GYNECOLOGICAL EMBRYOLOGY and ANATOMY

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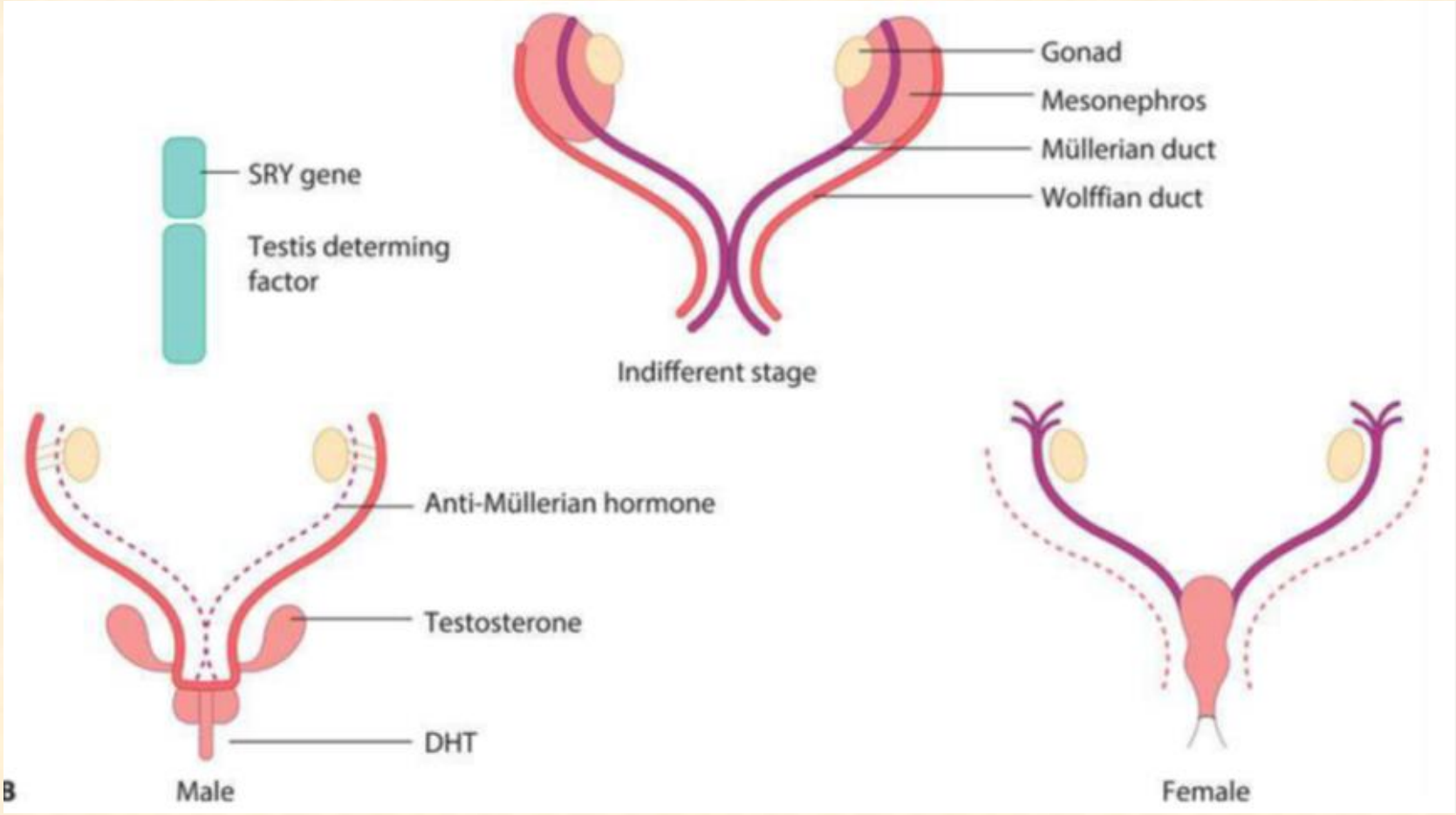

SRY gene
Testis determing factor
Gonad
Mesonephros
Müllerian duct
Wolffian duct
Indifferent stage
Anti-Müllerian hormone
Testosterone
DHT
Male
Female

Development of male genitalia

As the gonad develops into a testis, it differentiates into two cell types. The Sertoli cells produce anti-Müllerian hormone (AMH) and the Leydig cells produce testosterone. AMH suppresses further development of the Müllerian ducts whereas testosterone stimulates the Wolffian ducts to develop into the vas deferens, epididymis and seminal vesicles..

In addition, in the external genital skin,

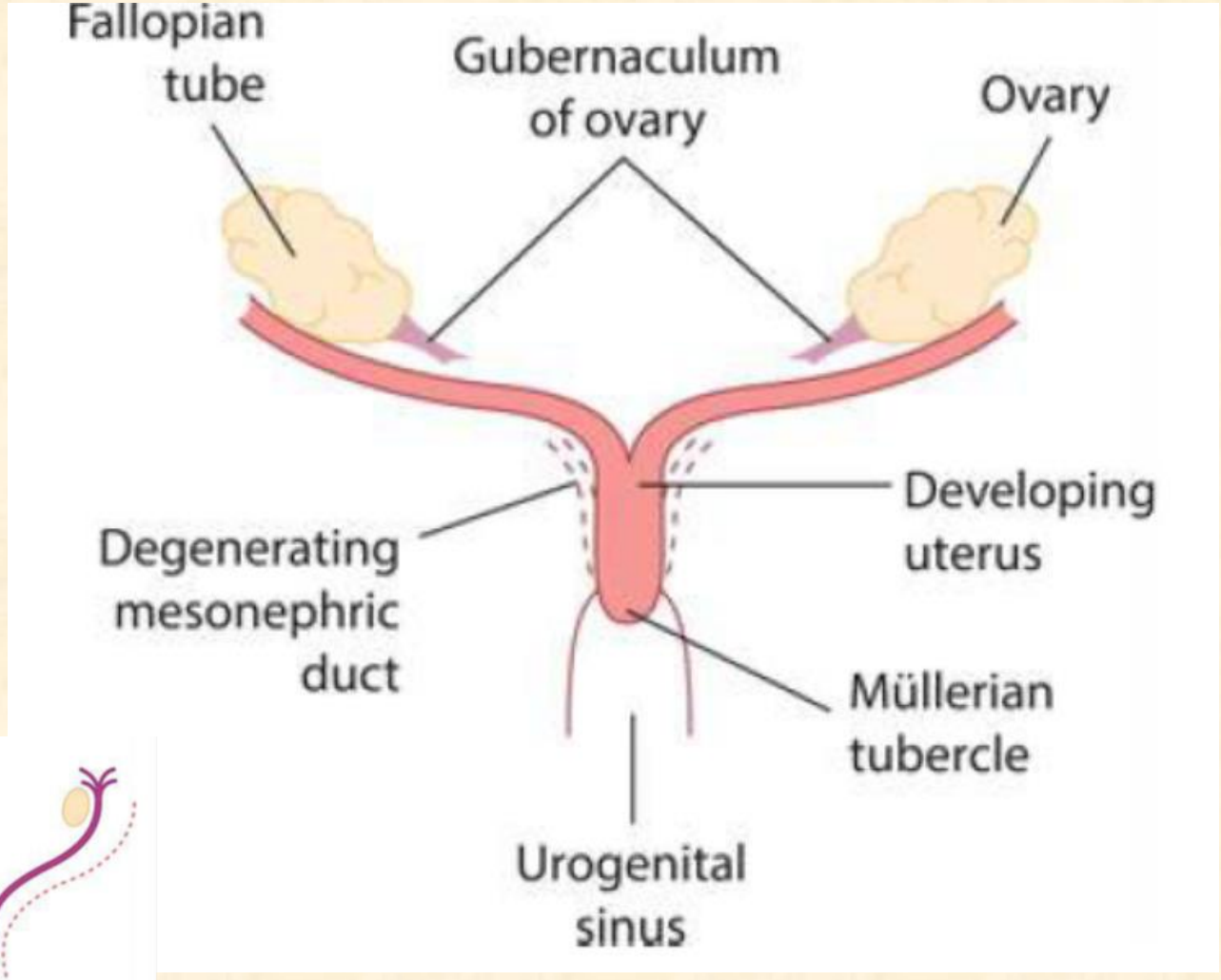
- testosterone is converted by the enzyme 5-alpha-reductase into dihydrotestosterone (DHT). This acts to virilize the external genitalia. The genital tubercle becomes the penis and the labioscrotal folds fuse to form the scrotum. The urogenital folds fuse along the ventral surface of the penis and enclose the urethra so that it opens at the tip of the penis

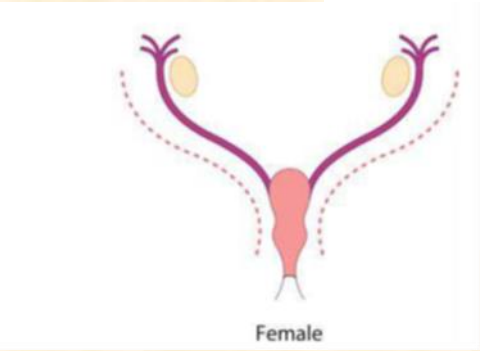
Development of the female sexual organs

In the primitive ovary granulosa cells, derived from the proliferating coelomic epithelium, surround the germ cells and form primordial follicles. Each primordial follicle consists of an oocyte within a single layer of granulosa cells. Theca cells develop from the proliferating coelomic epithelium and are separated from the granulosa cells by a basal lamina..

- The maximum number of primordial follicles is reached at 20 weeks' gestation when there are six to seven million primordial follicles present. The numbers of these reduce by atresia and at birth only 1–2 million remain. Atresia continues throughout life and by menarche only 300,000–400,000 are present, and by menopause none

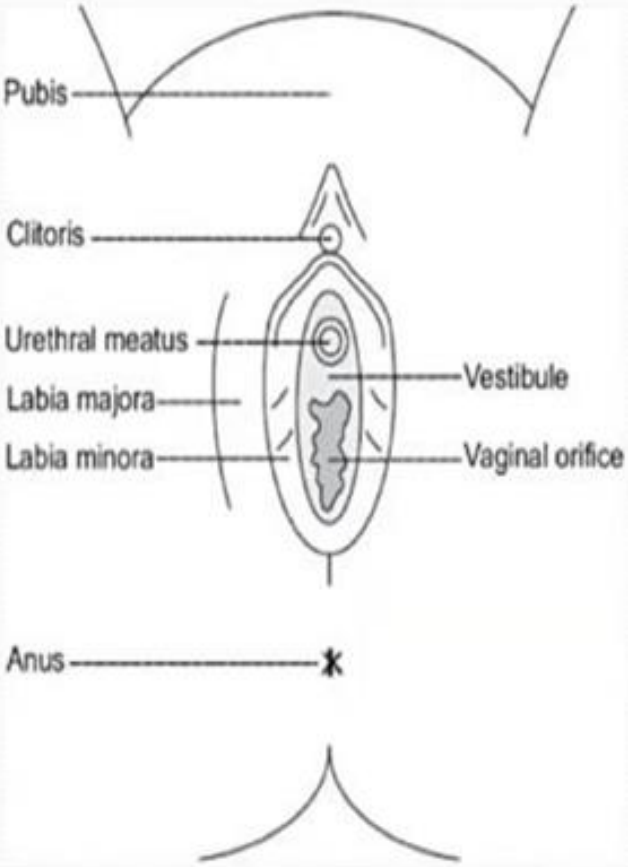
The development of an oocyte within a primordial follicle is arrested at the prophase of its first meiotic division. It remains in that state until it undergoes atresia or enters the meiotic process preceding ovulation.


Fallopian tube
Gubernaculum of ovary
Ovary
Developing uterus
Degenerating mesonephric duct
Müllerian tubercle
Urogenital sinus


Female

External female genitalia

The external genitalia do not virilize in the absence of testosterone. Between the fifth and seventh weeks of life, the cloacal folds, which are a pair of swellings adjacent to the cloacal membrane, fuse anteriorly to become the genital tubercle. This will become the clitoris. The perineum develops and divides the cloacal membrane into an anterior urogenital membrane and a posterior anal membrane. The cloacal fold anteriorly are called the urethral folds, which form the labia minora. Another pair of folds within the cloacal membrane form the labioscrotal folds that eventually become the labia majora. The urogenital sinus becomes the vestibule of the vagina. The external genitalia are recognizably female by the end of the twelfth embryonic week.


Pubis
Clitoris
Urethral meatus
Labia majora
Labia minora
Vestibule
Vaginal orifice
Anus

The vagina

The vagina is a fibromuscular canal lined with stratified squamous epithelium that leads from the uterus to the vulva. It is longer in the posterior wall (approximately 9 cm) than in the anterior wall (approximately 7 cm). The vault of the vagina is divided into four fornices: posterior, anterior and two lateral. The vagina has no glands and is kept moist by secretions from the uterine and cervical glands and by transudation from its epithelial lining.

Doderlein's bacillus is a normal commensal of the vaginal flora and breaks down glycogen to form lactic acid, producing a pH of around 4.5.

The uterus

The uterus in its non-pregnant state is situated entirely within the pelvis. Its maximum external dimensions are approximately 7.5 cm long, 5 cm wide and 3 cm thick. In the upper part, the uterus is termed the body or ‘corpus’. The area of insertion of each Fallopian tube is termed the ‘cornu’ and that part of the body above the cornu is called the ‘fundus’.

The longitudinal axis of the uterus is approximately at right angles to the vagina and normally tilts forward. This is called ‘anteversion’ The uterus is also usually flexed forward on itself at the isthmus –antiflexion. The uterus consists of three layers: the outer serous layer (peritoneum), the middle muscular layer (myometrium) and the inner mucous layer (endometrium).

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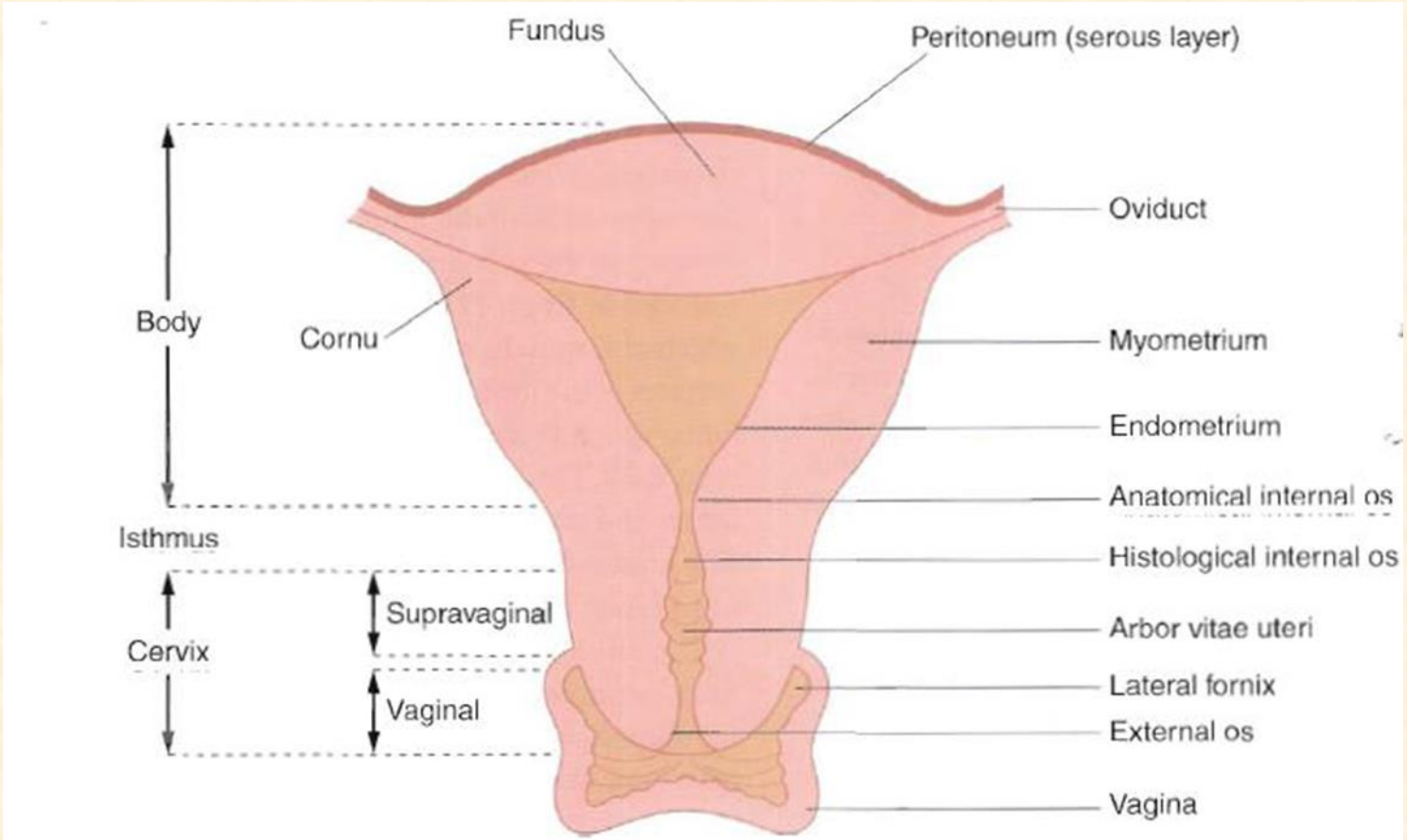
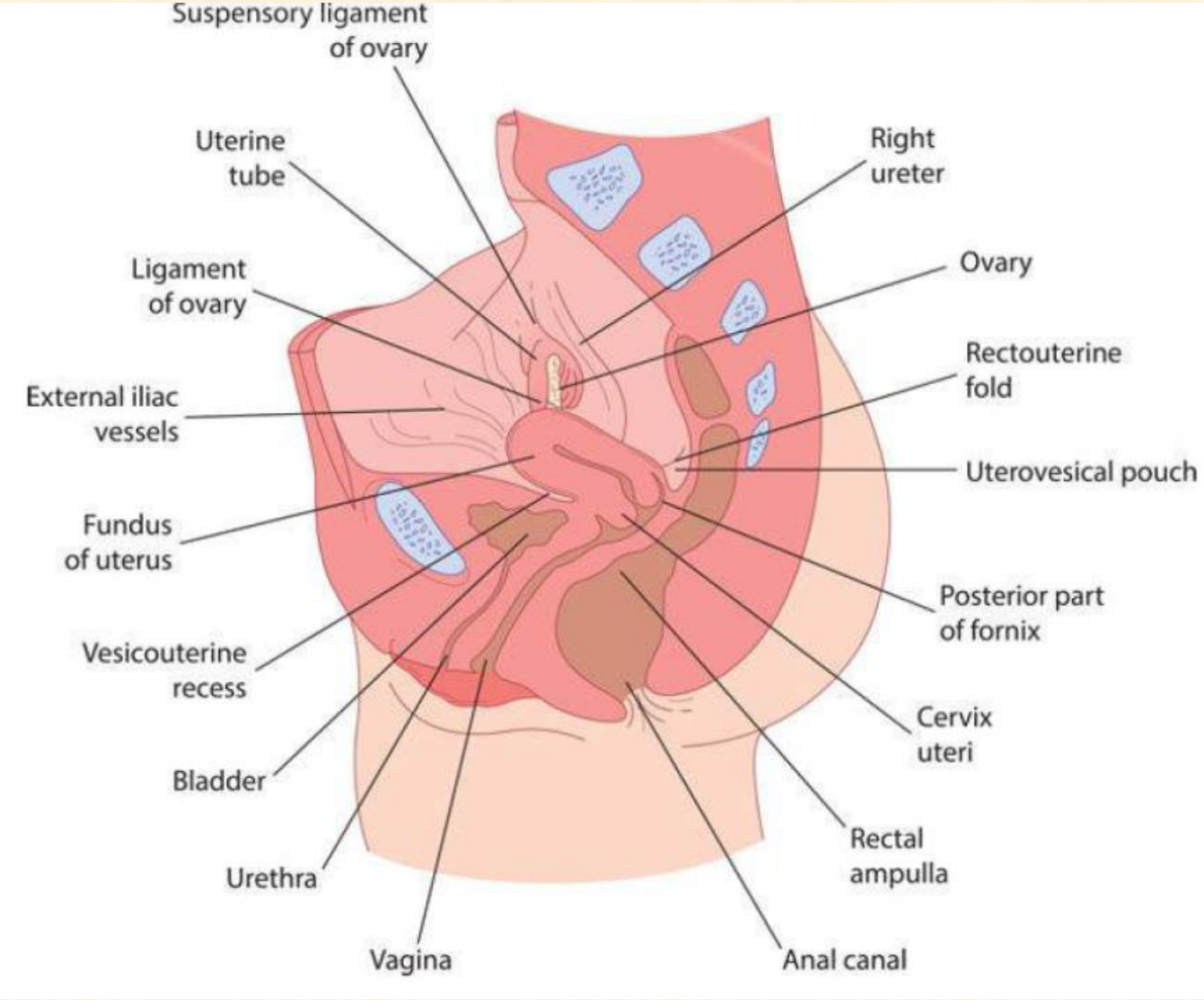


Figure 2.8 Coronal section of the uterine cavity.


Suspensory ligament of ovary
Uterine tube
Right ureter
Ligament of ovary
Ovary
Rectouterine fold
External iliac vessels
Uterovesical pouch
Fundus of uterus
Posterior part of fornix
Vesicouterine recess
Cervix uteri
Bladder
Rectal ampulla
Urethra
Vagina
Anal canal

The cervix

The cervix is narrower than the body of the uterus and is approximately 2.5 cm in length. The ureter runs about 1 cm laterally to the supravaginal cervix within the parametrium. The epithelium of the endocervix is columnar and is also ciliated in its upper two-thirds. This changes to stratified squamous epithelium around the region of the external os and the junction of these two types of epithelium is called the ‘squamocolumnar junction’

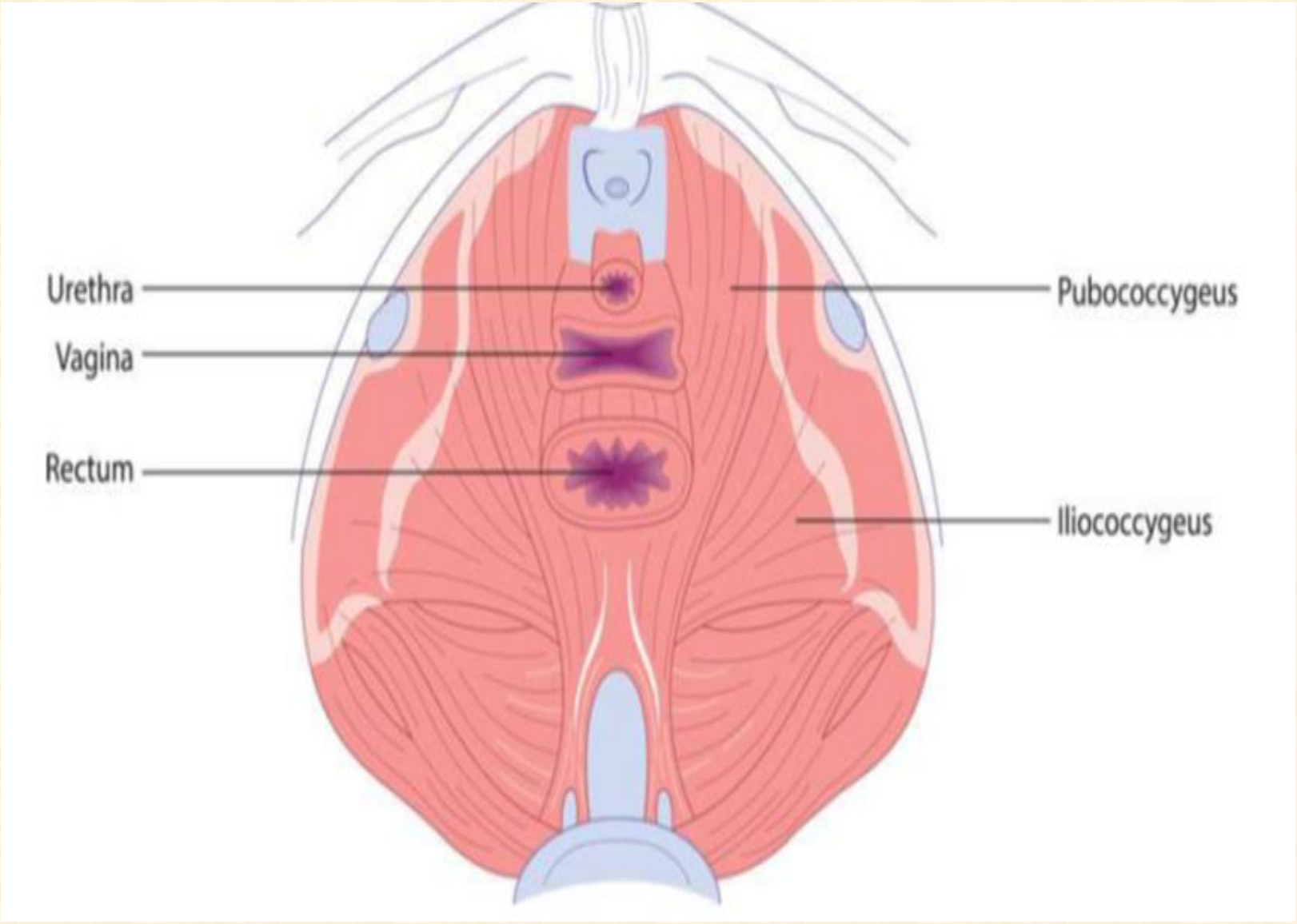
Fallopian tubes

The Fallopian tube extends outwards from the uterine cornu to end near the ovary. At the abdominal ostium, the tube opens into the peritoneal cavity, which is therefore in communication with the exterior of the body via the uterus and the vagina. This is essential to allow the sperm and egg to meet.

- The interstitial portion.
- The isthmus.
- The ampulla.
- The infundibulum or fimbrial portion.

The ureter

As the ureter crosses the pelvic brim, it lies in front of the bifurcation of the common iliac artery. It runs downwards and forwards on the lateral wall of the pelvis to reach the pelvic floor and then passes inwards and forwards attached to the peritoneum of the back of the broad ligament to pass beneath the uterine artery. It next passes forward through a fibrous tunnel, the ureteric canal, in the upper part of the cardinal ligament. Finally, it runs close to the lateral vaginal fornix to enter the trigone of the bladder.


Urethra
Vagina
Rectum
Pubococcygeus
Iliococcygeus

Age changes

1- **the vulva**

Before puberty —the skin devoid from the hair

After menopause-the skin atrophied and become thinner

2- **the vagina**

Before puberty and after menopause the estrogen level is low so there is low glycogen, the vaginal wall epithelium is atrophy and has high PH.

After menopause the vaginal wall atrophied and shrinkage

3- **the uterus**

The disappearance of maternal osterogen à the Uterus decrease size by around 1/3 and in weight by 1/2 and the cervix is then twice length of the uterus

After menopause the uterus atrophies and the mucosa become very thin the gland almost disappear and the wall less muscular.

Arteries supplying the pelvic organs

Because the ovary develops on the posterior abdominal wall and later migrates down into the pelvis, it carries its blood supply with it directly from the abdominal aorta.

- The artery divides into branches that supply the ovary and tube anastamose with the terminal branches of the uterine artery.

The internal iliac (hypogastic) artery

all from the anterior division and are as follows:

• The uterine artery provides the main blood supply to the uterus,

, ureter , cervix and upper vagina.

• The vaginal artery.

• The vesical arteries

• The middle rectal artery

• The pudendal artery

The pelvic veins

Venous drainage from the uterine, vaginal and vesical plexus is chiefly into the internal iliac veins.

The ovarian veins on each side begin in the pampiniform plexus, ending in the inferior vena cava and that on the left in the left renal vein.

Lymphatic drainage

1- from the vulva +perineum---superficial inguinal lymph node + femoral lymph node

2- vagina :

Lower 1/3....superficial inguinal L.N

Upper 2/3 ...internal +external iliac L.N

3- Cervix ---Obturator + internal & external iliac + common iliac L.N. & lower paraAortic L.N.

4- uterus--- internal ,external iliac + common iliac L.N + paraAortic L.N

5- Ovary +fallopian tube --- paraAortic L.N.

6- Bladder +urethra ---iliac L.N.

Nerve supply of the vulva and perineum

The pudendal nerve arises from the second, third and fourth sacral nerves. it gives off an inferior rectal branch and divides into the perineal nerve and dorsal nerve of the clitoris. The perineal nerve gives the sensory supply to the vulva and also innervates the anterior part of the external anal canal and the levator ani and the superficial perineal muscles. The dorsal nerve of the clitoris is sensory. Sensory fibres from the mons and labia also pass in the ilioinguinal and genitofemoral nerves to the first lumbar root. The posterior femoral cutaneous nerve carries sensation from the perineum to the first, second and third sacral nerves.

Thank you