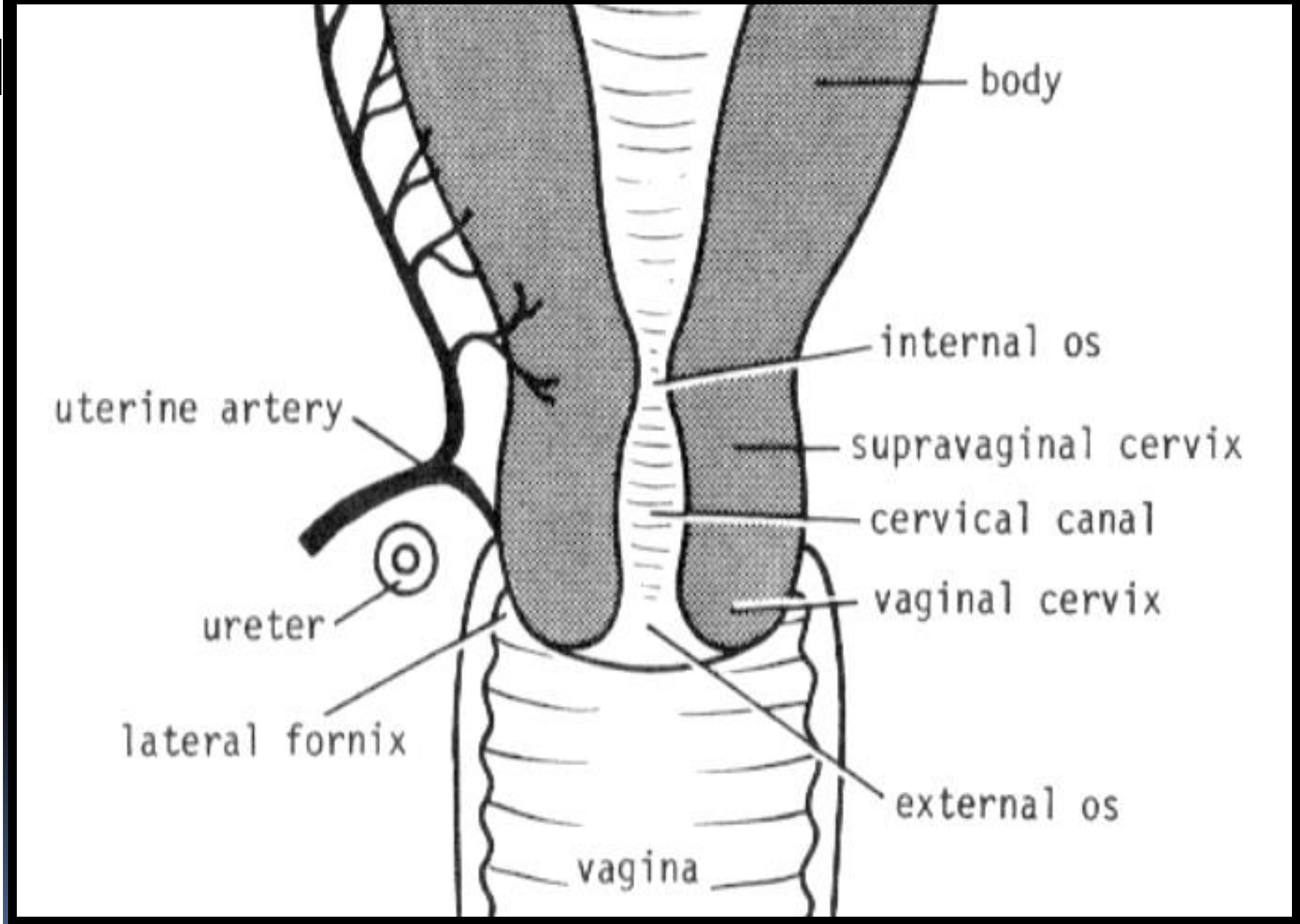

Intramural part of tube
Opening of uterine tube
Mesovarium
Mesosalpinx
Proper lig. of ovary, isthmus of uterine tube
Fundus of uterus
Longitudinal epoophoral duct
Tubal folds
Right uterine horn
Abdominal opening of uterine tube
Transverse epoophoral ductule
Vesicular follicle (tertiary)
Suspensory lig. of ovary
Tubal fimbriae
Corpus luteum, lig. teres uteri
Vesicular appendix
Corpus albicans
Body and cavity of uterus
Tunica albuginea, hemorrhagic follicle
Left ureter
Mesometrium
Uterine isthmus and canal
Supravaginal cervix
Vaginal fornix
Vaginal cervix
Anterior palmate fold, cervical canal

- The *supravaginal part of the cervix* is separated in front from the bladder by cellular connective tissue, the *parametrium,* which passes also to the sides of the cervix and laterally between the two layers of the broad ligaments.
- The uterine arteries flank the cervix in this tissue and the ureters descend forwards in it about 2 cm from the cervix, curving under the arch formed by the uterine arteries.
- The relation of the arteries to the ureters is not always symmetrical; one ureter may be anterior to the cervix.
- Posteriorly the supravaginal cervix is covered by peritoneum, prolonged below on to the posterior vaginal wall and then reflected on to the rectum via the recto-uterine recess.

- **Posteriorly, it is related to the rectum, but may be separated from it by a terminal ileal coil.**
- **The *vaginal part of the cervix* projects as a convex disc on to the anterior vaginal wall, forming grooves around its perimeter termed *vaginal fornices.***
- **On its rounded end the small external os connects its cavity with the vagina.**
- **In nulliparous women, the external os is usually a circular aperture, but after childbirth it has anterior and posterior lips, the anterior shorter, thicker and projecting lower than the posterior, and the aperture is irregular.**
- **Normally, both lips contact the posterior vaginal wall.**

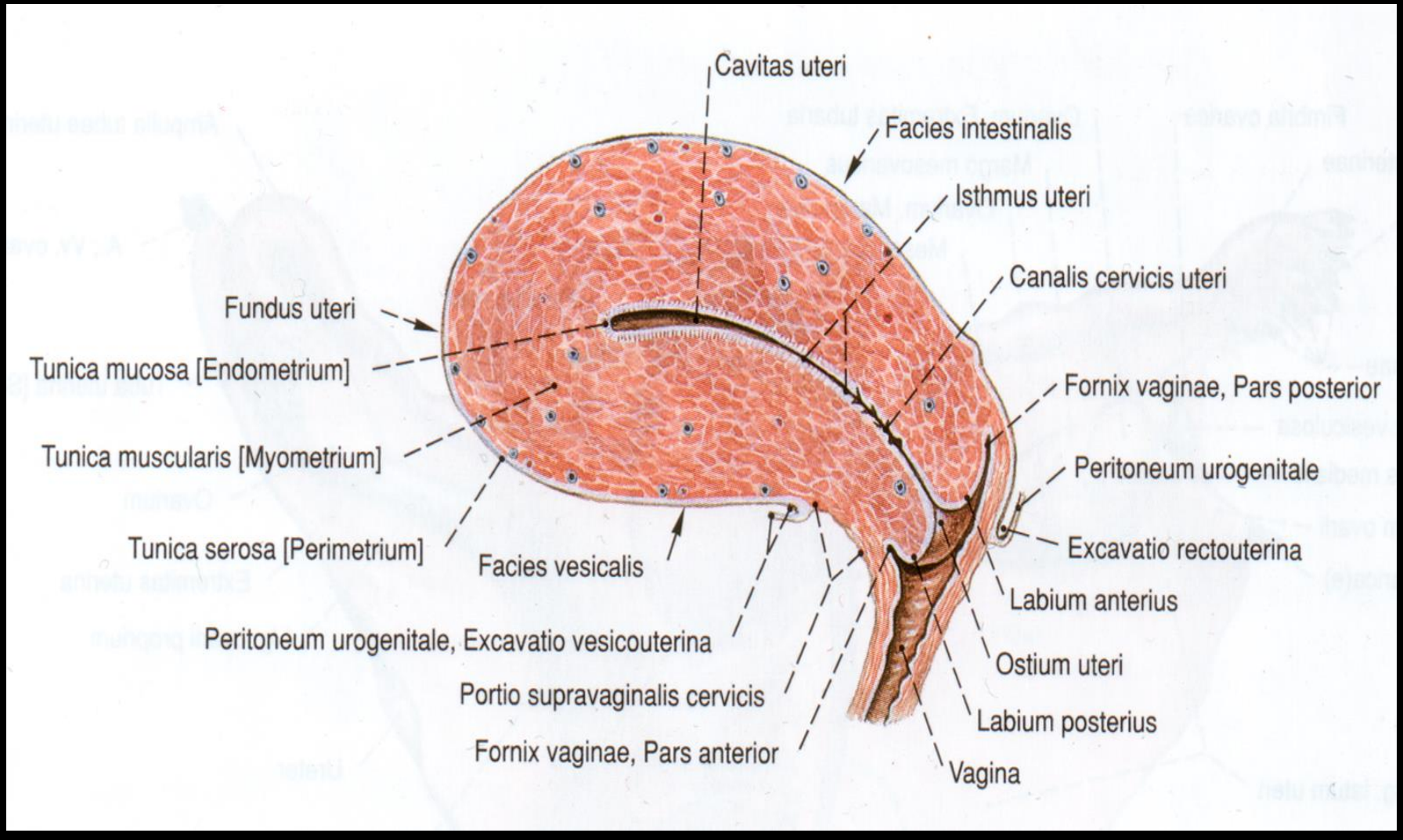
Cervical canal

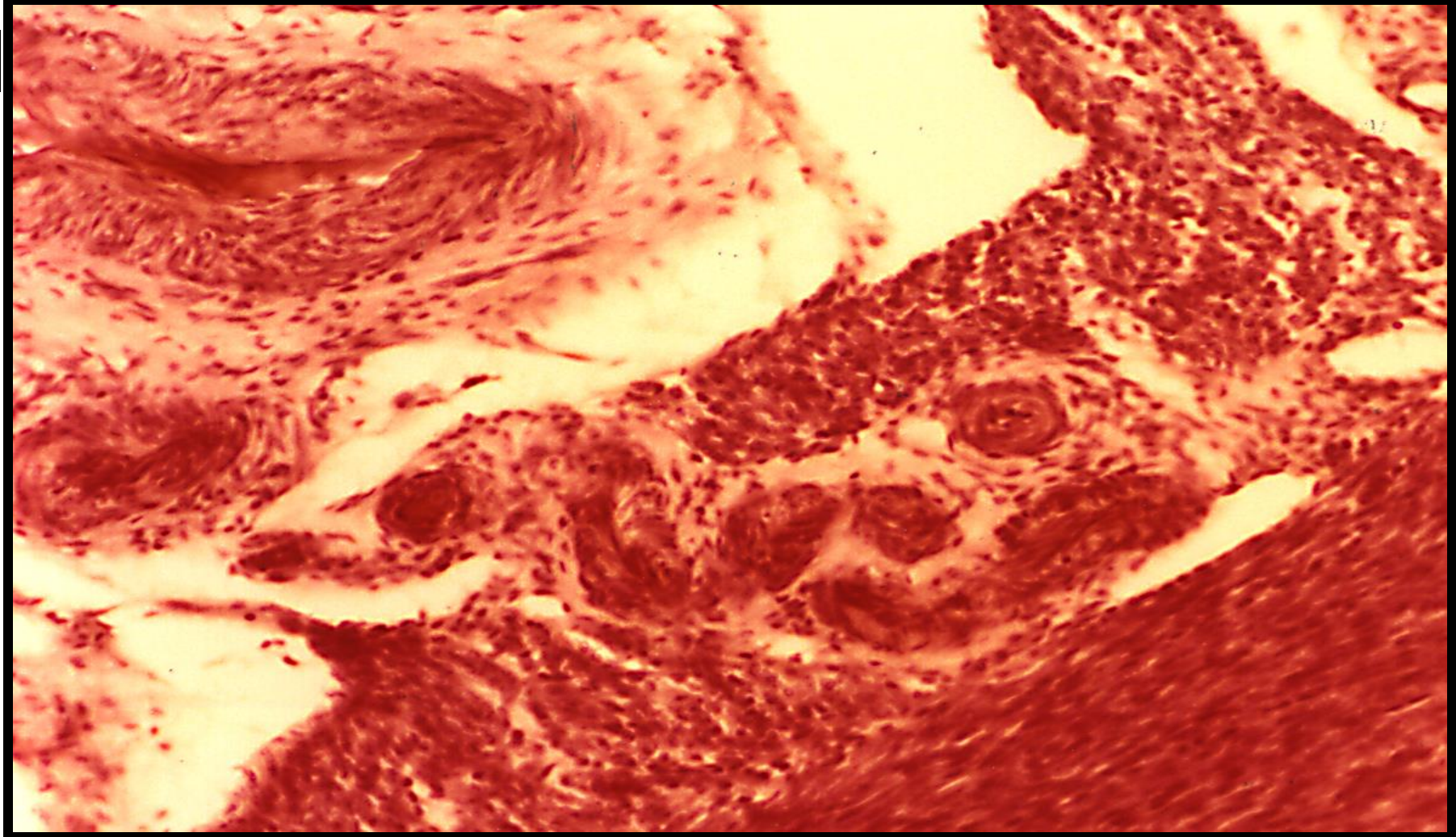
- In shape this is somewhat fusiform longitudinally, flattened transversely and broadest at midlevel.
- It communicates with the main uterine cavity via the internal os, and with the vagina by the external os.
- Two longitudinal ridges, one each on its anterior and posterior walls give off small oblique *palmate folds* which ascend laterally like the branches of a tree *(arbor vitae uteri).*
- The folds on opposing walls interdigitate to close the canal. The narrower *isthmus of the cervix,* forming its upper third, has some distinctive features.
- Although unaffected in the first month of pregnancy, it is gradually taken up into the uterine body during the second month to form the 'lower uterine segment'.
- Fetal membranes, firmly fused with the uterine mucosa elsewhere, are not attached to this lower segment.


body
internal os
uterine artery
supravaginal cervix
cervical canal
ureter
vaginal cervix
lateral fornix
external os
vagina

MICROSTRUCTURE OF THE UTERUS

- The uterine wall is composed of three major layers, from internal to outside:
  - endometrium (mucosa)
  - myometrium (smooth muscle coat)
  - perimetrium (serosa).

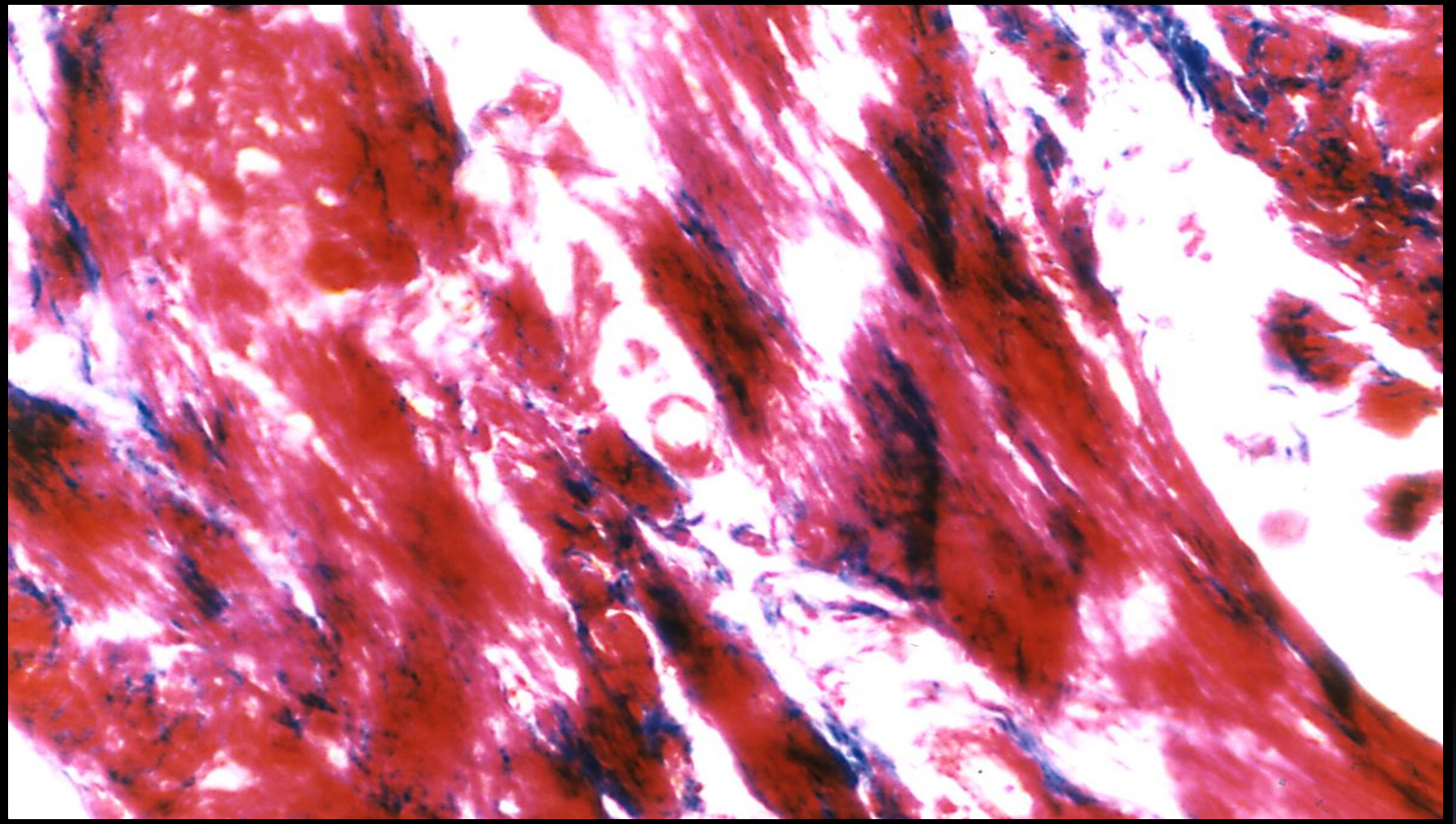

Cavitas uteri
Facies intestinalis
Isthmus uteri
Canalis cervicis uteri
Fundus uteri
Tunica mucosa [Endometrium]
Fornix vaginae, Pars posterior
Tunica muscularis [Myometrium]
Peritoneum urogenitale
Tunica serosa [Perimetrium]
Facies vesicalis
Excavatio rectouterina
Labium anterius
Peritoneum urogenitale, Excavatio vesicouterina
Ostium uteri
Portio supravaginalis cervicis
Labium posterius
Fornix vaginae, Pars anterior
Vagina



General view of endometrium at the level of uterine body and internal part of the myometrium. HE stain.

Myometrium

- **In nulliparae it is dense, firm, greyish and (in the fixed state) cuts almost like cartilage.**
- **It is about 1.3cm thick at the uterine midlevel and fundus but thin at the tubal orifices.**
- **It is composed largely of smooth muscle fasciculi mingled with loose connective tissue, blood vessels, lymphatic vessels and nerves.**
- **The body of the uterus is often described as having four more or less distinct layers:**
  - **The most internal layer *(stratum submucosum)* is composed mostly of longitudinal and some oblique smooth muscle**
  - **External to the submucosal layer is the *stratum vasculare***
  - **Next is a layer of predominantly circular muscle, the stratum supravasculare**
  - **Finally a thin longitudinal layer, the stratum subserosum**



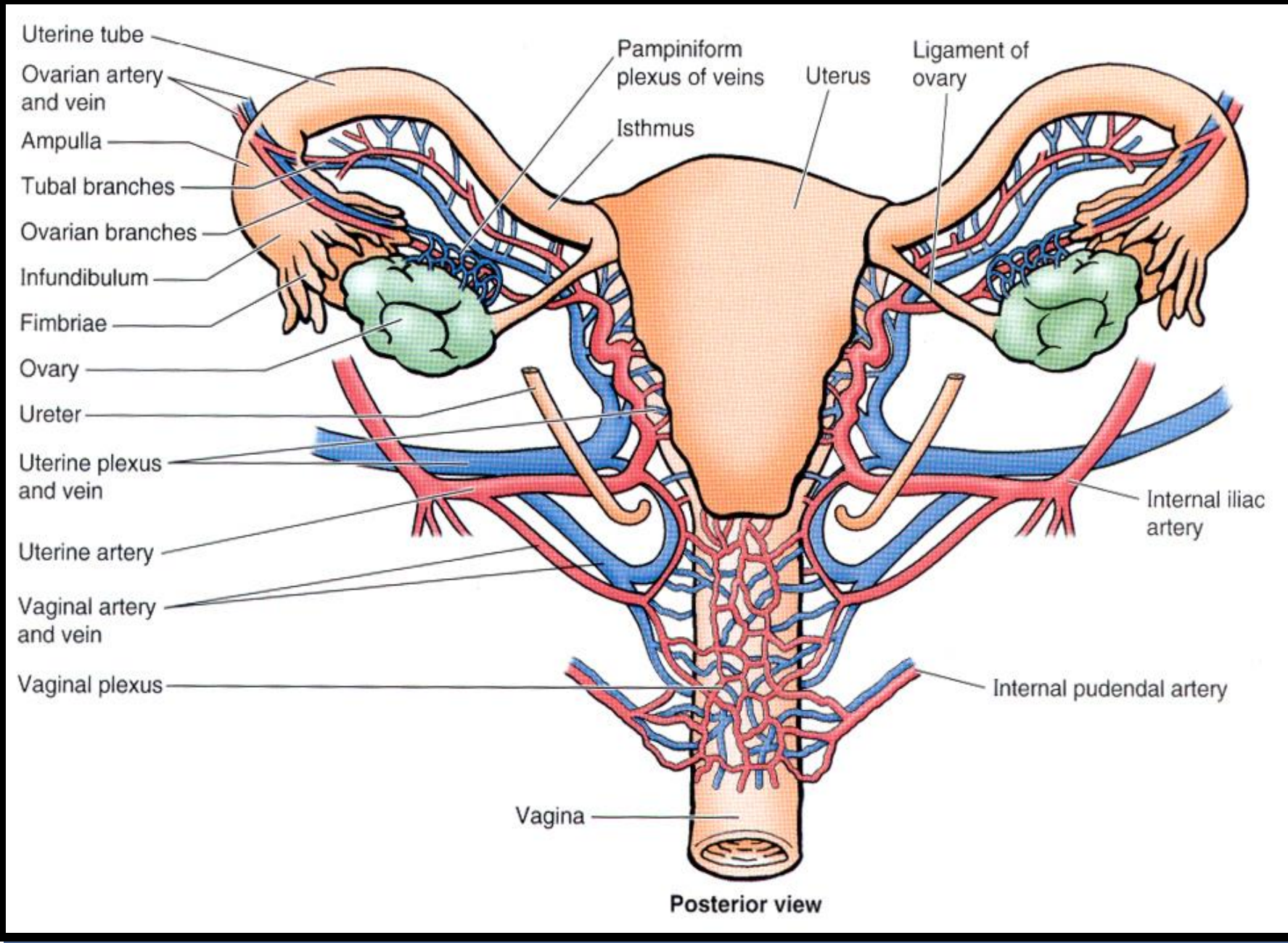
Detail of the myometrium – note the fibrilar longitudinal character of the smooth muscular tissue. Masson stain.

Perimetrium (serosa)

- **This is composed of peritoneum (mesothelium overlying a connective tissue lamina propria) posteriorly covering the uterine body and supravaginal cervix, but anteriorly only the body.**
- **Over the most inferior quarter of the uterine length the peritoneum is separated posteriorly from the underlying uterus by loose cellular tissue and large veins.**
- **Beneath the peritoneum is a subserous layer of loose fibrous tissue.**

Arteries

- The main arterial supply to the whole uterus is through the *uterine* branch of the *internal iliac* artery on each side.
- This anastomoses with the *ovarian* and *vaginal* arteries.
- The paired uterine arteries anastomose extensively with each other across the midline; one can be ligated without serious effects and even more extensive ligation has succeeded.
- Their tortuosity as they ascend in the broad ligaments is repeated in their branches within the uterine wall, but all the sinuosities disappear as the pregnant uterus expands.
- Each uterine artery gives numerous branches which immediately enter the uterine wall, where they divide to run circumferentially in the stratum vasculare as groups of anterior and posterior *arcuate* arteries, passing transversely in the myometrium in the stratum.


Uterine tube
Ovarian artery and vein
Ampulla
Tubal branches
Ovarian branches
Infundibulum
Fimbriae
Ovary
Ureter
Uterine plexus and vein
Uterine artery
Vaginal artery and vein
Vaginal plexus
Pampiniform plexus of veins
Isthmus
Uterus
Ligament of ovary
Internal iliac artery
Internal pudendal artery
Vagina
Posterior view

- These vessels ramify and narrow as they approach the anterior and posterior midline so that no large vessels are present in those regions, although they are not avascular, and the left and right arterial trees anastomose across the midline.
- The arcuate arteries supply many tortuous radial branches which pass centripetally through the deeper myometrial layers, supplying these en route, to reach the endometrium.

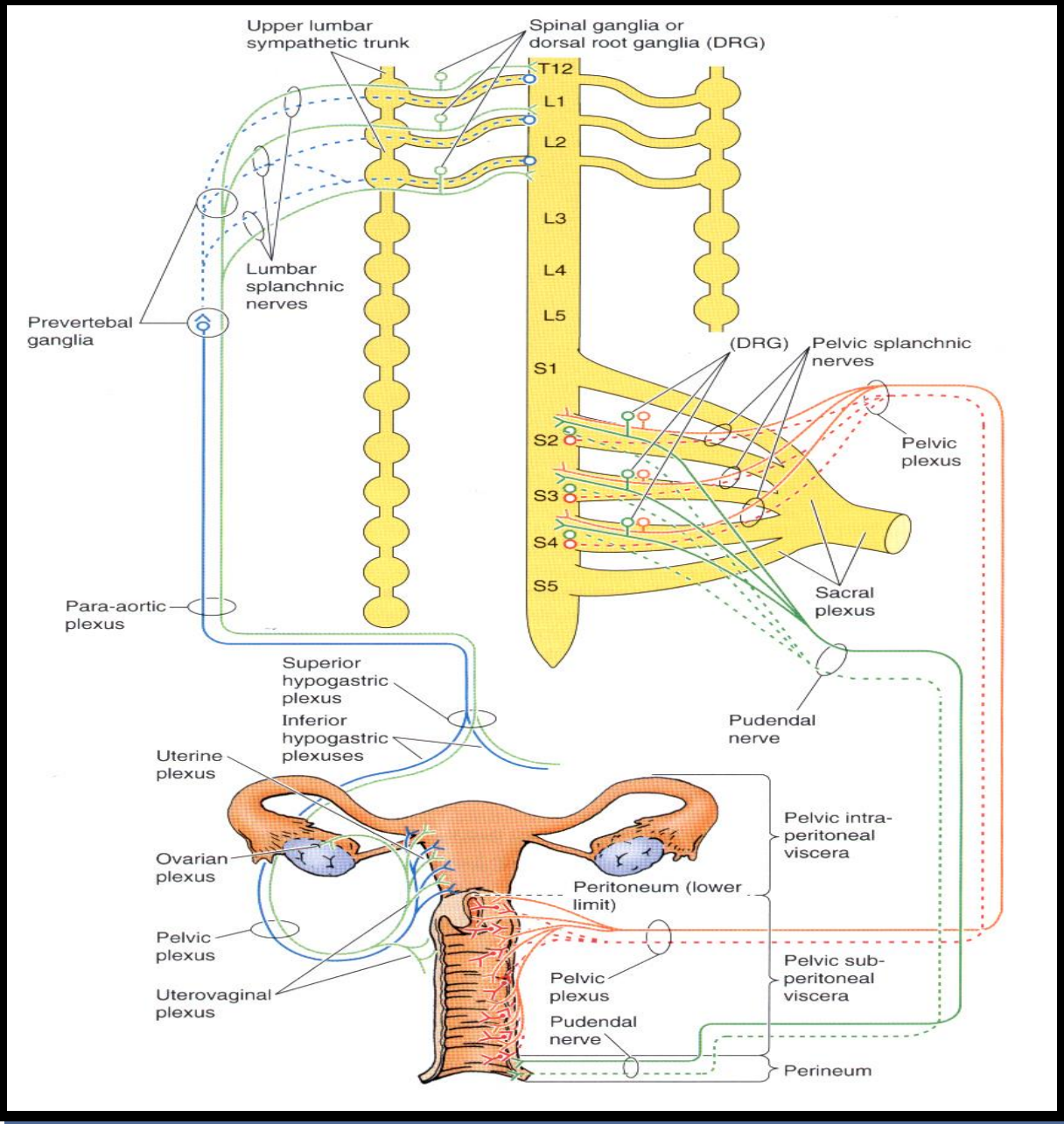
Veins

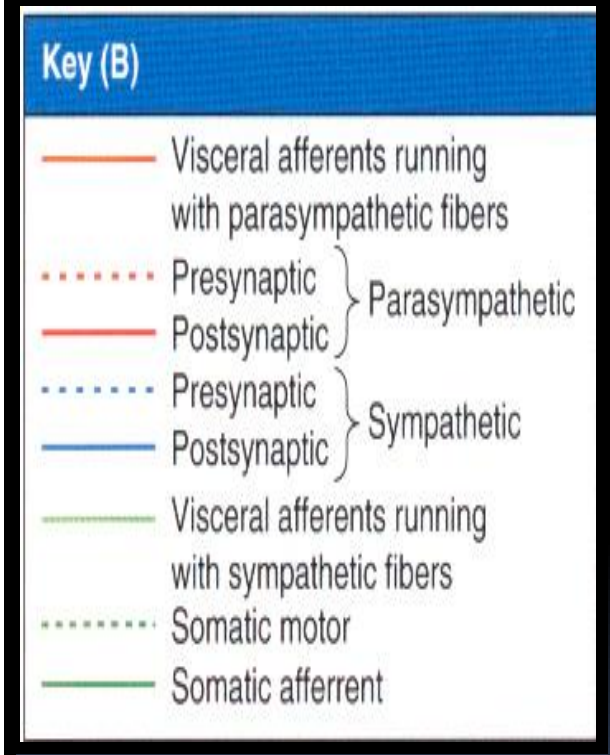
- The uterine veins are arranged like arteries, but volumetrically they are greater.
- Minute venous endometrial venous sinuses, a constant feature in the pregnant uterus, have also been noted in the resting organ.
- During pregnancy the ovarian veins, unlike their companion arteries, may be enlarged.

Nerves of the uterus

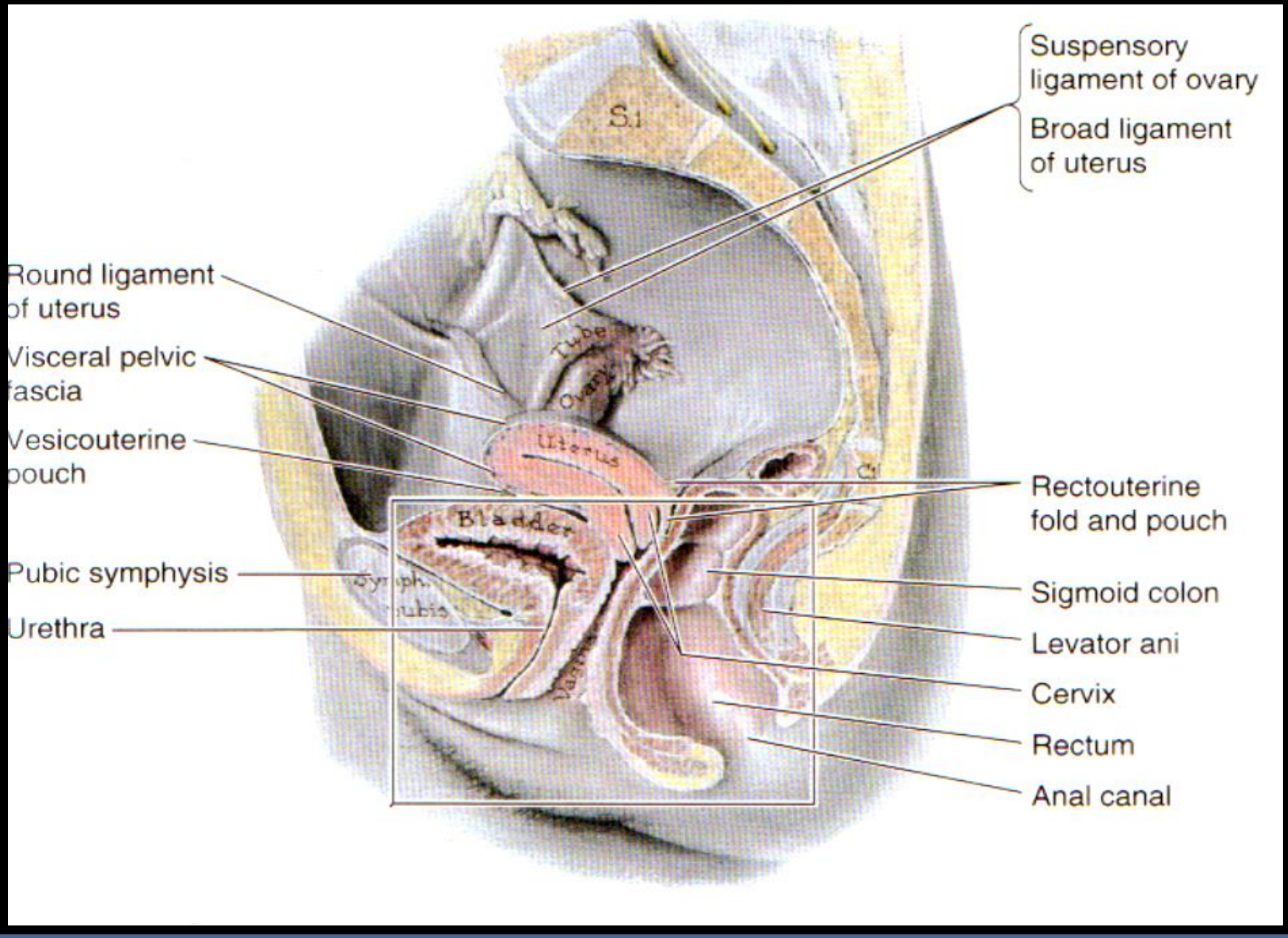
Uterovaginal plexus

- ***Uterine nerves*** **arise from the inferior hypogastric plexus, mainly the part in the broad ligament, the uterovaginal plexus, from which branches descend with the vaginal arteries, while others pass directly to the cervix uteri or ascend with or near uterine arteries in the broad ligament.**
- **Nerves to the cervix form a plexus in which are small *paracervical ganglia,* one ganglion sometimes being larger and termed the *uterine cervical ganglion.***
- **Nerves ascending with the uterine arteries supply the uterine body and tube, connecting with *tubal nerves* from the inferior hypogastric plexus and with the ovarian plexus.**


Upper lumbar sympathetic trunk
Spinal ganglia or dorsal root ganglia (DRG)
T12
L1
L2
L3
L4
L5
S1
S2
S3
S4
S5
Lumbar splanchnic nerves
Prevertebal ganglia
(DRG)
Pelvic splanchnic nerves
Pelvic plexus
Sacral plexus
Para-aortic plexus
Superior hypogastric plexus
Inferior hypogastric plexuses
Pudendal nerve
Uterine plexus
Ovarian plexus
Pelvic plexus
Uterovaginal plexus
Peritoneum (lower limit)
Pelvic intra-peritoneal viscera
Pelvic plexus
Pudendal nerve
Pelvic sub-peritoneal viscera
Perineum

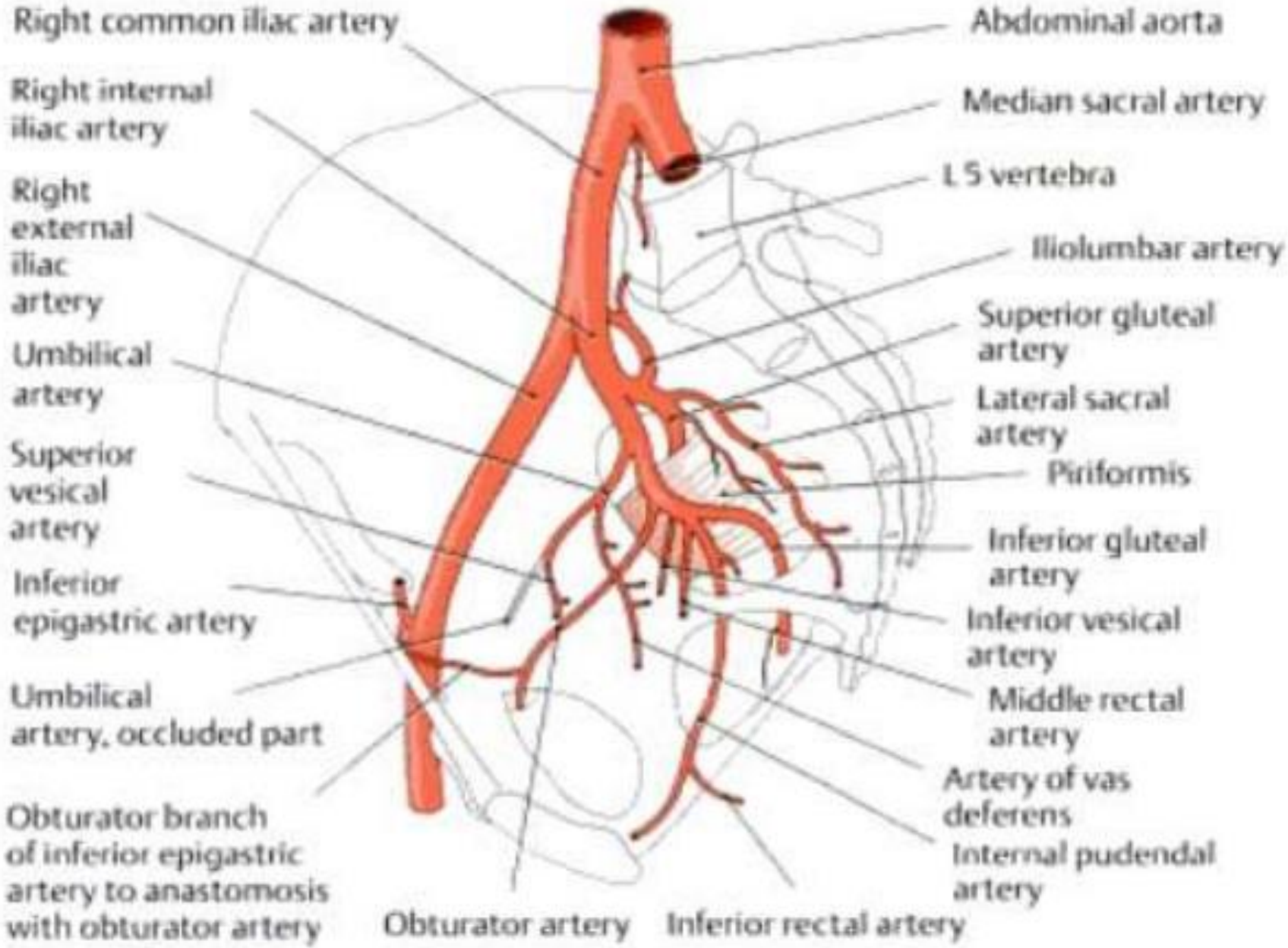

Key (B)
Visceral afferents running with parasympathetic fibers
Presynaptic
Postsynaptic
Parasympathetic
Presynaptic
Postsynaptic
Sympathetic
Visceral afferents running with sympathetic fibers
Somatic motor
Somatic afferrent

- **Sympathetic activity may produce uterine contraction and vasoconstriction and parasympathetic activity may produce uterine inhibition and vasodilatation, but these activities are complicated by hormonal control of uterine functions.**
- ***Vaginal nerves* from the lower parts of the inferior hypogastric and uterovaginal plexuses follow the vaginal arteries to supply the vaginal walls, the erectile tissue of the vestibular bulbs and clitoris (cavernous nerves of the clitoris), the urethra and the greater vestibular glands. The nerves contain many parasympathetic fibres which are vasodilator to the erectile tissue.**
- **The autonomic supply comes directly from the ovarian and hypogastric plexuses; sympathetic preganglionic fibres proceed from the twelfth thoracic and first lumbar spinal segments while parasympathetic preganglionic axons issue in the second to fourth ventral sacral spinal roots.**


Suspensory ligament of ovary
Broad ligament of uterus
Round ligament of uterus
Visceral pelvic fascia
Vesicouterine pouch
Pubic symphysis
Urethra
Rectouterine fold and pouch
Sigmoid colon
Levator ani
Cervix
Rectum
Anal canal
S1
Uterus
Bladder

The Hypogastric Artery— (*A. Hypogastrica*; Internal Iliac Artery)

- The **hypogastric artery** supplies the walls and viscera of the pelvis, the buttock, the generative organs, and the medial side of the thigh.
- It is a short, thick vessel, smaller than the external iliac, and about 4 cm. in length.
- It *arises* at the bifurcation of the common iliac, opposite the lumbosacral articulation, and, passing downward to the upper margin of the greater sciatic foramen, divides into two large trunks, an **anterior** and a **posterior.**


Right common iliac artery
Right internal iliac artery
Right external iliac artery
Umbilical artery
Superior vesical artery
Inferior epigastric artery
Umbilical artery, occluded part
Obturator branch of inferior epigastric artery to anastomosis with obturator artery
Abdominal aorta
Median sacral artery
L 5 vertebra
Iliolumbar artery
Superior gluteal artery
Lateral sacral artery
Piriformis
Inferior gluteal artery
Inferior vesical artery
Middle rectal artery
Artery of vas deferens
Internal pudendal artery
Obturator artery
Inferior rectal artery

Relations

- It is in relation
- *in front* with the ureter;
- *behind,* with the internal iliac vein, the lumbosacral trunk, and the Piriformis muscle;
- *laterally,* near its origin, with the external iliac vein, which lies between it and the Psoas major muscle; lower down, with the obturator nerve.

Branches

From the Anterior Trunk.

- **Pudendal (Internal).**
- **Inferior Vesical. (Vaginal).**
- **Middle Rectal.**
- **Obturator.**
- **Umbilical (Superior vesical).**
- **Uterine**

From the Posterior Trunk.

Iliolumbar.
Lateral Sacral.
Gluteal(Superior

The **superior vesical artery** (*a. vesicalis superior*)

- supplies numerous branches to the upper part of the bladder.
- From one of these a slender vessel, the **artery to the *ductus deferens*,** takes origin and accompanies the duct in its course to the testis, where it anastomoses with the internal spermatic artery.
- Other branches supply the ureter.
- The first part of the superior vesical artery represents the terminal section of the pervious portion of the fetal hypogastric artery.

The **middle vesical artery** (*a. vesicalis medialis*),

- usually a branch of the superior, is distributed to the fundus of the bladder and the vesiculæ seminales.

The **inferior vesical artery** (*a. vesicalis inferior*)

- frequently *arises* in common with the middle haemorrhoidal, and is distributed to the fundus of the bladder, the prostate, and the vesiculæ seminales.
- The branches to the prostate communicate with the corresponding vessels of the opposite side.

The **middle hemorrhoidal artery** (*a. hæmorrhoidalis media*)

- usually *arises* with the inferior vesical artery.
- It is distributed to the rectum, anastomosing with the inferior vesical and with the superior and inferior hemorrhoidal arteries.
- It gives offsets to the *vesiculæ seminales* and prostate.

The **uterine artery** (*a. uterina*)

- springs from the anterior division of the hypogastric and runs medialward on the Levator ani and toward the cervix uteri; about 2 cm. from the cervix it crosses above and in front of the ureter, to which it supplies a small branch.
- Reaching the side of the uterus it ascends in a tortuous manner between the two layers of the broad ligament to the junction of the uterine tube and uterus.
- It then runs lateralward toward the hilus of the ovary, and ends by joining with the ovarian artery.
- It supplies branches to the cervix uteri and others which descend on the vagina; the latter anastomose with branches of the vaginal arteries and form with them two median longitudinal vessels—the **azygos arteries of the vagina**—one of which runs down in front of and the other behind the vagina.
- It supplies numerous branches to the body of the uterus, and from its terminal portion twigs are distributed to the uterine tube and the round ligament of the uterus.

The **vaginal artery** (*a. vaginalis*)

- usually corresponds to the inferior vesical in the male; it descends upon the vagina, supplying its mucous membrane, and sends branches to the bulb of the vestibule, the fundus of the bladder, and the contiguous part of the rectum.
- It assists in forming the azygos arteries of the vagina, and is frequently represented by two or three branches.

The **obturator artery** (*a. obturatoria*)

- passes forward and downward on the lateral wall of the pelvis, to the upper part of the obturator foramen, and, escaping from the pelvic cavity through the obturator canal, it divides into an **anterior** and a **posterior branch.**
- In the pelvic cavity this vessel is in relation, laterally, with the obturator fascia; medially, with the ureter, ductus deferens, and peritoneum; while a little below it is the obturator nerve.

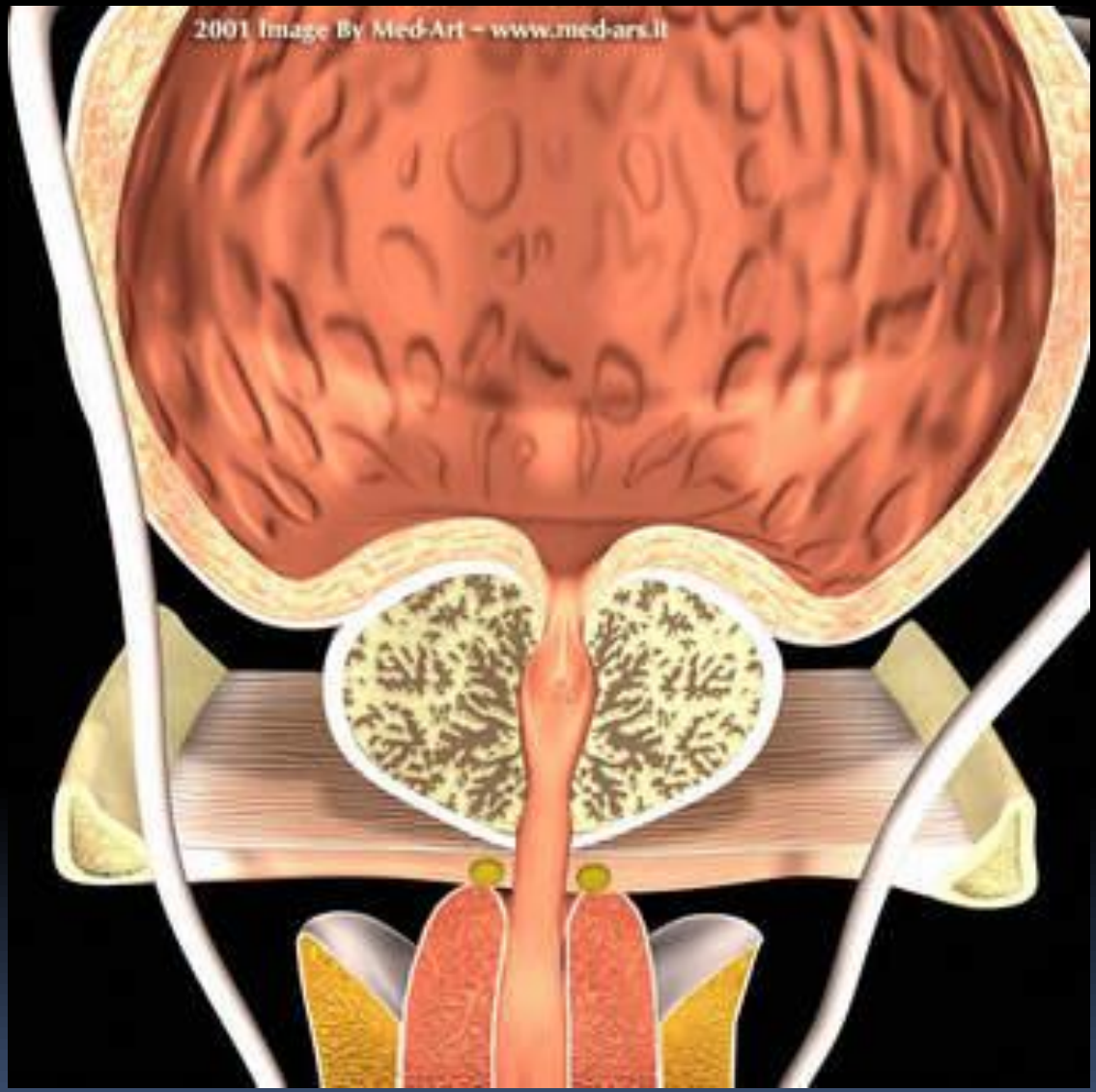
The **internal pudendal artery** (*a. pudenda interna; internal pudic artery*)

- is the smaller of the two terminal branches of the anterior trunk of the hypogastric, and supplies the external organs of generation.
- The **internal pudendal artery in the male** passes downward and outward to the lower border of the greater sciatic foramen, and emerges from the pelvis between the Piriformis and Coccygeus; it then crosses the ischial spine, and enters the perineum through the lesser sciatic foramen.
- The artery now crosses the Obturator internus, along the lateral wall of the ischiorectal fossa, being situated about 4 cm. above the lower margin of the ischial tuberosity.
- It gradually approaches the margin of the inferior ramus of the ischium and passes forward between the two layers of the fascia of the urogenital diaphragm; it then runs forward along the medial margin of the inferior ramus of the pubis, and about 1.25 cm. behind the pubic arcuate ligament it pierces the inferior fascia of the urogenital diaphragm and divides into the **dorsal and deep arteries of the penis.**

- The **internal pudendal artery** **in the female** is smaller than in the male. Its origin and course are similar, and there is considerable analogy in the distribution of its branches. The perineal artery supplies the labia pudendi; the artery of the bulb supplies the bulbus vestibuli and the erectile tissue of the vagina; the deep artery of the clitoris supplies the corpus cavernosum clitoridis; and the dorsal artery of the clitoris supplies the dorsum of that organ, and ends in the glans and prepuce of the clitoris.

THE URINARY BLADDER

- is a reservoir where urine accumulates in the intervals between urination.
- The urinary bladder lies behind the symphysis pubis.
- In state of medium distension it has a vertical diameter of about 12 cm, one transverse diameter of 8 cm and one anterior-posterior diameter of 6 cm.
- The physiological bladder capacity is about 250 cmc.
- In children it is pear shaped. In adults it has the appearance of crescent moon when it is empty and ovoid shape when it is filled.


2001 Image By Med-Art - www.med-art.it

- The urinary bladder has an apex, a fundus and a body.
- - The apex is pointing up and forward. It is continued by the median umbilical ligament.
- - The intermediate segment between apex and fundus is called body. It forms most of the urinary bladder.
- - The fundus is oriented down and backwards. The latch part is called the bladder urinary neck (cervix). From this level the urethra is leaving.
- The empty bladder presents : an anterior surface, a posterior one, two lateral borders, the apex and the fundus. In case of a filled bladder the lateral borders become lateral surfaces.

Relations.

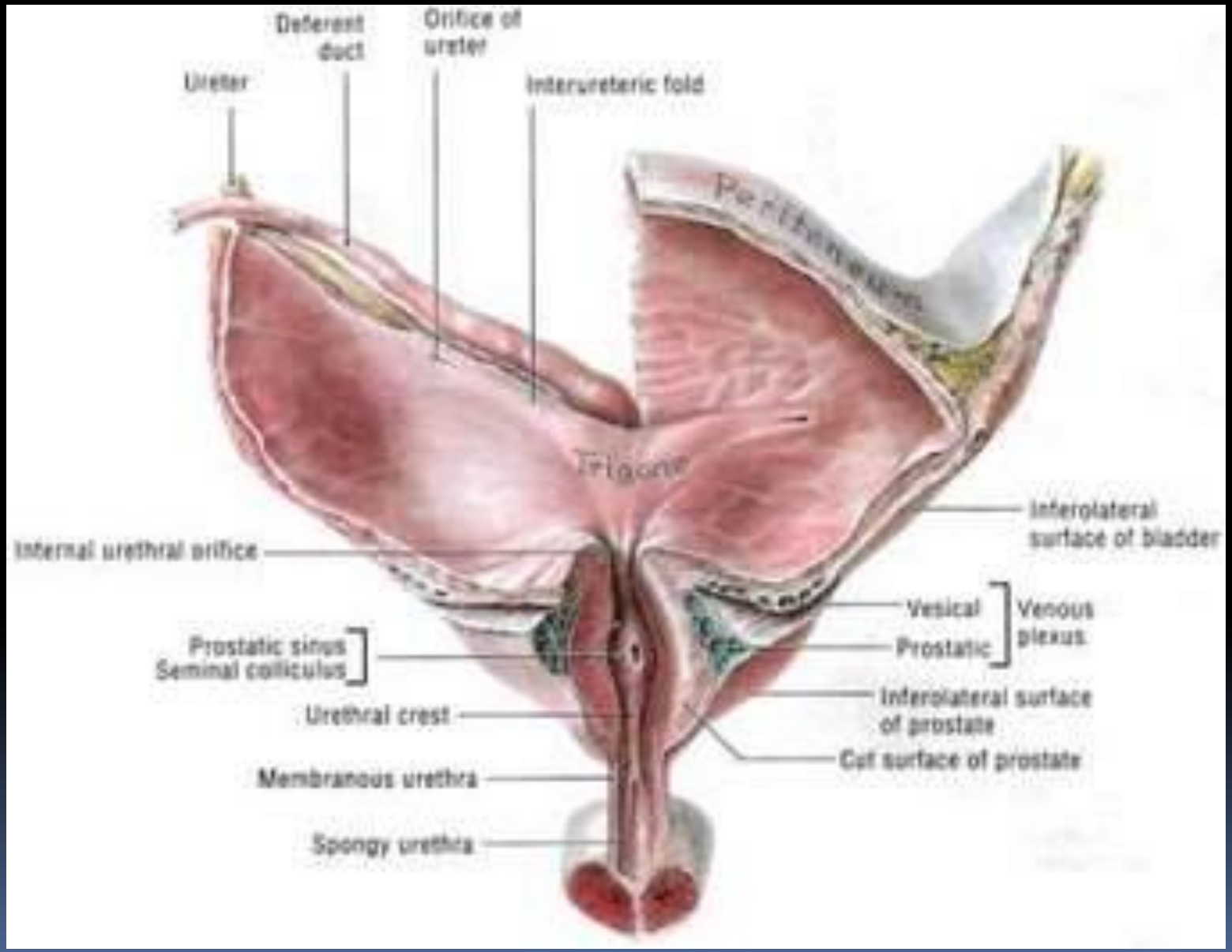
- There are different relations from female to male and from an empty bladder to a filled bladder .
- Interior conformation. At the level of the fundus we meet the vesical trigone and the retroureteric fossa
- - The vesical trigone is shaped like a triangle with sides approximately equal to the posterior base, marked by two ureteral orifices, limited by a falciform plica (prevent the return of urine in the ureters) and the top marked by internal orifice of the urethra.
- The trigone is a smooth region without plicas.
- The retroureteric fossa is a transversal depression located behind the interureteric crest.

Structure.

- The bladder's wall structure comprises fibroseros layer, muscle layer and mucous layer. The top and the posterior portion of the body are covered by peritoneum. Otherwise the bladder is extraperitoneal.
- The muscular tunica consists of longitudinal and circular fibers.

Blood supply.

- The arteries of the urinary bladder derive from the neighboring vessels.
- The most important are superior vesical artery (umbilical artery) and inferior vesical artery (internal iliac artery).
- The veins drain into the bladder's venous plexus which communicates with neighboring venous plexi of the neighboring organs.
- Innervation. The nerves are likely vegetative and derive from the vesical plexus.


Deferent duct
Orifice of ureter
Ureter
Interureteric fold
Peritoneum
Trigone
Inferolateral surface of bladder
Internal urethral orifice
Vesical
Prostatic
Venous plexus
Prostatic sinus
Seminal colliculus
Inferolateral surface of prostate
Urethral crest
Cut surface of prostate
Membranous urethra
Spongy urethra

The URETHRA

- is the tube through which urine is expelled from the urinary bladder to the outside.
- It differs from man to woman.
- In males the urethra serves to expel the urine but also the semen during ejaculation.
- In females it serves only to pass the urine.

MALE URETHRA

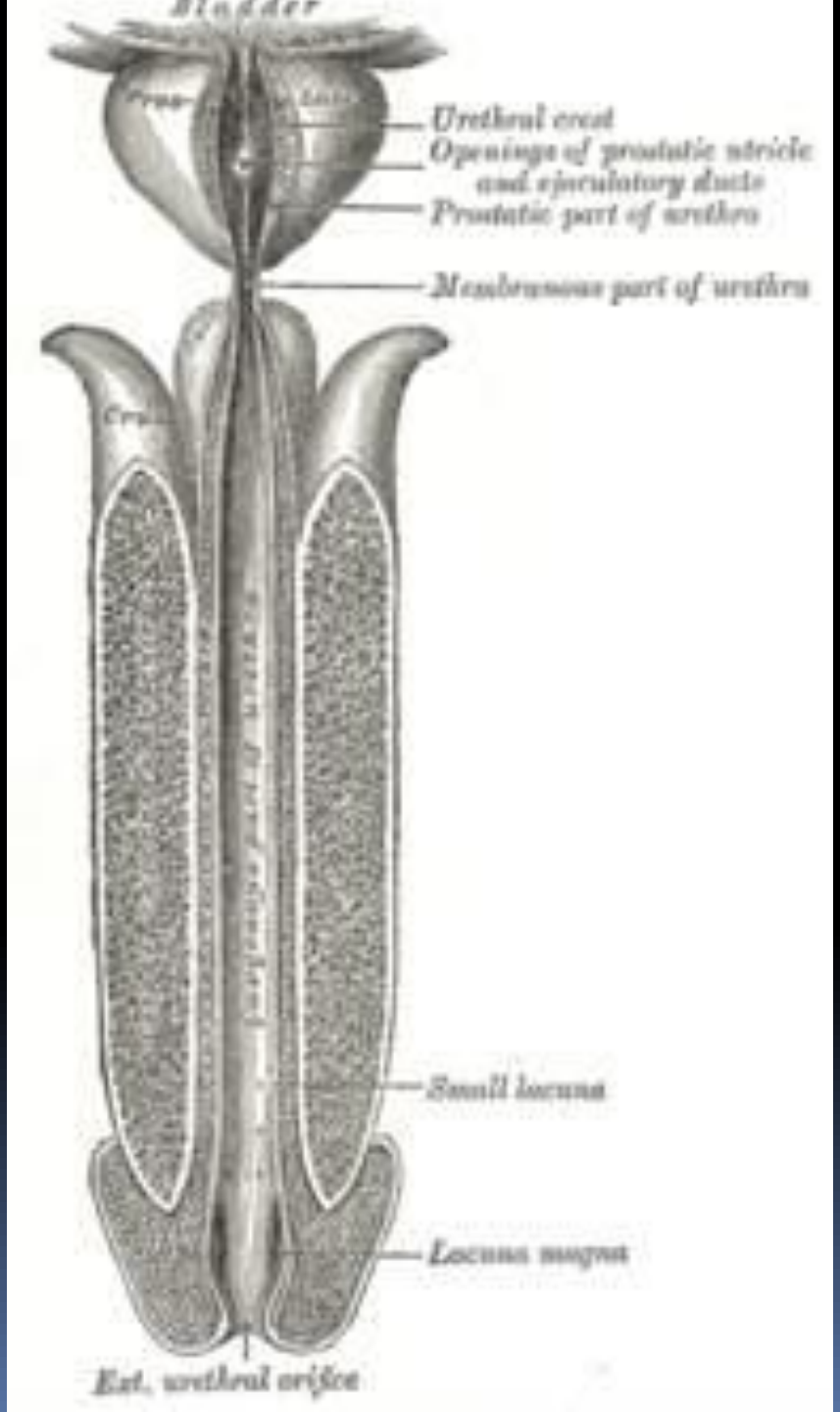
- Limits. It extends from the urethral orifice of the urinary bladder to the external orifice (or urinary meatus), located at the free extremity of the penis.
- The average length of the urethra is 16 cm in adults.
- It describes an italic S-shaped trajectory.
- After the organs it crosses, it is divided into 4 parts: prostatic,
- diaphragmatic
- membranous
- spongeous

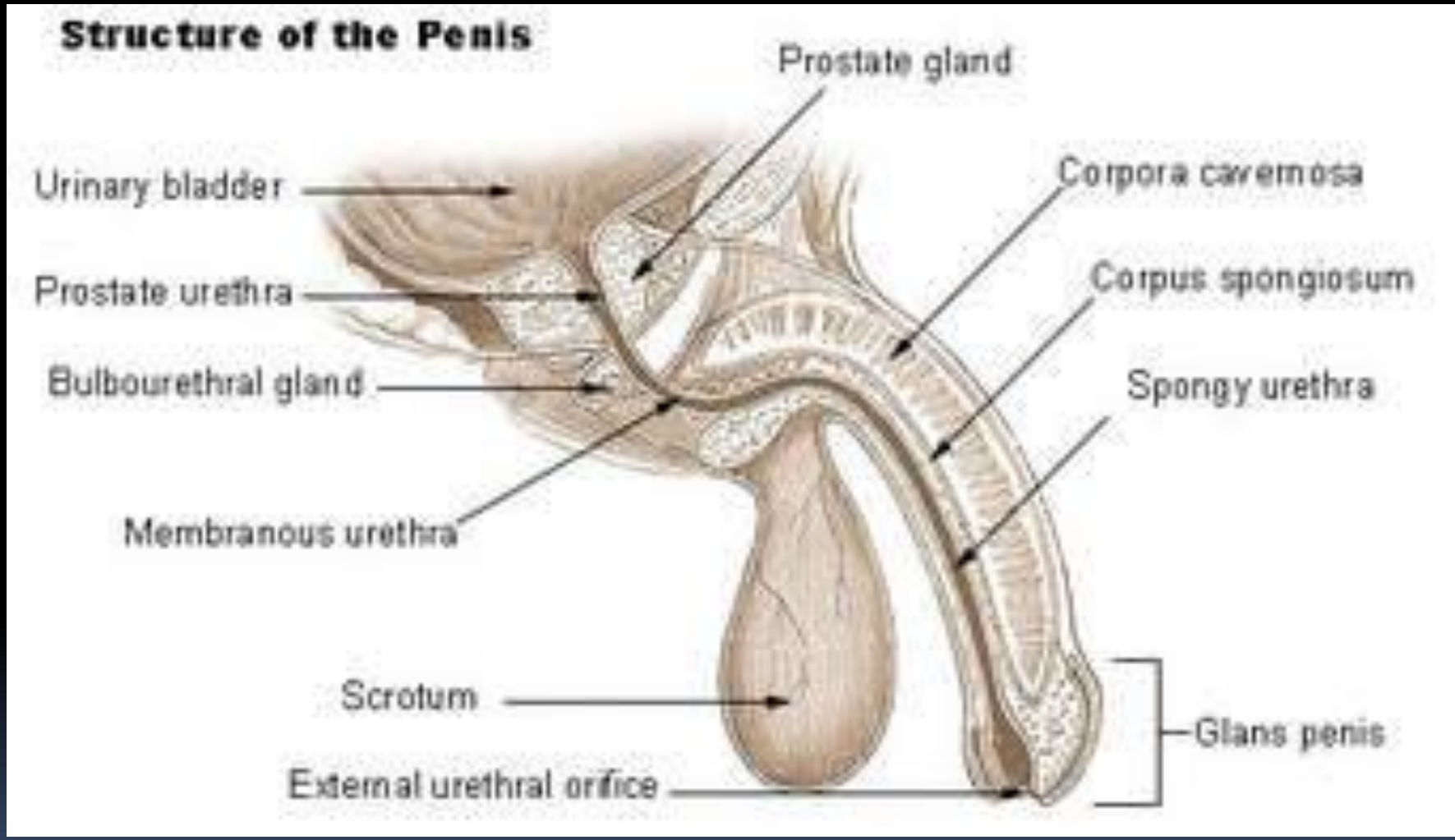
- Structure. The urethral wall is composed of a mucous tunic and a muscular tunic.
- - The muscular tunic is consists of smooth fibers disposed circularly or longitudinally and striated fibers. The bladder's sphincter is located inside the prostate surrounding the urethra.
- - Tunica mucosa is reddish in living man. It presents a series of longitudinal plicas and numerous urethral glands.
- Blood supply. The arteries derive from surrounding vessels.
- The veins form a venous plexus around the urethra in which the blood is drained to neighboring veins.
- Innervation is likely organovegetative.

FEMALE URETHRA

- It extends from the urinary bladder (internal orifice) to the external opening (or urinary meatus) located in the vestibule of the vagina.
- It has a length of about 4 cm.
- The female urethra is rectilinear, being oriented from top to bottom and from backwards to forward.
- The female urethra is divided into a pelvic part and a perineal one, separated by the uro-genital diaphragm.

- The pelvic part is located posterior to the pubic symphysis and anterior to the vagina.
- The perineal part passes through uro-genital diaphragm.
- The urethral wall contains a mucous tunic and a muscular tunic.
- - Tunica mucosa has a reddish gray color. It is thin and very flexible.
- - The muscular tunica is formed by smooth circular and longitudinal fibers and striated fibers.
- The striated fibers surround at the exterior the layer of smooth fibers and form the external urethral sphincter.
- The arteries derive from the inferior vesical artery and the vaginal artery.
- The veins drain into the vesical and the vaginal plexus.
- .


Urethral crest
Openings of prostatic utricle and ejaculatory ducts
Prostatic part of urethra
Membranous part of urethra
Small lacuna
Lacuna magna
Ext. urethral orifice


Structure of the Penis
Prostate gland
Urinary bladder
Corpora cavernosa
Prostate urethra
Corpus spongiosum
Bulbourethral gland
Spongy urethra
Membranous urethra
Scrotum
Glans penis
External urethral orifice