

UGS Lecture – 10
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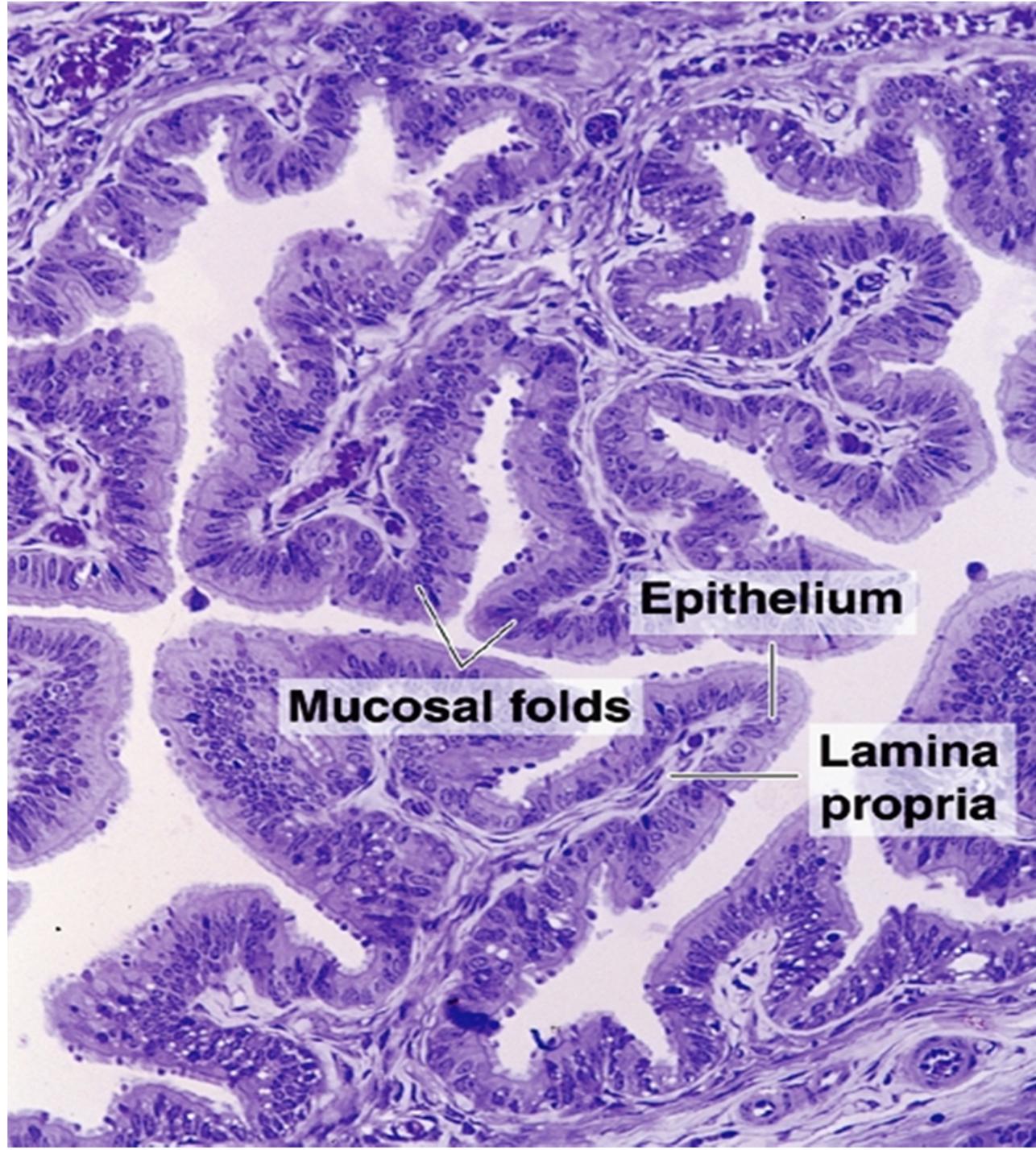
Uterine Tubes

The wall of the oviduct is composed of three layers:

(1) Mucosa:

- Presents branching, longitudinal folds that are most numerous in ampulla.
- It is composed of a simple columnar epithelium and a lamina propria.
- The columnar of two types: ciliated and non-ciliated secretory cells.

- **The latter cells produce a secretion that is propelled towards uterus by wave-like beating of cilia of ciliated cells, carrying with it the ovum.**
- **The secretion also has a role in nutrition and protection of ovum.**
- **The lamina propria composed of loose connective tissue.**

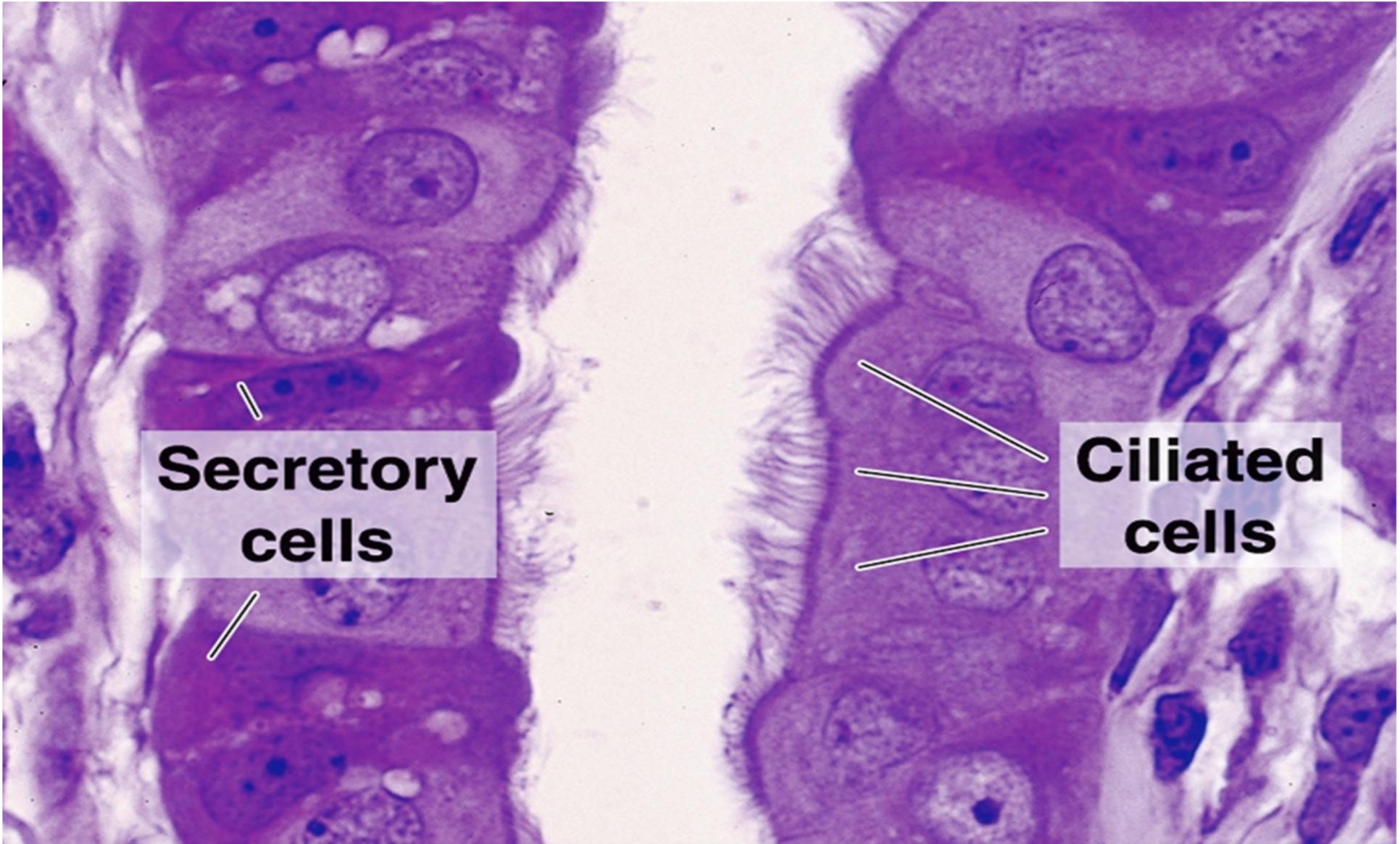


Epithelium

Mucosal folds

Lamina
propria

**Section
from uterine
tube**



**Secretory
cells**

**Ciliated
cells**

**Lining epithelium of uterine tube
(high power)**

(2) Muscular layer:

- Is thick, consists of two layers, an inner circular and an outer longitudinal.**
- Peristaltic action of these smooth muscles assists movement of ovum along the tube.**

(3) Serosa: Visceral peritoneum.

Note:

- The uterine tube is a direct route of communication from the vulva through the vagina and uterine cavity to the peritoneal cavity.**
- After sexual contact pathogenic organism may ascend through uterus and enter tube causing salpingitis.**
- Leakage of pus into peritoneal cavity may follow, causing pelvic peritonitis and even pelvic abscess.**
- Infection may spread further, causing general peritonitis.**
- Implantation and growth of a fertilized ovum may occur in wall of uterine tube, leading to ectopic pregnancy.**

Uterus

- The wall of uterus is relatively thick composed of three layers, an outer layer (perimetrium), a middle muscular layer (myometrium), and an inner layer (endometrium):
 - (1) **Perimetrium:** Depending on part of uterus, there is either an outer serosa (connective tissue and mesothelium) or adventitia (connective tissue only).
 - (2) **Myometrium:**
 - Makes up bulk of uterus.
 - It is composed of bundles of smooth muscle fibers that form four ill-defined layers.

- The 1st and 4th layers are composed mainly of fibers disposed longitudinally.
- In middle layers (2nd and 3rd layers) fibers disposed circularly.
- Branches of uterine artery pass to middle layers of myometrium and immediately divide into two different types of arteries, straight arteries and spiral arteries.
- During pregnancy, in response to increased level of estrogens, myometrium increases greatly in size, mainly by increasing cell size (hypertrophy), although some increase in cell numbers (hyperplasia) due to cell division may also occur.

(3) Endometrium: Consists of:

i. Epithelium: Is simple columnar epithelium contains two types of cells, ciliated and non-ciliated secretory cells.

ii. Lamina propria:

- Consists of a connective tissue, which is rich in fibroblast and contains abundant ground substance.**
- Simple tubular glands are embedded in the CT. they sometimes branch in their deeper portions.**

- **The epithelial lining of glands is similar to lining epithelium of endometrium except ciliated cells are rare within gland.**

The endometrium can be subdivided in to two zones:

a. Stratum basalis:

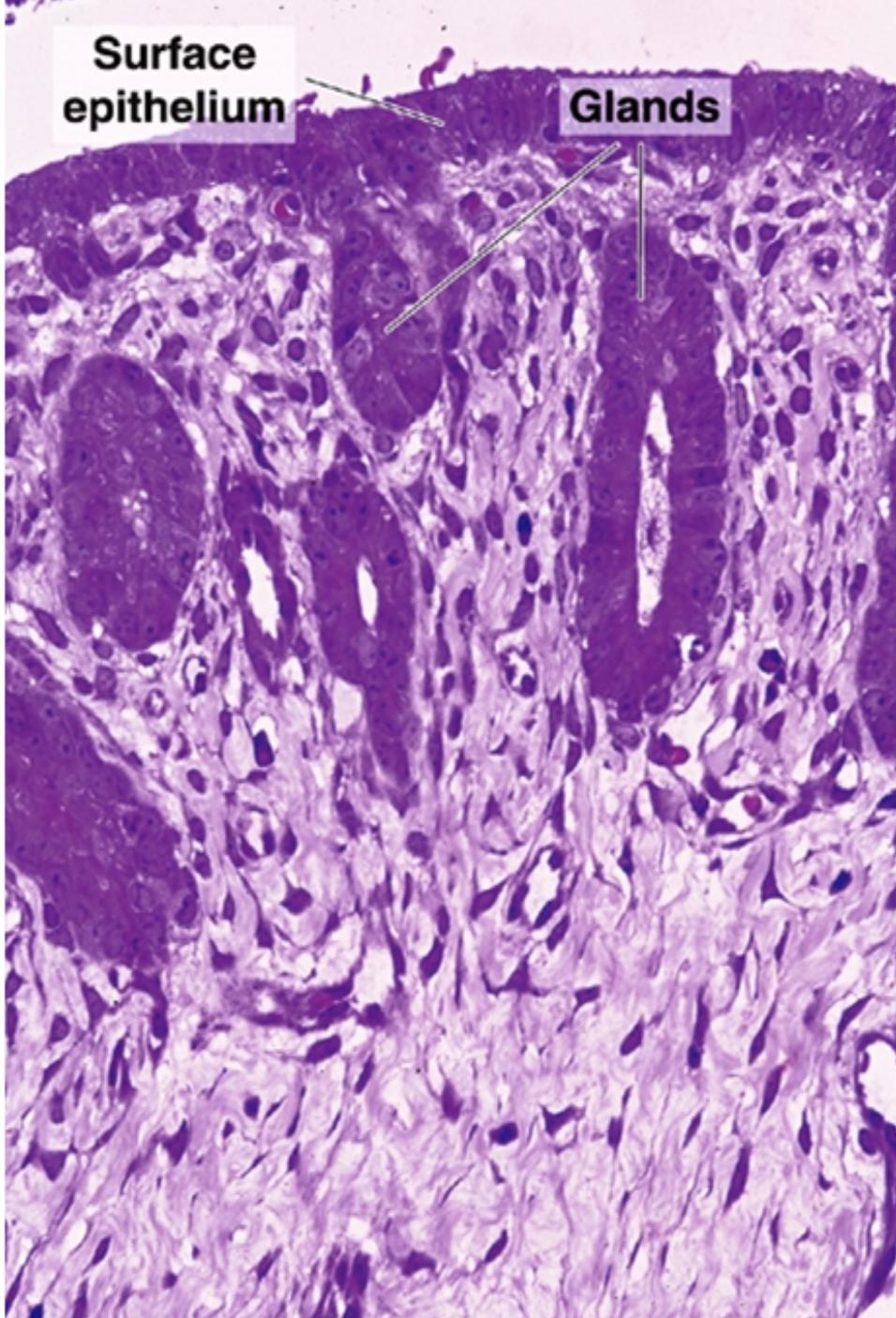
- **Supplied by straight arteries.**
- **Region adjacent to myometrium; it contains lamina propria and closed tips of uterine glands.**
- **It undergoes little change during menstrual cycle and is not shed during menstruation.**

b. Stratum functionalis:

- **Supplied by spiral arteries.**
- **Contains surface epithelium, remaining part of lamina propria, and uterine glands.**
- **It exhibits dramatic changes throughout menstrual cycle and is shed during menstruation.**

**Surface
epithelium**

Glands



**Endometrium
Layer of Uterus**

Menstrual Cycle

- The cycle of changes in endometrium proceeds through three distinct phases, menstrual, proliferative, and secretory:

(1) Menstrual phase

- The first day of menstruation is taken as 1st day of cycle simply because it is easily identified.
- It lasts 3 – 4 days on average.
- Failure of fertilization ovum leads to inhibition in production of progesterone by corpus luteum.

- **In the absence of progesterone, endometrium cannot be maintained, leads to breakdown of blood vessel wall and basement membranes.**
- **Consequently, part of functional layer of endometrium becomes detached.**
- **The amount of blood lost varies between women and even in same woman at different times.**
- **At end of menstrual phase, endometrium is usually reduced to a thin layer of lamina propria, deep ends of uterine glands, and some covering epithelium.**

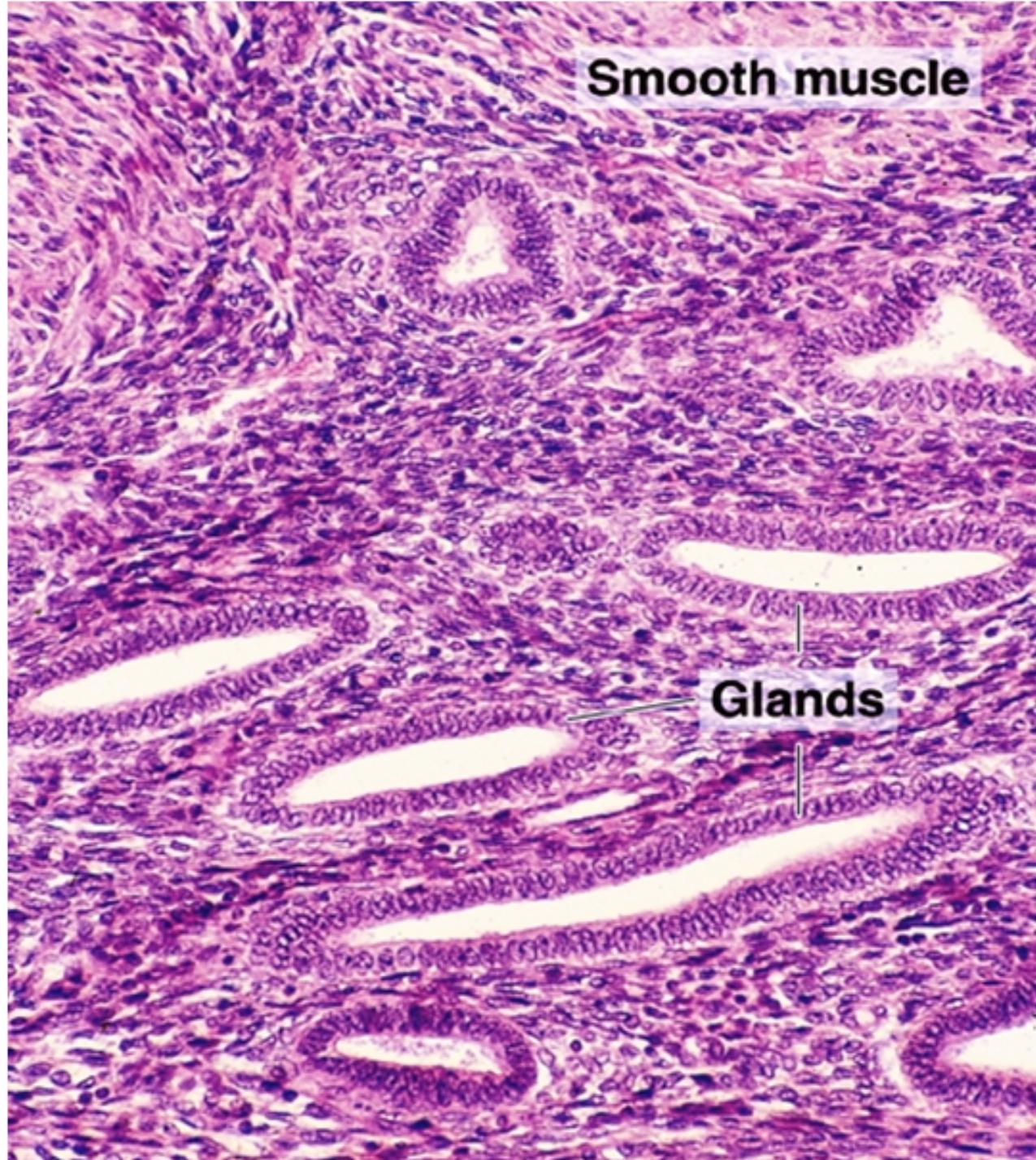
(2) Proliferative phase

- Takes about 10 days on average.**
- Estrogens produced by theca interna of growing ovarian follicles act on endometrium, inducing cell proliferation and replace endometrium lost during menstruation.**

As a result:

- i. The endometrium becomes covered by a simple columnar epithelium.**
- ii. The lamina propria becomes thicker and richly vascularized.**

- **The glands, formed by simple columnar epithelial cells, are straight tubules with narrow lumen.**
- **The cells of glands gradually accumulate more cisternae of RER, and the Golgi complex increase in size in preparation for secretory activity.**



Smooth muscle

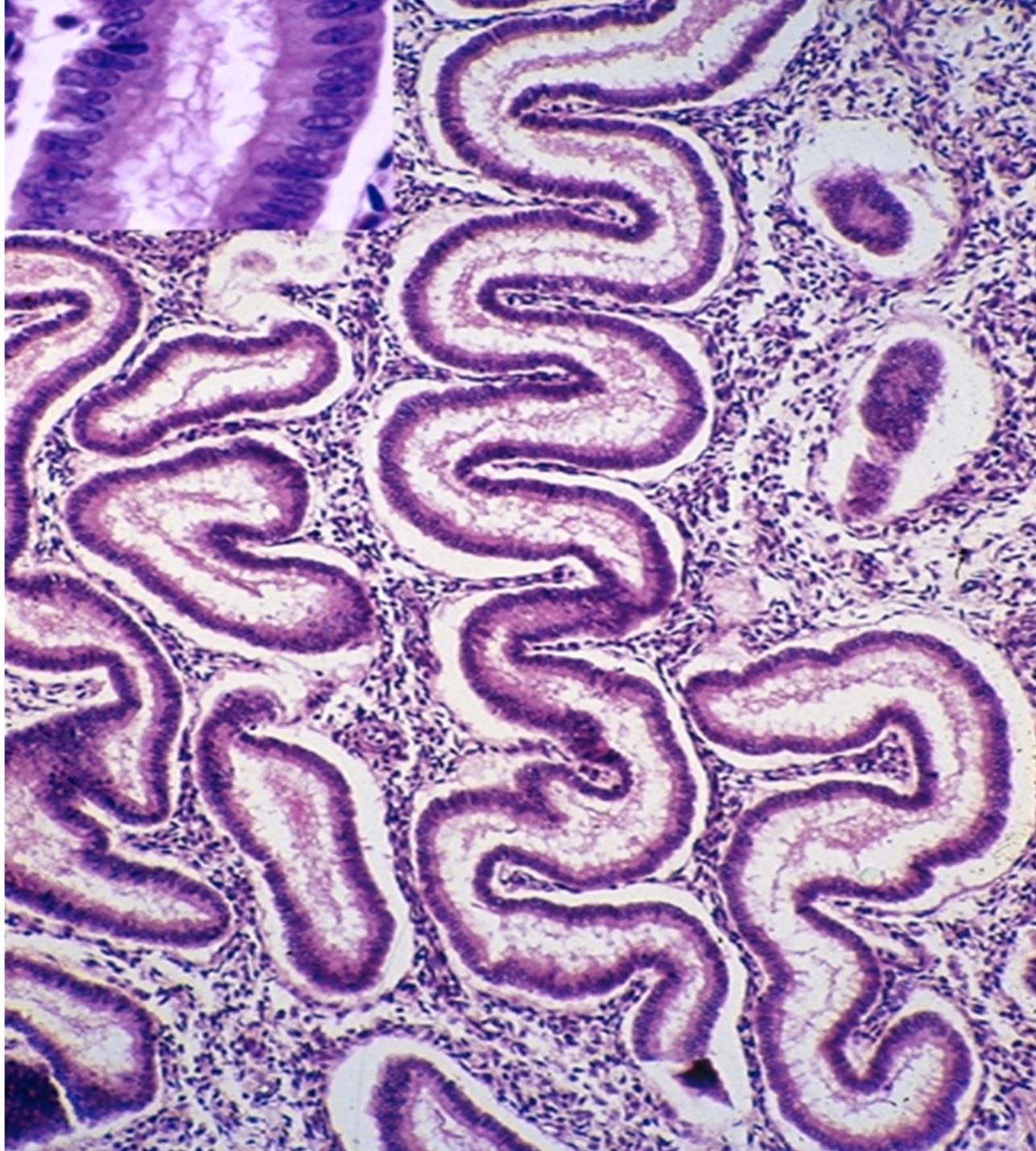
Glands

Proliferative phase in the uterus

3) Secretory phase

- Start at ovulation and lasts about 14 days.**
- It results from action of progesterone secreted by corpus luteum.**
- Epithelium of glands, start to accumulate glycogen below their nuclei.**
- Later, glycoprotein secretory products dilate lumens of glands.**
- Glands become highly coiled.**

- **In this phase endometrium reaches its maximum thickness as a result of accumulation of secretions and of edema in stroma.**
- **Mitosis is rarely seen during this phase.**



**Secretory
Phase in
the Uterus**

Cervix

- Is lined by a simple, high columnar mucous-secreting epithelial cells.**
- The main bulk is composed of dense connective tissue containing a little smooth muscle.**
- The external surface of the cervix that bulges into lumen of vagina is covered with stratified squamous epithelium.**
- The mucosa contains cervical mucous glands, which are extensively branched.**

- **During menstrual cycle, mucosa does not undergo remarkable changes.**
- **In a pregnant woman, cervical mucous glands proliferate and secrete a more viscous and abundant mucous.**
- **At time of ovulation, mucous secretions are watery and allow sperm to enter uterine cavity.**
- **In secretory phase or in pregnancy, progesterone levels alter mucous secretions so that they become more viscous and prevent passage of sperm, as well as microorganisms, into uterine cavity.**

- **Sonography (ultrasound) of female pelvis can be used to visualize uterus and developing fetus and vagina.**

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Vagina

The wall of vagina consists of three layers, an inner mucosa layer, a middle muscular layer, and an outer dense connective tissue layer, adventitia:

(1) Mucosa

- Lined by stratified squamous epithelium.**
- The lamina propria is composed of loose connective tissue that contains many elastic fibers, plexus of small veins, and is devoid of glands.**
- In relaxed state, vaginal mucosa is thrown up into folds (ruge).**

- **Under stimulus of estrogen, vaginal epithelium synthesizes and accumulates a large quantity of glycogen, which is excreted into lumen of vagina.**
- **Bacteria metabolize glycogen and form lactic acid, which is responsible for usually low pH of vagina.**
- **This acidic environment provides a protective action against growth of pathogenic microorganisms.**

(2) Muscular layer

The smooth muscle bundles of this layer are arranged in ill-defined inner circular and outer longitudinal layers.

(3) Adventitia

- Composed of dense connective tissue, rich in elastic fibers, and contains an extensive venous plexus, nerve bundles, and groups of nerve cells.**
- The great elasticity of vagina is related to large number of elastic fibers in connective tissues of its wall.**

- **The vagina is lubricated by cervical mucus, a fluid transudate from rich vascular network of lamina propria, and mucus secreted by glands of labia minora.**



**Higher
Magnification
of Epithelium
and Lamina
propria of
Vagina**

Gonads (testes and Ovaries) are derived from three sources:

(1) Mesothelium (mesodermal epithelium) lining the posterior abdominal wall.

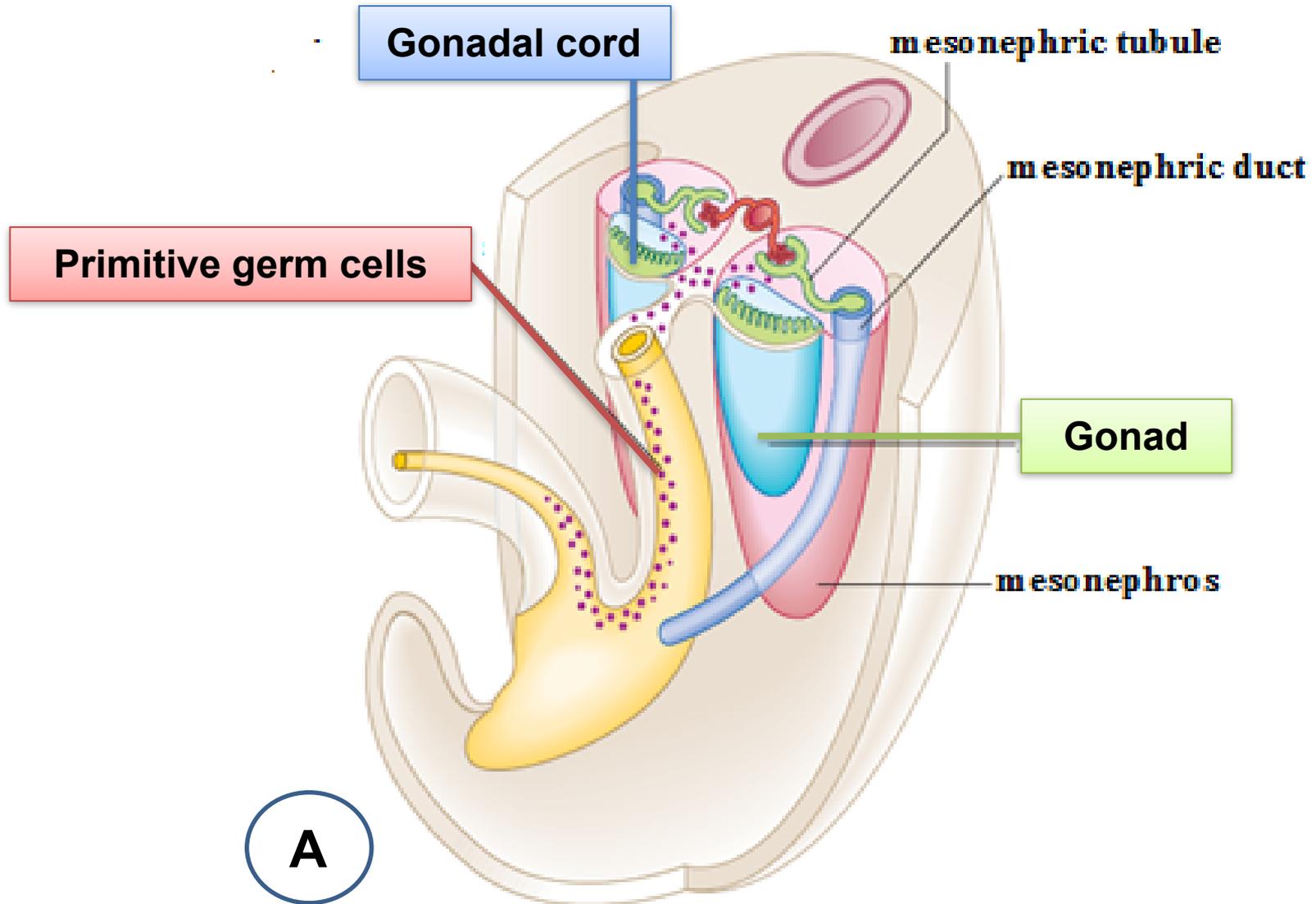
(2) Underlying mesenchyme (embryonic connective tissue).

(3) Primordial germ cells.

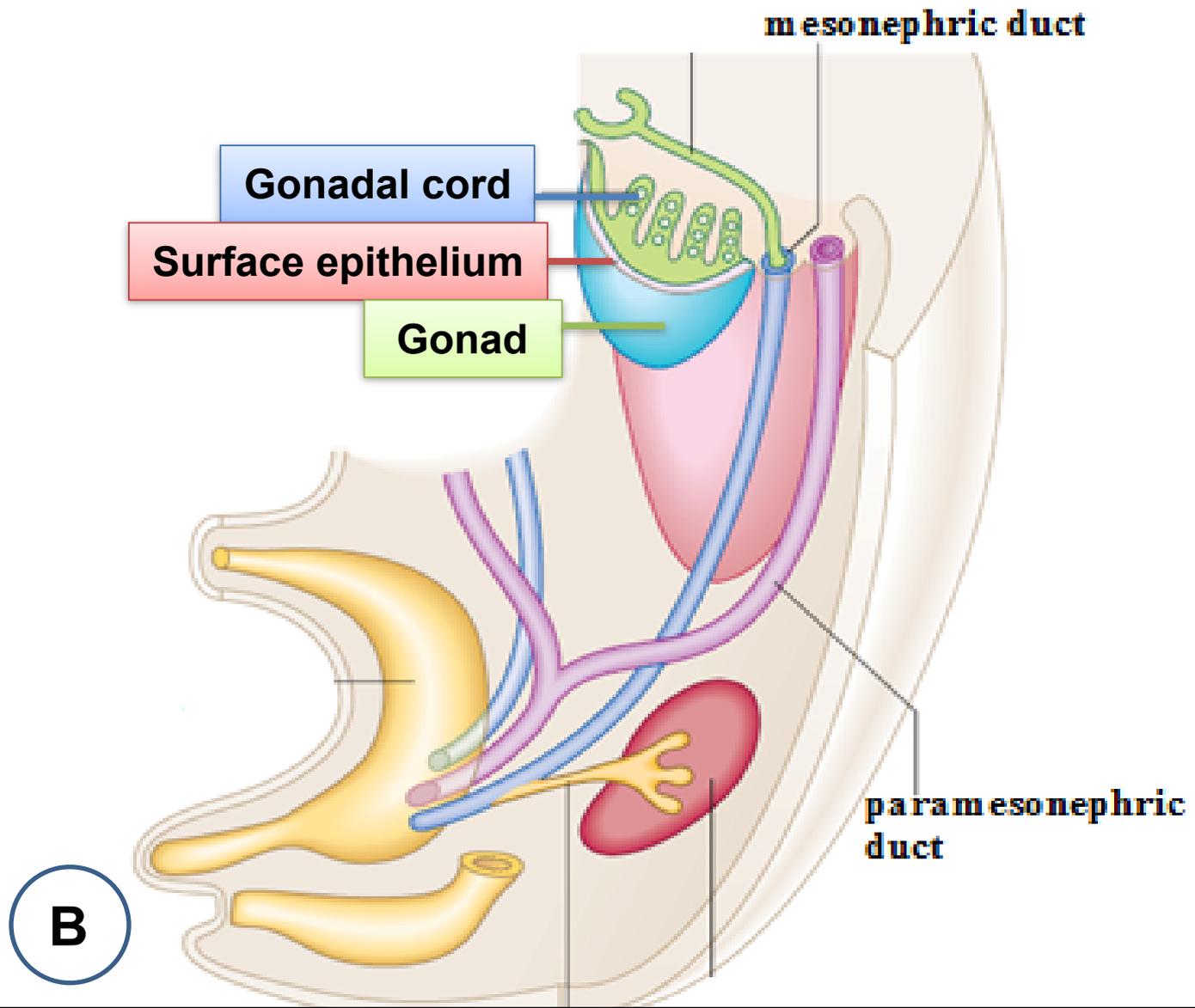
Indifferent Gonads

- The gonads appear initially at 5th W of development, as a pair of longitudinal ridges, genital or gonadal ridges, on medial side of mesonephrous.
- They are formed by proliferation of epithelium and a condensation of underlying mesenchyme.
- Primordial germ cells migrate from wall of yolk sac to reach primitive gonads at beginning of 5th W, and invading genital ridges in 6th W.

- **Shortly before and during arrival of primordial germ cells, the epithelium of gonadal ridge proliferates, and penetrates underlying mesenchyme to form a number of irregularly shaped cords, gonadal cords.**



Development of indifferent gonads



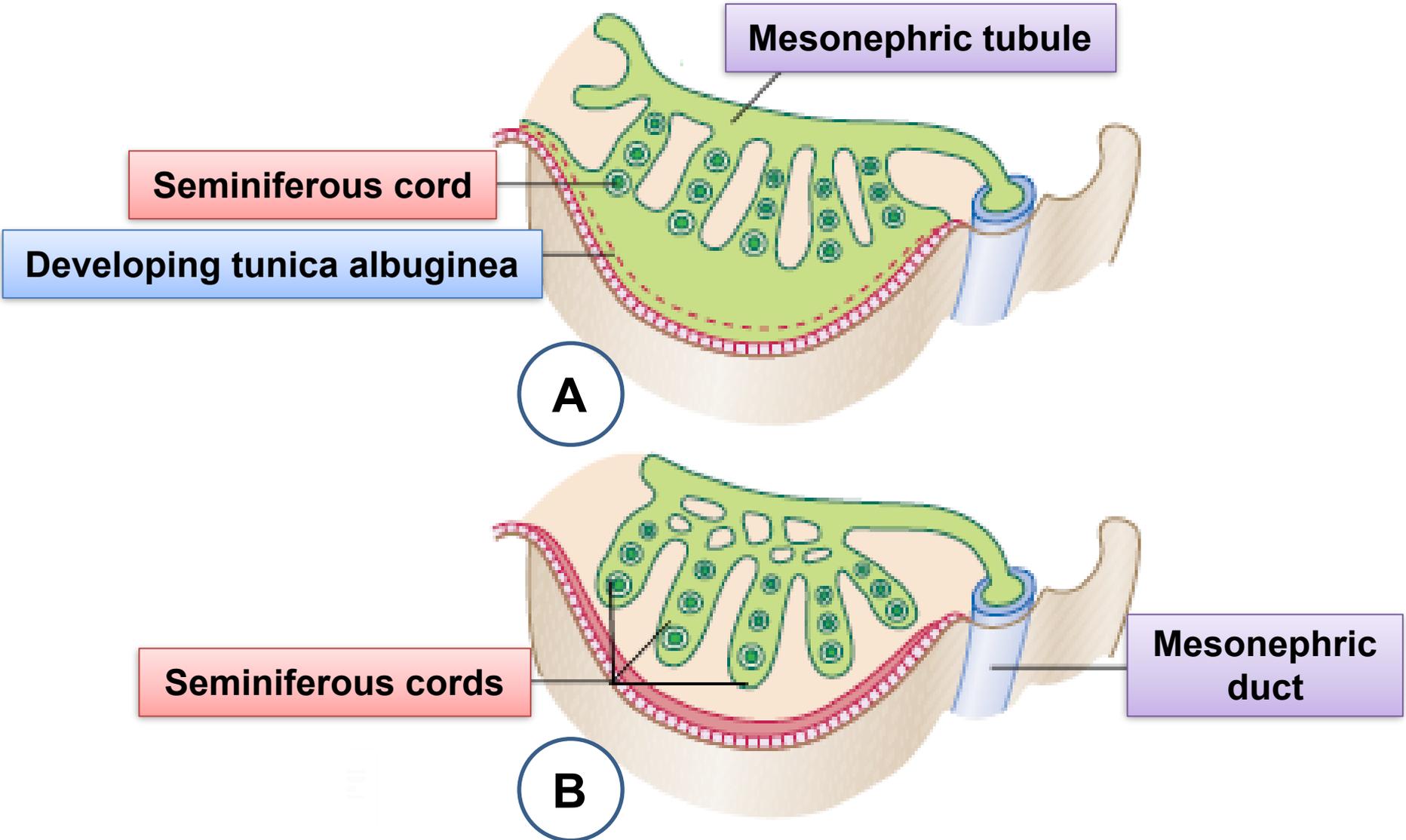
Development of indifferent gonads

- **The indifferent gonad now consists of an external cortex and internal medulla.**
- **In embryos with XY sex chromosome complex, medulla differentiates into testis, while cortex regresses.**
- **In embryo with XX sex chromosome complex, cortex differentiates into ovary, while medulla regresses.**
- **Until 7th W, gonads of two sexes are identical and called indifferent gonads. 34**

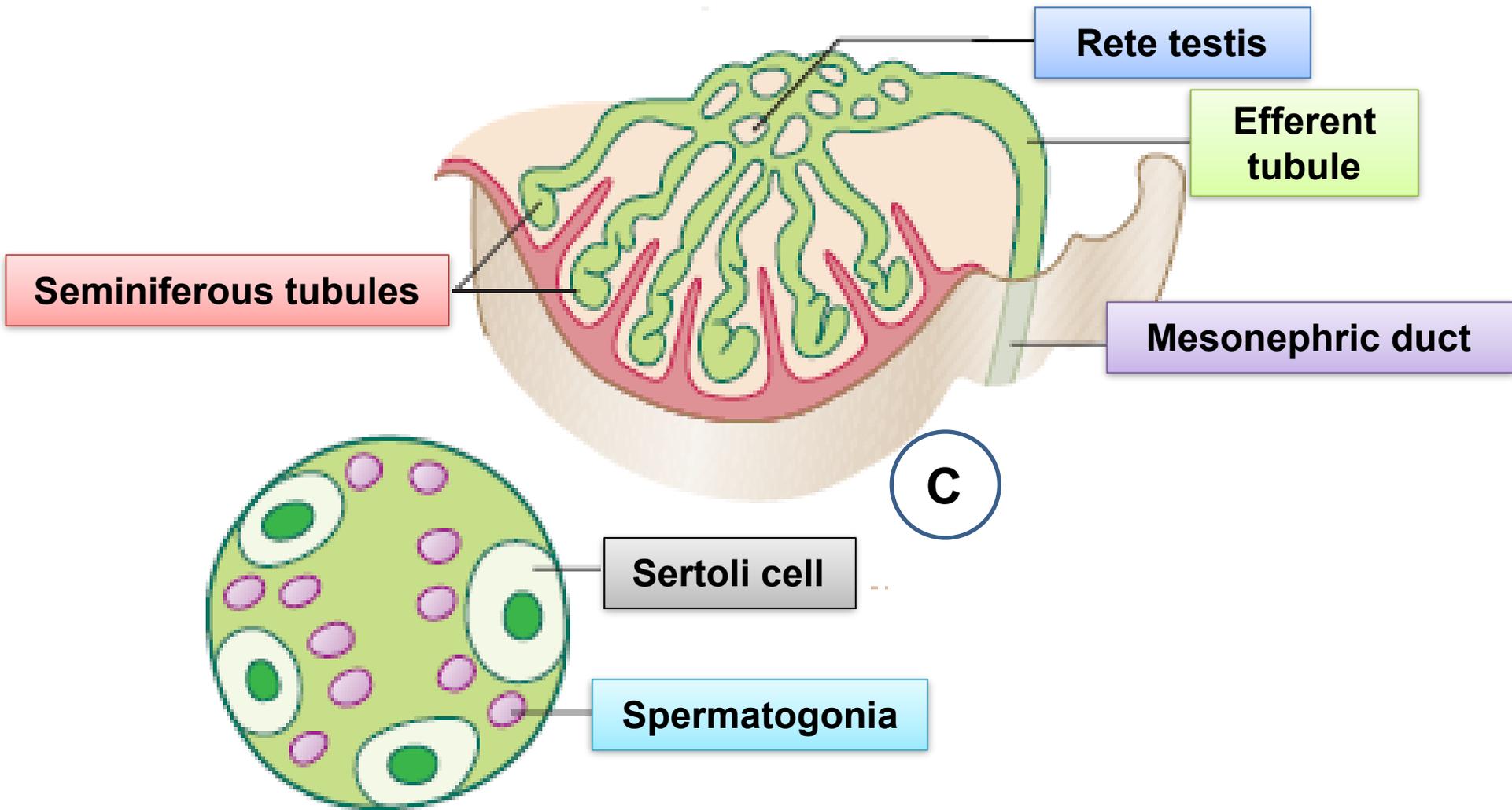
Development of Testes

- If embryo is genetically male, under influence of testis-determining factor (TDF), the gonadal cords continue to proliferate and penetrate deep into medulla to form medullary or seminiferous cords.
- Toward hilum of gonad, the cords break up into a network of tiny cell strands that later give rise to tubules of rete testis.
- During further development a dense layer of fibrous connective tissue, tunica albuginea that separate seminiferous cords from surface epithelium.

- In 4th Mon., seminiferous cords become continuous at their extremities with rete testis.
- Seminiferous cords are now composed of spermatogonia derived from primordial germ cells and Sertoli cells derived from surface epithelium of gland.
- The Sertoli cells produce a glycoprotein known as mullerian inhibiting substance (MIS) until puberty, at which time level of MIS decrease.



Development of the Testes



Development of the Testes

- **MIS suppress development of paramesonephric ducts, which form uterus and uterine tubes.**
- **Interstitial (leydig) cells , derived from original mesenchyme of gonadal ridge, lie between seminiferous cords.**
- **They begin development shortly after onset of differentiation of these cords.**
- **By 8th W, leydig cells begin production of androgenic hormones (testosterone).**

- **Testosterone production is stimulated by human chorionic gonadotropin (GTH).**
- **It reaches peak amount during the 8 – 12 W period of fetal development.**
- **Seminiferous cords remain solid until puberty, when they acquire a lumen, thus forming seminiferous tubules.**
- **Once seminiferous tubules are canalized, they join rete testis tubules, which in turn become continuous with 15 – 20 mesonephric tubules.**
- **The latter become efferent ducts.**