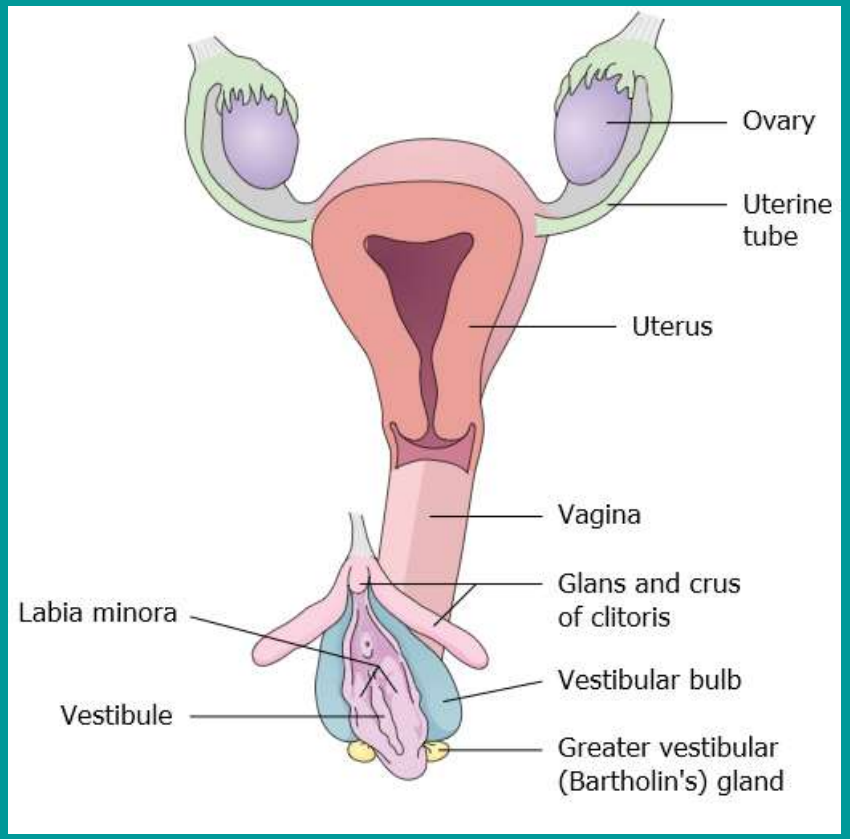


Female genital system

Miloš Grim
Institute of Anatomy, First Faculty of Medicine,
Summer semester 2017 / 2018

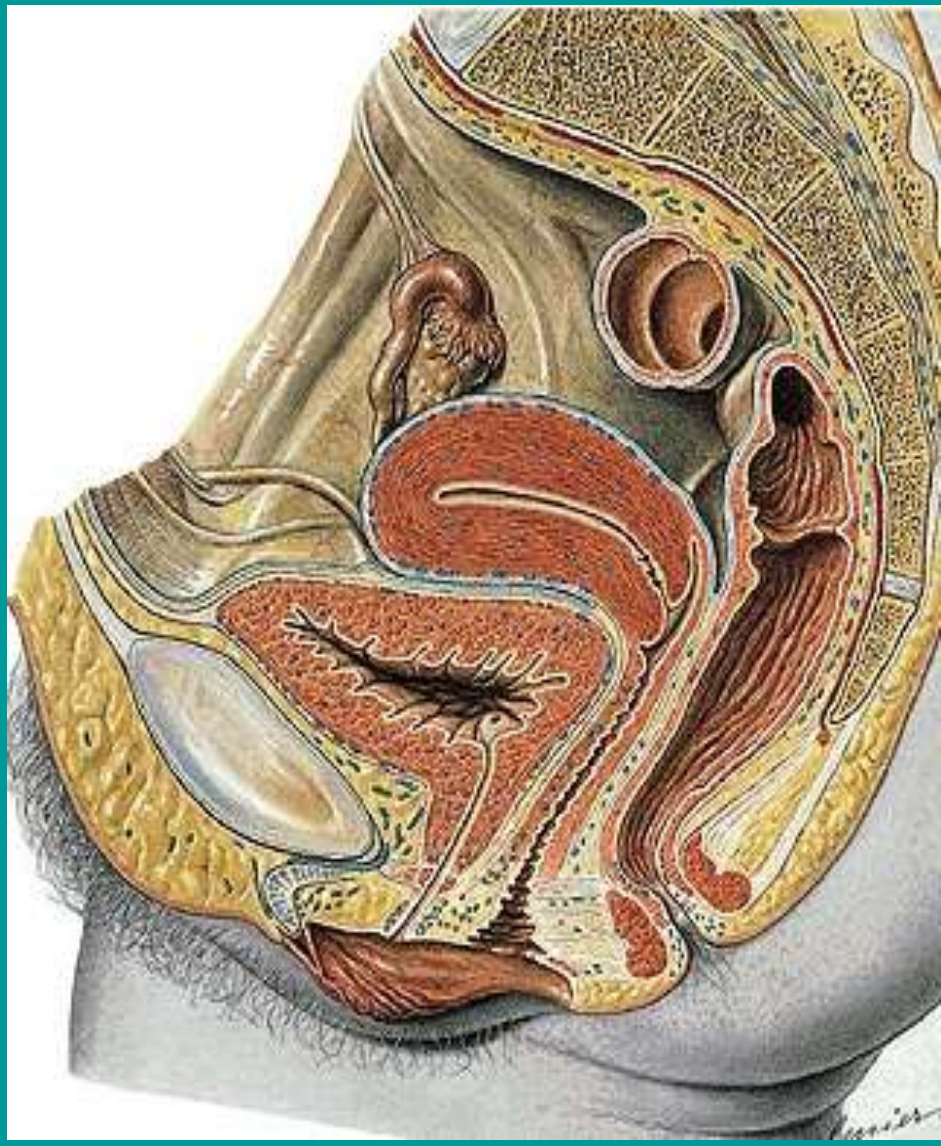
Female genital system

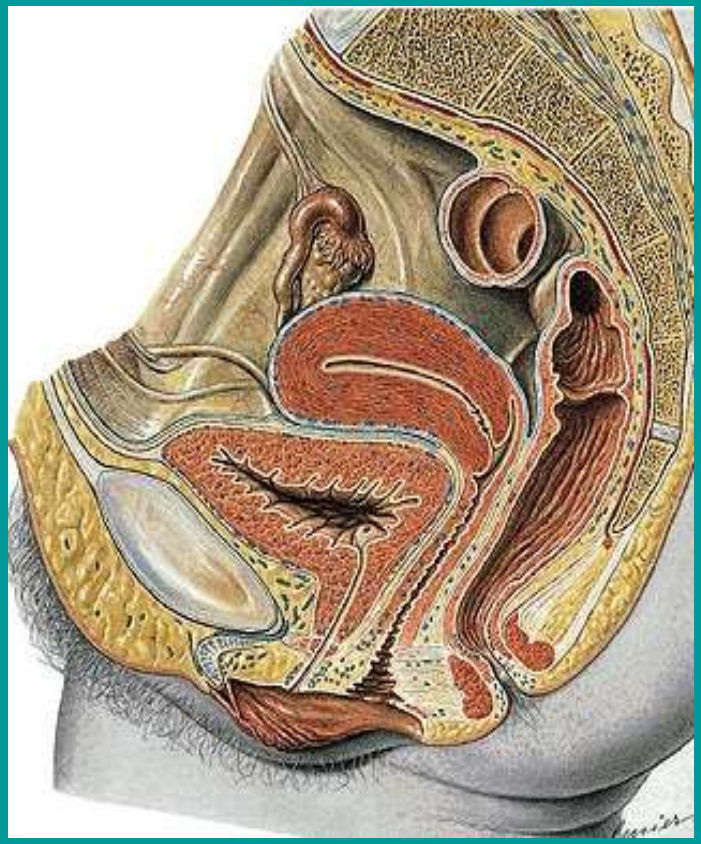
Internal genital organs

Ovary, Uterine tube- Salpinx, Fallopian tube, Uterus - Metra, Hystera, Vagina, colpos

External genital organs

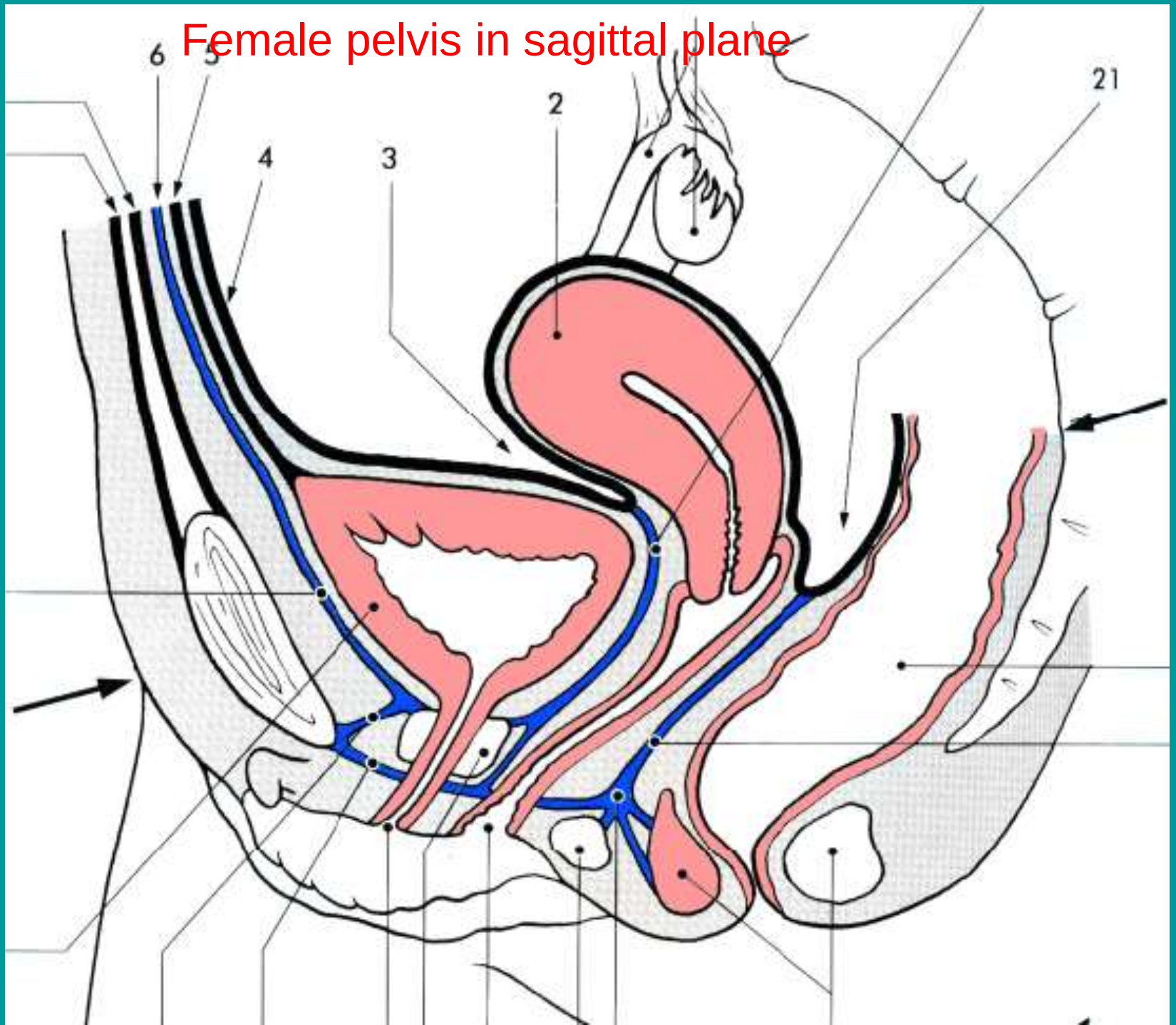
Pudendum- vulva, cunnus
Mons pubis
Labium majus
Pudendal cleft
Labium minus
Vestibule
Bulb of vestibule
Clitoris

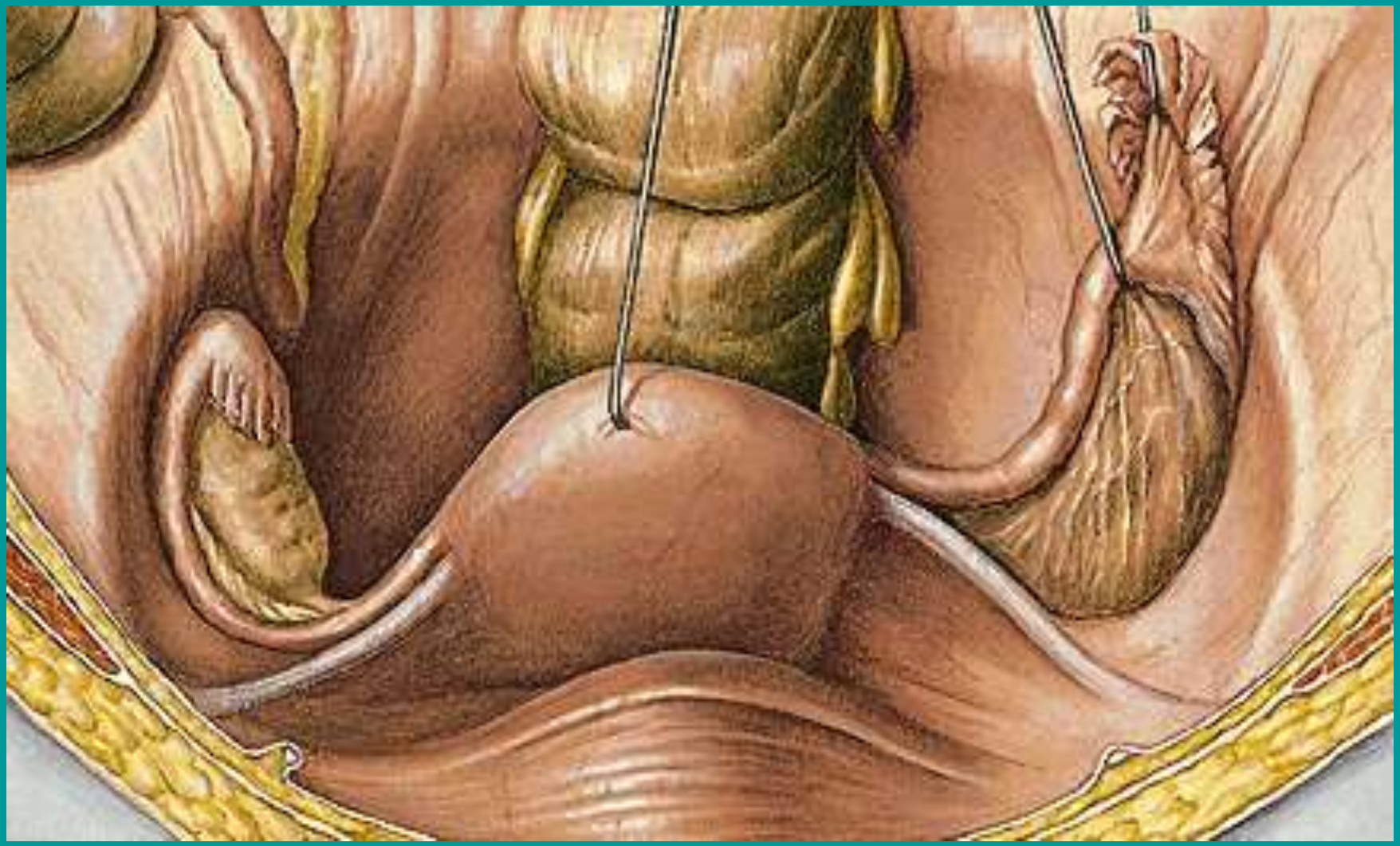




MRI of female pelvis in sagittal plane

Female pelvis in sagittal plane

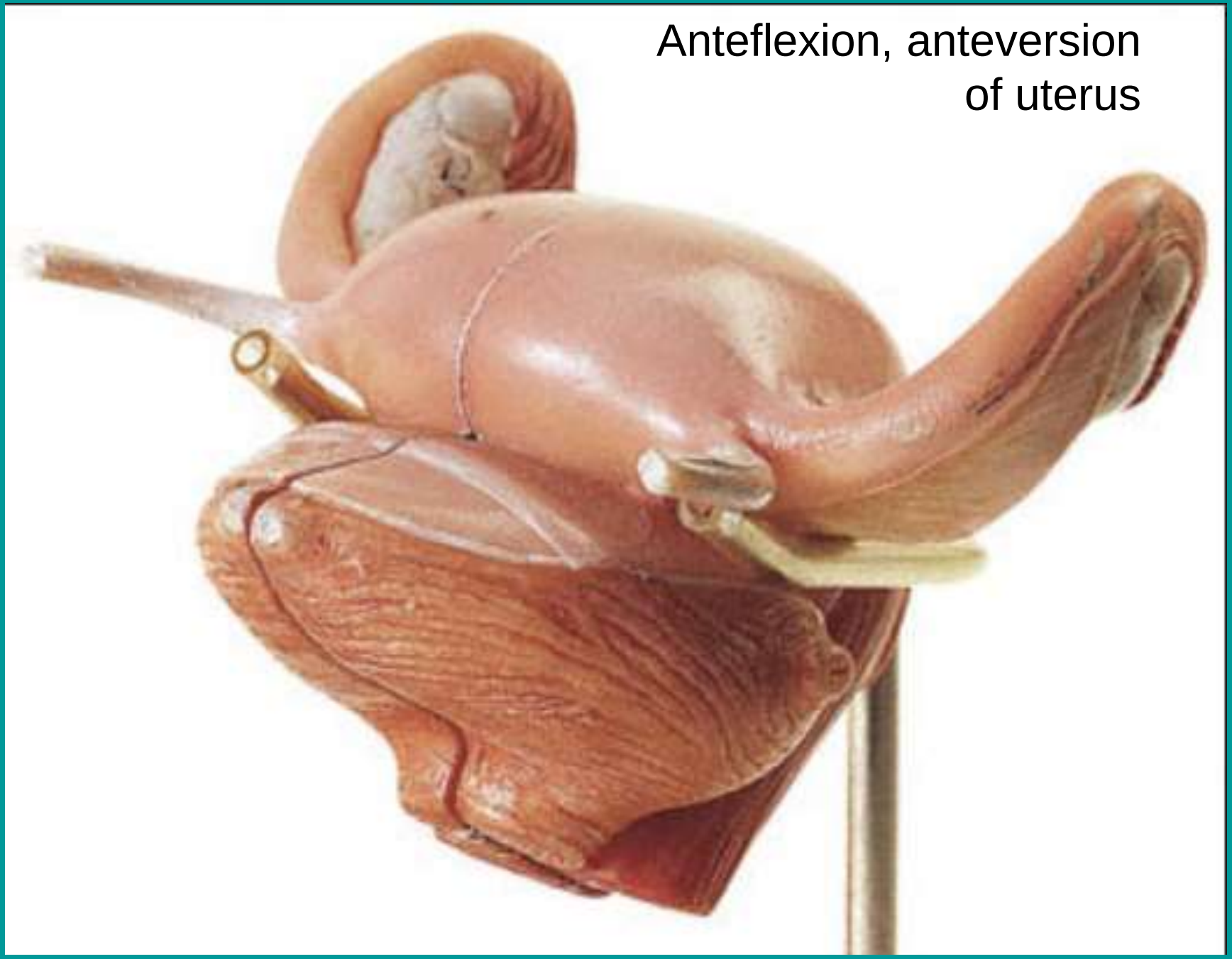




Internal genital organs of female genital system

Ovary, Uterine tube, Uterus, Broad ligament of uterus, Round lig. of uterus

Anteflexion, anteversion
of uterus



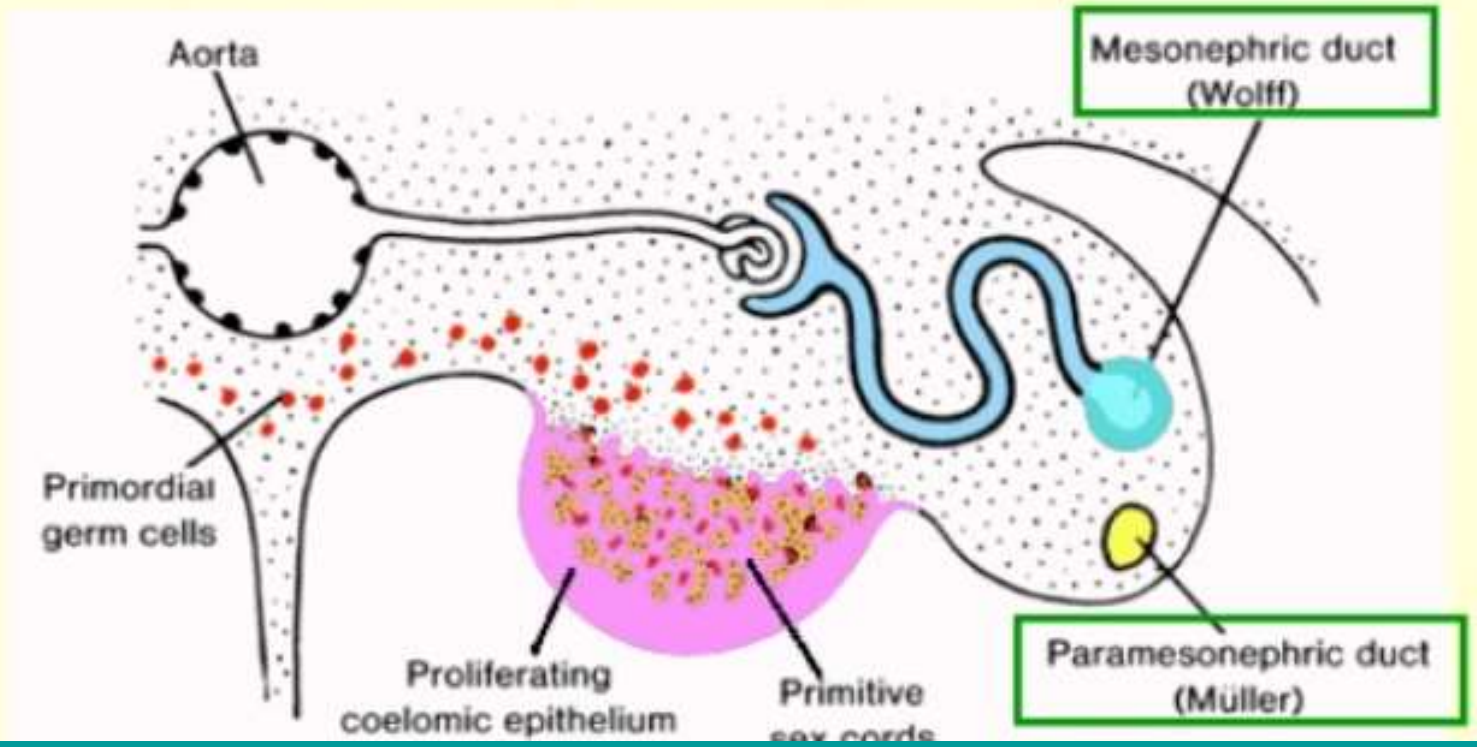
Development of reproductive passages

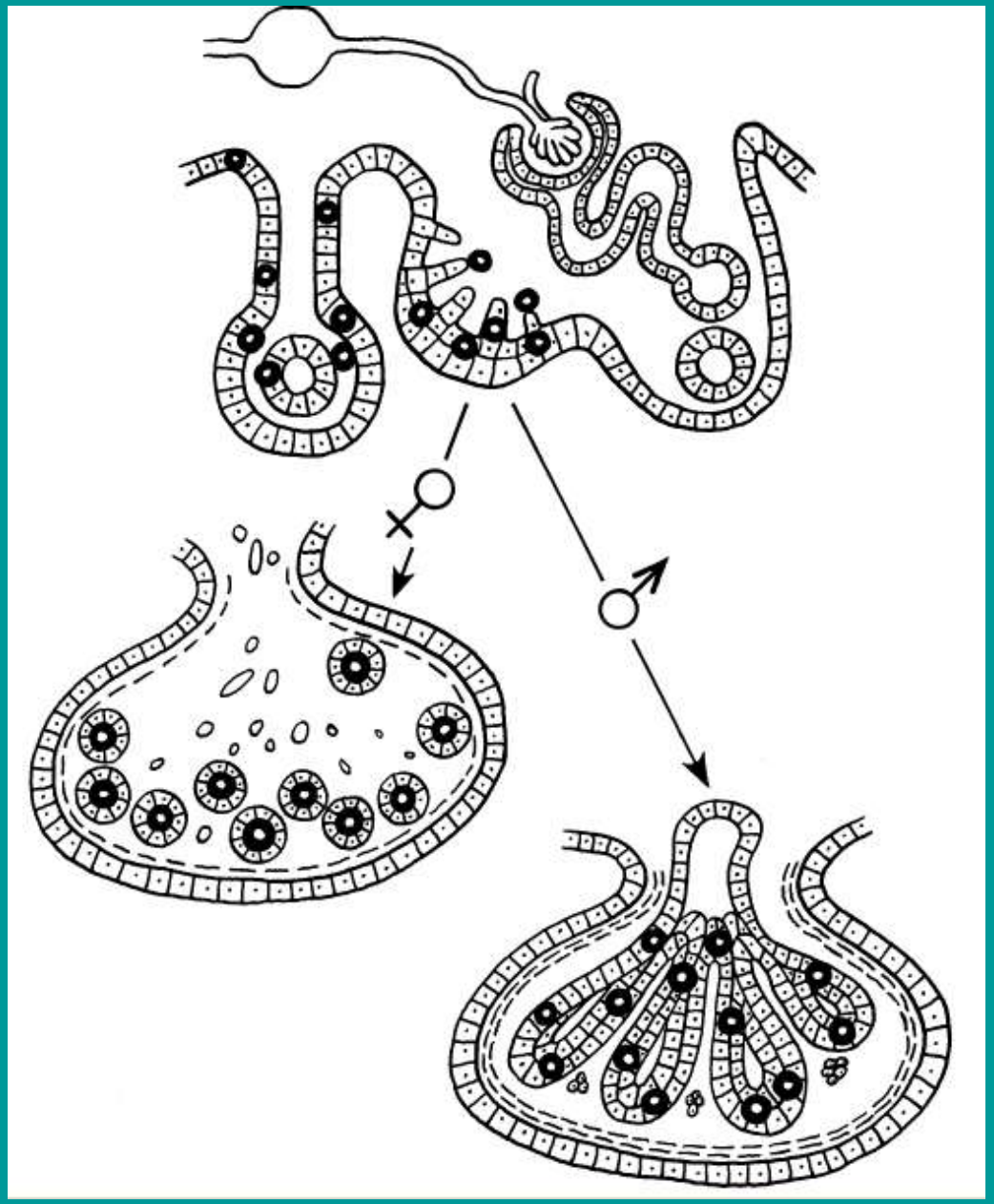
Transverse section through the lumbar region of a 6-week embryo, colonization of primitive gonade by primordial germ cells

- Plica urogenitalis (urogenital ridge) – 2 ducts:

Ductus mesonephricus (Wolffi)

Ductus paramesonephricus (Mülleri)

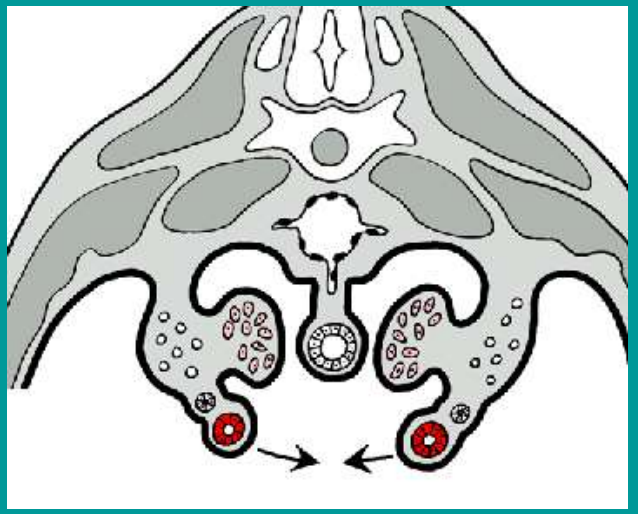


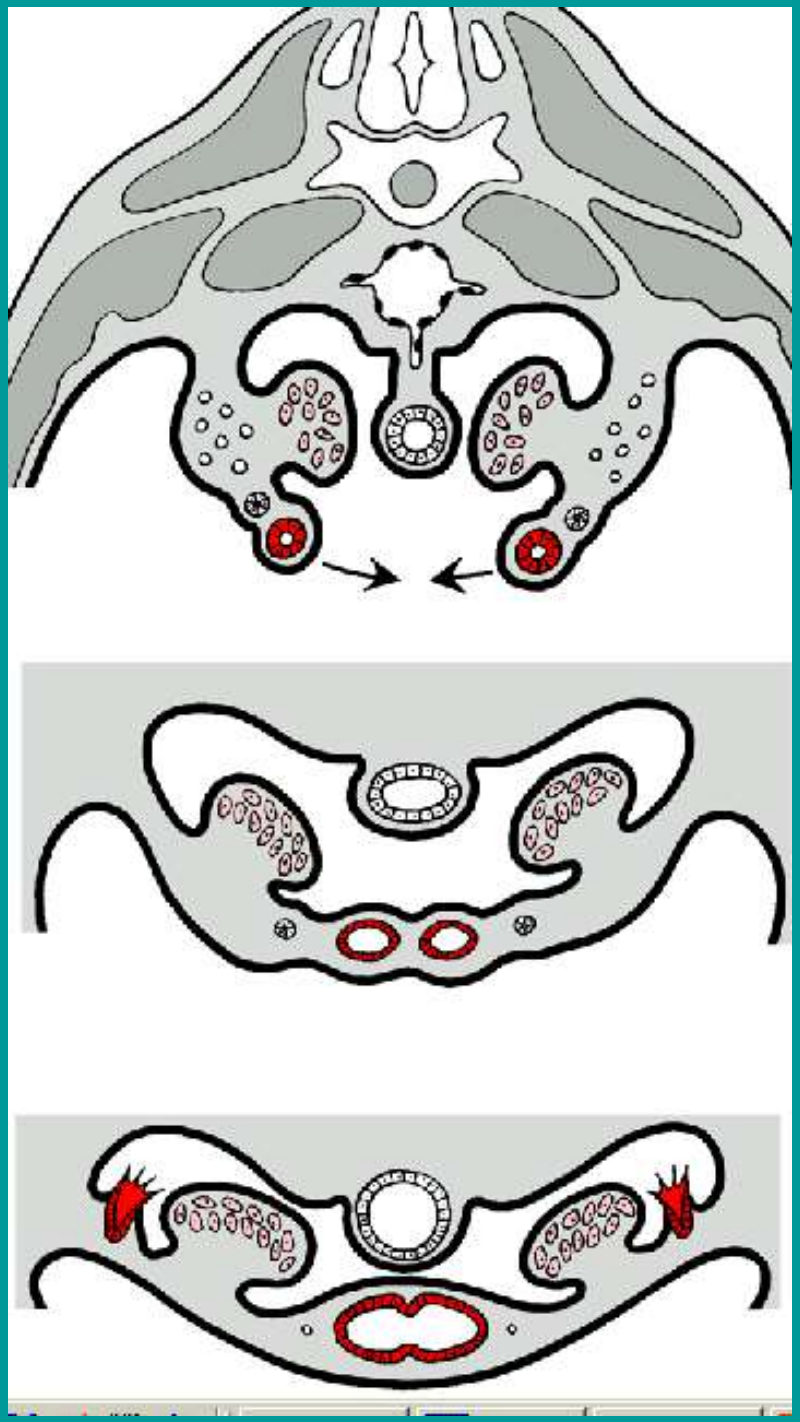


Primordial germ cells migrate into gonads from the yolk sac

Differentiation of indifferent gonads into ovary and testis

Ovary: ovarian follicles
Testis: seminiferous tubules, tunica albuginea

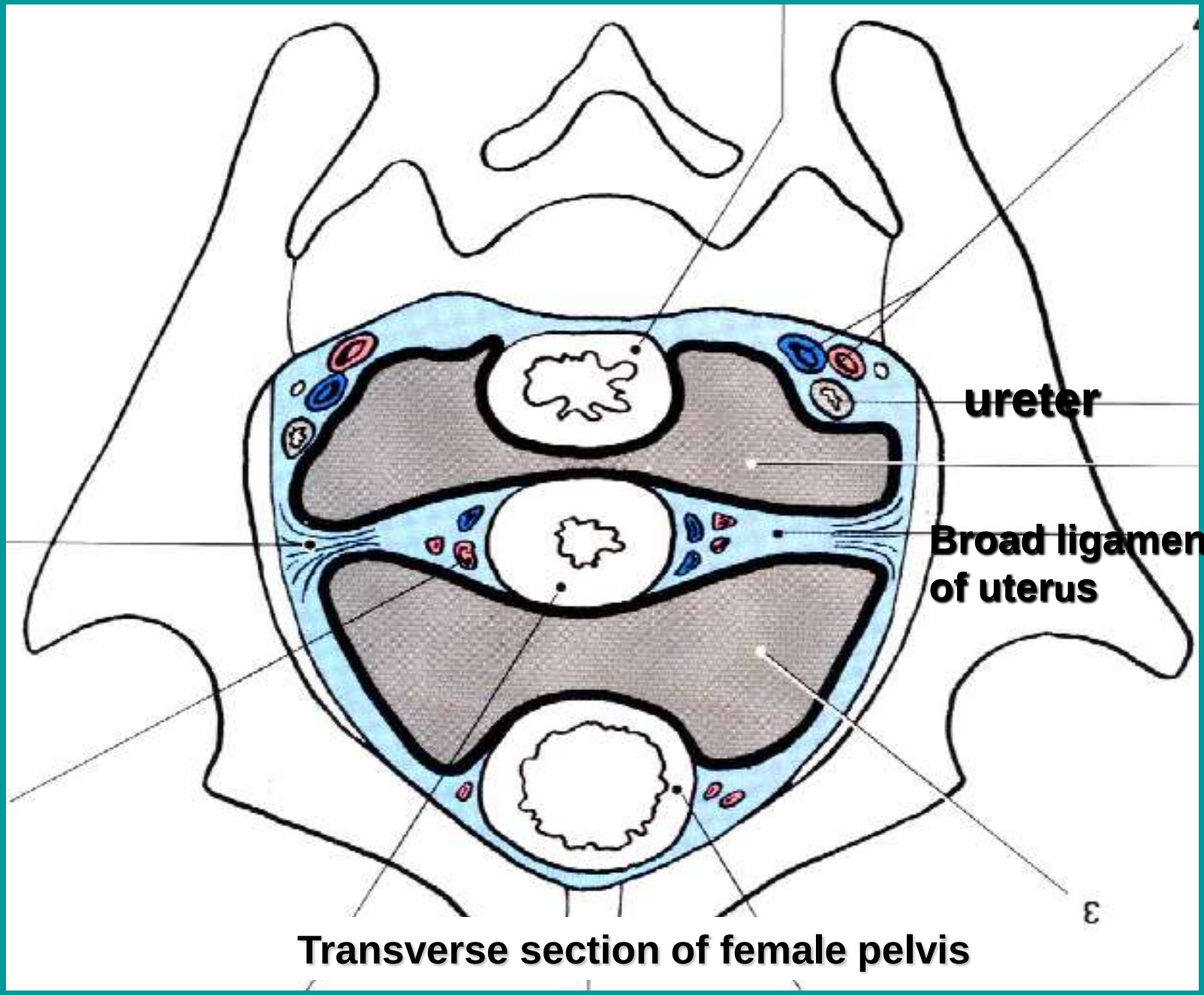




Development of broad ligament of uterus from urogenital ridge

Development of uterine tube, uterus and part of vagina from paramesonephric (Mullerian) duct

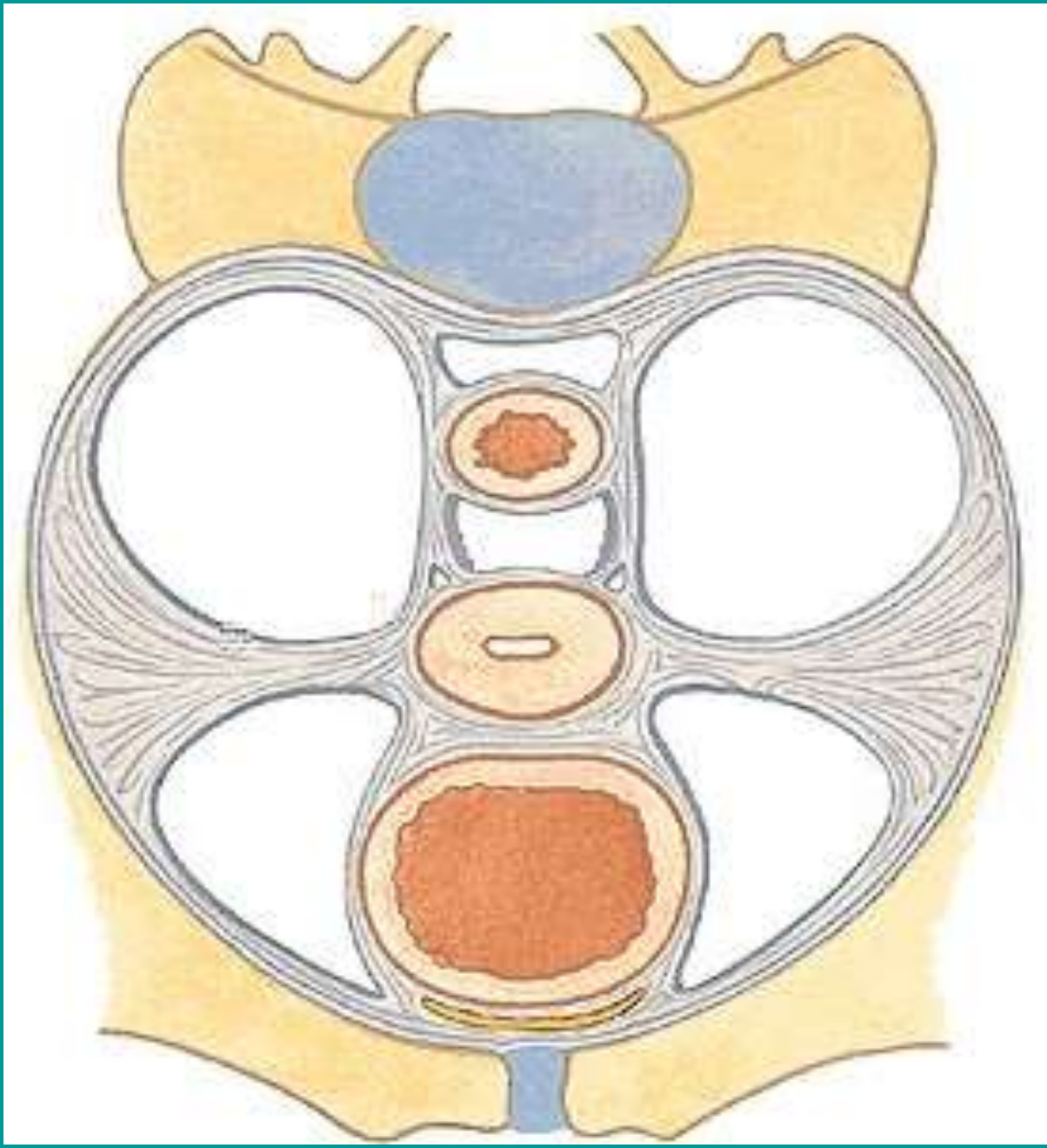
Development of position of female internal genital organs,

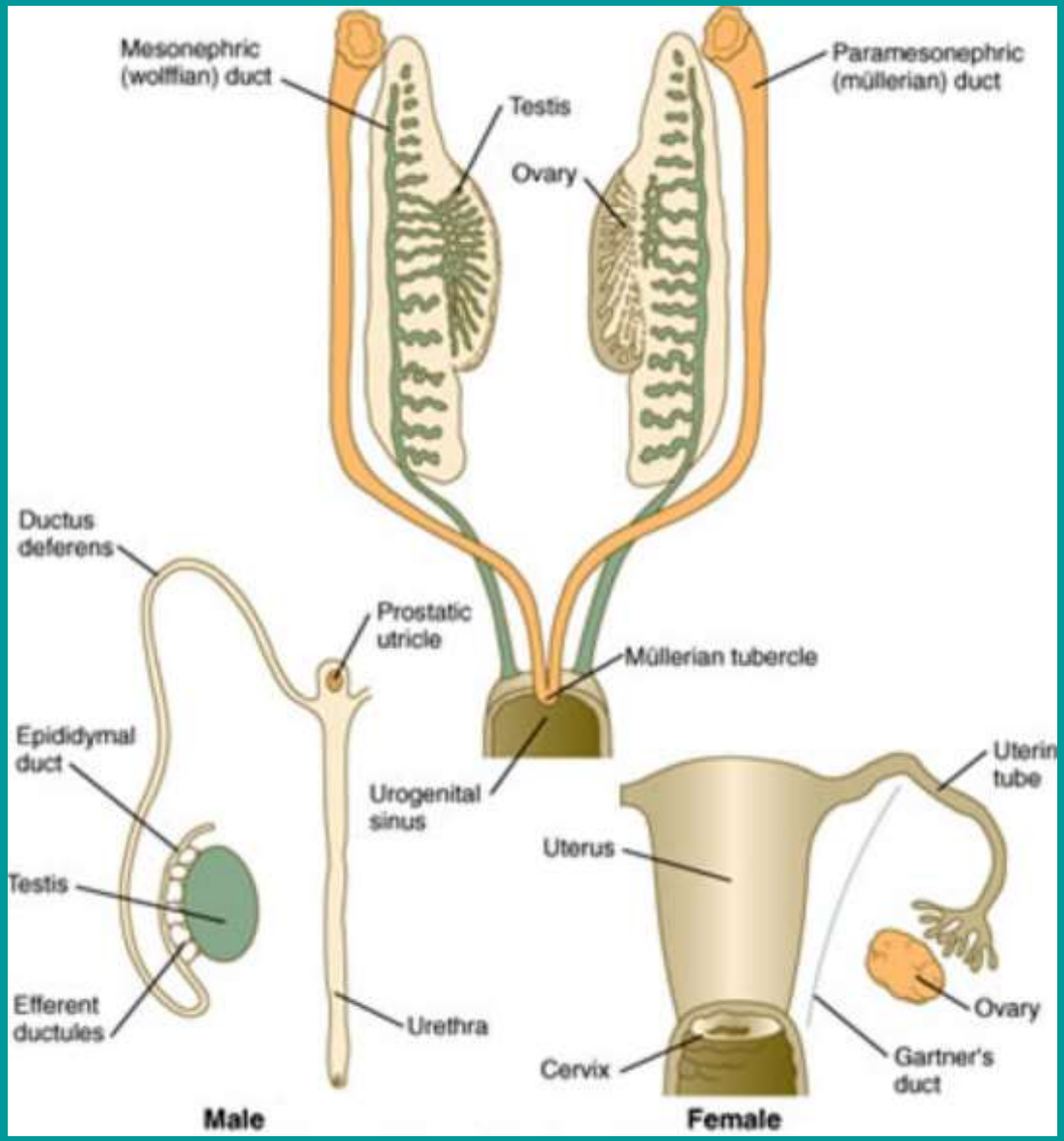


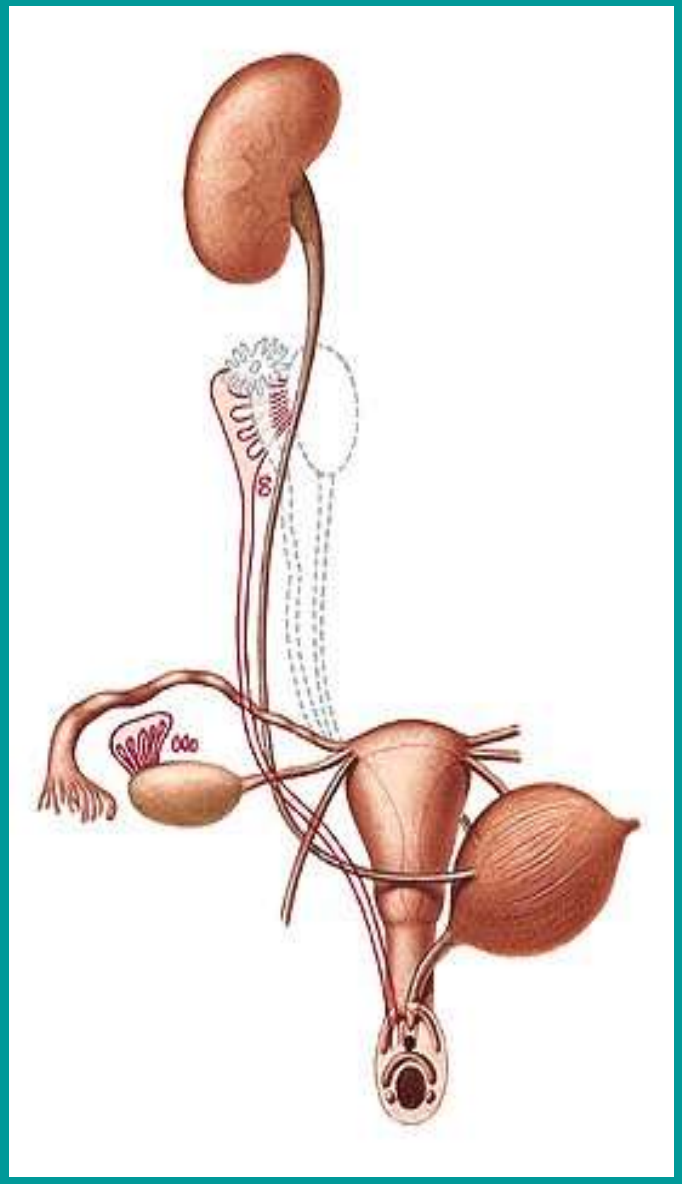
Transverse section of female pelvis

Parametrium

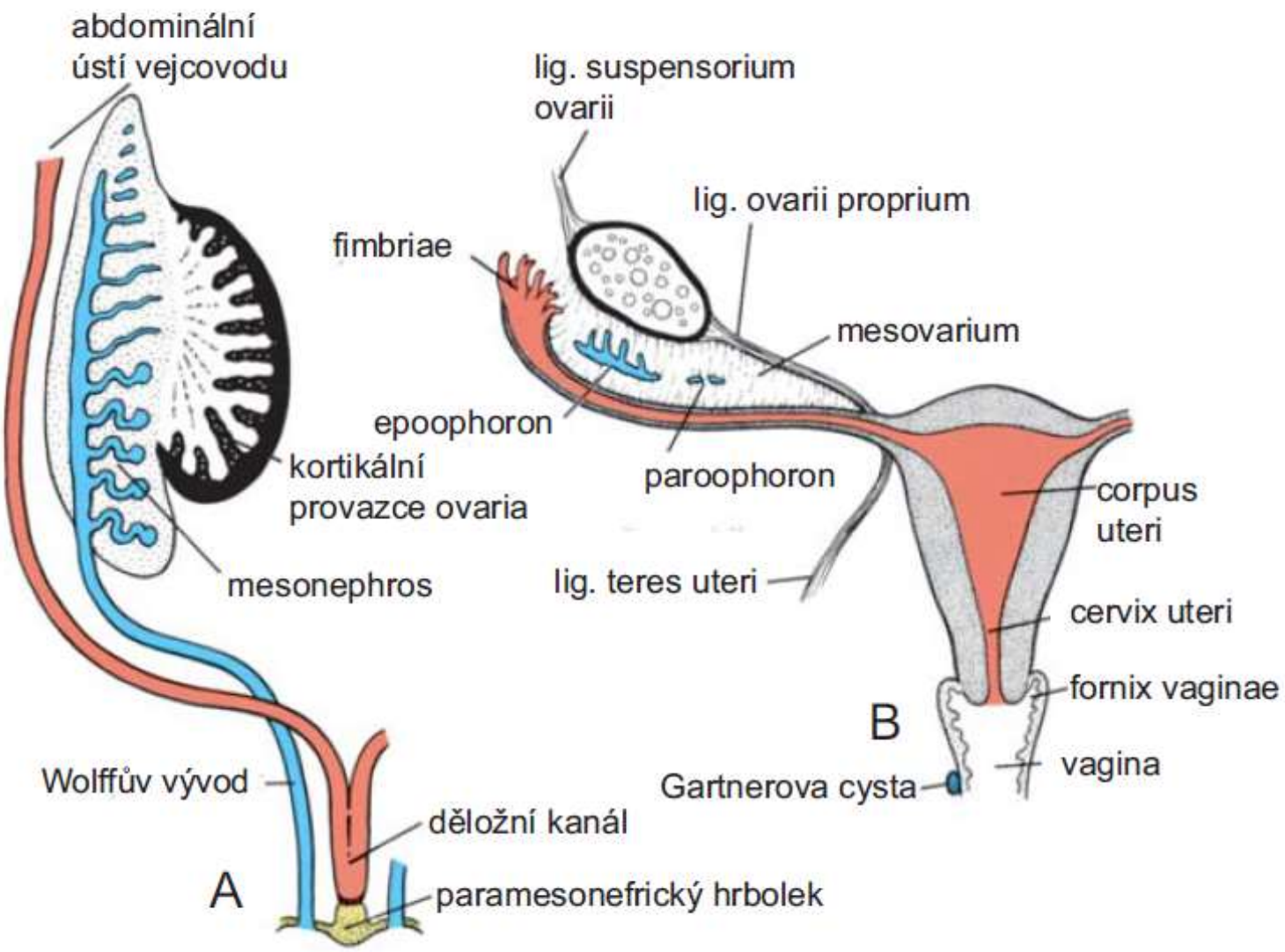
Supporting apparatus of uterus,
cardinal lig.
(broad ligament)
round ligament
pubocervical lig.
recto-uterine lig.

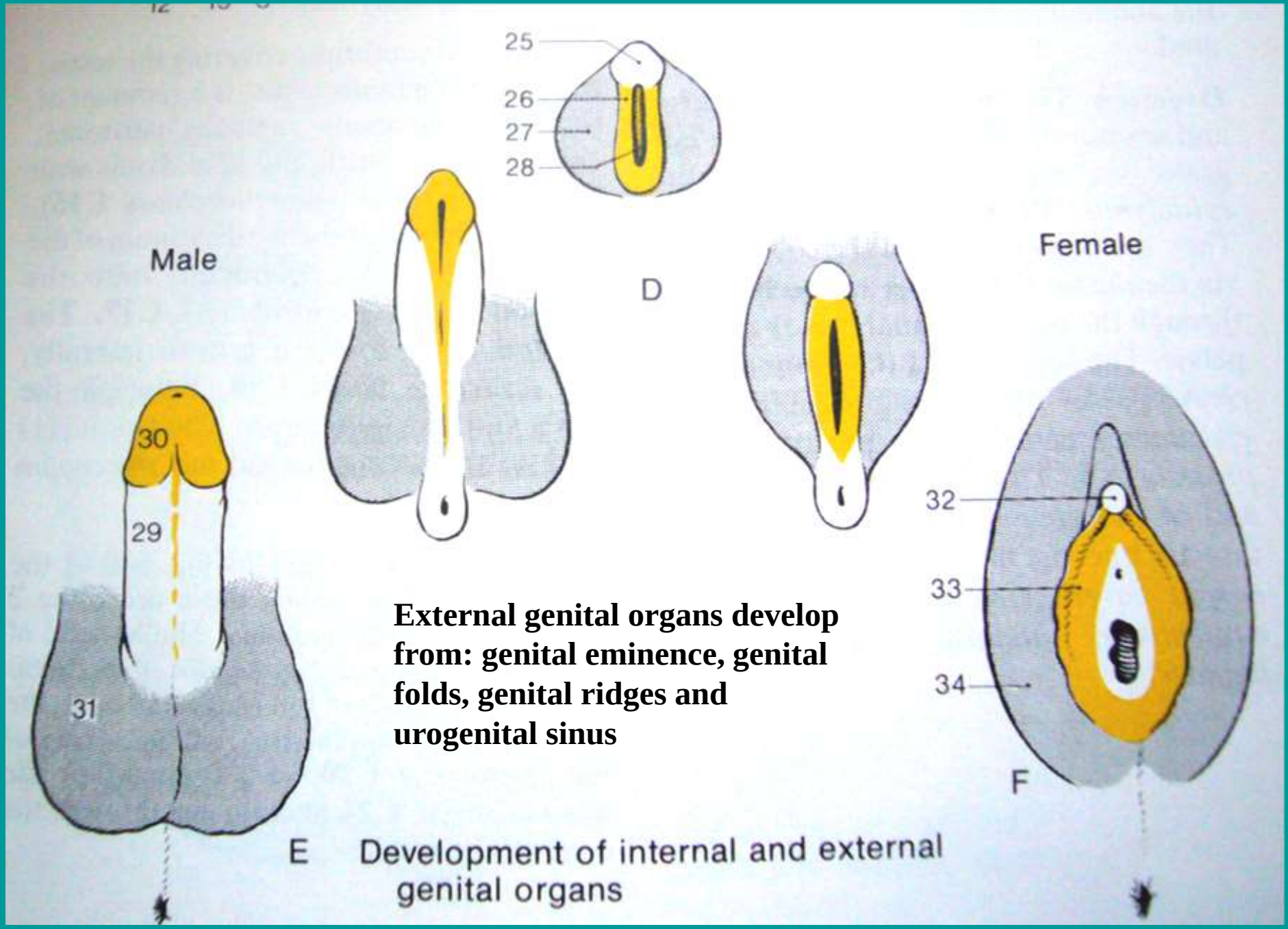




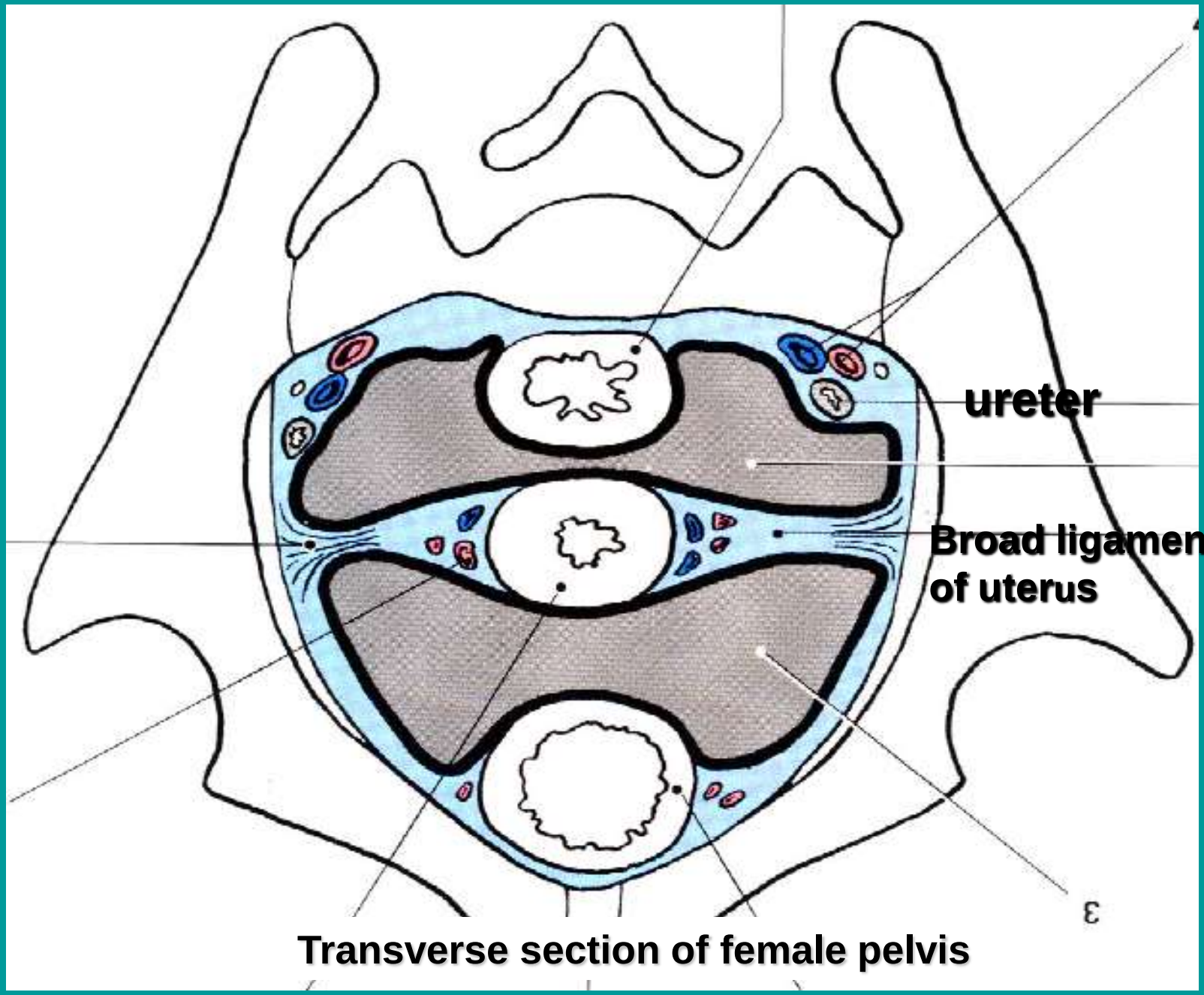


Descent of ovary. Development of uterine tube , uterus and part of vagina from paramesonephric (Mullerian) duct

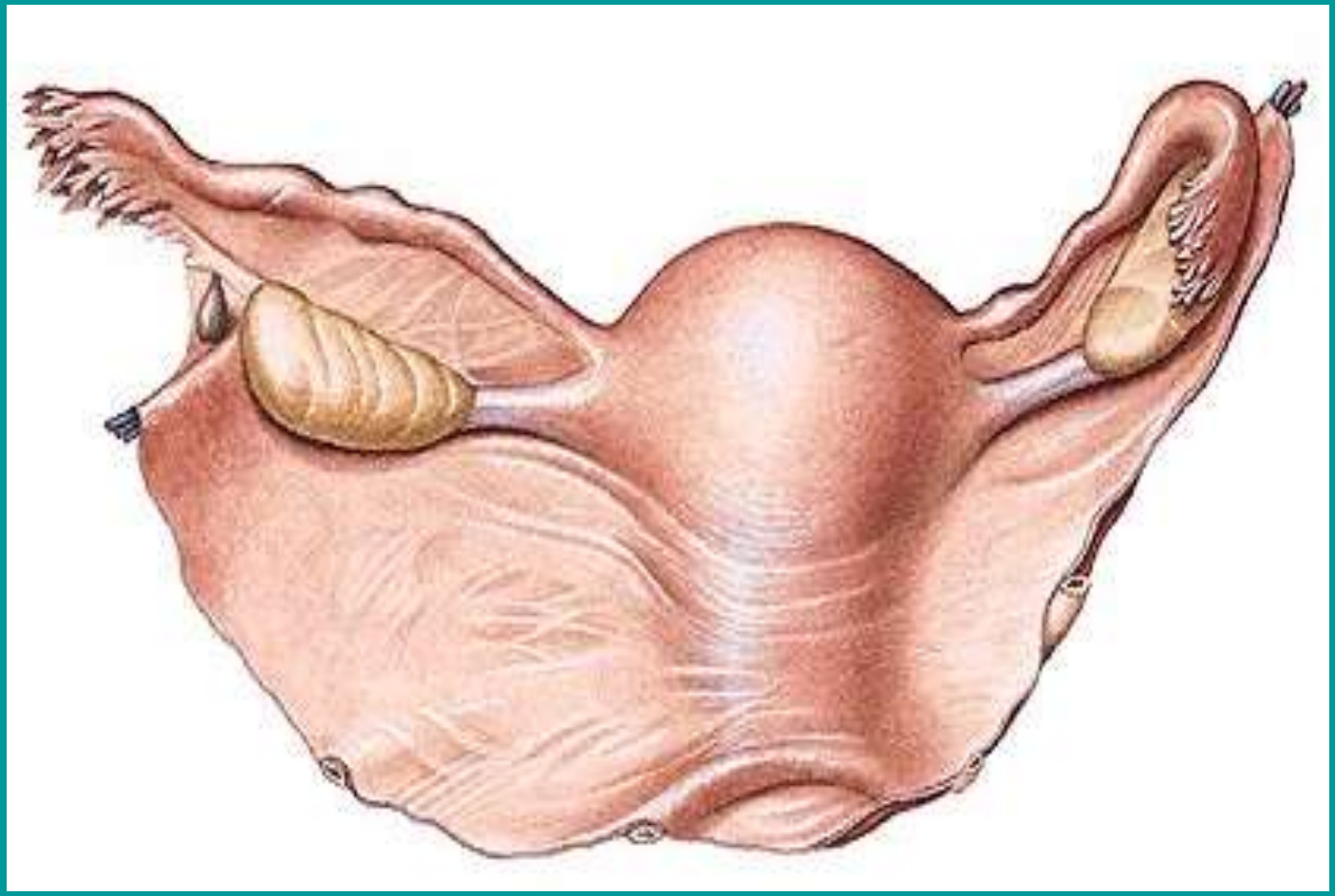

abdominální
ústí vejcovodu
lig. suspensorium
ovarii
lig. ovarii proprium
fimbriae
mesovarium
epoophoron
kortikální
provazce ovaria
paroophoron
corpus
uteri
mesonephros
lig. teres uteri
cervix uteri
fornix vaginae
B
vagina
Gartnerova cysta
Wolffův vývod
děložní kanál
A
paramesonefrický hrbolek



External genital organs develop from: genital eminence, genital folds, genital ridges and urogenital sinus



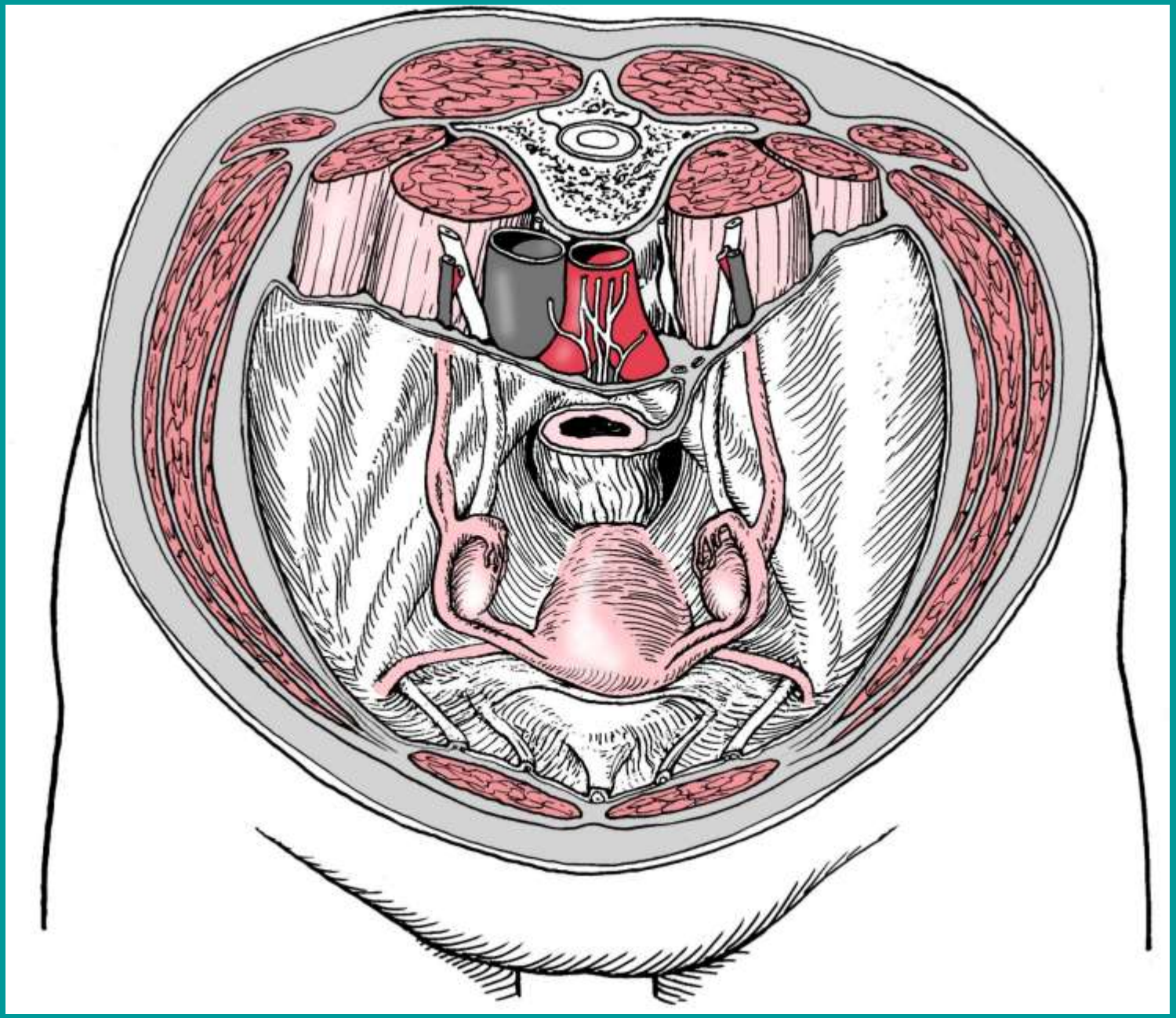
Transverse section of female pelvis



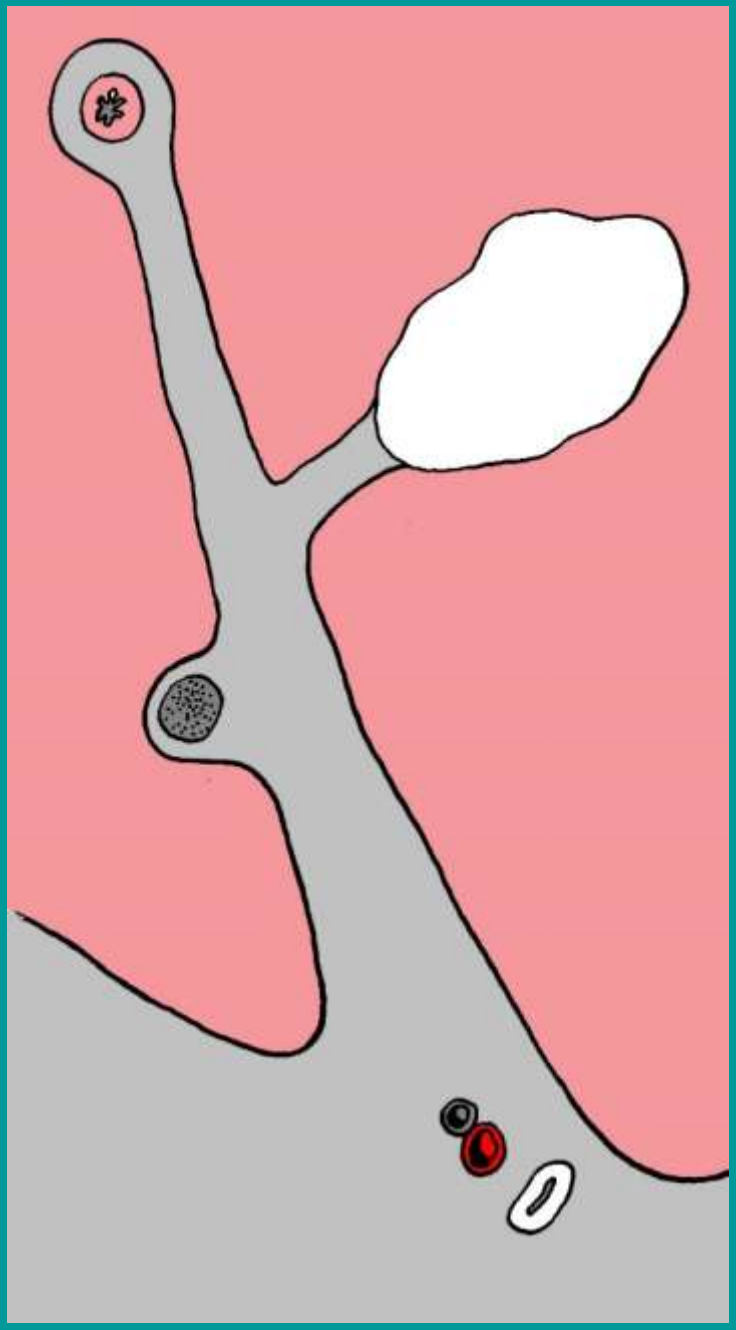
Ovary (posterior view)

Tubal + uterine extremity, Medial + lateral surface
Free + mesovarian border,
Mesovarium, Uteroovaric lig., Suspensory lig. of ovary,
Mesosalpinx, Mesometrium

Ovary, uterine tube, fimbrie of the tube, fundus of uterus



Ovaric fossa between internal nd external iliac artery



Sagittal section of plica lata uteri (broad lig. of uterus)

Ovary - free +
mesovarian border,
Mesovarium,
Uterine tube (salpinx)
Mesosalpinx,
Round lig. of uterus
Mesometrium,
Ureter
Uterine a. +. v.

Ovary

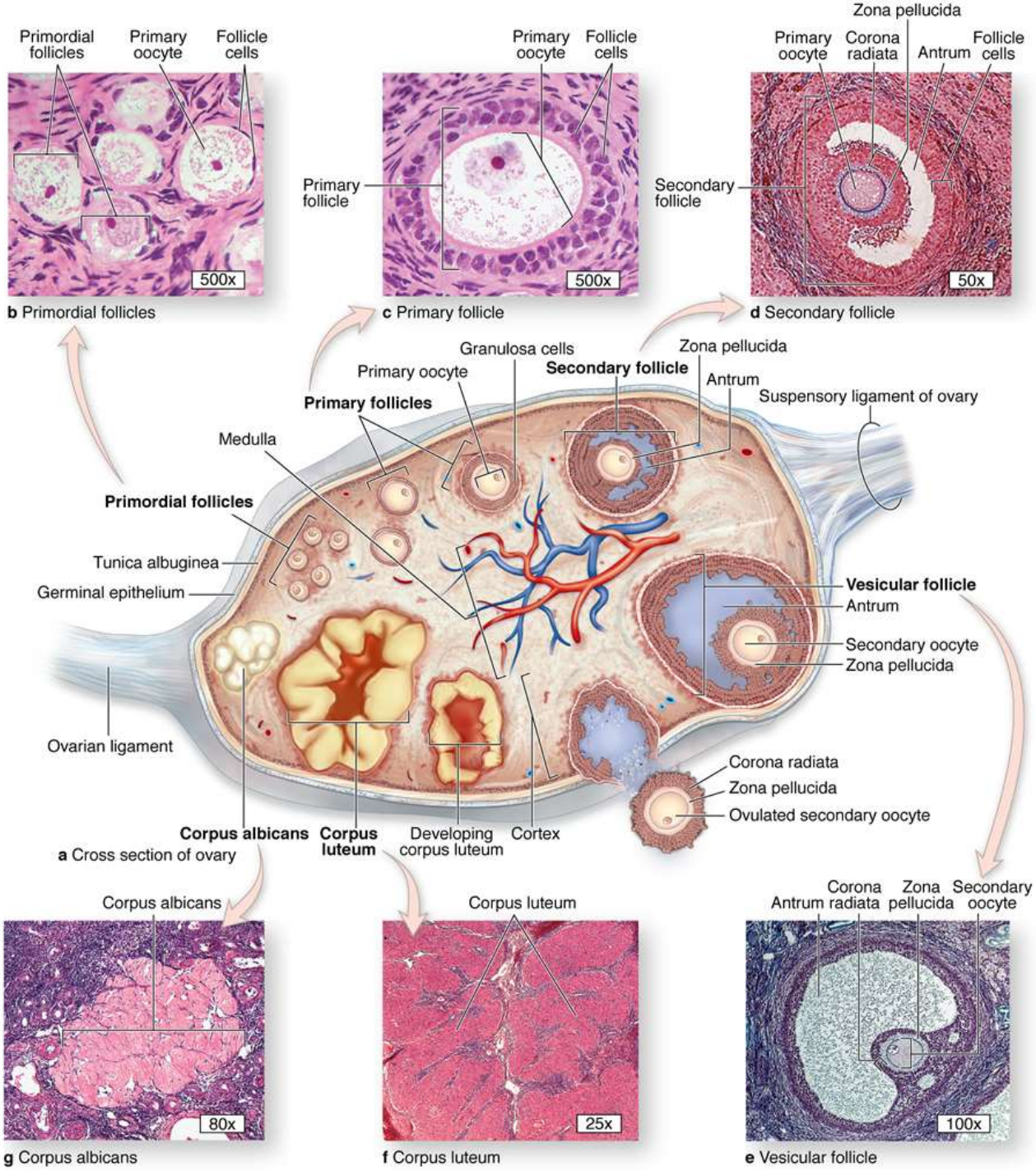
Hilum, Tunica albuginea,
Cortex, Medulla
Ovarian follicle: primordial, primary, secondary, tertiary (vesicular, Graafian)

Oogenesis:
Mutiplication, maturation

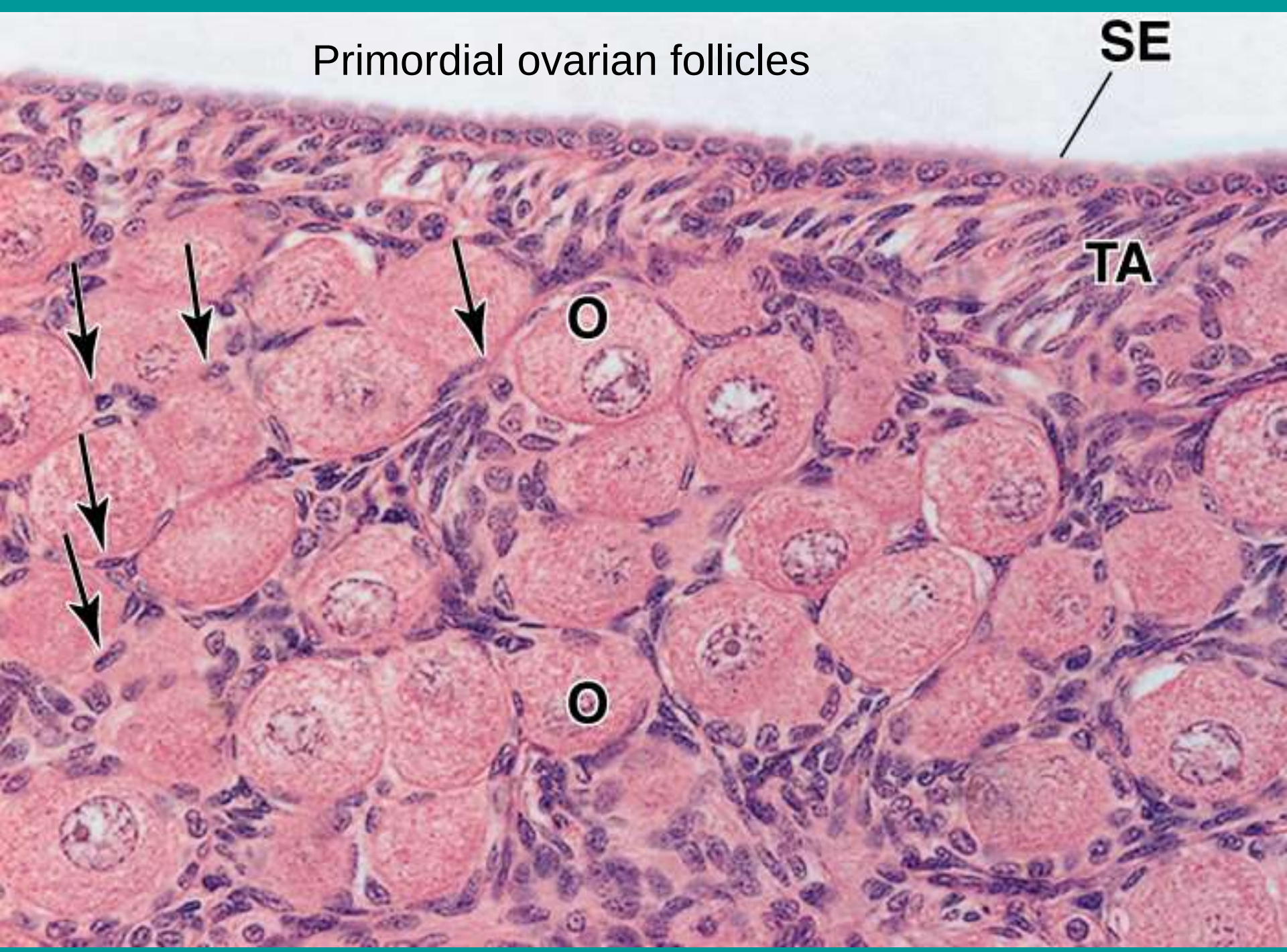
Ovulation

Sex hormones production:
Estrogenes in cells of theca interna of the growing follicle

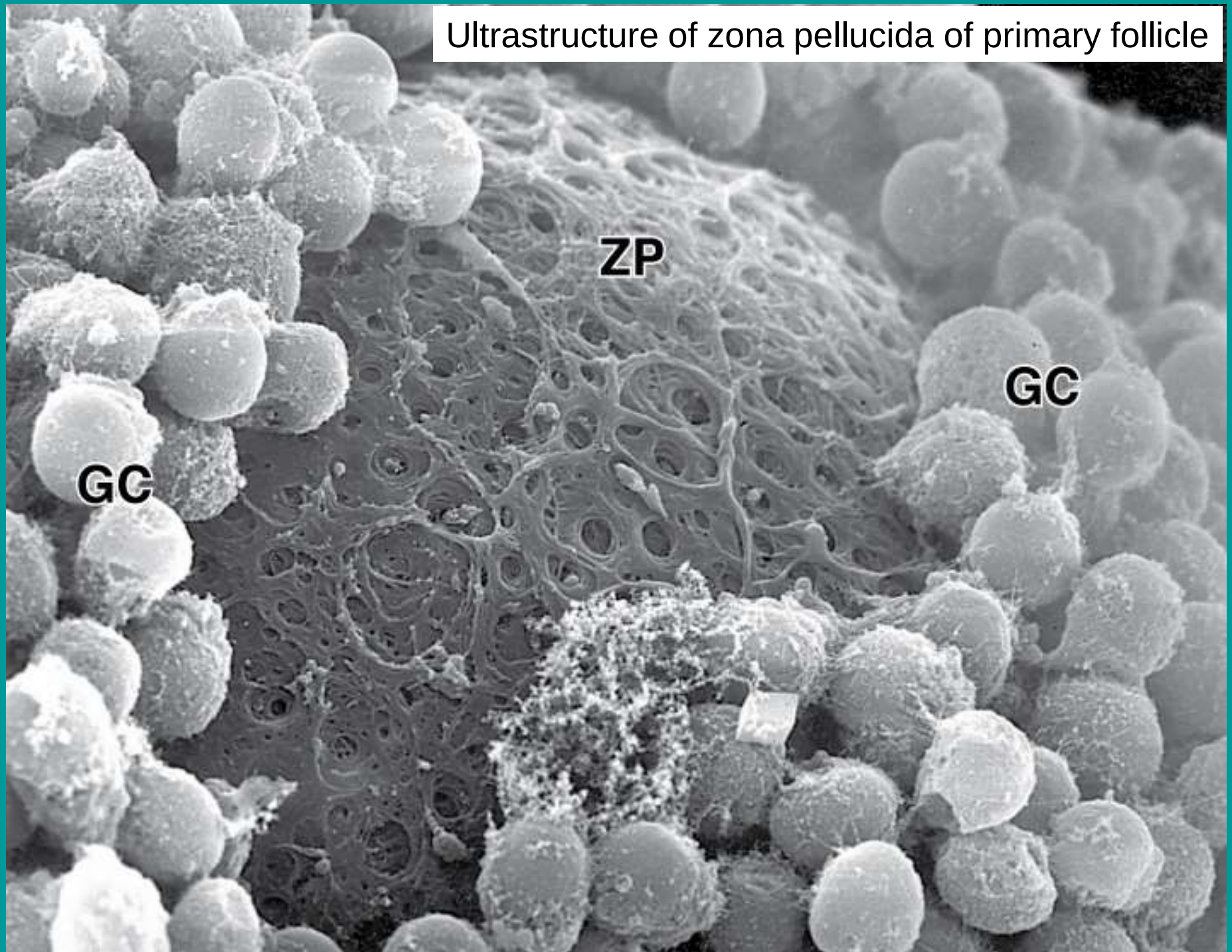
Progesteron in corpus luteum,


Primordial follicles
Primary oocyte
Follicle cells
500x
b Primordial follicles
Primary follicle
Primary oocyte
Follicle cells
500x
c Primary follicle
Zona pellucida
Primary oocyte
Corona radiata
Antrum
Follicle cells
Secondary follicle
50x
d Secondary follicle
Granulosa cells
Primary oocyte
Secondary follicle
Zona pellucida
Antrum
Suspensory ligament of ovary
Primary follicles
Medulla
Primordial follicles
Tunica albuginea
Germinal epithelium
Vesicular follicle
Antrum
Secondary oocyte
Zona pellucida
Ovarian ligament
Corona radiata
Zona pellucida
Ovulated secondary oocyte
Corpus albicans
Corpus luteum
Developing corpus luteum
Cortex
a Cross section of ovary
Corpus albicans
80x
g Corpus albicans
Corpus luteum
25x
f Corpus luteum
Corona radiata
Antrum
Zona pellucida
Secondary oocyte
100x
e Vesicular follicle

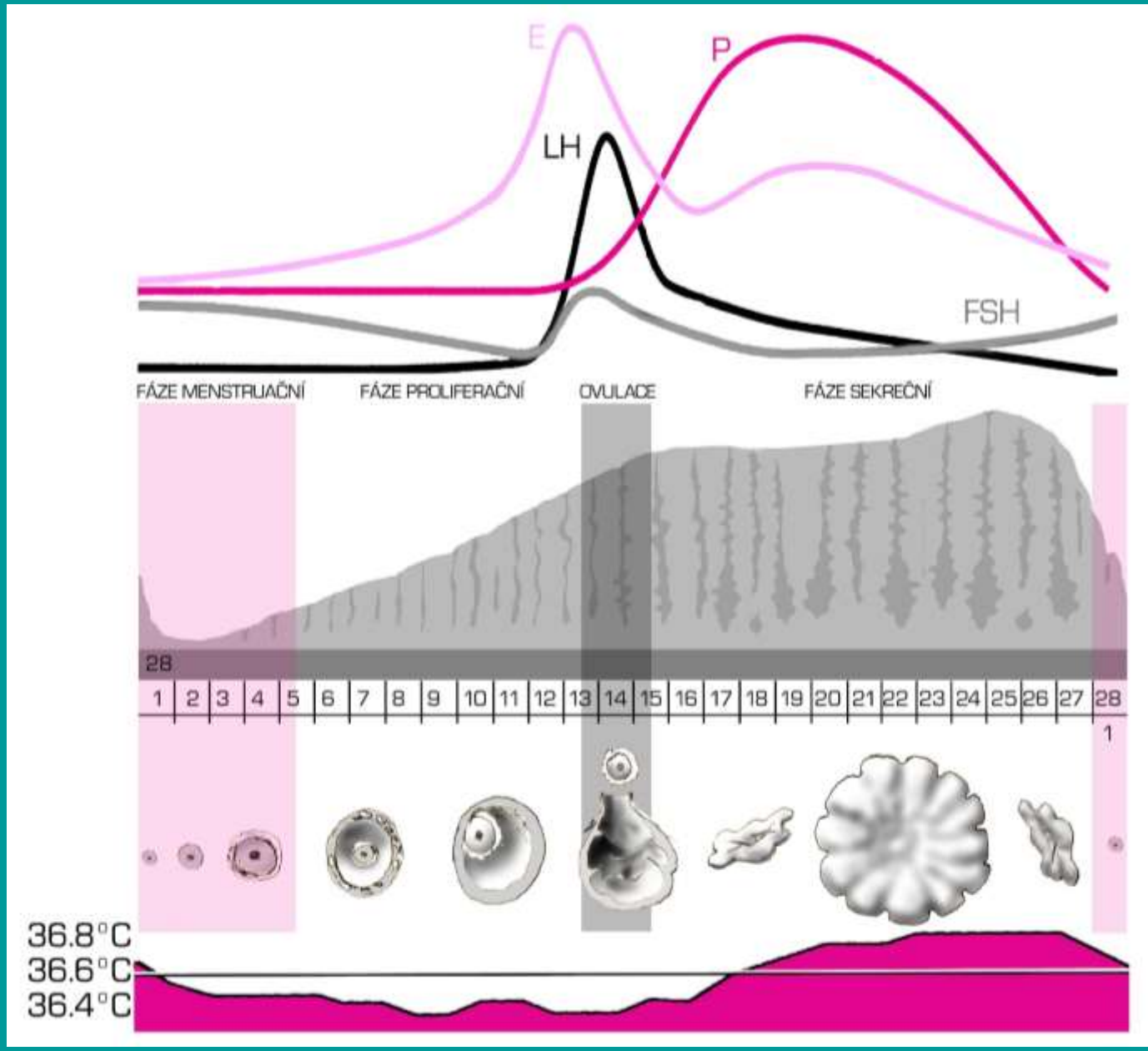
Primordial ovarian follicles



Ultrastructure of zona pellucida of primary follicle

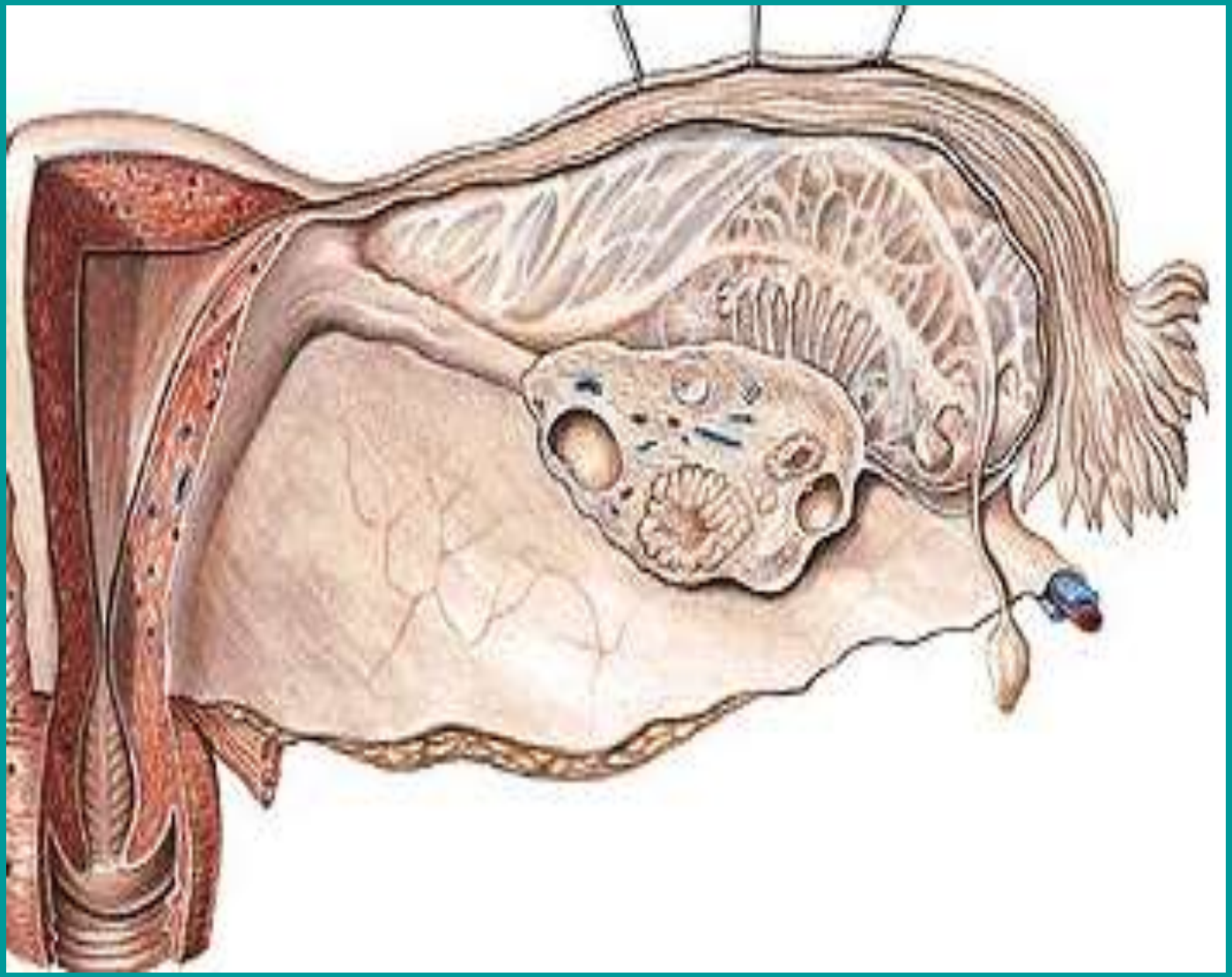


Gonadotropic hormones:
Luteinizing hormon (LH)
Follicle stimulating hormon (FSH)
Ovarian hormones:
Estrogen (E)
Progesterone (P)
Ovarian cycle:
Estrogen phase
Ovulation
Progesterone phase
Menstrual cycle



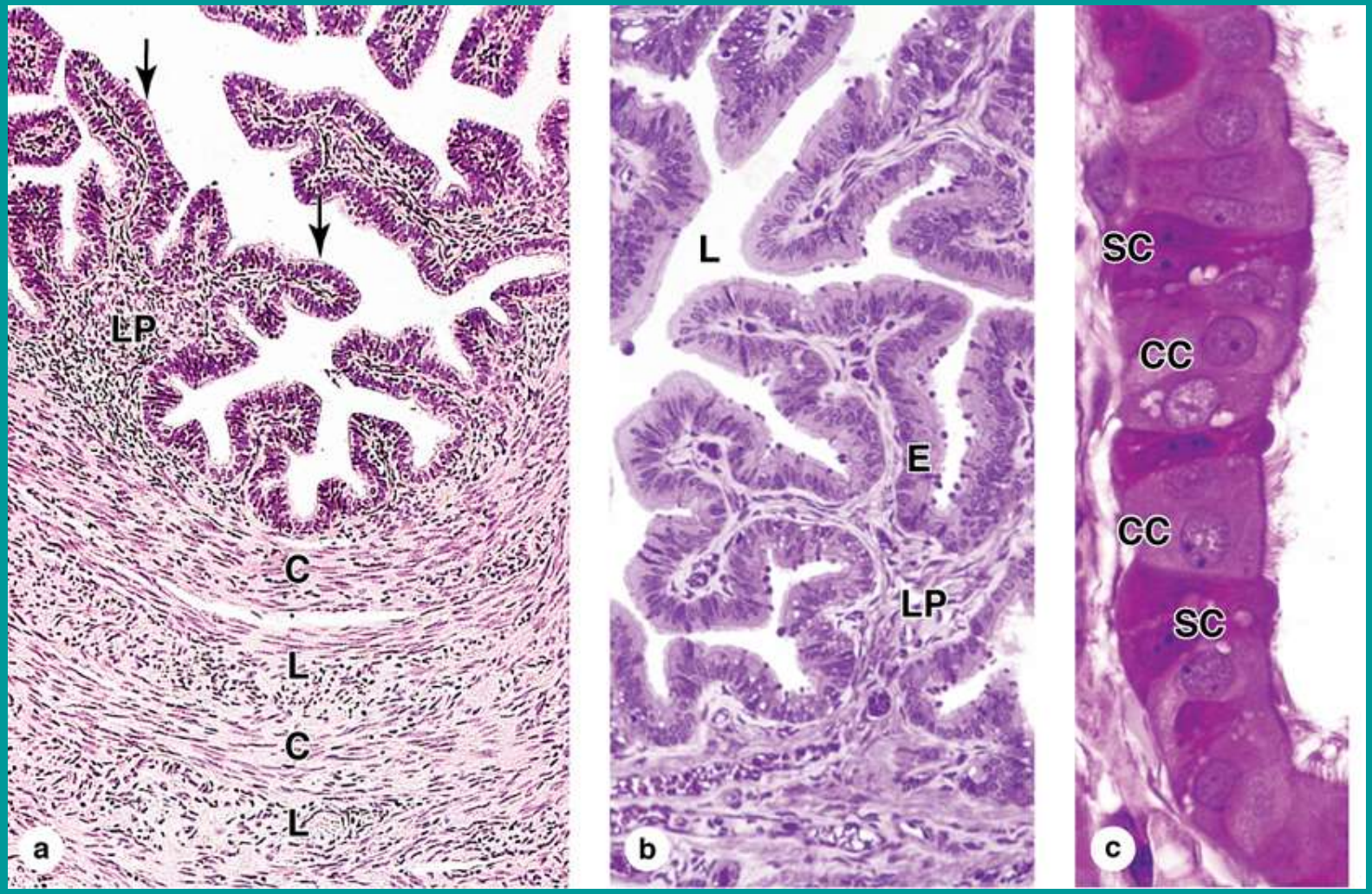
Uterine tube (Salpinx, Fallopian tube): (8-15 cm)

Abdominal ostium, Uterine ostium, Infundibulum, Ampulla, Fimbriae, Isthmus, Intramural part , Mesosaplpinx, Mesoovarium, Mesometrium

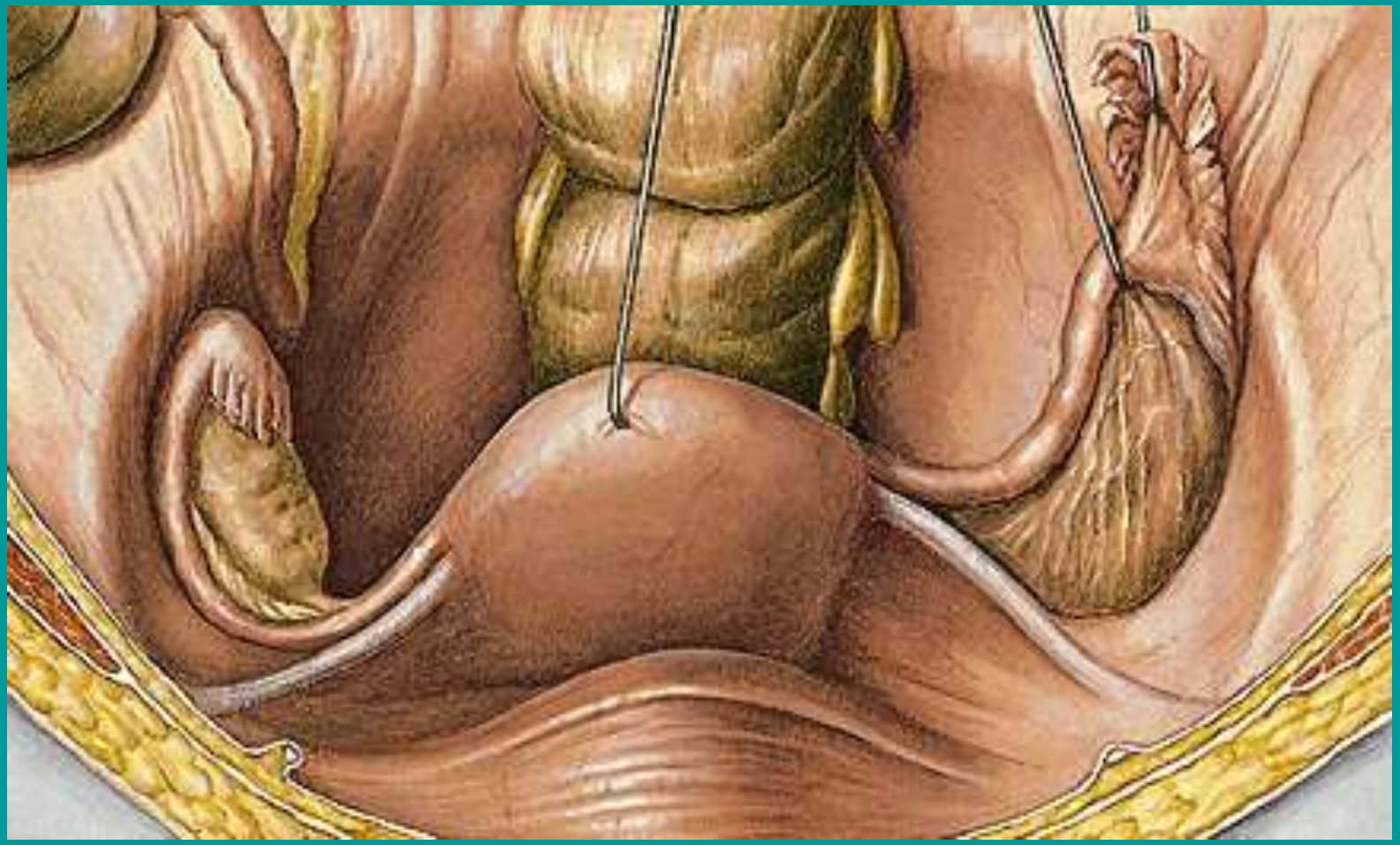


Serous coat,
Muscular coat,
Mucous Membrane
Membrane folds
Peristalsis,
Fluid current

•Mucous membrane of Fallopian tube



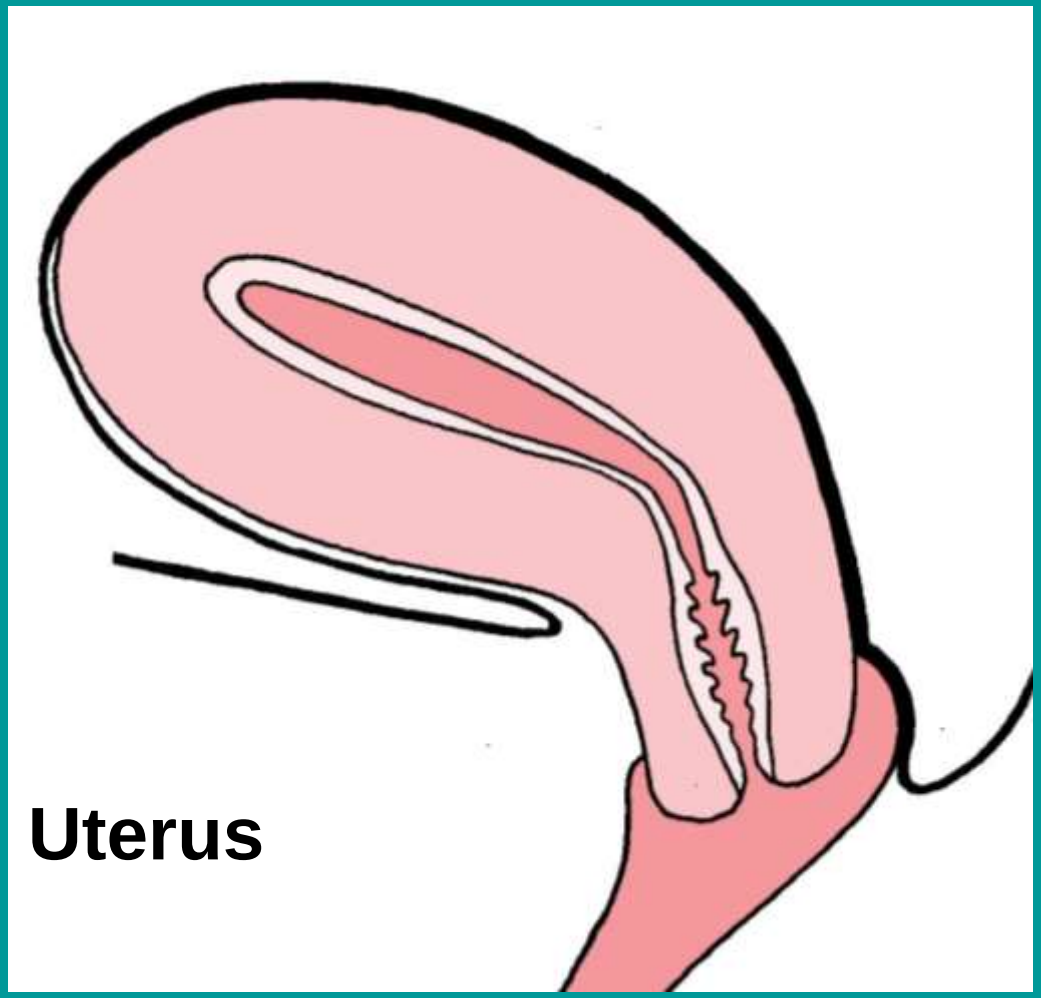
Membrane folds, ciliated and glandular cells, Transport of oocytes and spermatozoa during fertilization, Peristalsis, Fluid current

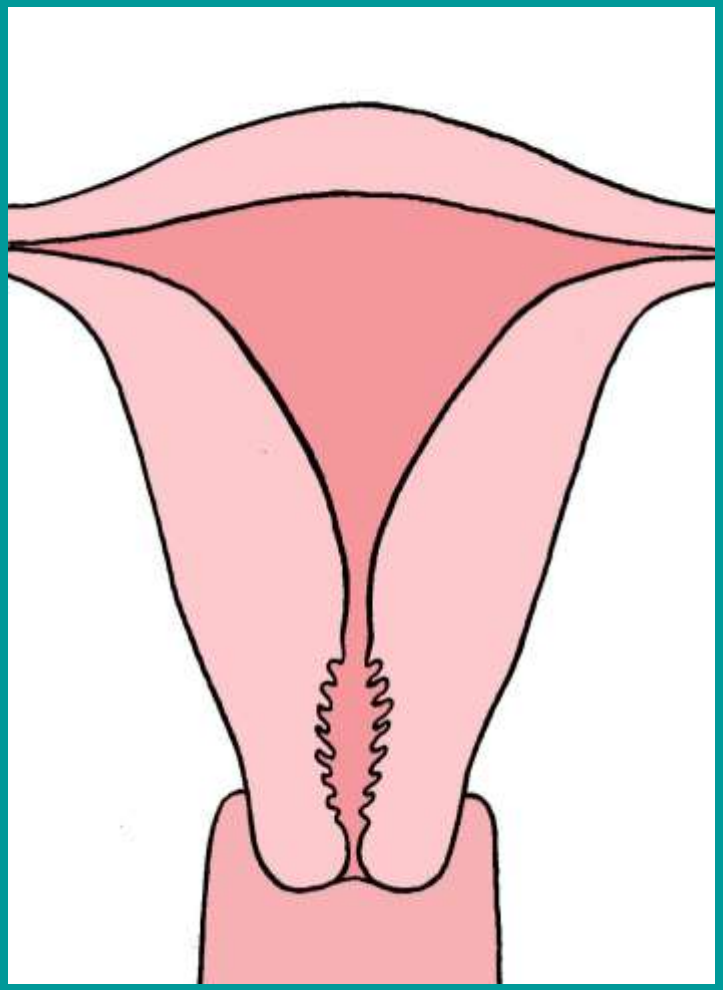


Uterus

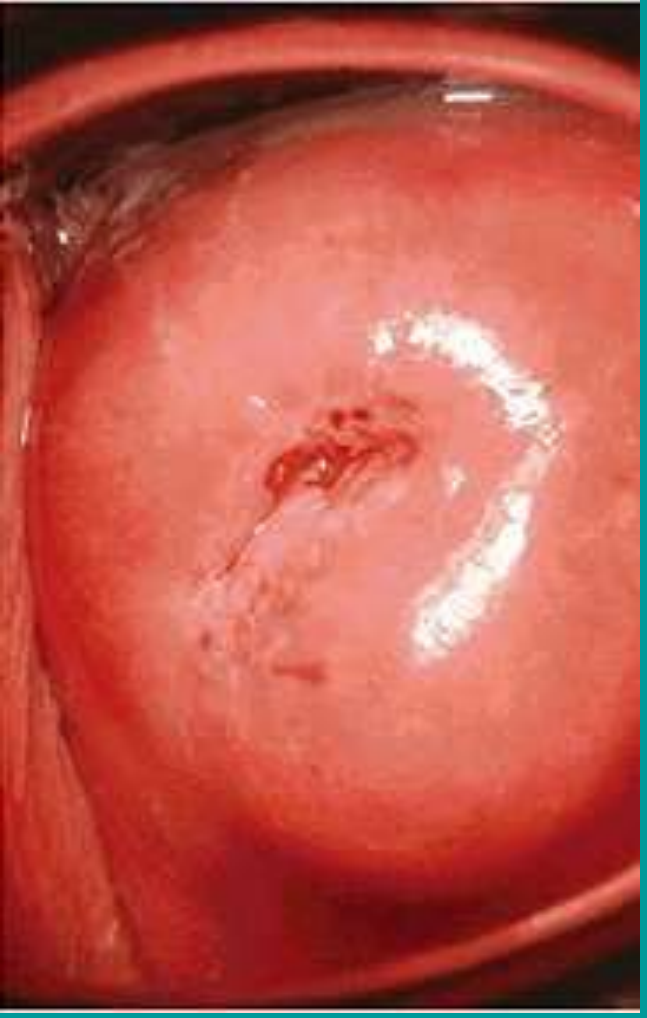
fundus, horns, body, isthmus, cervix, intestinal surface, vesical surface, perimetrium, round ligament

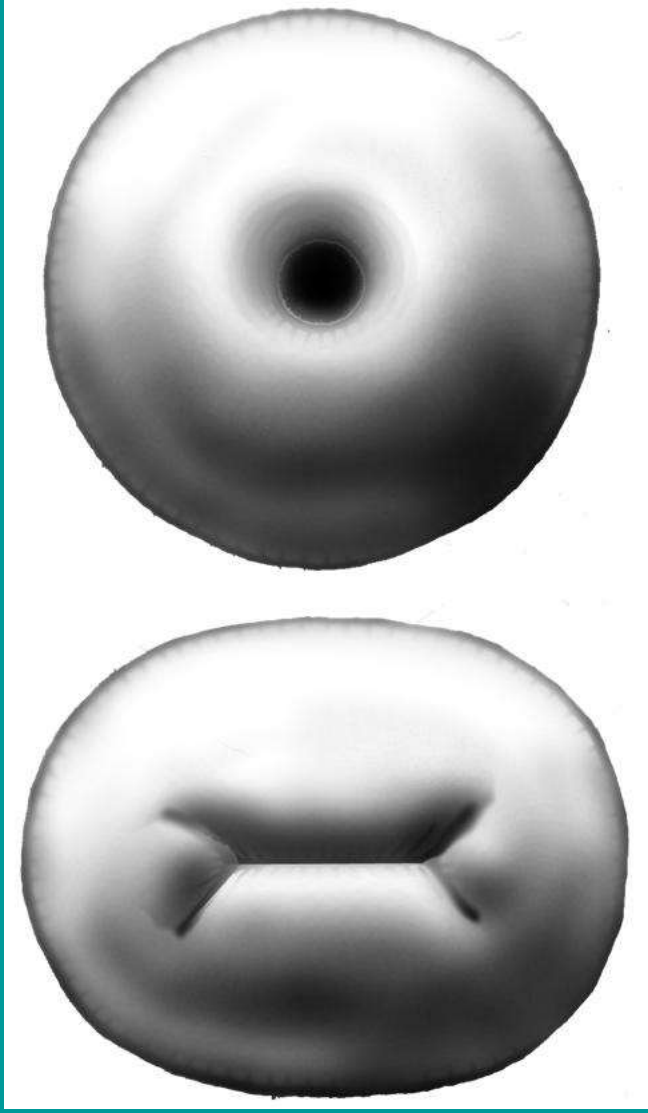
Receptacle for developing embryo (fetus),expulsion at birth





perimetrium, myometriu,endometrium, anteflexion, anteversion, uterine cavity, isthmus, cervical canal, palmate folds, ostium uteri, supravaginal and vaginal part of cervix, uterine glands, cervical glands





Cervix of uterus – vaginal part

Ostium uteri: nulliparous women, multiparous women
anterior + posterior lip, cervical mucous plug

Endometrium (mucous membrane)

basal layer,

functional layer – proliferative phase (estrogens),
- secretory phase (progesteron),
- menstrual phase (decline of ovarian hormones),

Uterine glands – nutriens, particulary glykogen,

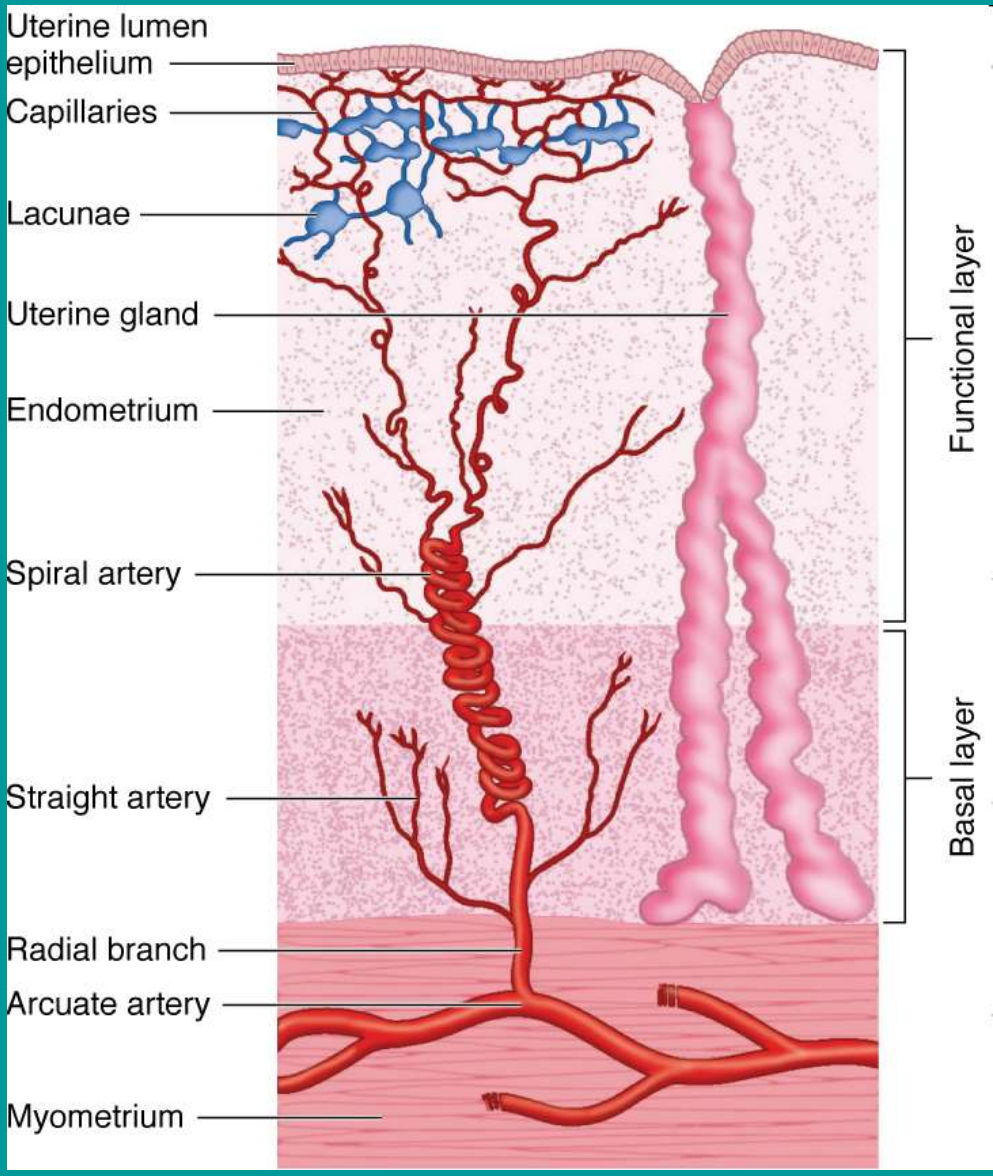
Cervical glands - mucous plug

Arterial supply to the endometrium:
straight and spiral arteries

Myometrium (muscular wall)
– middle layer (stratum vasculare),
- inner and outer layers,

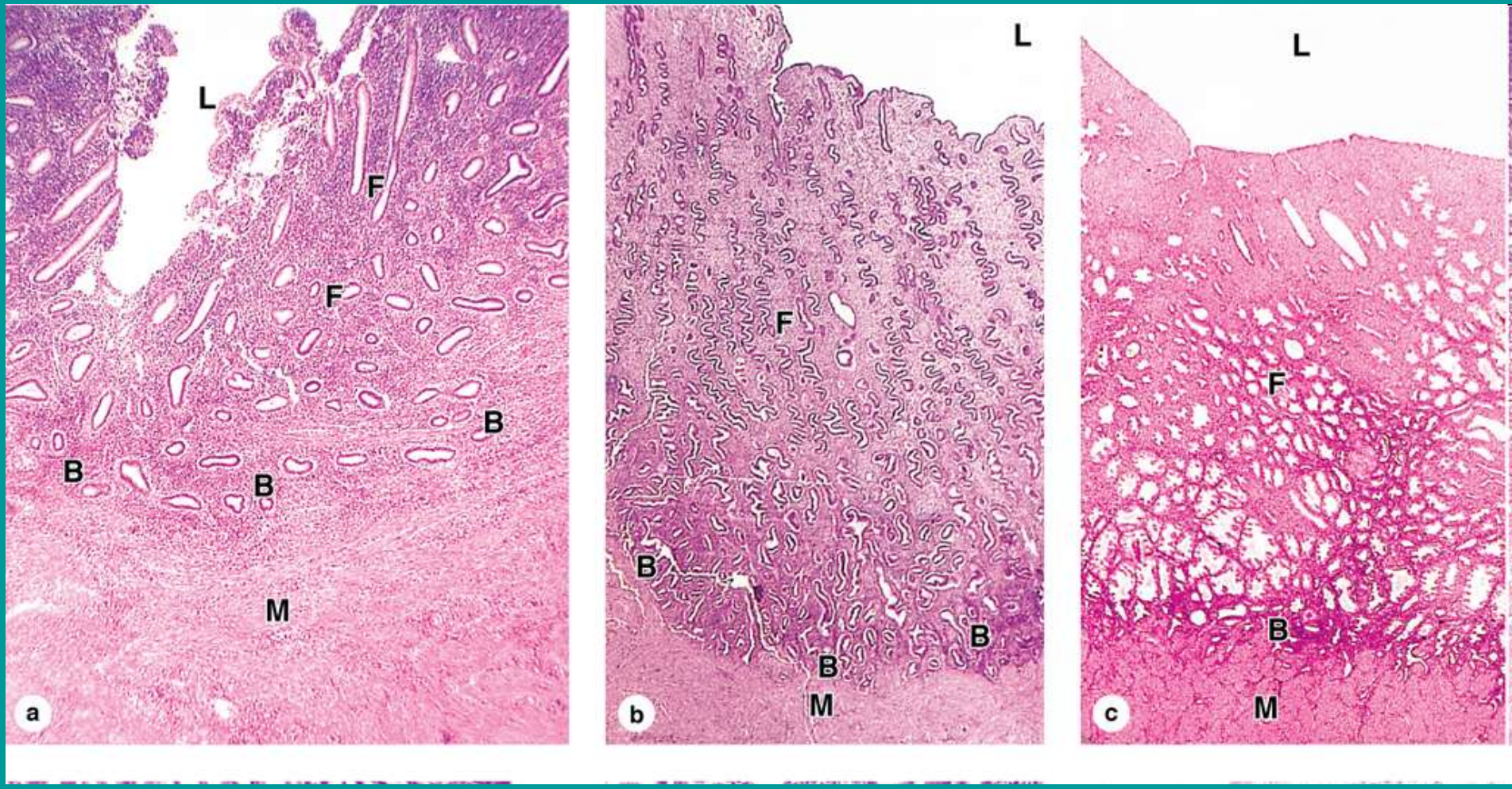
Perimetrium (peritoneum, tunica adventitia)

Arterial supply to the endometrium. The **basal and functional layers** are supplied by the **straight arteries** and **spiral arteries** respectively. The **spiral arteries are uniquely sensitive to progesterone, growing rapidly and providing blood to a microvasculature that includes many lacunae lined by thin endothelium. The rapid decline in the level of progesterone causes constriction of the spiral arteries that quickly lead to local ischemia in the functional layer and its separation from the basal layer during menstruation**

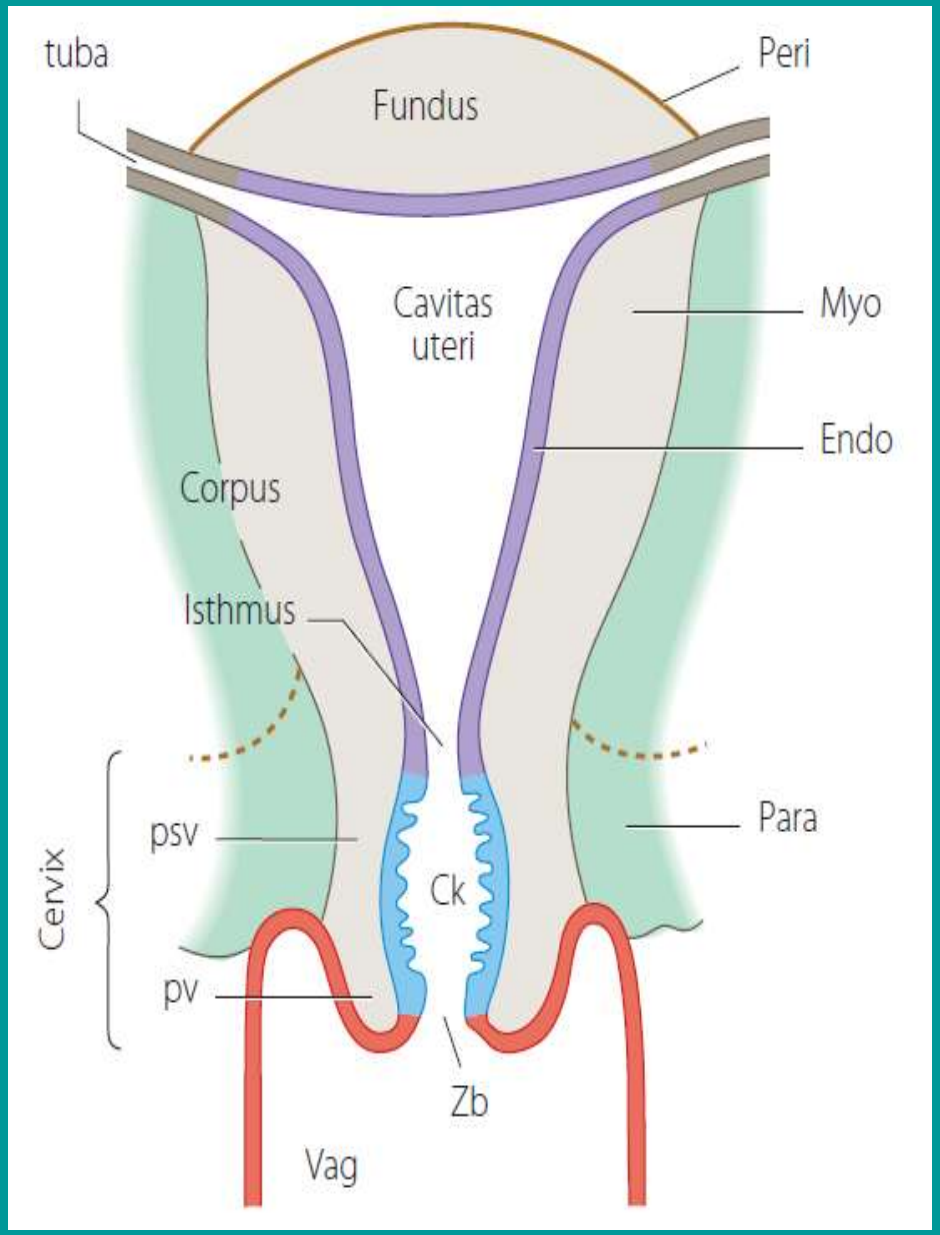


Uterine wall, myometrium, endometriem (functional and basal layer)

Endometrium



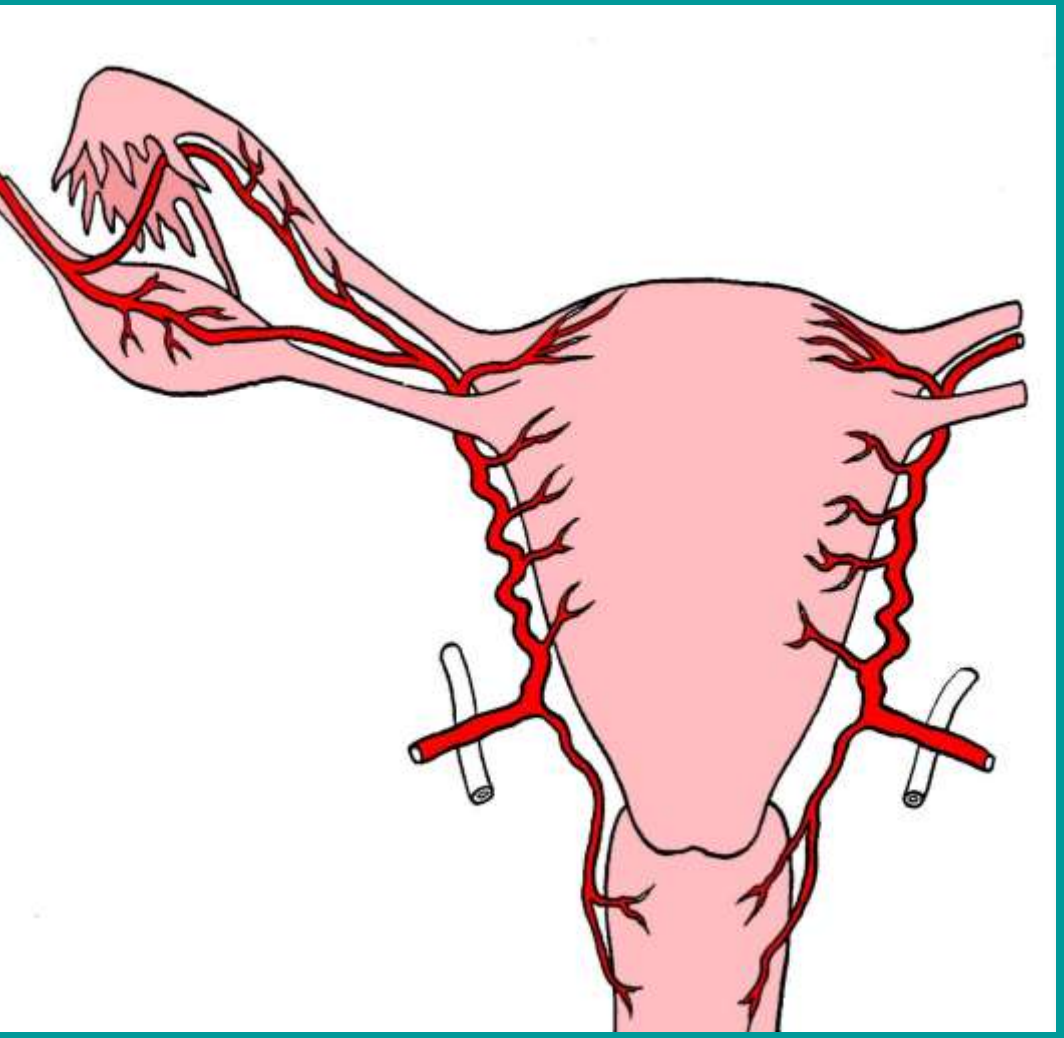
Proliferative, secretory, premenstrual phases of endometrium

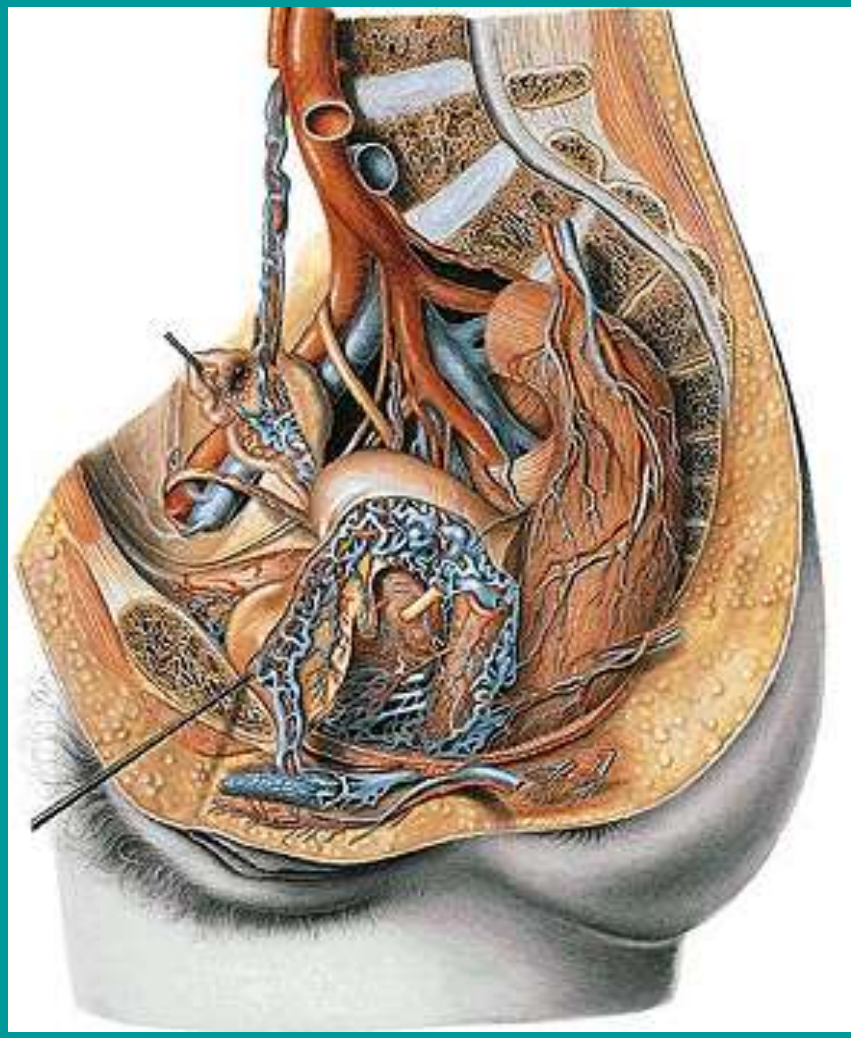


Cervix

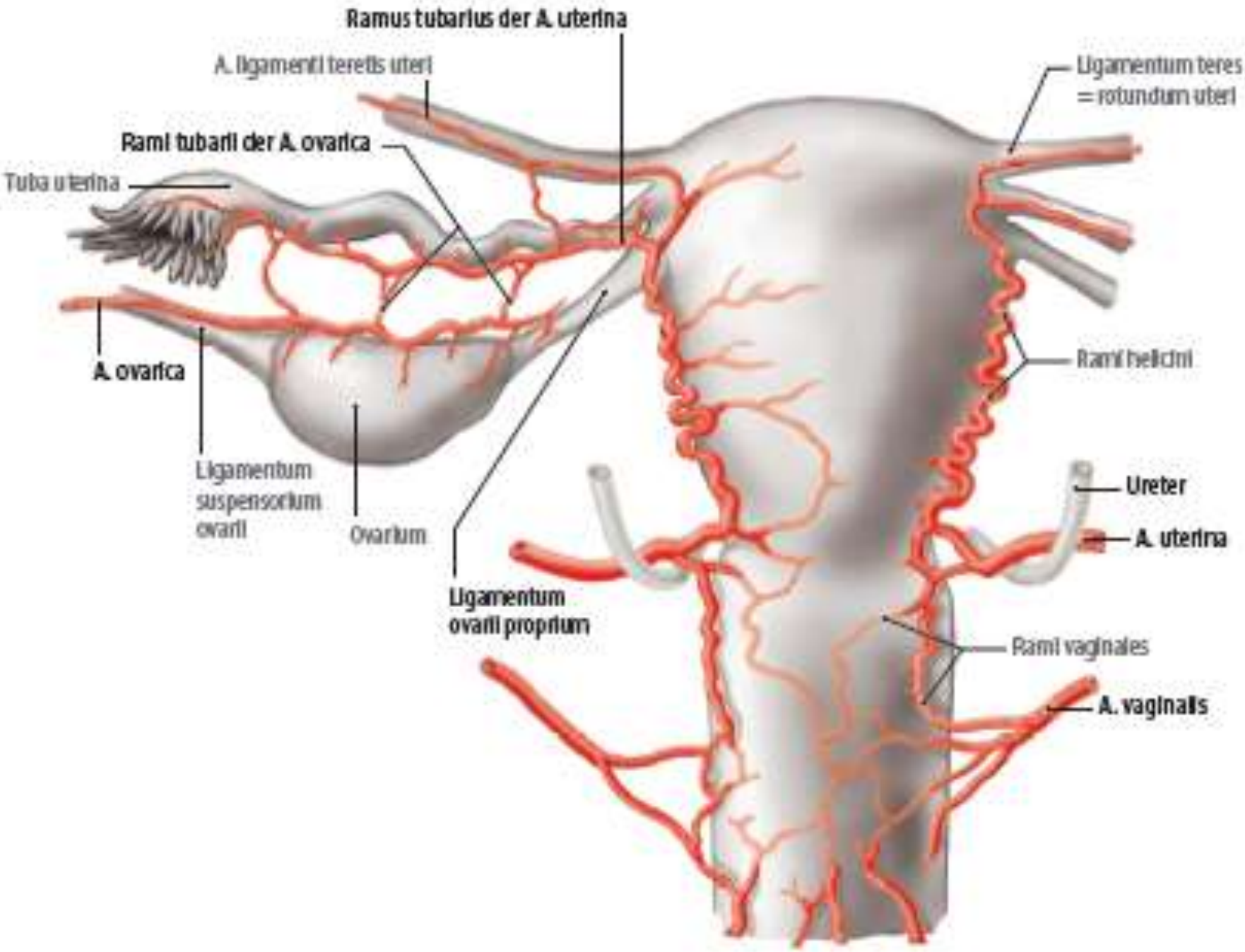
The mucosa of the cervical canal is lined by simple columnar epithelium and contains many large branched cervical glands secreting mucus.

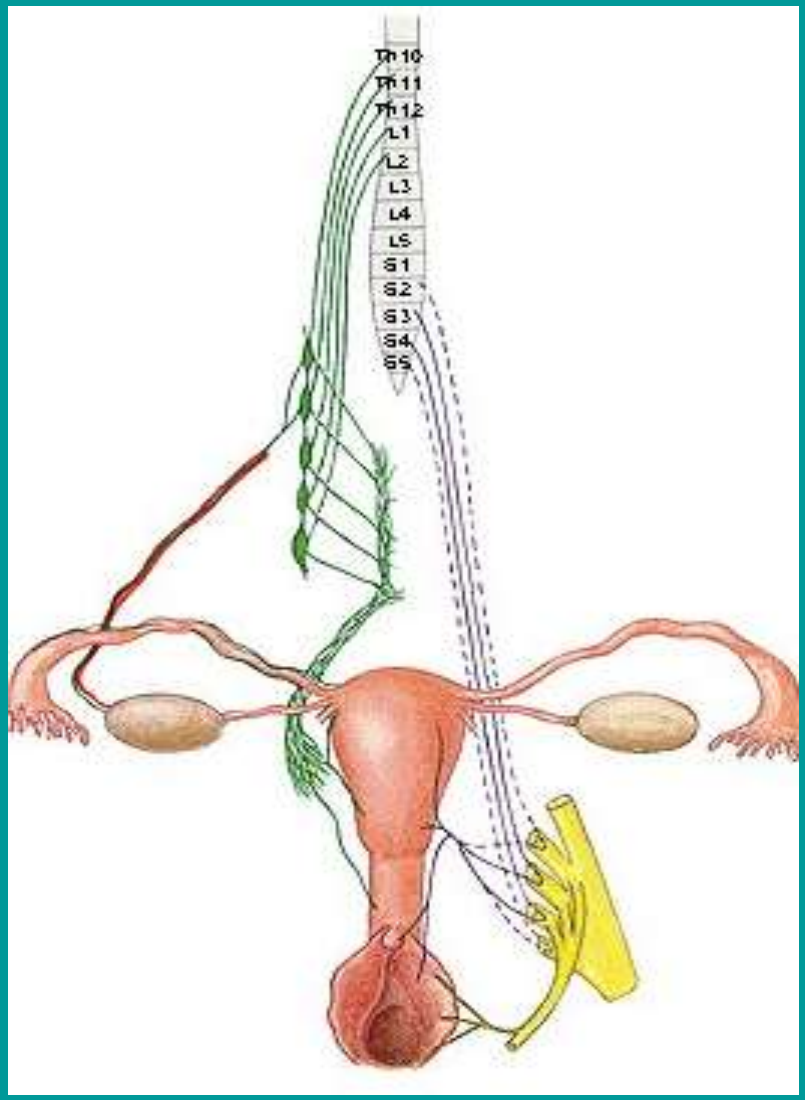
At the external os, there is an abrupt junction (J) between cervical epithelium (EC) and the stratified squamous (SS) epithelium covering the exocervix and vagina (V).





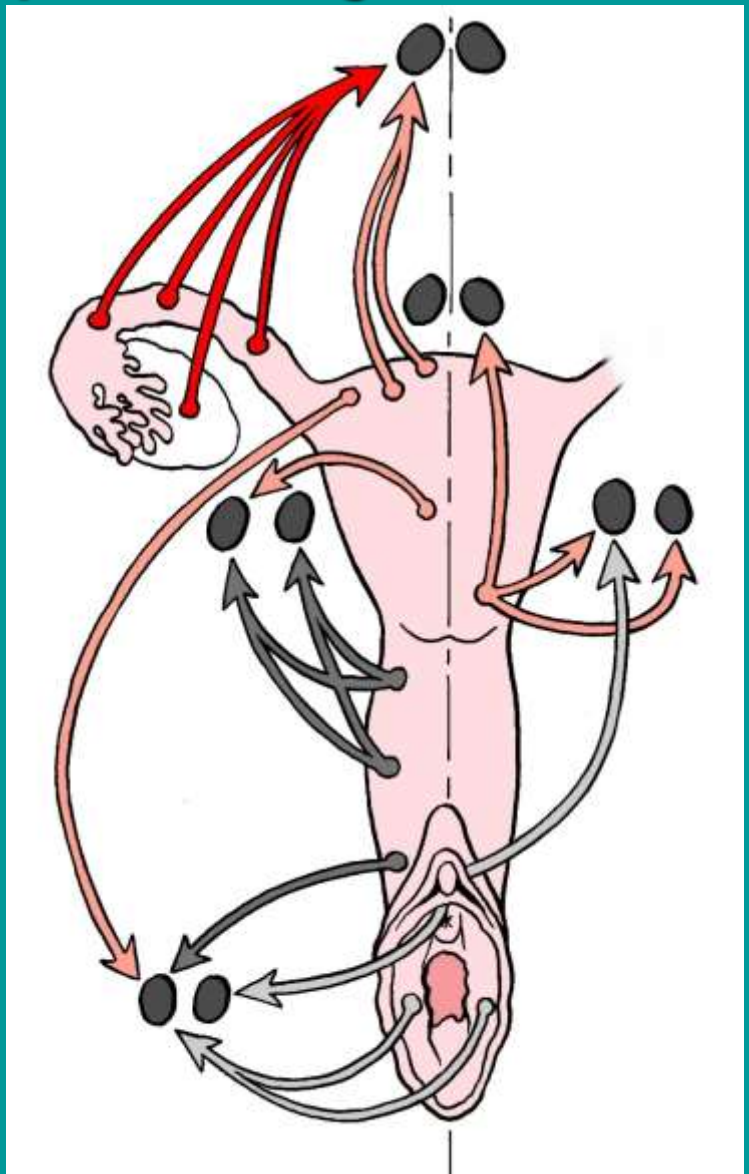
uterine artery, vaginal branch, ovarian artery, anastomosis, uterovaginal venous plexus

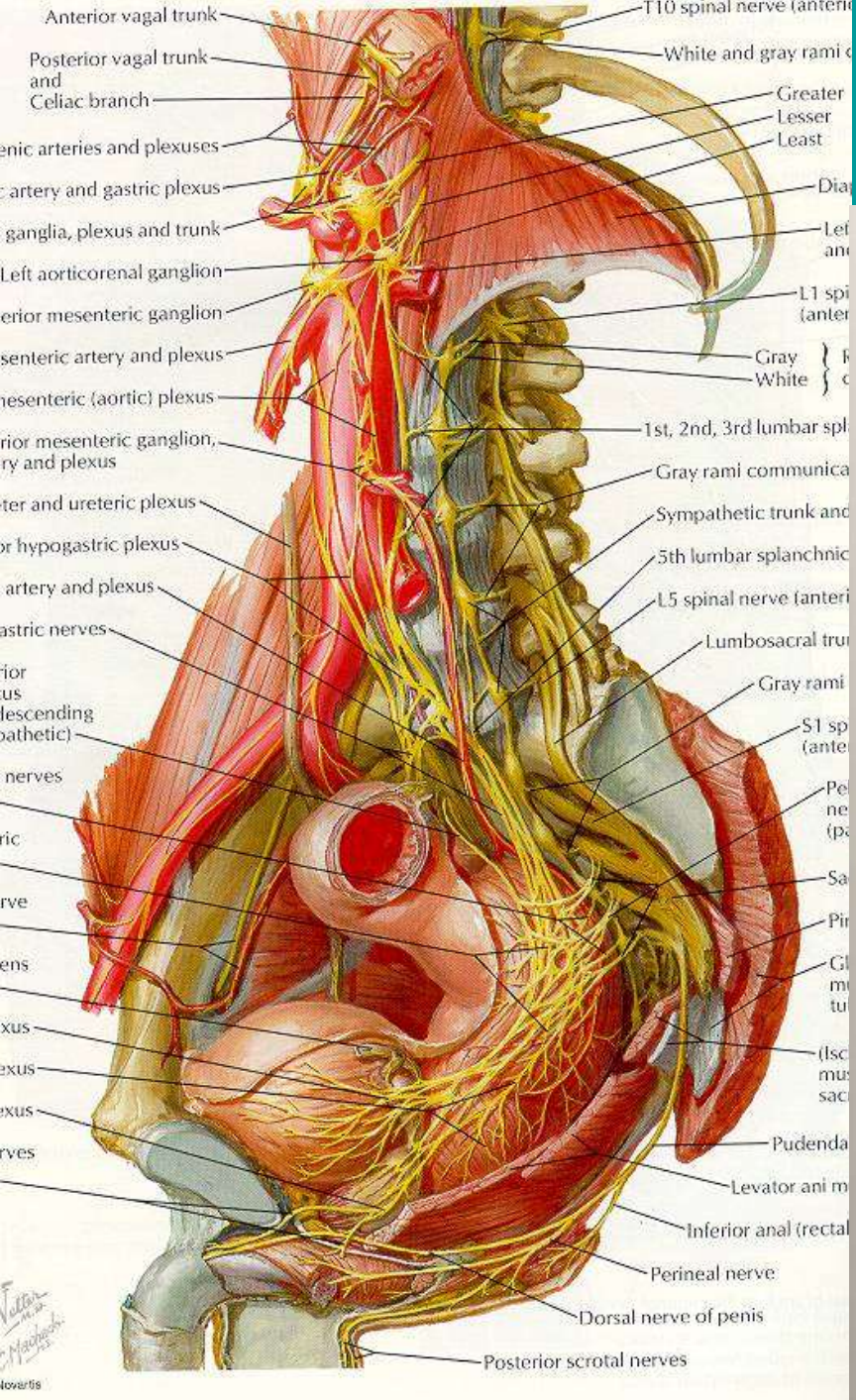

Ramus tubarius der A. uterina
A. ligamenti teretis uteri
Ligamentum teres = rotundum uteri
Rami tubarii der A. ovarica
Tuba uterina
A. ovarica
Rami helicini
Ligamentum suspensorium ovarii
Ovarium
Ureter
A. uterina
Ligamentum ovarii proprium
Rami vaginales
A. vaginalis

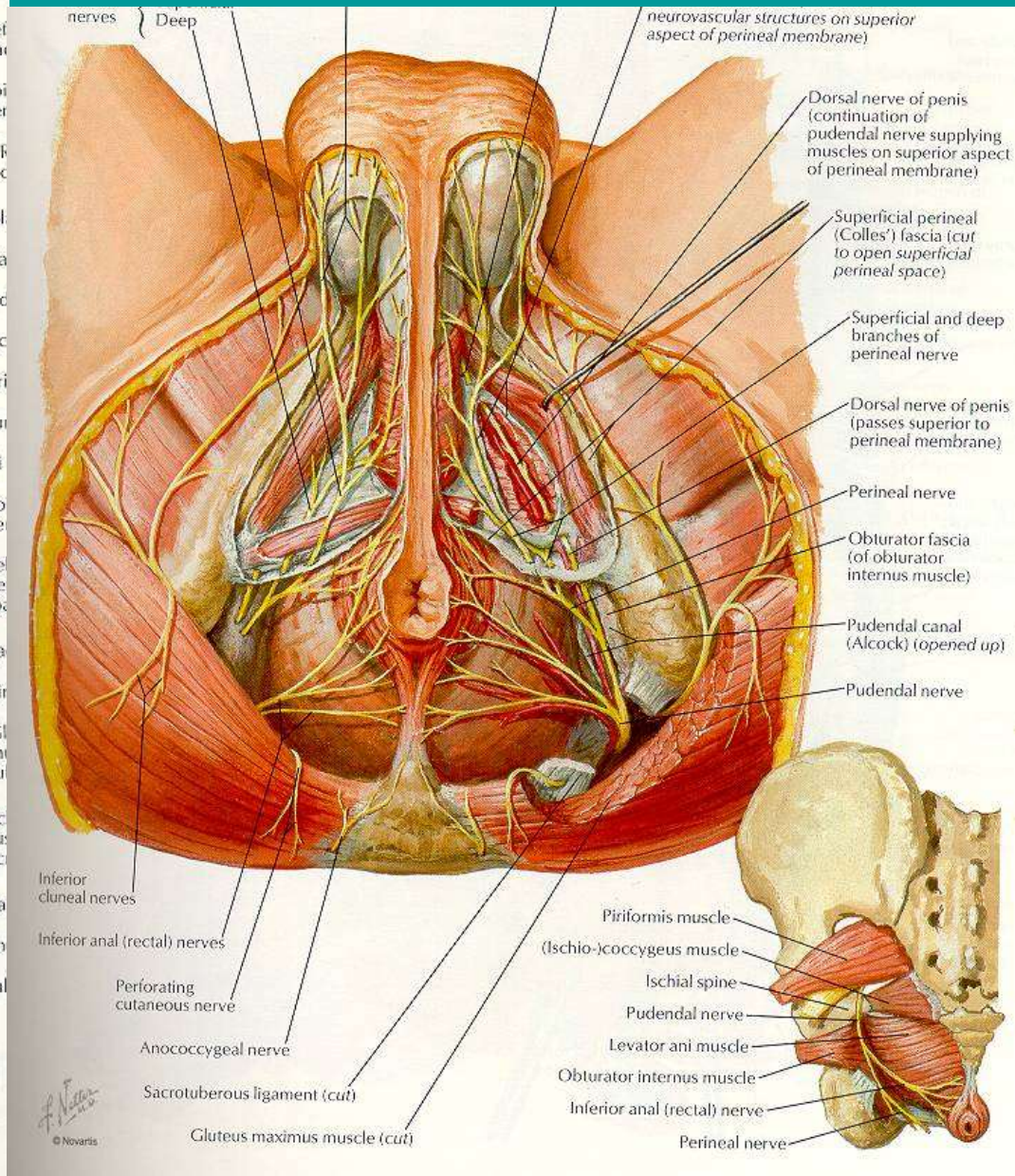


Uterovaginal plexus sympathetic, parasympathetic and sensory fibres from ovarian and inf. hypogastric plexuses

Lymph nodes: lumbar, sacral, internal iliac, external iliac, superficial inguinal




Anterior vagal trunk
Posterior vagal trunk and Celiac branch
enic arteries and plexuses
artery and gastric plexus
ganglia, plexus and trunk
Left aorticorenal ganglion
erior mesenteric ganglion
senteric artery and plexus
nesenteric (aortic) plexus
rior mesenteric ganglion, ry and plexus
ter and ureteric plexus
r hypogastric plexus
artery and plexus
astric nerves
rior us lescending pathetic)
nerves
ric
rve
ens
xus
exus
exus
rves
T10 spinal nerve (anteri
White and gray rami
Greater
Lesser
Least
Dia
Lef an
L1 spi (ante
Gray
White
1st, 2nd, 3rd lumbar spl
Gray rami communica
Sympathetic trunk and
5th lumbar splanchnic
L5 spinal nerve (anteri
Lumbosacral tru
Gray rami
S1 sp (ante
Pe ne (pa
Sa
Pir
Gl mu tu
(Isc mus sac
Pudenda
Levator ani m
Inferior anal (rectal
Perineal nerve
Dorsal nerve of penis
Posterior scrotal nerves
Novartis


nerves
Deep
neurovascular structures on superior aspect of perineal membrane)
Dorsal nerve of penis (continuation of pudendal nerve supplying muscles on superior aspect of perineal membrane)
Superficial perineal (Colles') fascia (cut to open superficial perineal space)
Superficial and deep branches of perineal nerve
Dorsal nerve of penis (passes superior to perineal membrane)
Perineal nerve
Obturator fascia (of obturator internus muscle)
Pudendal canal (Alcock) (opened up)
Pudendal nerve
Inferior cluneal nerves
Inferior anal (rectal) nerves
Perforating cutaneous nerve
Anococcygeal nerve
Sacrotuberous ligament (cut)
Gluteus maximus muscle (cut)
Piriformis muscle
(Ischio-)coccygeus muscle
Ischial spine
Pudendal nerve
Levator ani muscle
Obturator internus muscle
Inferior anal (rectal) nerve
Perineal nerve
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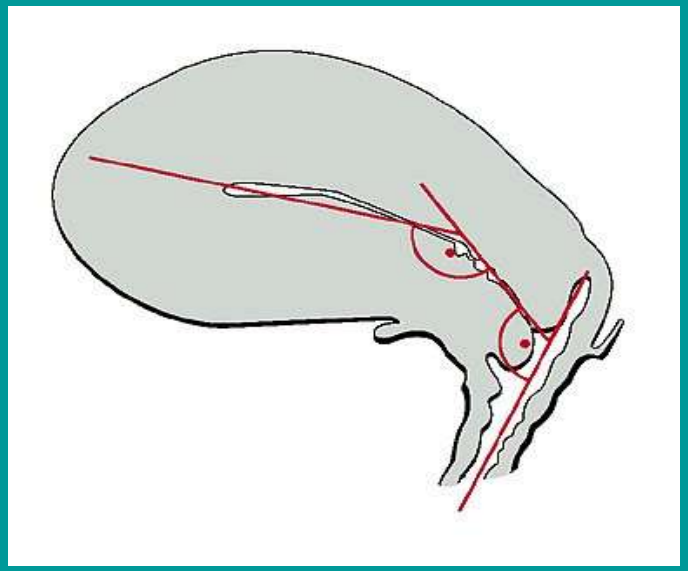
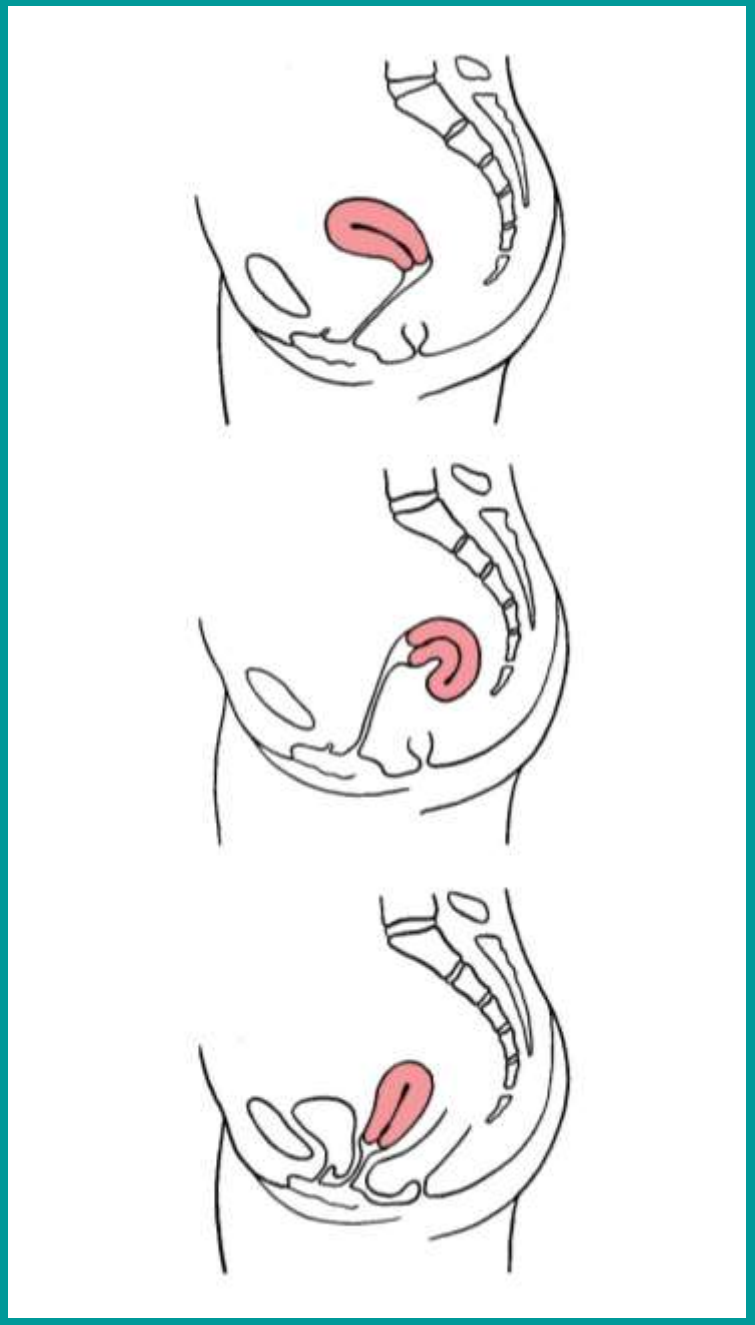
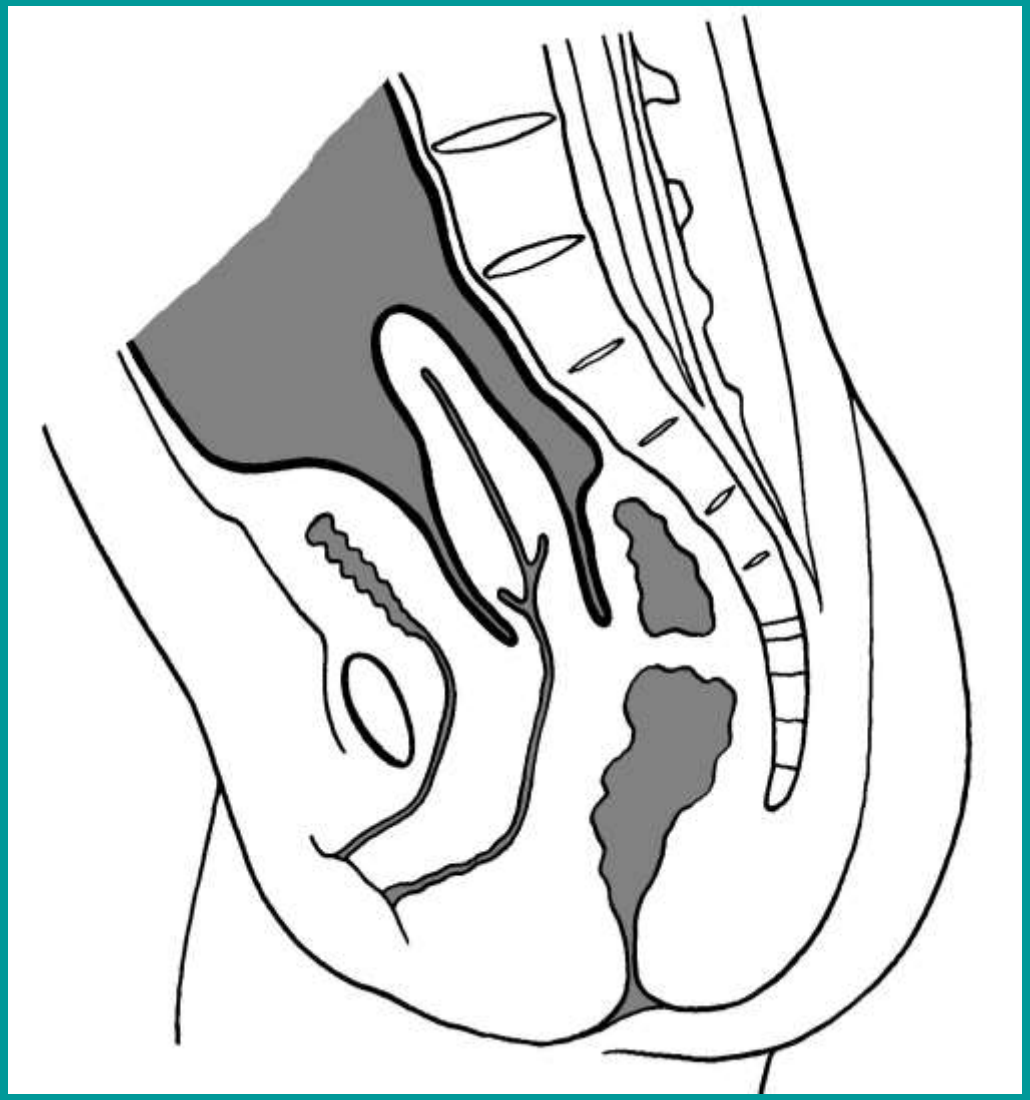


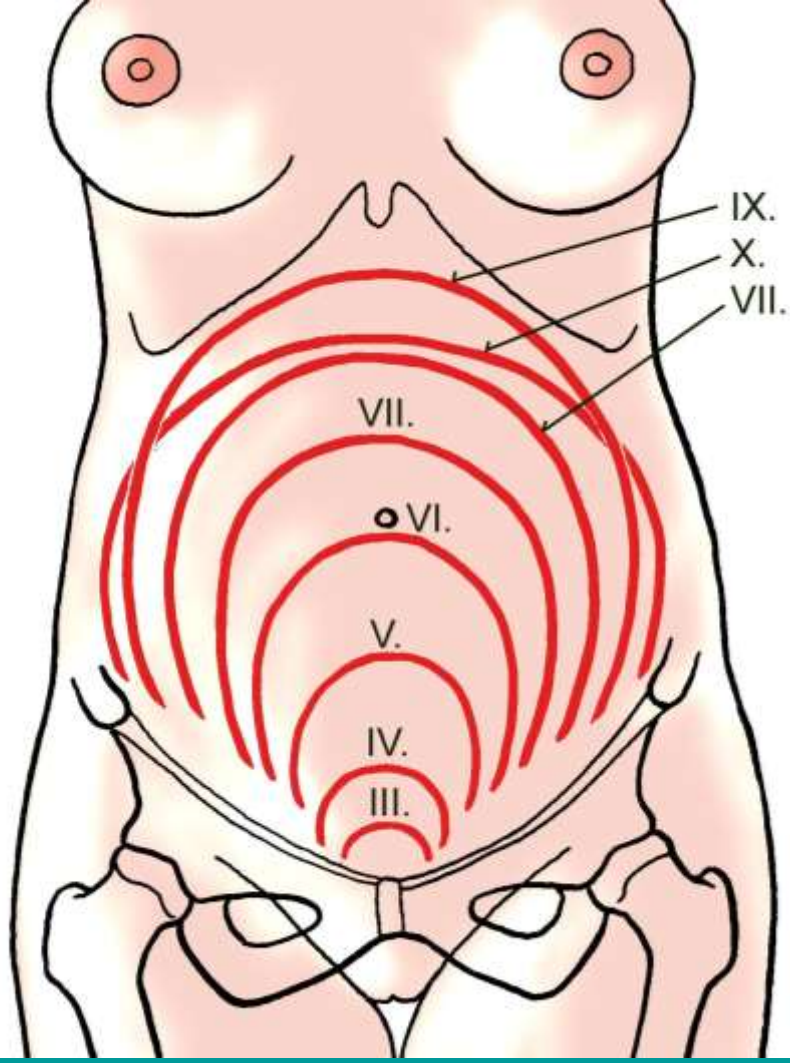
Position of the uterus

Anteflexion
Anteversion
Retroversion,
Retroflexion
Descent of the uterus
prolapse
cystocele
rectocele



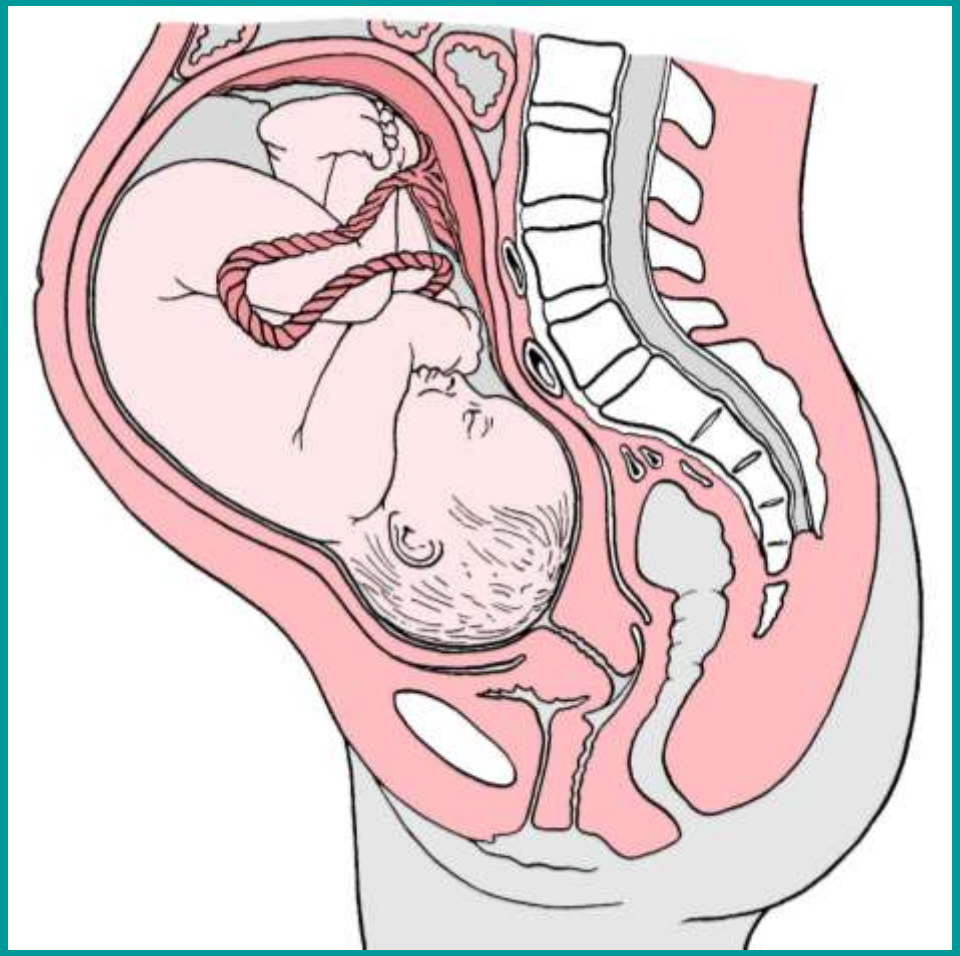


In childern, the body of the uterus body is shorter than the cervix



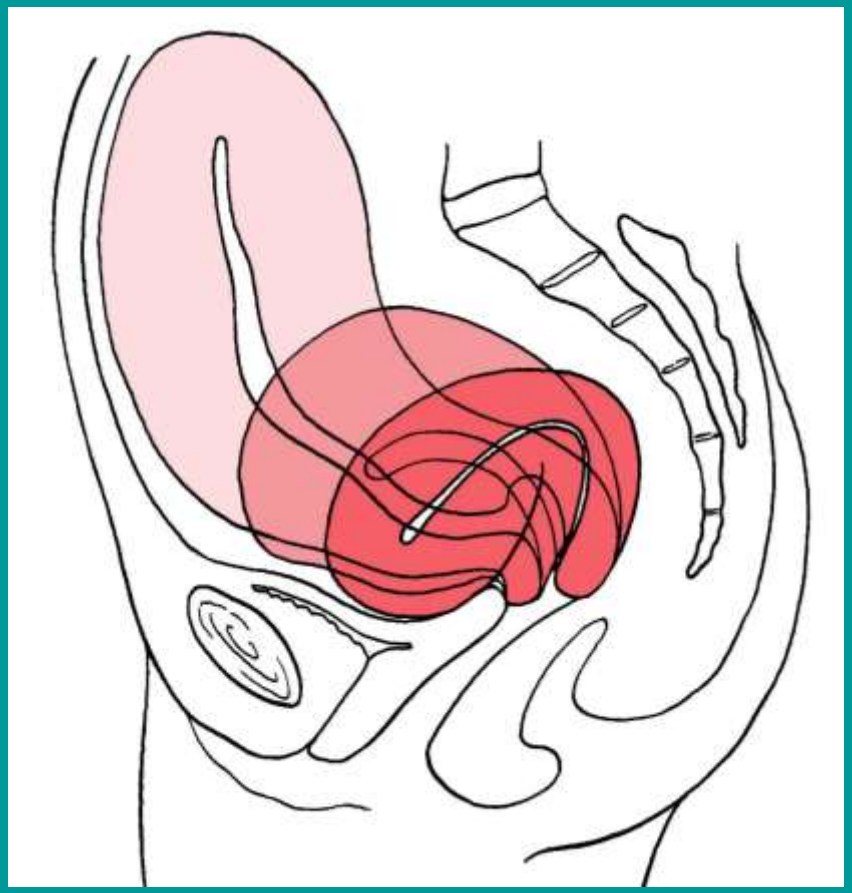
Projection of pregnant uterus during lunar months I. – X.

Ultrasonography of the female pelvis through pregnant uterus



Expansion and enlargement of the uterus during pregnancy:
The cervical canal remains closed

Involution of the uterus after parturition:
Immediately after parturition,
after 2. weeks
after 6. weeks



Vagina

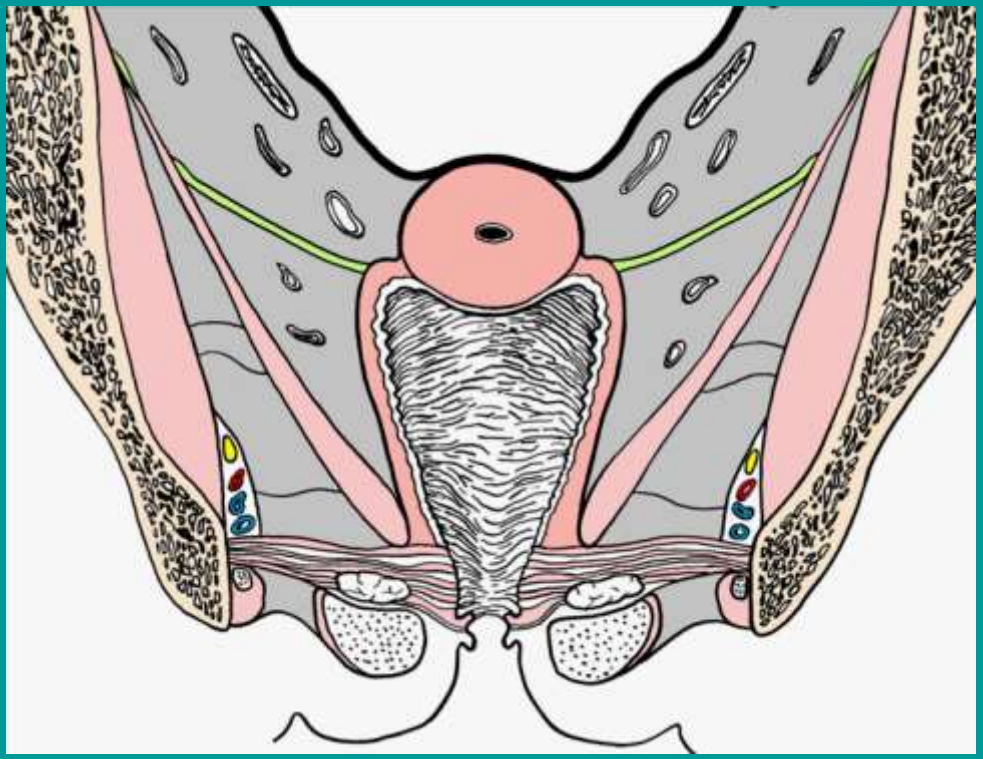
The vagina has mucosal, muscular, and adventitial layers

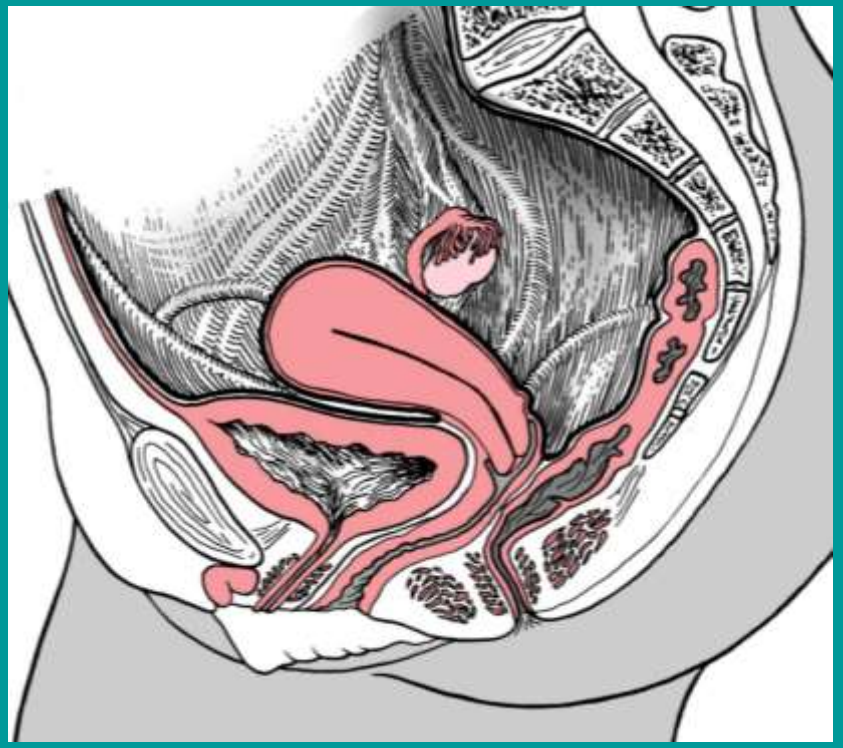
There are no secretory glands, cells of the thick, nonkeratinized stratified squamous epithelium become filled with glycogen before desquamation.

The lamina propria mucosae contains thin—walled veins and muscular layers exude fluid on the surface of the epithelium.

The papillae and entire lamina propria are very rich in protective lymphocytes and neutrophils.

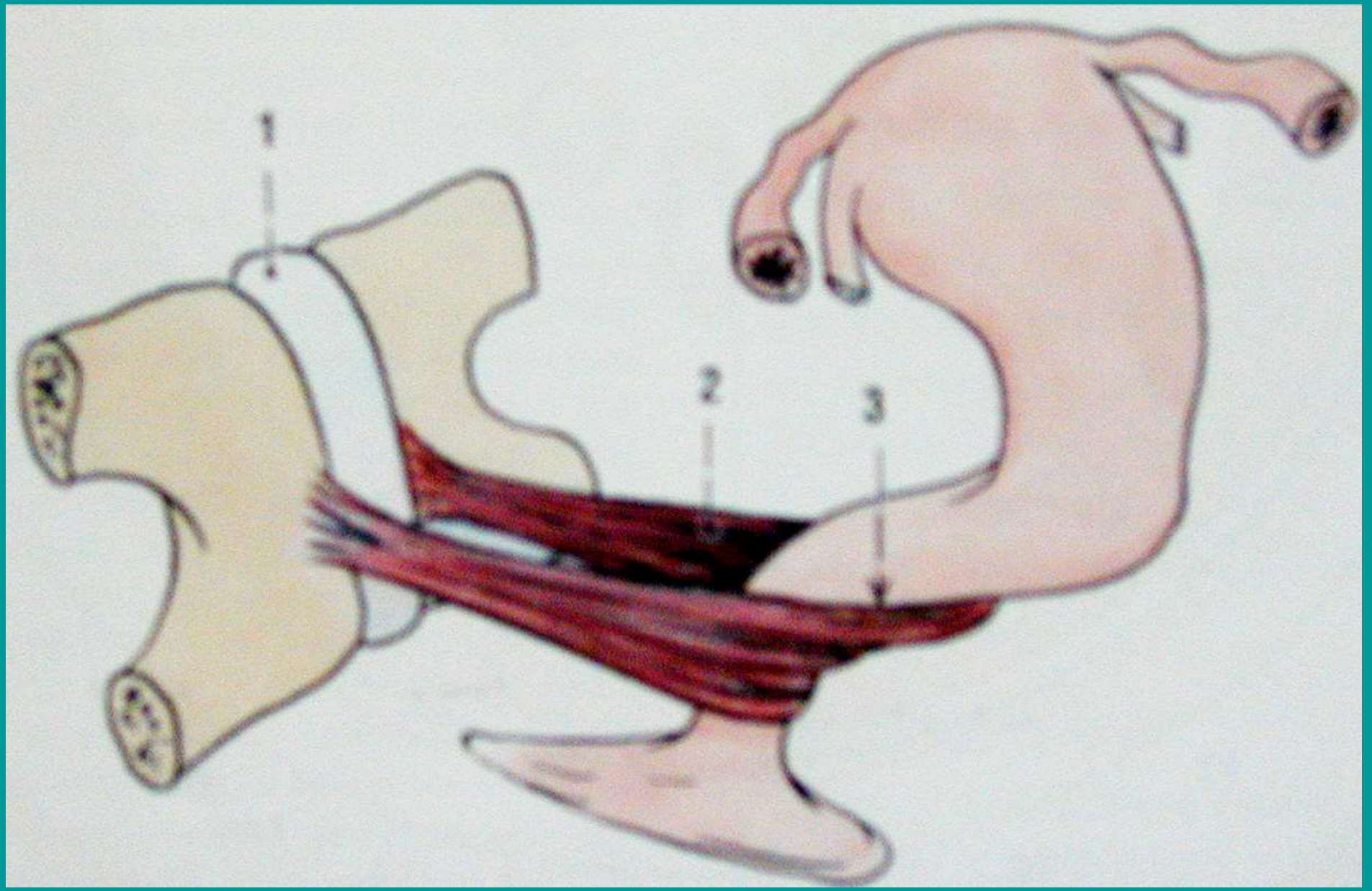
The muscular layer has bundles of smooth muscle arranged in a circular manner near the mucosa and longitudinally near the adventitia.



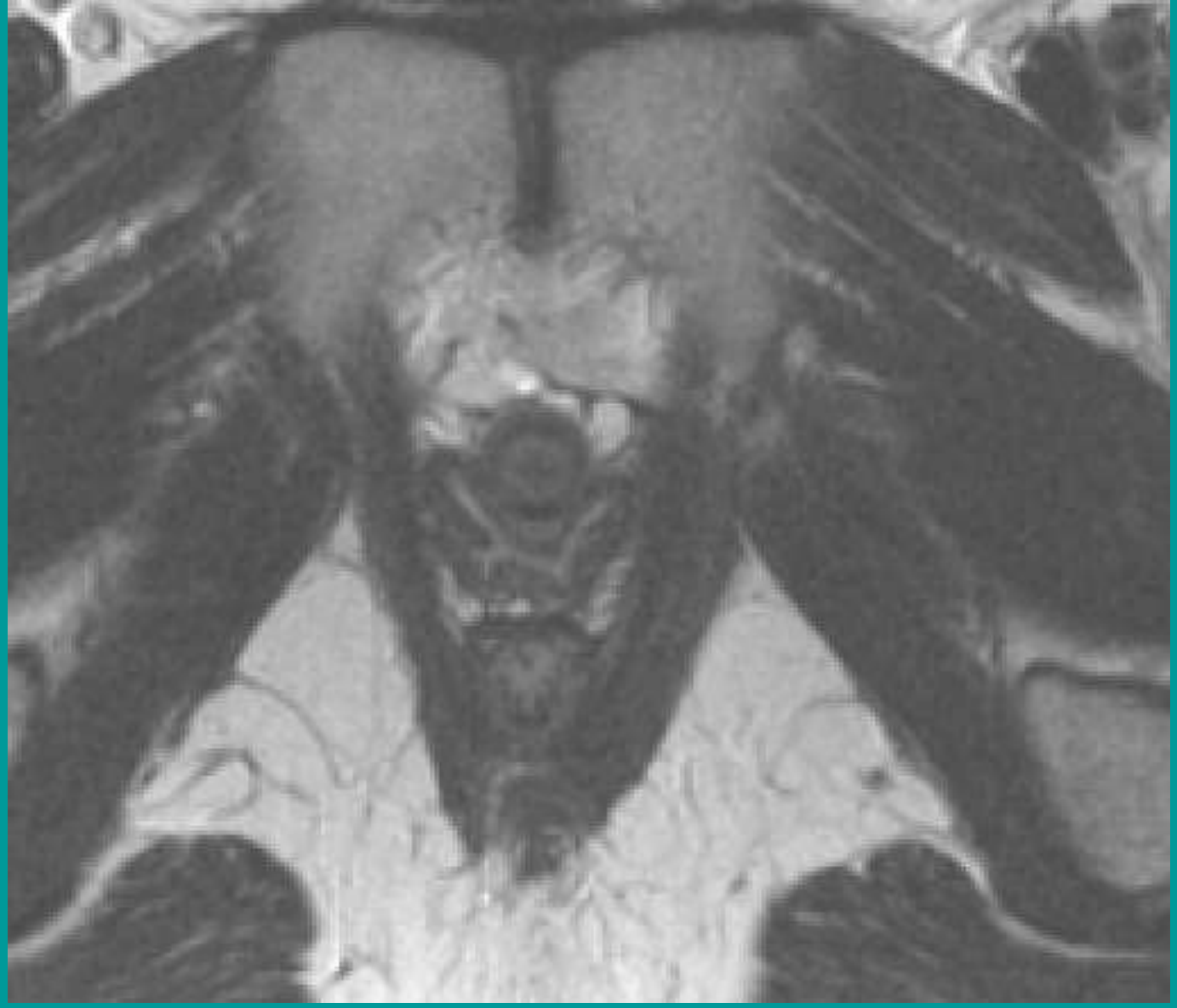


Vagina (kolpos) fornix, ostium, hymen, rugae, columns, urethral carina, trigonal area of vagina, mucous membrane, muscular layer, spongy layer, parakolpium, urogenital hiatus, pubovaginal m., promontorium of vagina, urethrovaginal sphincter muscle, bulbospongiosus muscle,

Magnetic resonance image of female pelvis in sagittal plane

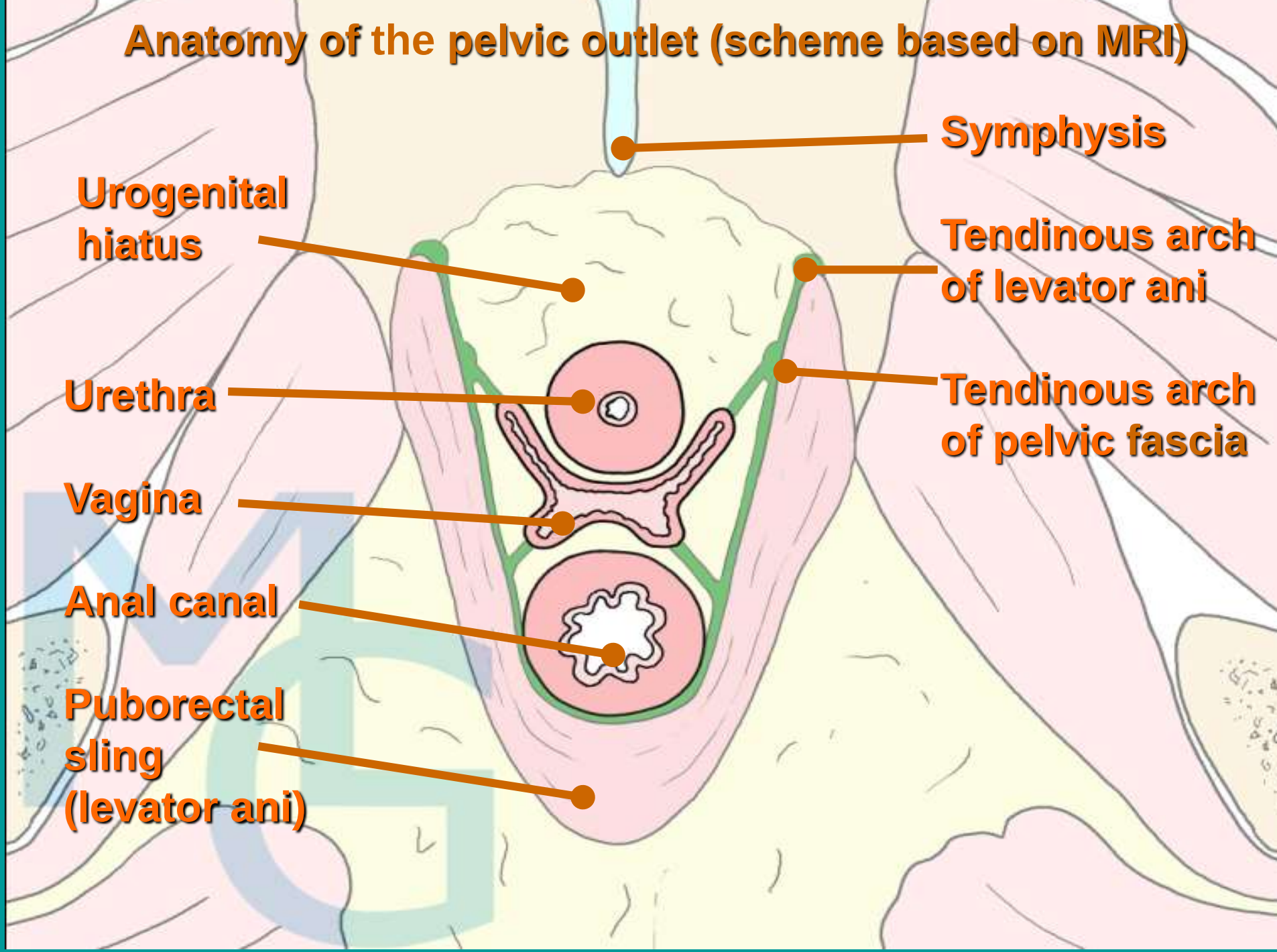


Sling of the pubovaginalis muscle

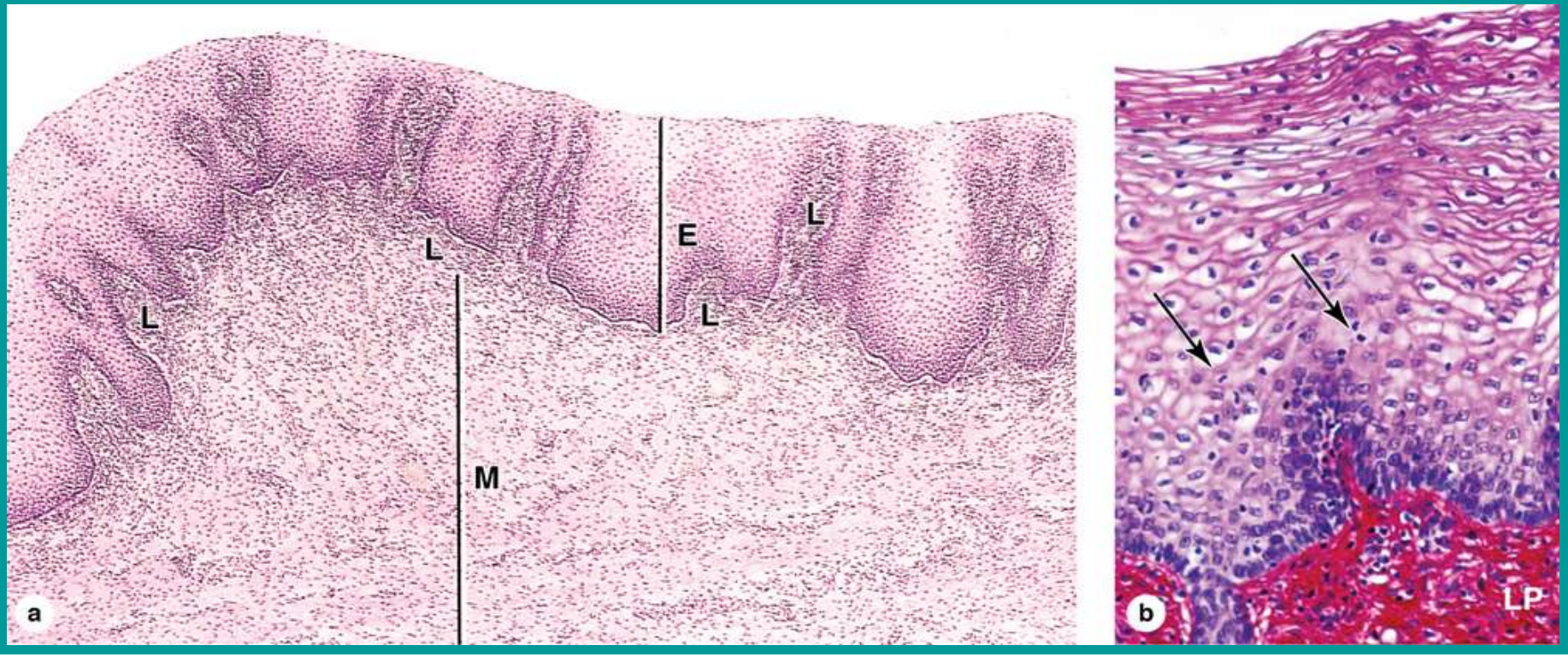


Magnetic resonance image of female pelvis in plane of urogenital hiatus (level 2 according to DeLancey)

Anatomy of the pelvic outlet (scheme based on MRI)



The wall of vagina (mucosal, muscular, and adventitial layers)



(a): The micrograph shows the lamina propria (L) is highly cellular and extends narrow papillae into the epithelium (E).

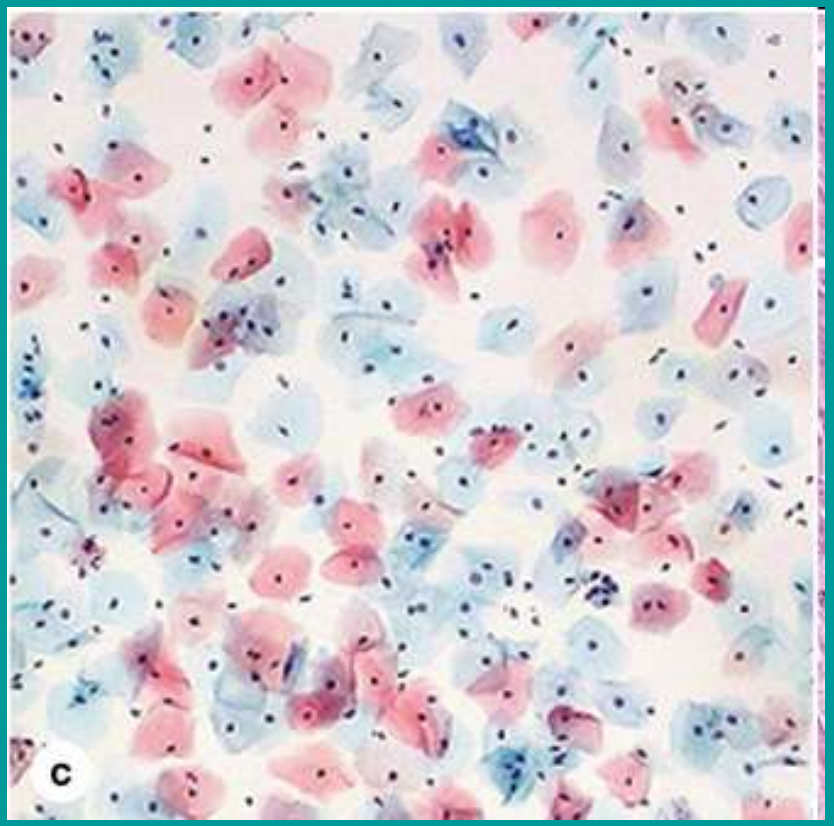
(b): Higher magnification of the epithelium and lamina propria (LP) shows **invasion of leukocytes** (arrows) between epithelial cells from the connective tissue

Exfoliative cytology of cells scraped from a normal cervix in a routine cervical smear

The Papanicolaou procedure stains cells differently according to their content of keratins

Surface cells have denser cytoplasmic keratin and stain pinkish orange.
Less differentiated subsurface cells have blue—green cytoplasm.

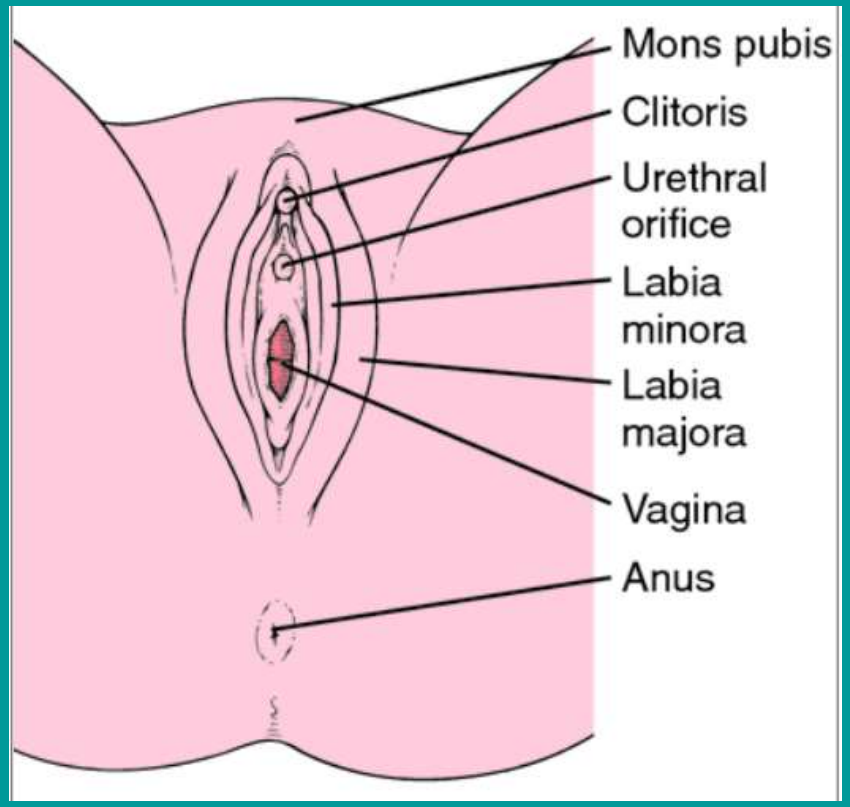
Unusually high numbers of blue—green cells, prompt further tests for the possibility of cervical carcinoma

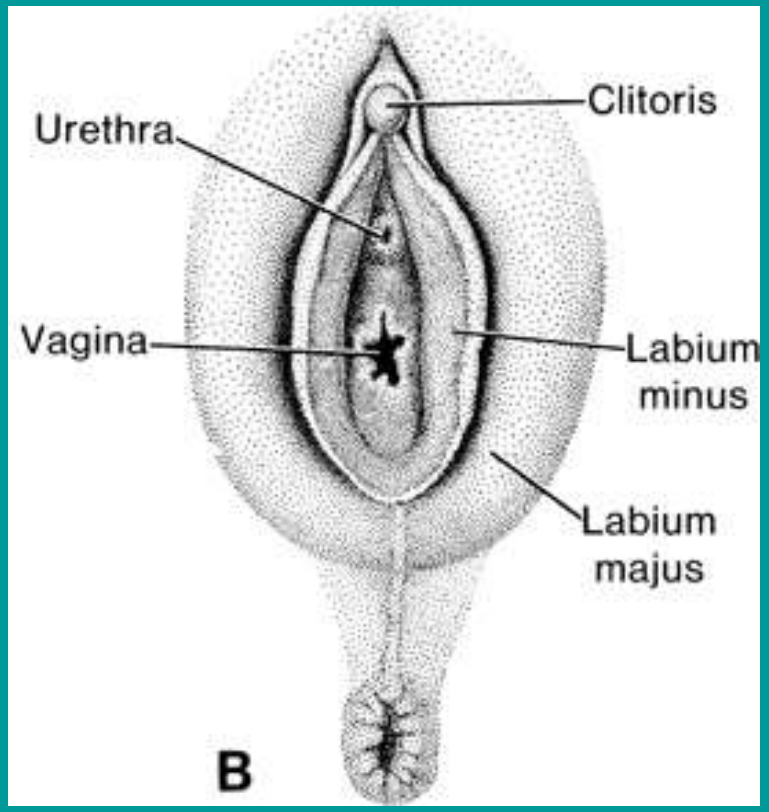


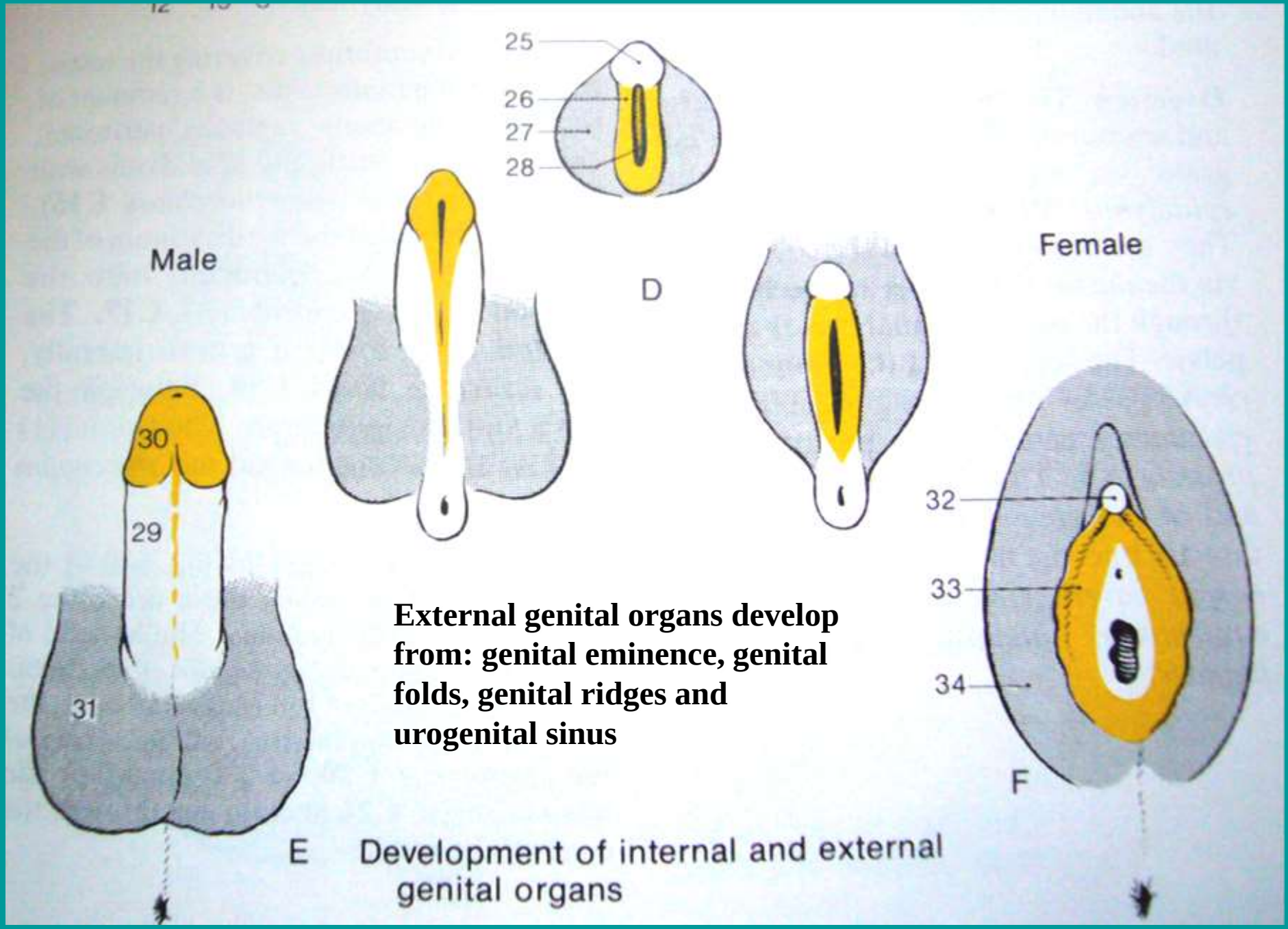
External genital organs

Pudendum (vulva)
Mons pubis
Labium majus
Labium minus
Pudendal cleft
Vestibule
Bulb of vestibule
Clitoris

Pudendum femininum (vulva)

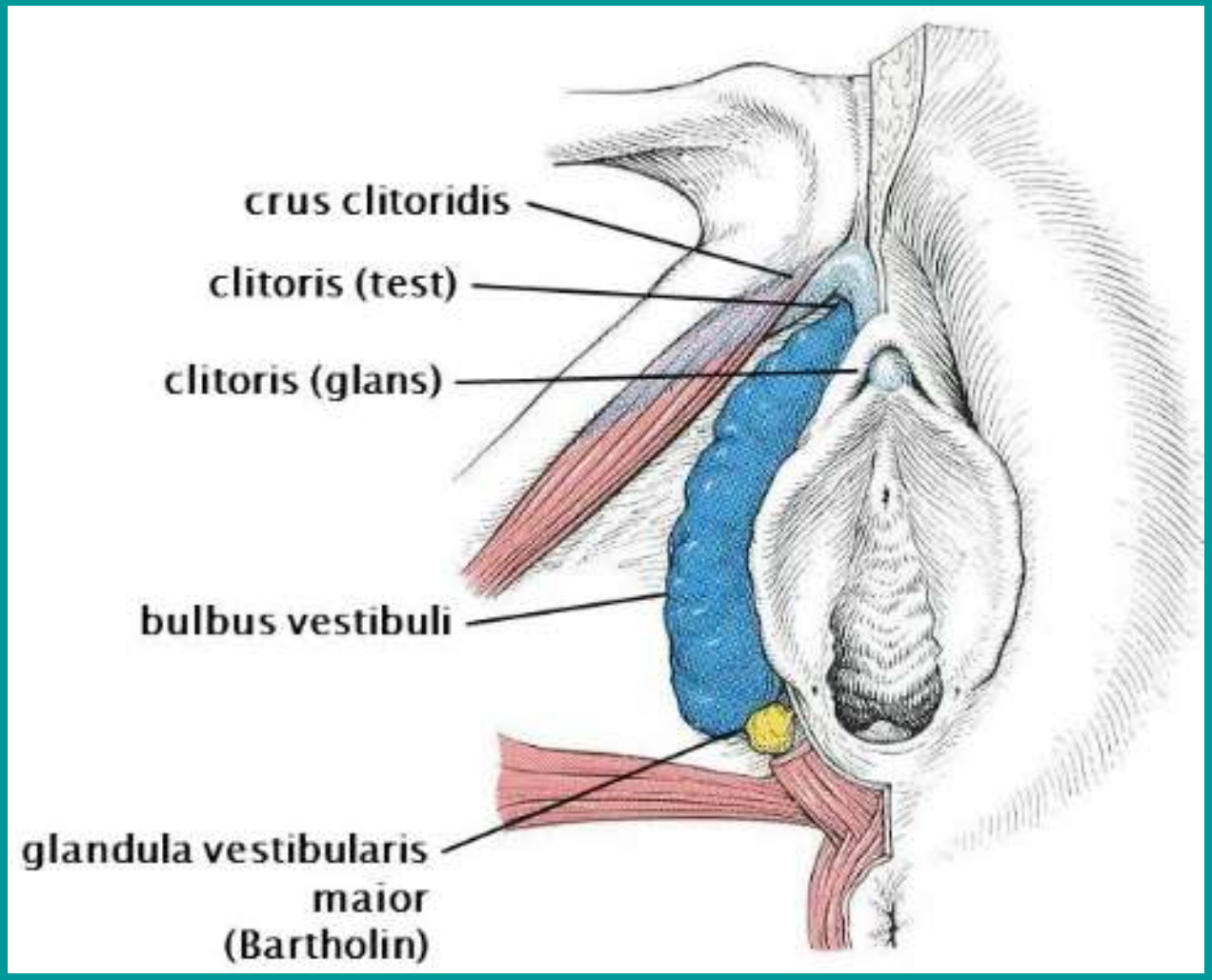






External genital organs develop from: genital eminence, genital folds, genital ridges and urogenital sinus

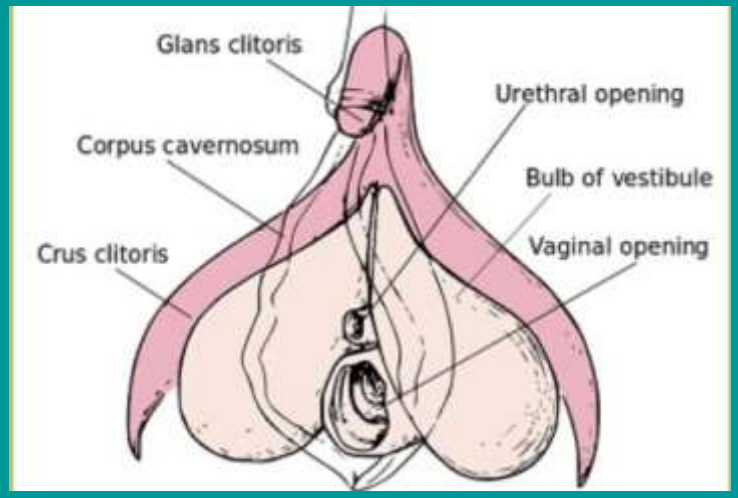
Vestibulum vaginae, bulbus vestibuli, gl. vestibularis major, m. ischiocavernosus,

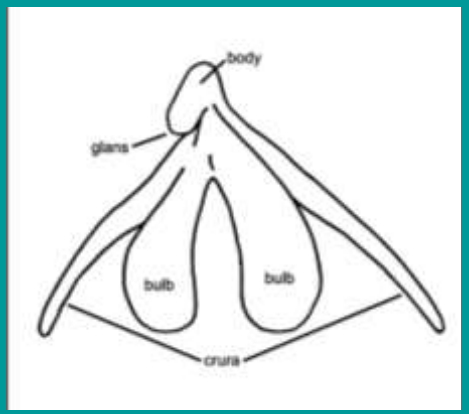


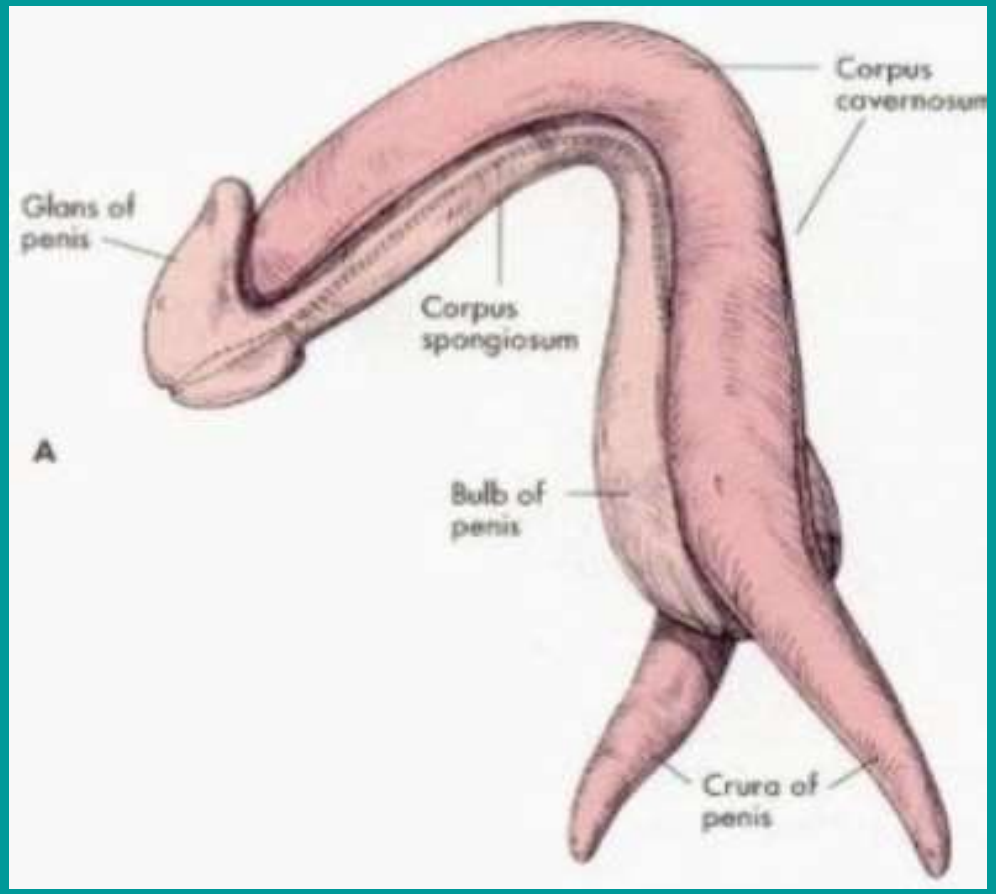
Cavernous tissue of female and male

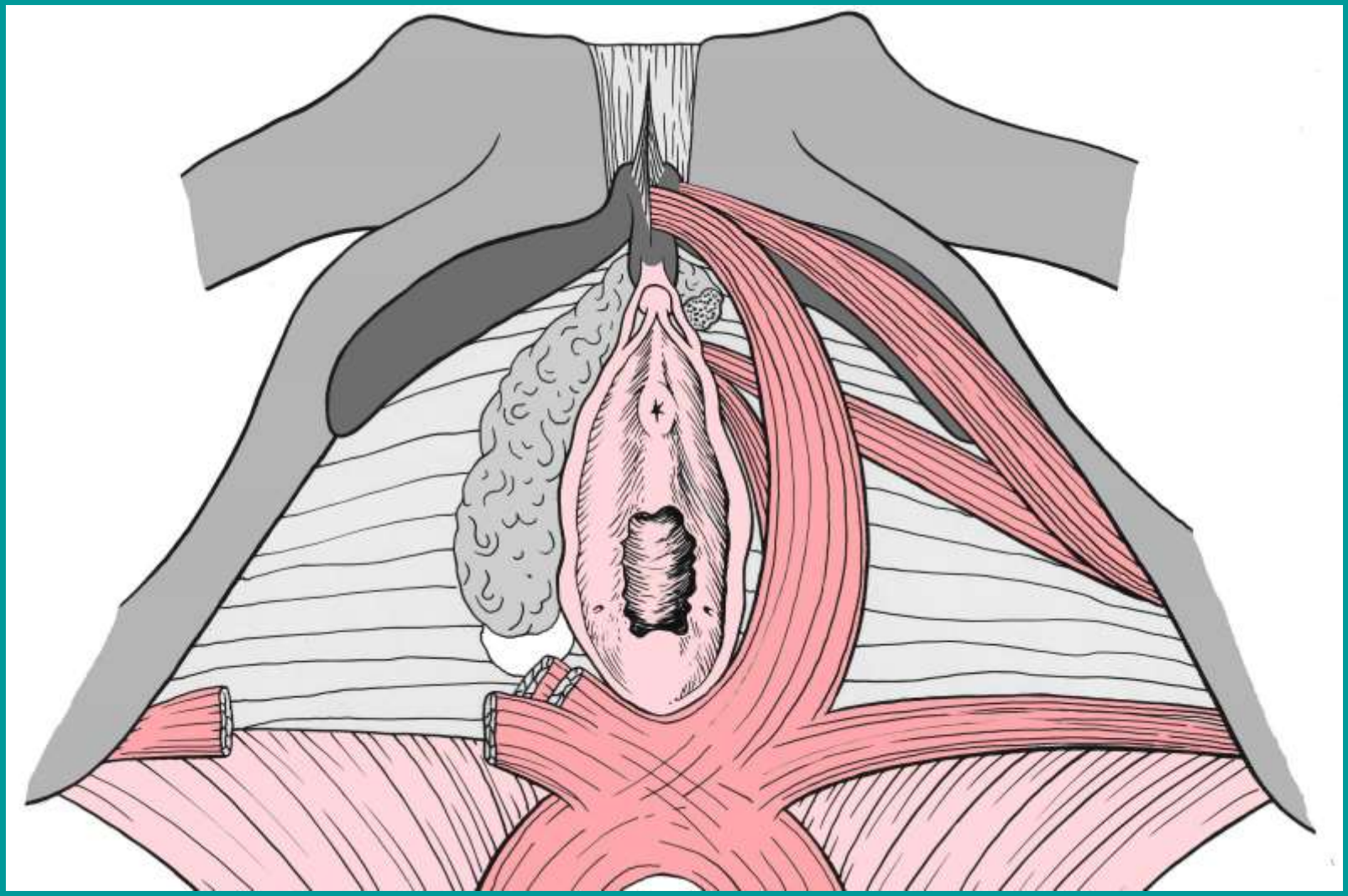
Clitoris, bulbus vestibuli- glans clitoridis, corpus clitoridis, crus clitoridis

Penis – corpora cavernosa, corpus spongiosum, glans









Perineal muscles in urogenital region:
bulbospongiosus, ischocavernosus, compressor of urethra, urethrovaginal sphincter, superficial transverse perineal m.

Sources of illustrations used :

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