Dadasaheb Jotiram Godse Arts Commerce Science College Vaduj,Dist- Satara

Presentation for one day workshop on NEP 2020 and new changed syllabus B.Sc. II

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DJGACS College Vaduj

B. Sc. Part II Semester- IV

ZOOLOGY

Semester IV Paper-VII

DSC-C (REPRODUCTIVE BIOLOGY - NEP 2020)

Theory: 30 hrs. (37.5 lectures of 48 minutes)

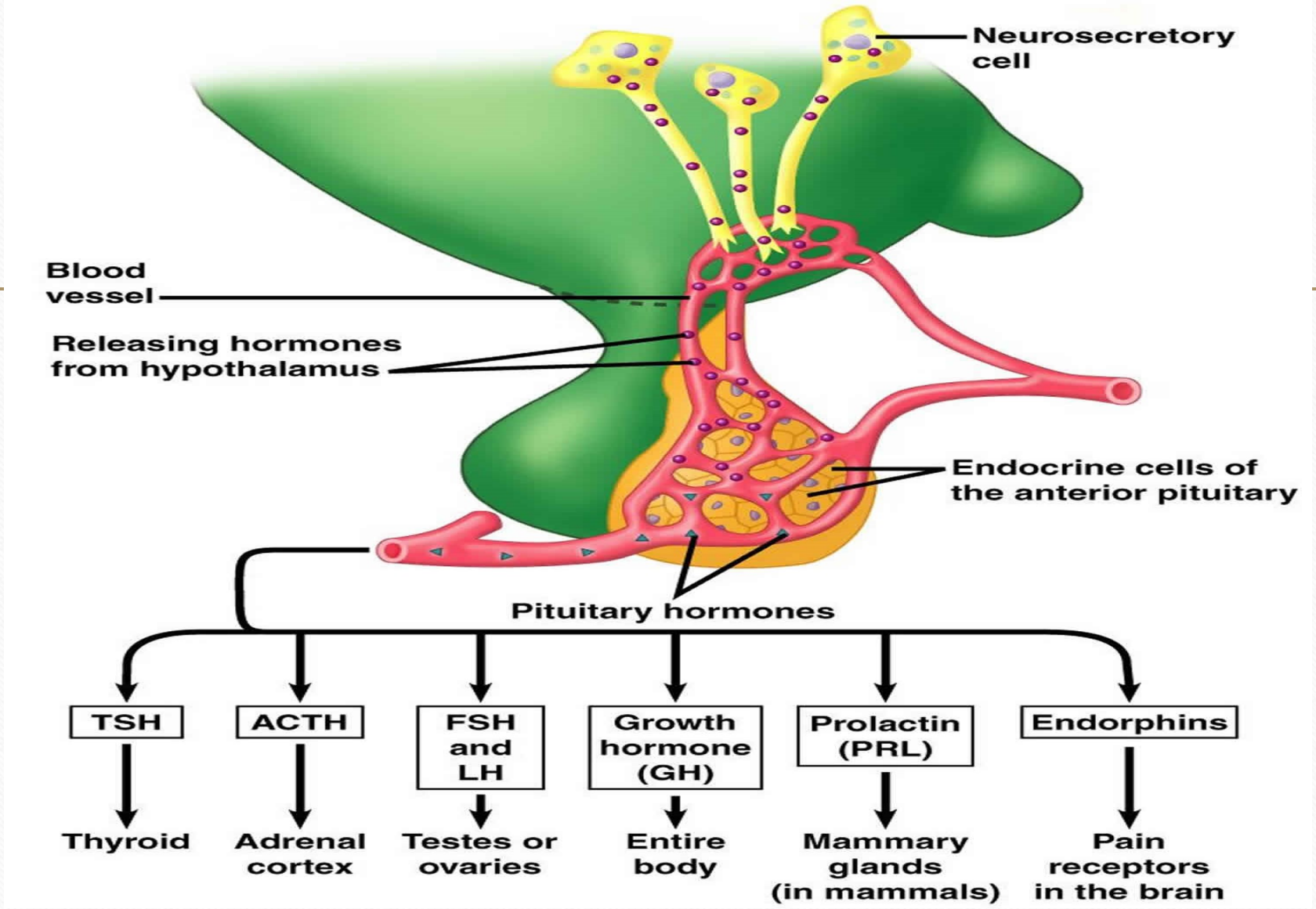
Unit I: Structure and hormones of pituitary gland (3 hrs.)

The pituitary gland is a small gland about 1cm in diameter and 0.5 to 1 g in weight. The pituitary gland lies in the Sella turcica, a body cavity at the base of the brain, and is connected to the hypothalamus by the pituitary or hypophysial stalk.

Physiologically, the pituitary gland is divisible into two distinct portions: the anterior pituitary, also known as the adenohypophysis and the posterior pituitary, also known as the neurohypophysis.

Between these is a small, relatively avascular zone called the pars intermedia, which is almost absent in the human being is much larger and much more functional in some lower animals.

Embryologically, the two portions of the pituitary originate from different sources.


Neurosecretory cell
Blood vessel
Releasing hormones from hypothalamus
Endocrine cells of the anterior pituitary
Pituitary hormones
TSH
ACTH
FSH and LH
Growth hormone (GH)
Prolactin (PRL)
Endorphins
Thyroid
Adrenal cortex
Testes or ovaries
Entire body
Mammary glands (in mammals)
Pain receptors in the brain

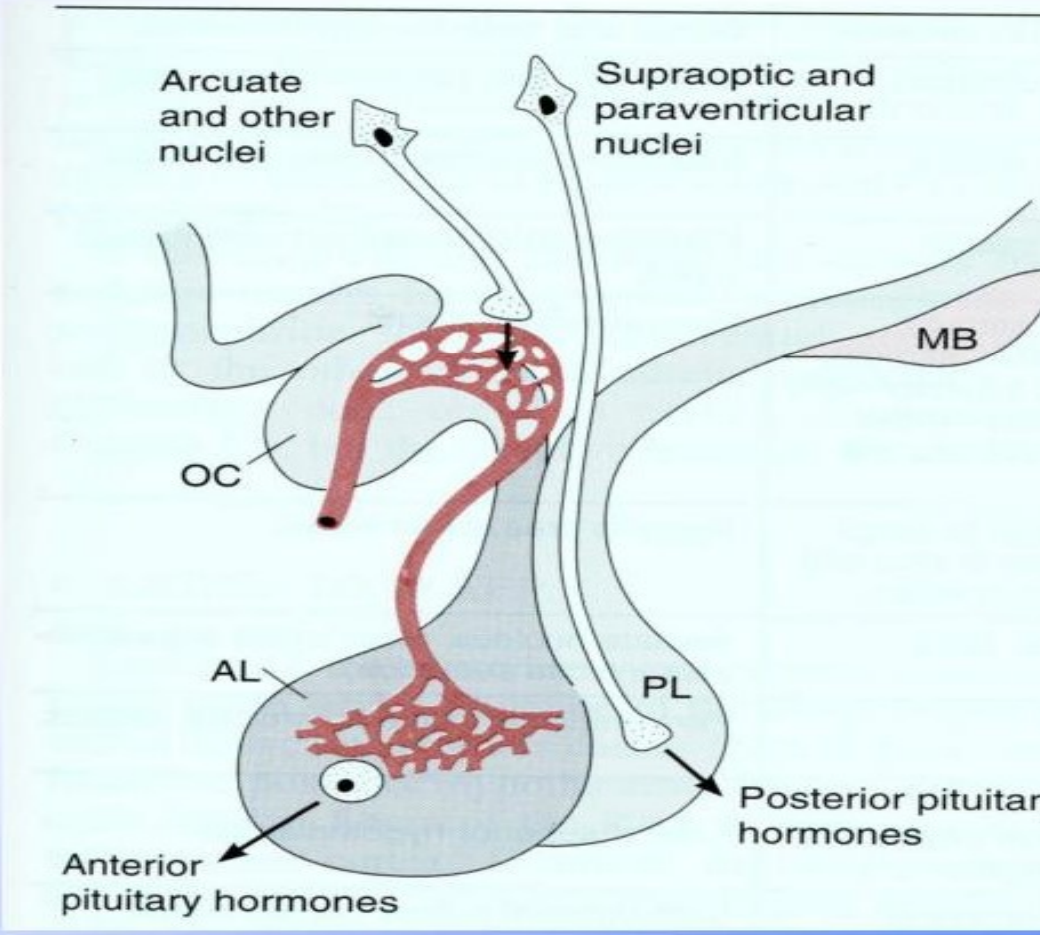
- Structure of Pituitary gland
    a) Aedinohypophysis
    b) Nerohypophysis
- Harmones of Pituitary gland

Adenohypophysis

Linked to hypothalamus via hypophyseal-portal system in the infundibulum

Connection allows hypothalamus to stimulate/inhibit 5 distinct pituitary cell types:

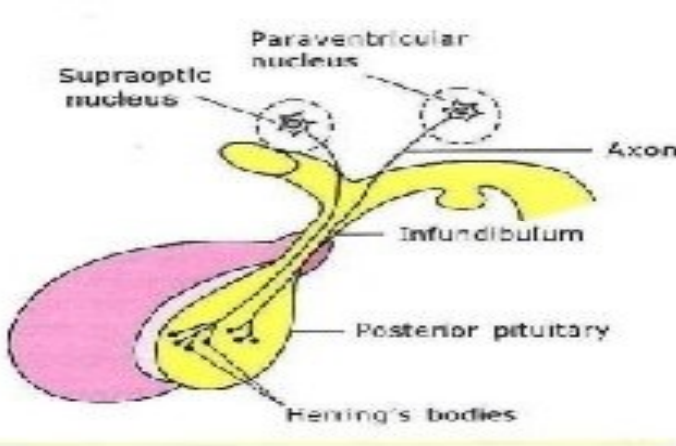
1. somatotropes -human growth hormone
2. corticotropes - adrenocortictropin
3. Thyrotropes - TSH
4. Gonadotropes – LH and FSH
5. Lactotropes - Prolactin



Neurohypophysis

Consists of:

- Numerous non-myelinated nerve fibres
- Supporting cells **(pituicytes)**
- Sinusoids



Produce 2 hormones:

- Oxytocin
- Vasopressin

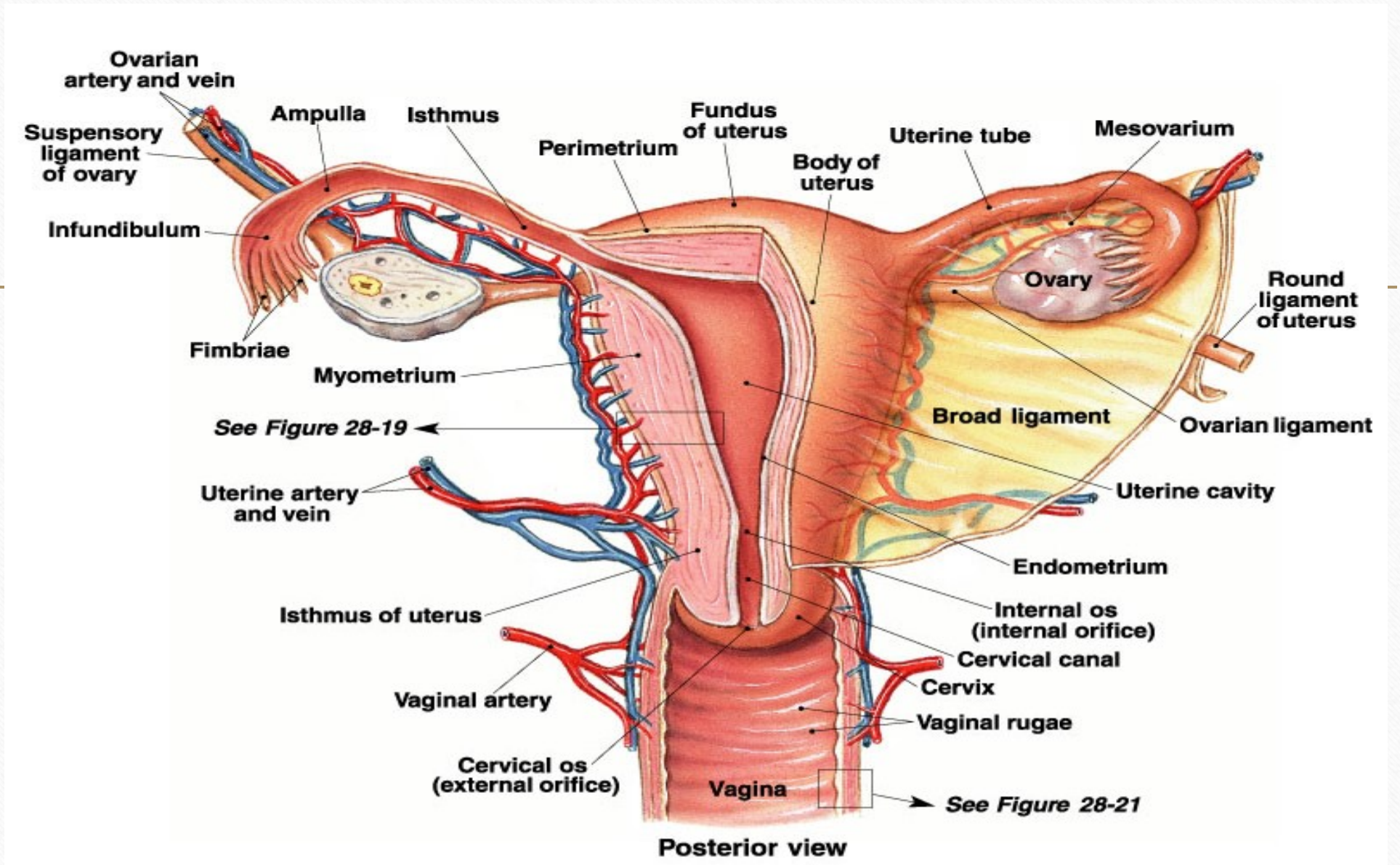
Herring bodies: collection of secretory granules at the terminal portion of axonal processing.

Unit II: Functional anatomy of female reproductive system: (12 hrs.)

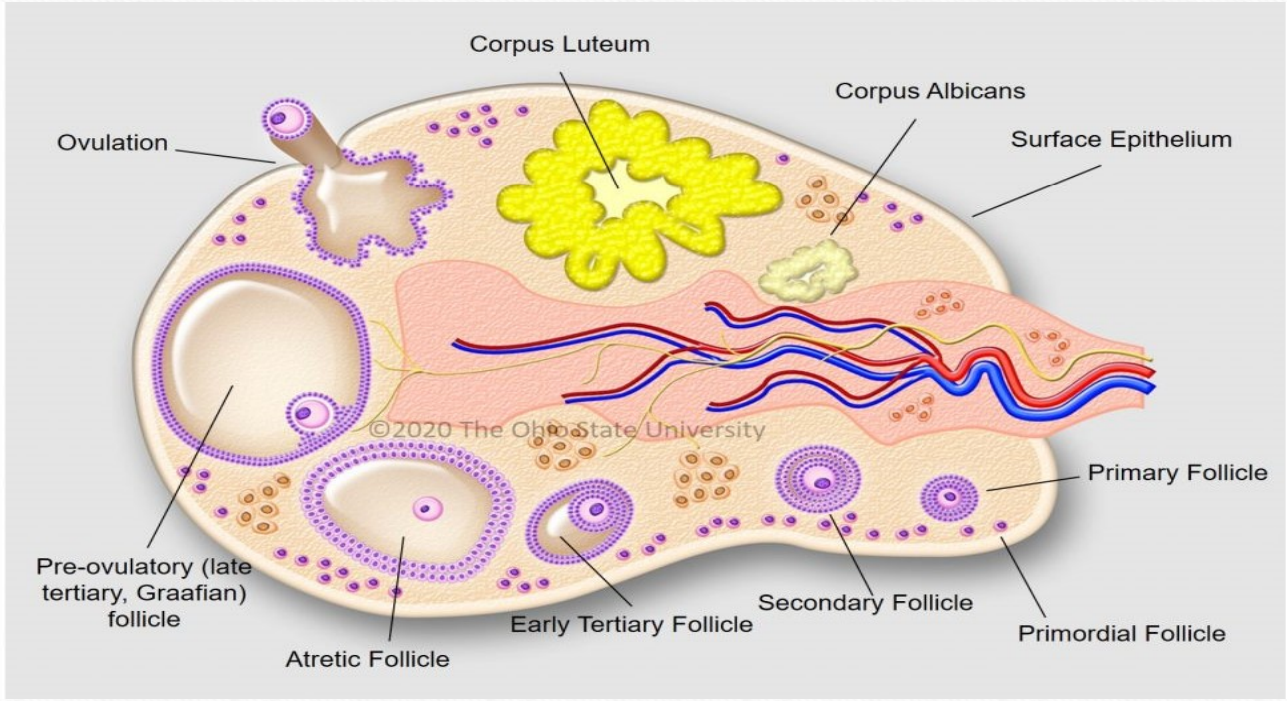
~~Anatomy of female reproductive system~~

- Histology of Ovary
- Histology of Oviduct/Fallopian Tube
- Histology of Uterus
- Histology of Cervix and vagina
- Reproductive cycle in Human
- Female sex hormones

- Folliculogenesis, process of Oogenesis and structure of ovum
- Menstrual cycle and hormonal regulation
- Transport of ovum and sperm in female genital tract
- Process of fertilization
- Hormonal control in Implantation
- Diagnostic features of pregnancy and hormonal regulation
- Mechanism and hormonal regulation of Parturition and Lactation


Ovarian artery and vein
Suspensory ligament of ovary
Ampulla
Isthmus
Perimetrium
Fundus of uterus
Body of uterus
Uterine tube
Mesovarium
Infundibulum
Ovary
Round ligament of uterus
Fimbriae
Myometrium
See Figure 28-19
Broad ligament
Ovarian ligament
Uterine artery and vein
Uterine cavity
Endometrium
Isthmus of uterus
Internal os (internal orifice)
Cervical canal
Cervix
Vaginal artery
Vaginal rugae
Cervical os (external orifice)
Vagina
See Figure 28-21
Posterior view

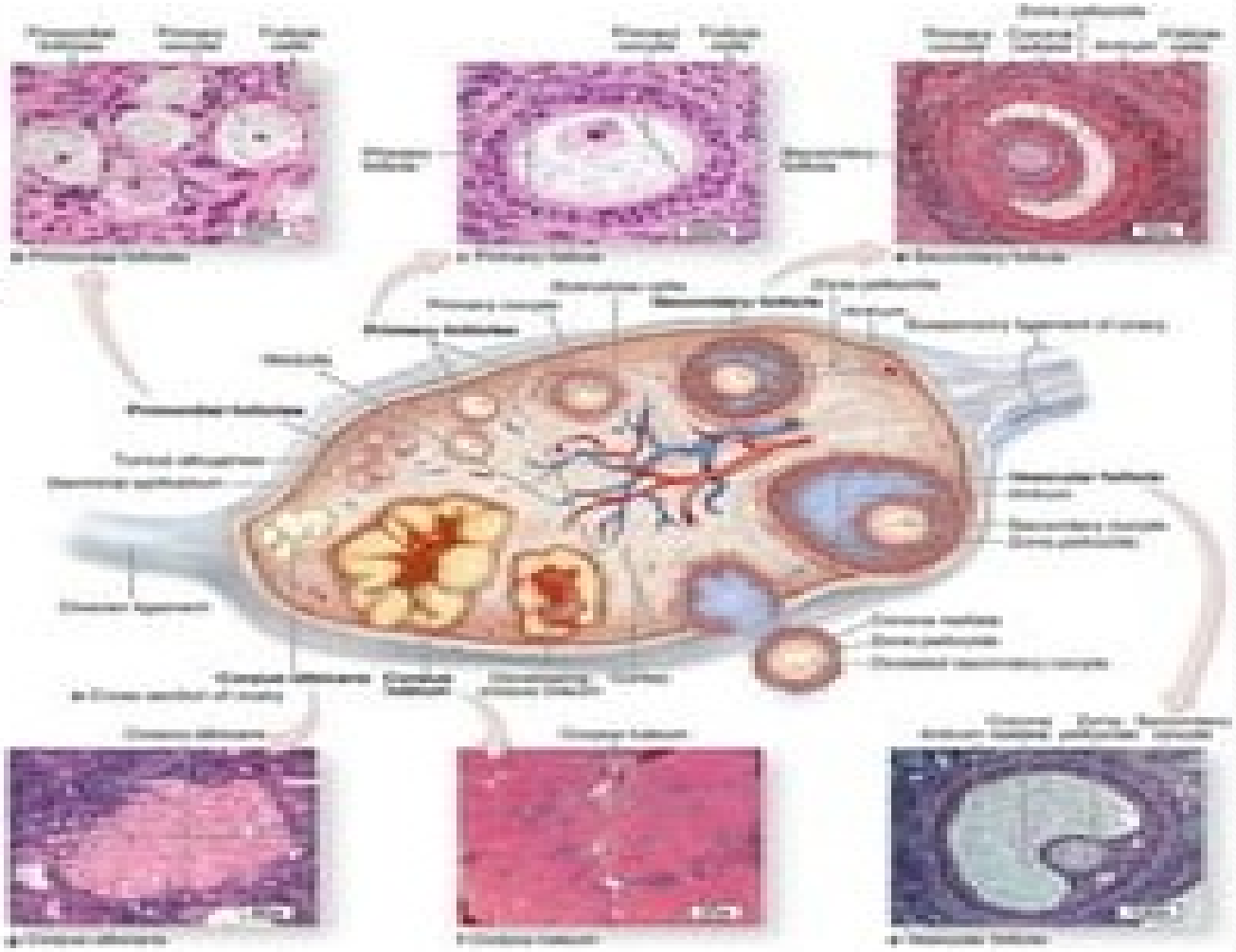
Histology of Ovary



The ovary is a rounded body approx. 3 x 1.5 cm long and 1 cm thick. It is encapsulated by the tunica albuginea, a dense layer of connective tissue which is covered by the germinal epithelium (Ovarian surface epithelium), a layer of simple squamous or cuboidal epithelium.

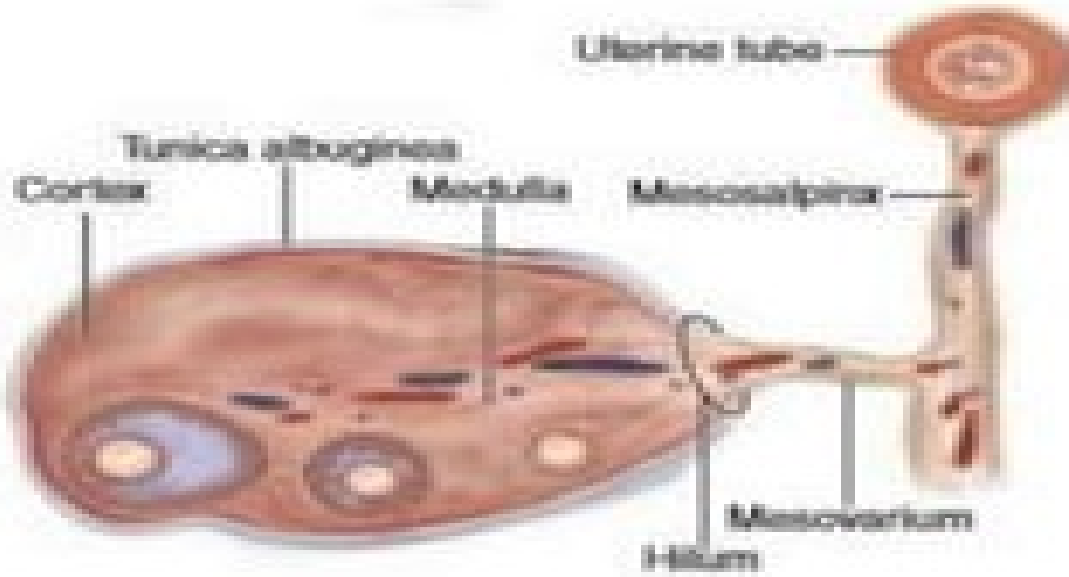
Ovary

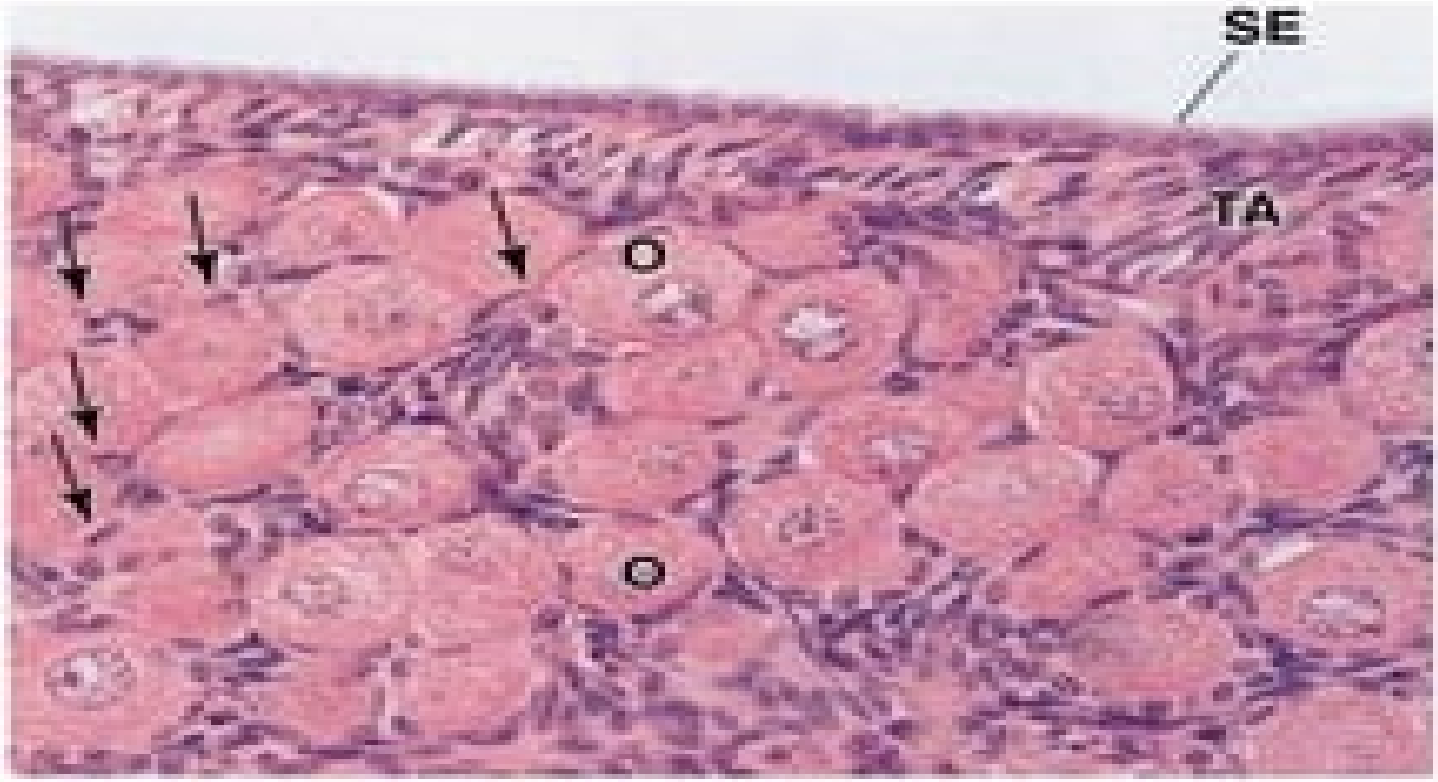
- Cortex: outer part consists of:
- Stroma: connective tissue & stromal cells
- Paranchyma: different phases of ovarian follicles



Ovary

- Medulla: Most internal part of the ovary, consists of loose con. Ts. and blood vessels entering through hilum from mesenteries.

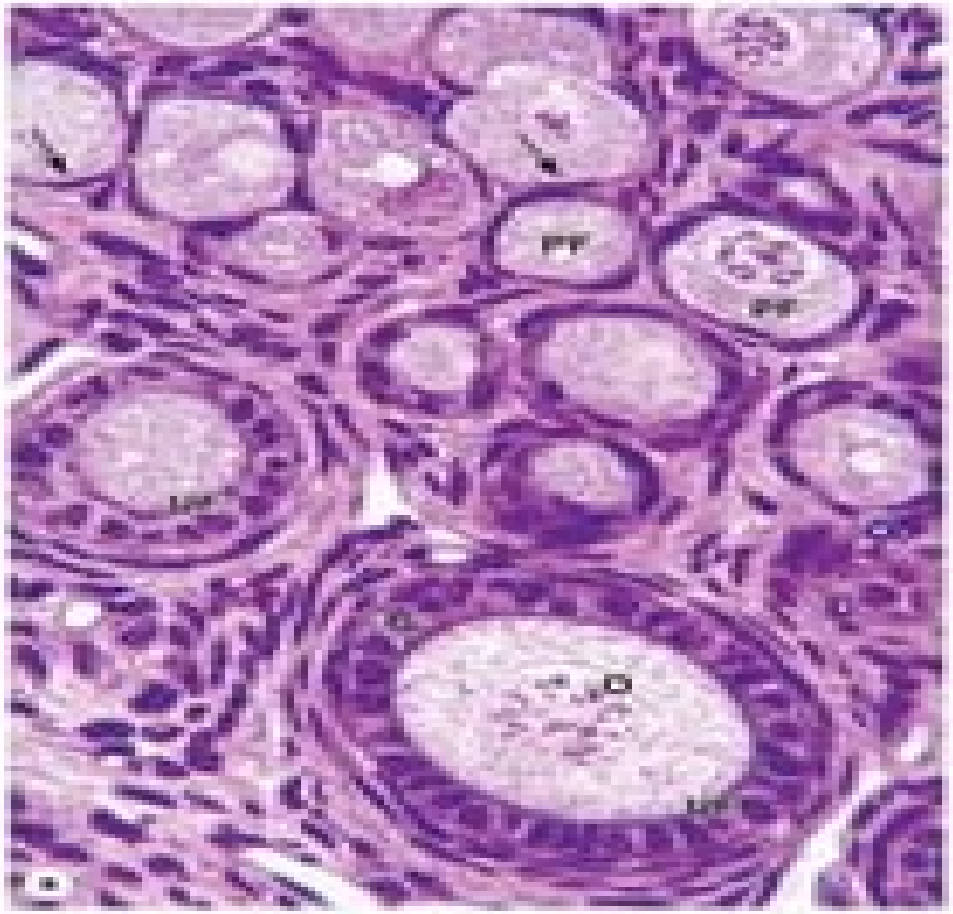




Primordial Follicle

Prim. Oocyte 25 µm in diameter with pale staining large nucleus in 1st Meiotic prophase, surrounded by a single layer of follicular cells resting on B/M

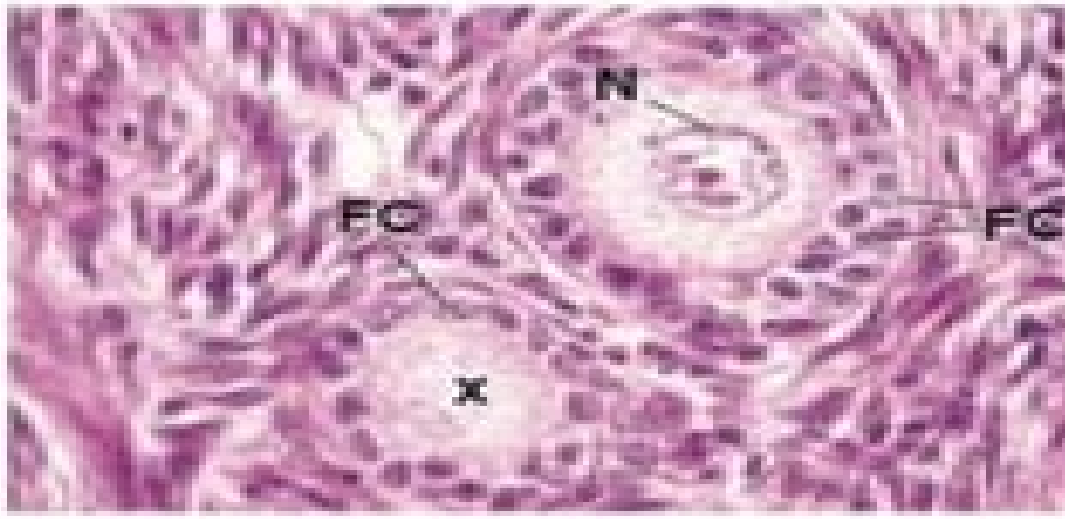
Primary Follicle



- Growing follicles include:
- Uni-laminar primary follicle
- Multi-laminar primary follicle
- Antral follicle
- As follicles started growth three things change:
- Oocyte
- Follicular cells
- Surrounding stroma

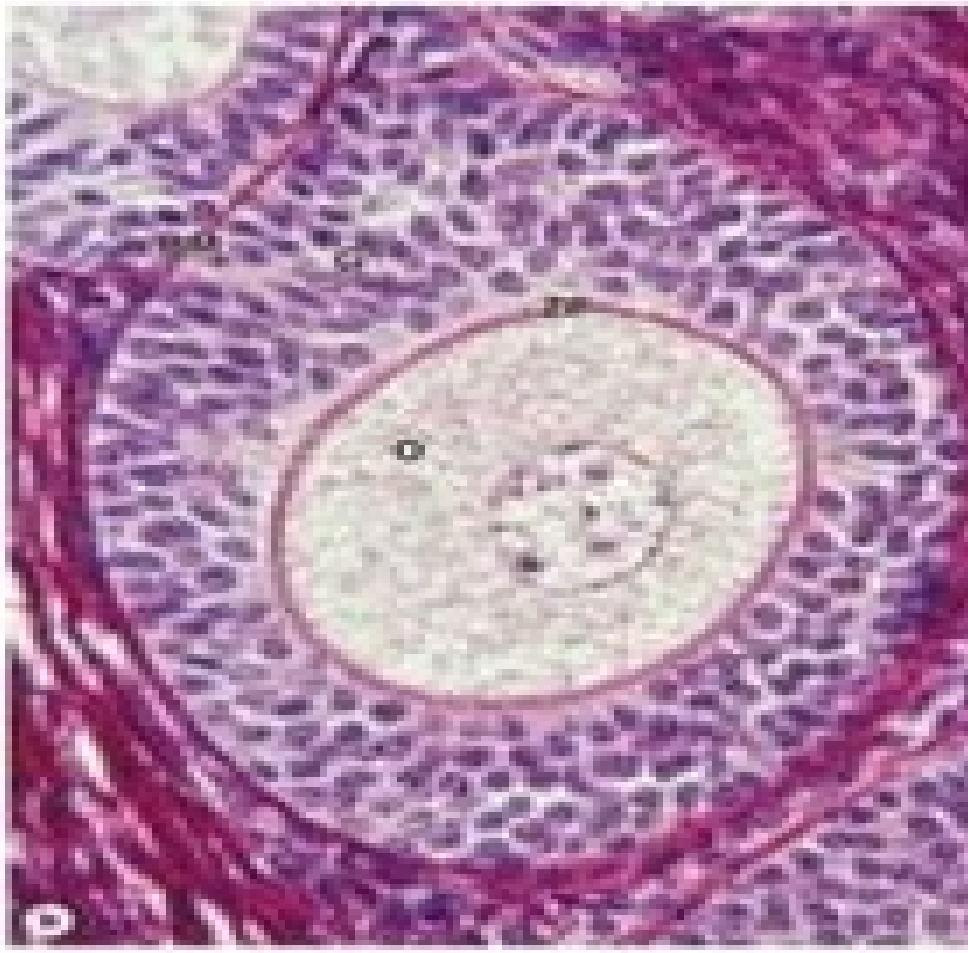
Primary Follicle

- Formation of primary follicle – marked by
- Growth of oocyte size from 25-30µm to 50 then 80µm
- Flattened follicular cells start mitosis and become cuboidal then single layer of columnar cells forming unilaminar primary follicle



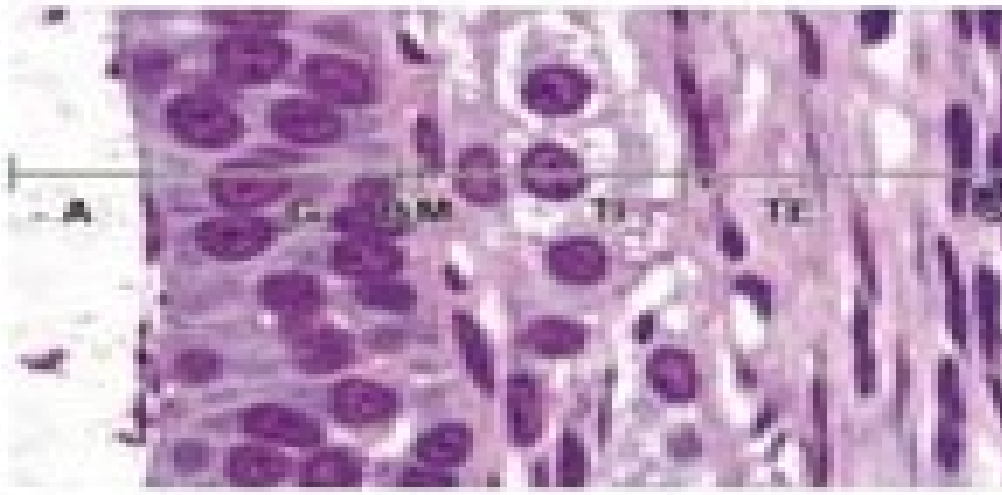
Primary Follicle

- Further proliferation of follicular cells forming multilaminar primary follicle- stratum granulosum
- With growth of oocyte it started secreting zona pellucida – gel like material rich in glycopr. & glycosaminoglycans



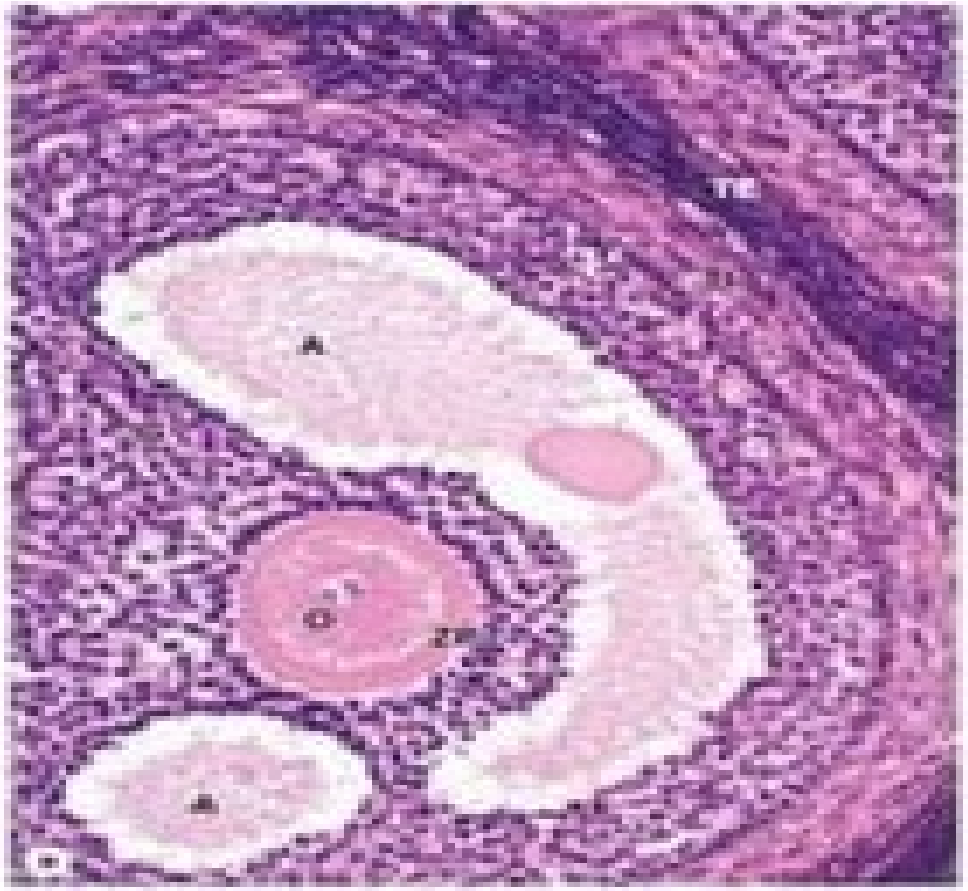
Growing Follicle

- With further growth surrounding connective tissue stroal cells specialize forming a sheath "**Theca folliculi**"
- **Fibroblasts** outside the growing follicles have developed as a steroid-secreting theca interna (TI)
- A covering theca externa where some stromal cells become smooth muscle cells



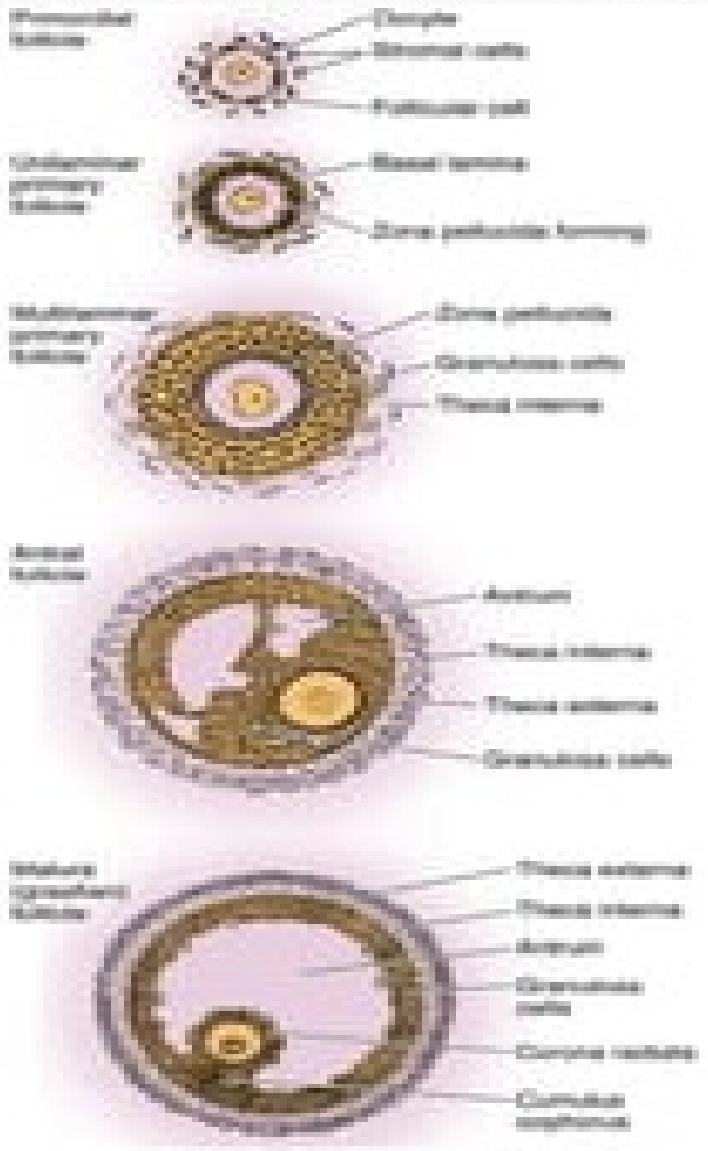
Antral Follicle

- An antral follicle with large, fluid-filled antral cavities or vesicles (A) forming within granulosa layer by the follicular cells.
- The oocyte (O) is surrounded by the zona pellucida (ZP) and granulosa cells (G).



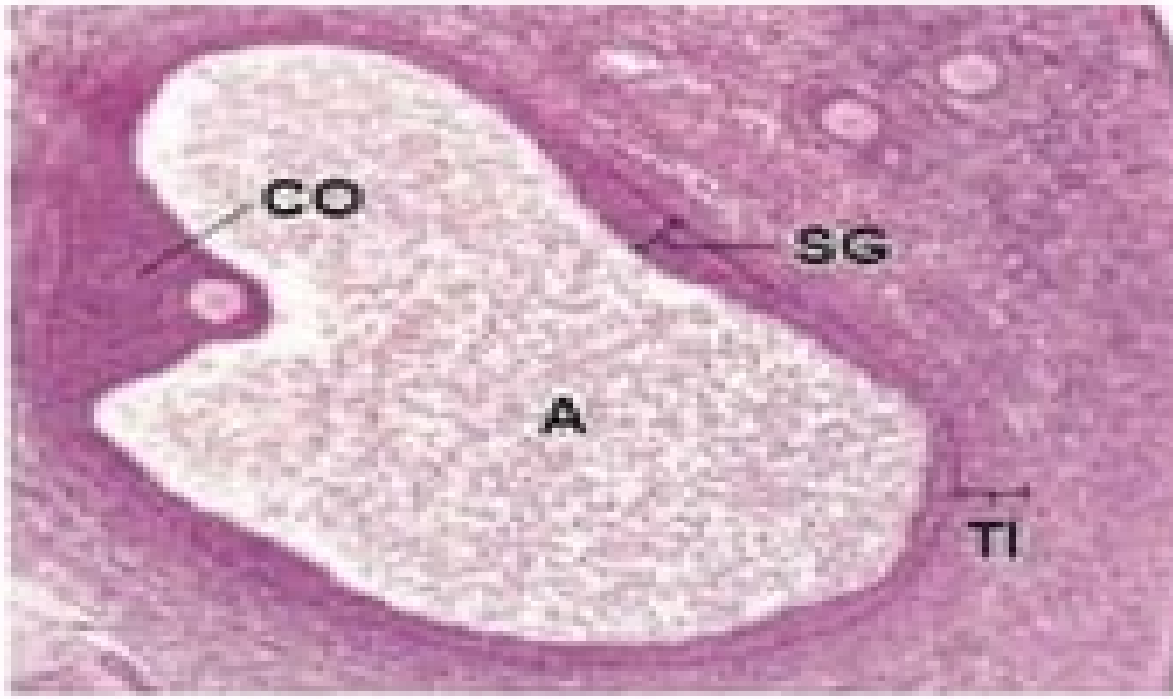
Graafian follicle

- When size of growing follicle reaches 10mm called Graafian follicle
- Oocyte development:
  - ➢ Formation of cortical granules
  - ➢ Formation of microvilli
- Follicular development:
- Single layer of corona cells
- Accumulation of fluid with increase in size upto 10mm.



Graafian follicle

- A buldge on suface of ovary
- Development of theca cells
- Accumulation of lipid drolets in theca interna cells

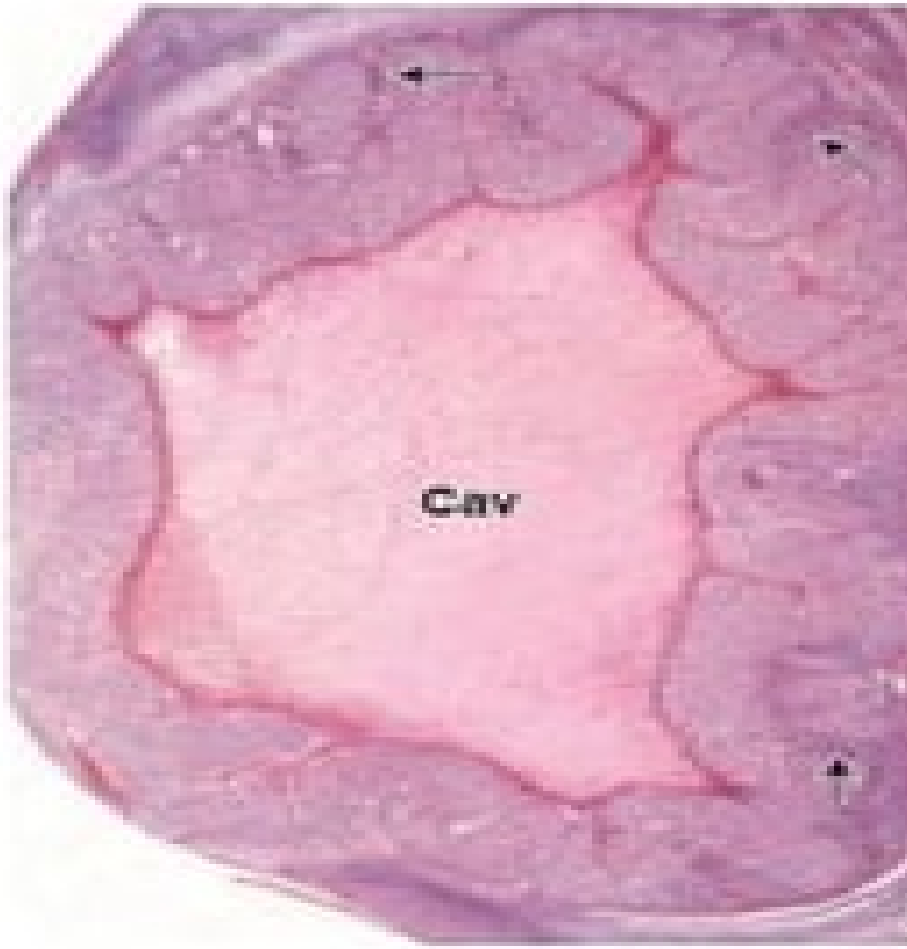


Ovulation & Atresia

- Release of secondary oocyte from mature graafian follicle, during LH surge.
- Factors responsible are
  - Increase in volume & pressure of follicular fliud
  - Lysis of follicular by activated plasminogen
  - Contraction of smooth muscles in theca externa
- Only one follicle reaches this fate others undergo atretic changes. Atresia involves apoptosis and detachment of the granulosa cells, autolysis of the oocyte, and collapse of the zona pellucida. Macrophages invade the degenerating follicle and phagocytose the debris

Corpus Luteum

- After ovulation reorganization of collapsed follicular wall
- Formation of the corpus hemorrhagicum
- Invasion of connective tissue
- Differentiation of granulosa & theca interna cells into luteal cells – luteinization
- Leuteal cells have structure of steroid secreting cells.



Histology of Oviduct/Fallopian tube

e (also called Fallopian or uterine tube) transports ovum from the ovary to the uterus. Its wall is mposed of three layers:

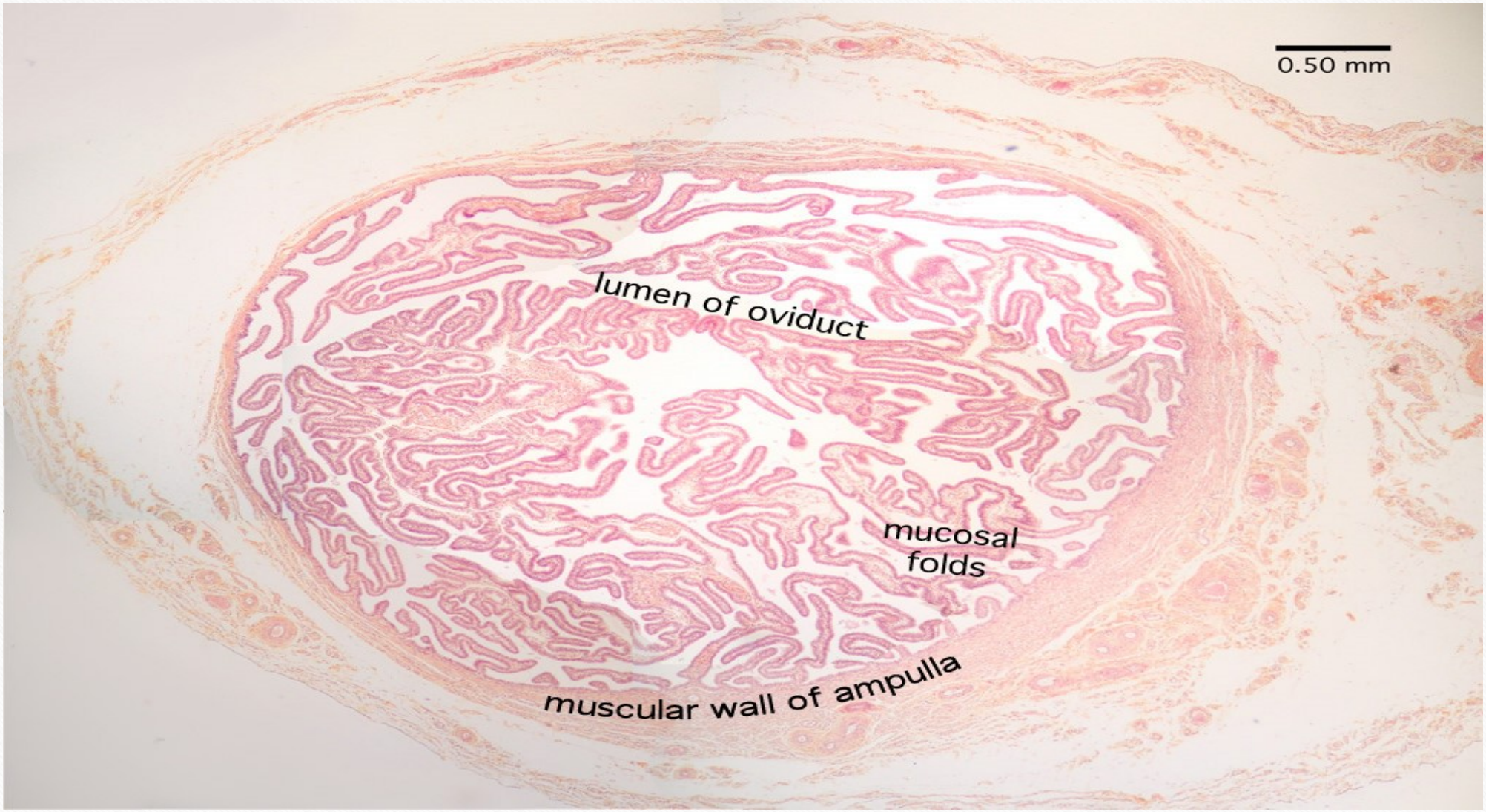
exhibits thin that project into the lumen. These folds are a distinctive characteristic of the oviduct.

- •Simple Columnar Epithelium - consists of two types of cells:
  - • - the cilia wave towards the uterus to help propel ovum or fertilized zygote to the uterus.
  - • - secrete fluid that provides nutrients for the ovum or fertilized zygote.
- • - connective tissue that supports the epithelium and contains blood vessels and nerves.

consists of an inner circular or spiral layer and an outer longitudinal layer whose peristaltic ntractions help propel the ovum or fertilized zygote to the uterus.

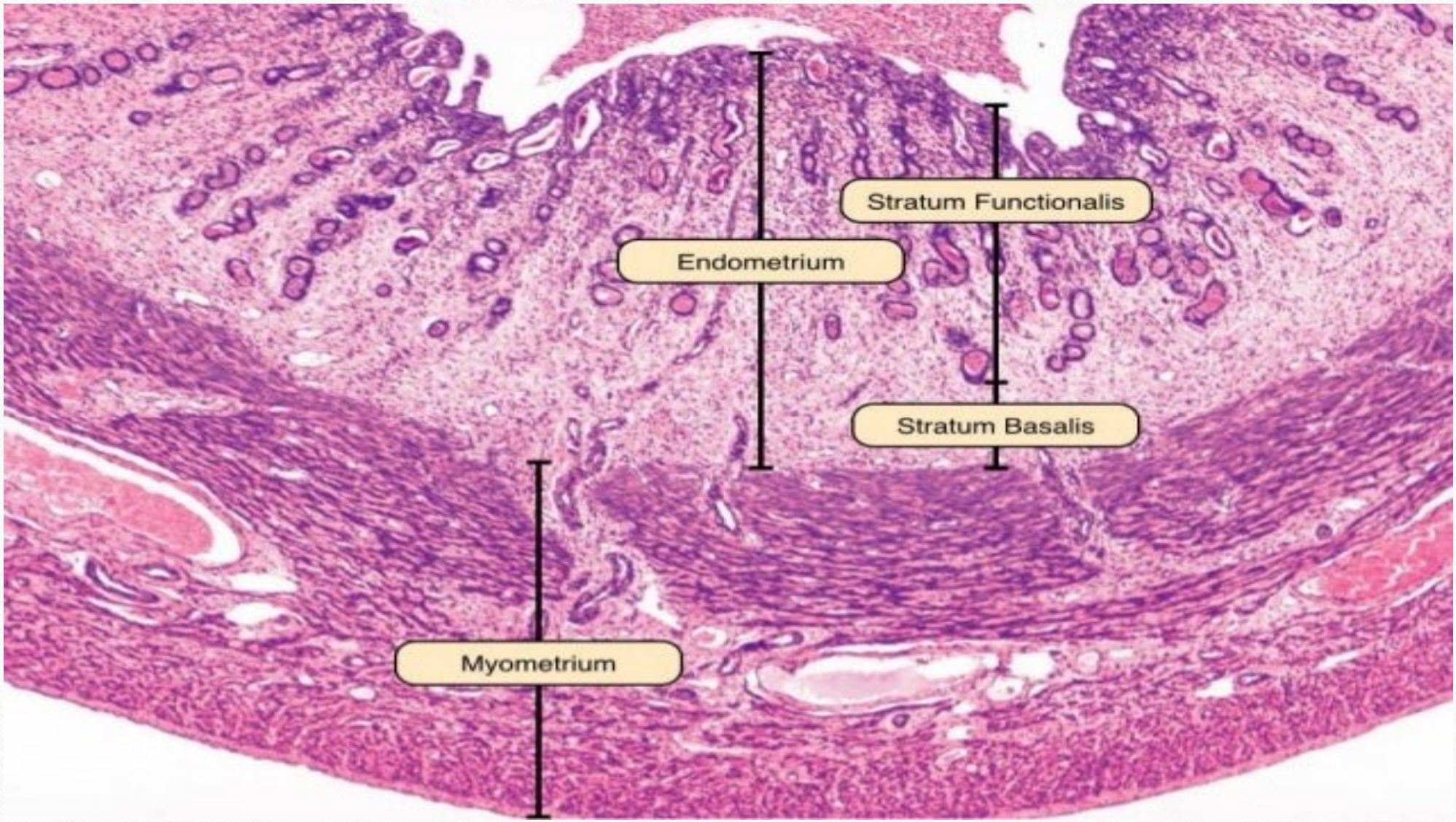
erosa - composed of a simple cuboidal epithelium (or mesothelium) supported by a thin layer of nnective tissue.

like many tubular tissues, there are no goblet cells or glands in the epithelium or any other glands in e wall of the oviducts.


0.50 mm
lumen of oviduct
mucosal folds
muscular wall of ampulla

Histology of Uterus

- Uterus is the site of implantation of conceptus and undergoes a definite sequence of change during estrous and reproductive cycle. In uterus histology you will find three defined layers – mucosa submucosa (endometrium), muscularis (myometrium) and serosa (perimetrium).
- In endometrium histology you will find two zones – superficial functional zone and thin deep layer called basal zone. The superficial layer of endometrium layer degenerate partially or completely during a reproductive, estrous or menstrual cycle.


Stratum Functionalis
Endometrium
Stratum Basalis
Myometrium

Again the functional zone of endometrium contains loose connective tissue with higher number of cells (mainly fibroblasts, macrophages and mast cells). The deep part of endometrium consists of loose connective tissue with less numbers of cells.

- The branching and coiling of uterine glands are more in mare and less in carnivorous animals. Again in proliferative phage of uterus you will find less, simple straight tubular gland with narrow lumen. But in secretory phage of uterus you will find more, highly coiled uterine gland with dilated lumen.
- Myometrium is the thickest middle layer of uterus histology. This layer is consists of mostly inner circular and outer longitudinal layer of smooth muscles. In pregnancy, the number and size of this myometrium layer may increase. You will also find large arteries, vein and lymphatic vessels in this myometrium layer of uterus.

Due to presence of larger numbers of vessels in the myometrium layer, it is also known as stratum vasculare.

The thickness of endometrium layer is more in secretory phage of uterus compare to proliferative phage

#2. You will also find difference in the lining epithelium in two phages of uterus; the lining epithelium of proliferative phage is simple columnar and hypertrophied columnar epithelium in secretory phage

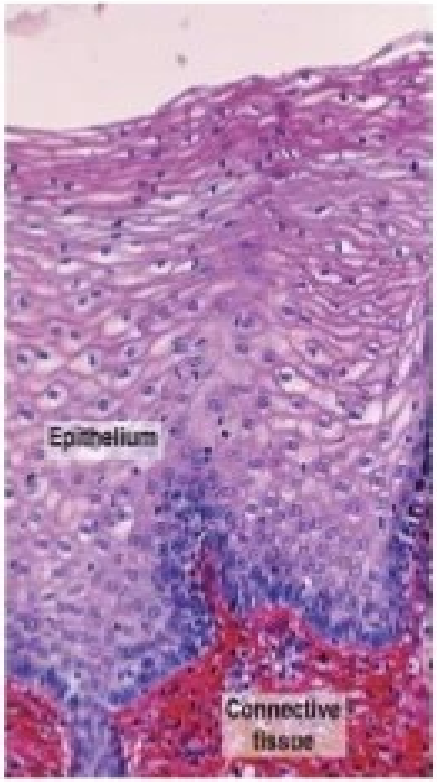
There are less uterine glands (simple straight tubular) with narrow lumen in proliferative phage; but in secretory phage you will find the more, highly coiled uterine gland with dilated lumen.

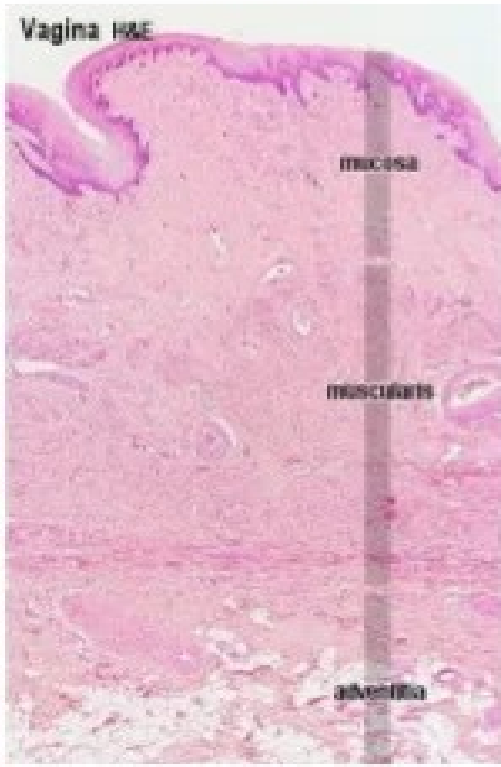
No secretory material will find in the lumen of proliferative phage; but in secretory phage – there may present secretion in the lumen of glands.

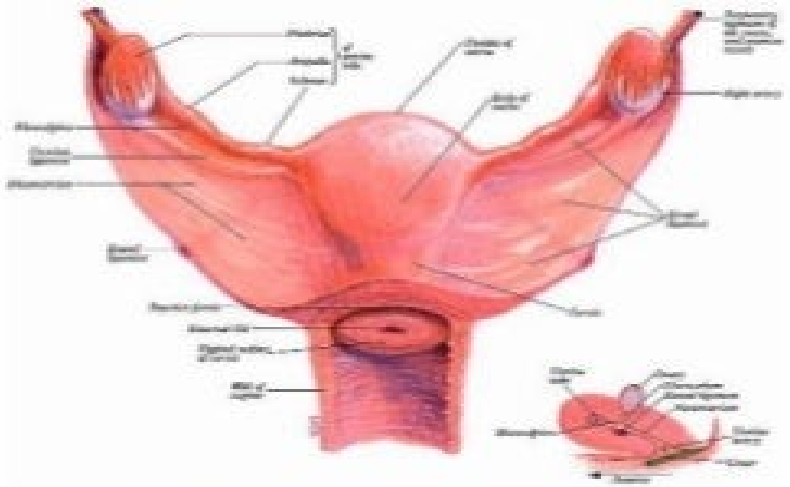
The stroma is highly cellular and non-edematous in proliferative phage, whereas stroma is highly vascular and edematous in secretory phage.

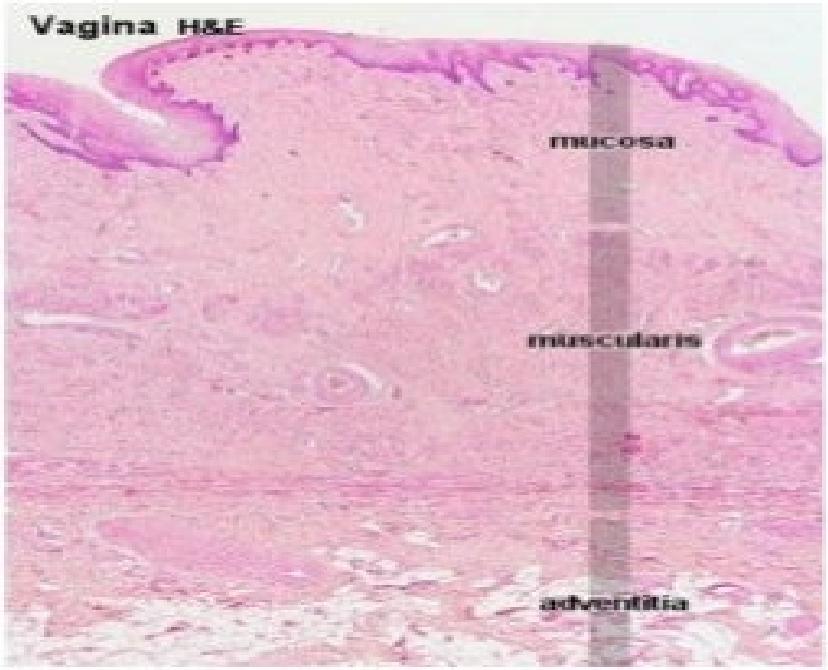
VAGINA

- Mucous membrane
  - Lamina propria-dense with elastic fibers, lymphatic nodules
  - Stratified squamous non keratinized epithelium
  - Superficial cells rich in glycogen
- Sub mucosa with connective tissue and blood vessels
- Intermingled longitudinal and circular muscle









VAGINA

- Tubular organ
- Mucous
- muscular layer
- tunica adventitia
- Connective tissue (elastic fibers) and blood vessels

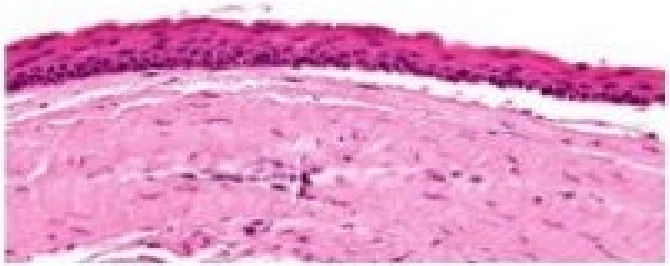
Histology of the Cervix

Epithelium: Simple squamous epithelium. Secretory cells are also present which secrete mucus during estrus and pass through the vagina. During pregnancy it causes mucus plug.

In the sow 90% of the lining epithelium is stratified squamous epithelium.

The lamina propria is of connective tissue and Tunica muscularis consists of inner circular and outer longitudinal smooth muscles.

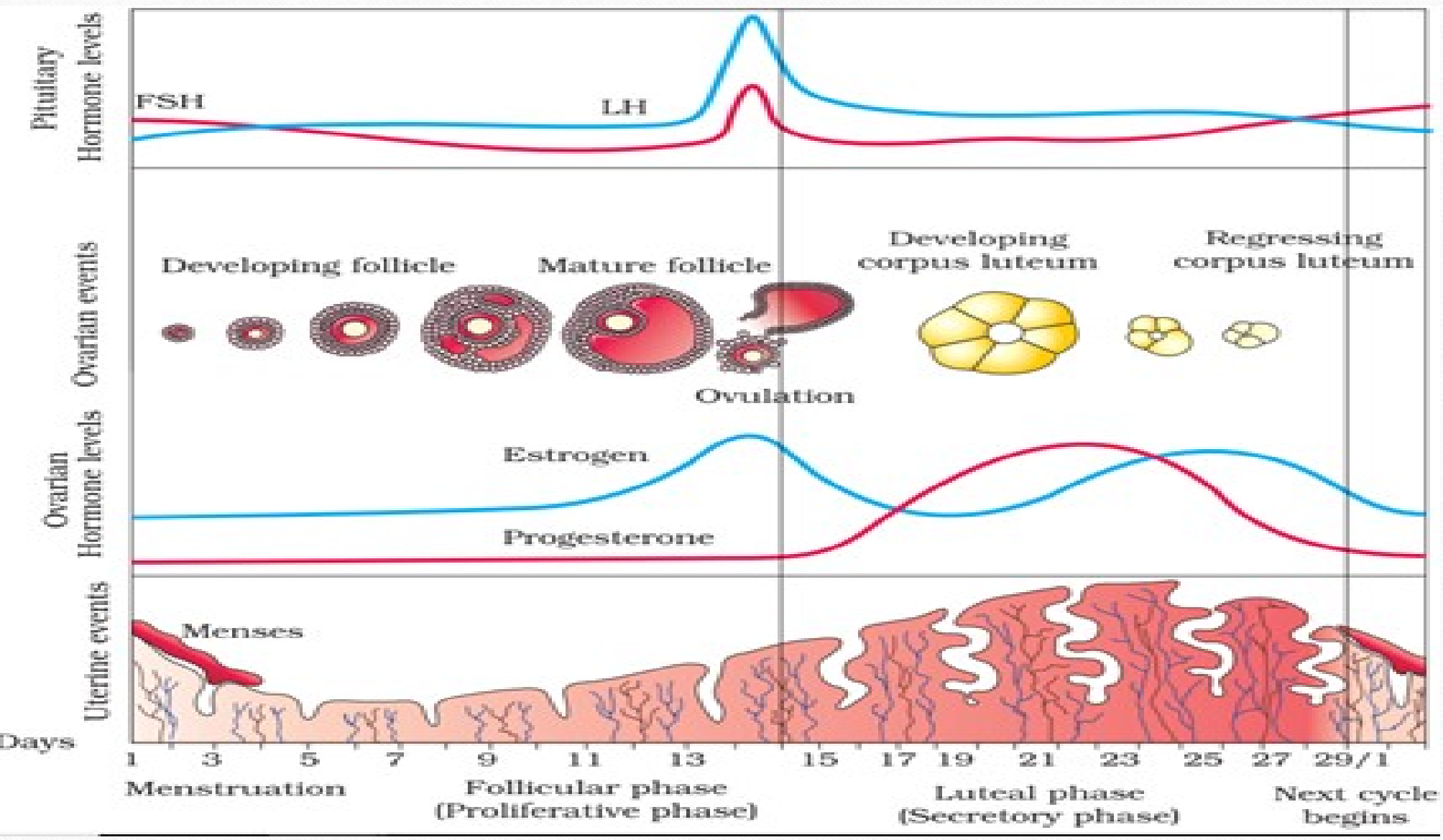
Histological features



1. Thin Stratified squamous epithelium lining
2. Lacks of rete ridges/pegs.
3. Well defined basal cell layer having cuboidal or columnar cells arranged in palisaded fashion("picket fence or tombstone appearance")
4. A thin spinous cell layer
5. Surface keratinisation
6. Thin cystic wall composed of fibrous connective tissue which is usually uninflamed.
7. satellite cysts, daughter cysts may include cholesterol crystals and Rushton bodies.

Reproductive cycle in Human

- In human females, at the start of the puberty period,the menstruation is repeated at an average interval of about 28/29 days and the cycle of events starting from one menstruation till the next one is called as menstruation cycle.It is monthly flow of blood from the uterus it last about 25 days.


Pituitary Hormone levels
FSH
LH
Ovarian events
Developing follicle
Mature follicle
Ovulation
Developing corpus luteum
Regressing corpus luteum
Ovarian Hormone levels
Estrogen
Progesterone
Uterine events
Menses
Days
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29/1
Menstruation
Follicular phase (Proliferative phase)
Luteal phase (Secretory phase)
Next cycle begins

Female sex hormones

- Hormones are chemical messengers that the endocrine glands produce and release into the bloodstream. Hormones help regulate many bodily processes, such as appetite, sleep, and growth.
- Sex hormones are those that play an essential role in sexual development and reproduction. The main glands that produce sex hormones are the adrenal glands and the gonads, which include the ovaries in females and testes in males.

Types of female sex hormone

In females, the ovaries and adrenal glands are the main producers of sex hormones. Female sex hormones include estrogen, progesterone, and small quantities of testosterone.

We discuss each of these sex hormones below:

Estrogen

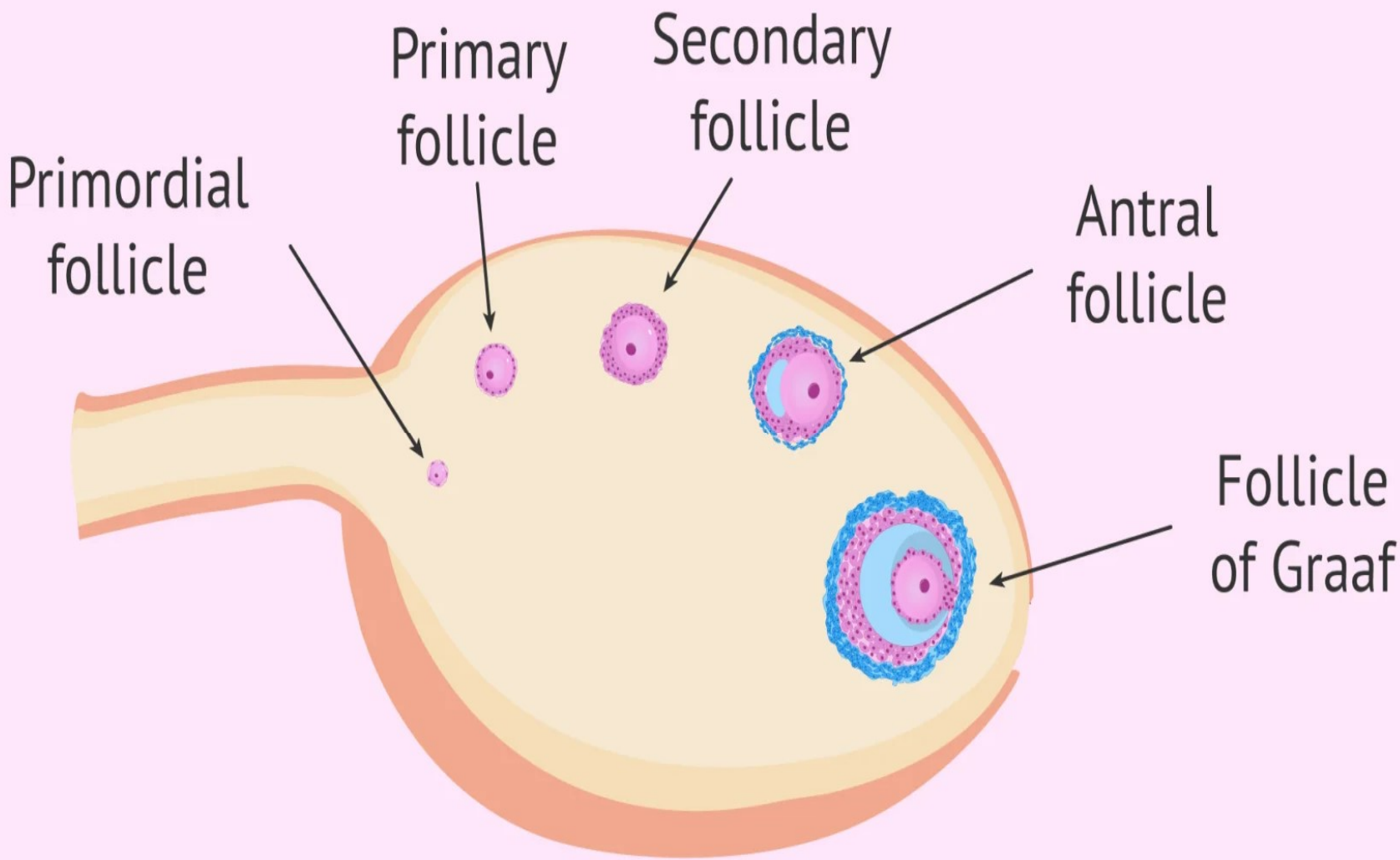
Estrogen is probably the most well-known sex hormone.

Although the majority of estrogen production occurs in the ovaries, the adrenal glands and fat cells produce small amounts of estrogen, too. Estrogen plays a crucial role in reproductive and sexual development, which begins when a person reaches puberty.

Relaxin-This is another female sex hormone produced by the corpus luteum during pregnancy.It is polypeptide,non-steroidal,water soluble hormone.

Folliculogenesis,process of Oogenesis and structure of Ovum

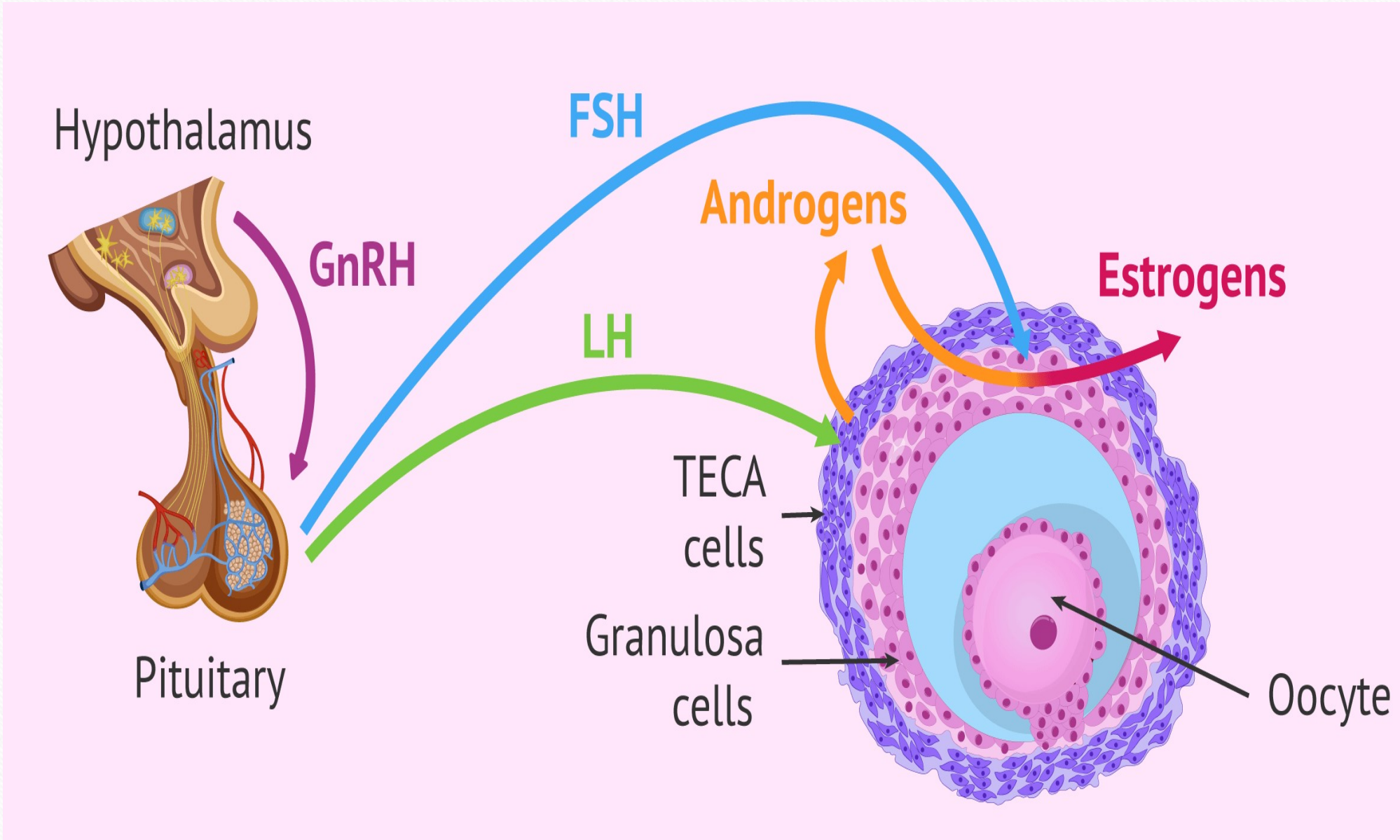
- Folliculogenesis refers to the development of ovarian follicles from primordial follicles to their final stage: the follicle of Graaf. This process involves an increase in follicular size, as well as in its maturational state, as its development progresses.
- **What are the stages of folliculogenesis?**
- The follicles are located in the ovarian cortex, that is, peripherally in the ovary, and are the structures that contain the oocytes. As the follicular development process progresses, the follicles are named differently, which determines the different **phases of folliculogenesis**.


Primordial follicle
Primary follicle
Secondary follicle
Antral follicle
Follicle of Graaf

The mature follicle must also expel a mature egg at ovulation. This is why the **development and maturation** of the oocyte, i.e., ovogenesis, must occur in parallel with folliculogenesis.

The primordial follicles will contain **primary oocytes** arrested in the prophase of the first division of meiosis. Once puberty arrives, these primary oocytes will be able to continue their maturation. However, for this to occur, it is necessary that the follicle that contains them also advances in its development.

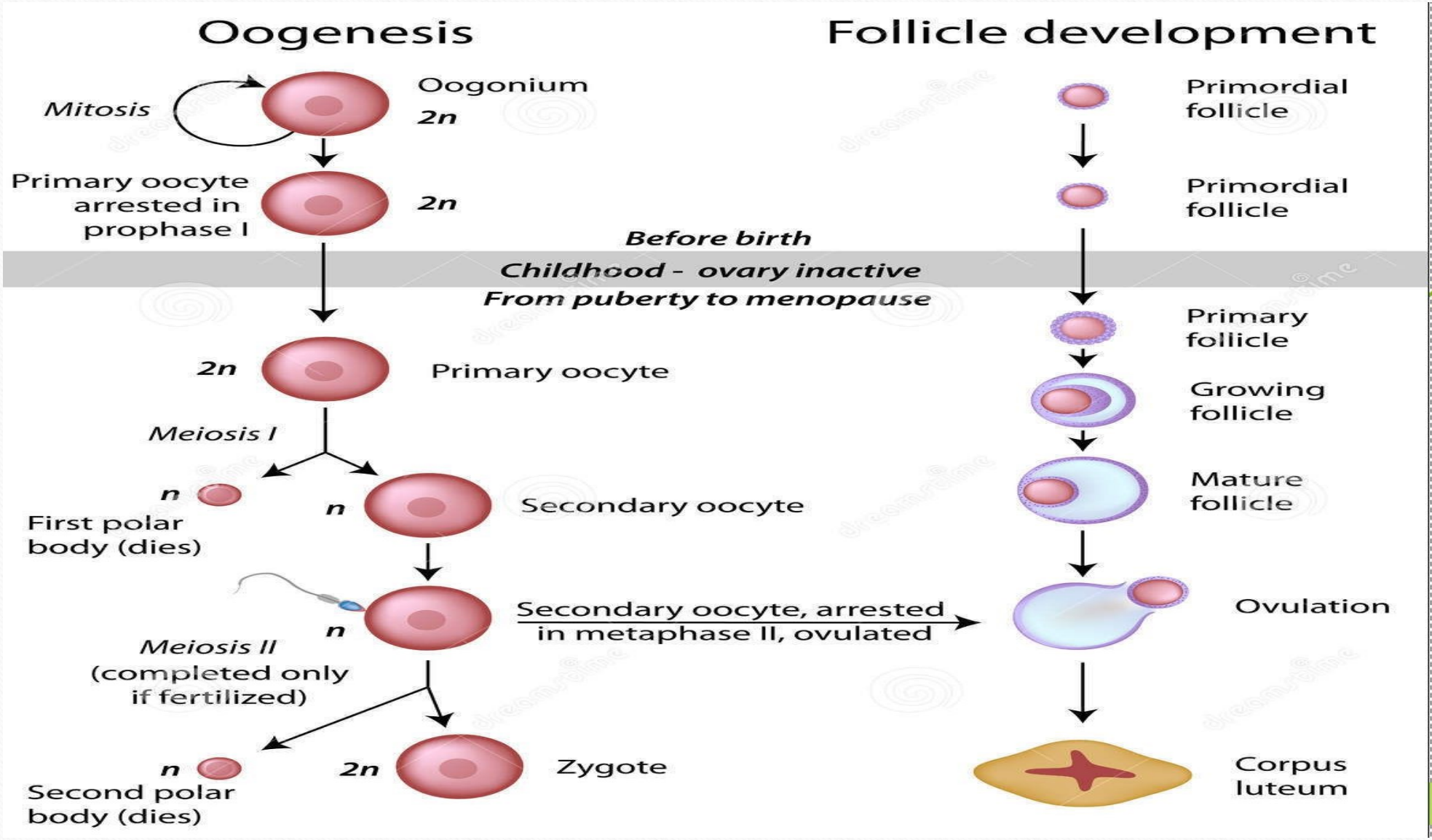
- In Graafian follicles, just before ovulation, the peak of luteinizing hormone (LH) triggers the oocyte to resume **meiosis**. In this way, the primary oocyte will give rise to a **secondary oocyte** and the first polar corpuscle. This process could be related to the mucification of the cumulus explained above, since this expansion of the cumulus would diminish the inhibitory effect of meiosis that the surrounding cells would be exerting on the oocyte.


Hypothalamus
GnRH
Pituitary
FSH
LH
Androgens
Estrogens
TECA cells
Granulosa cells
Oocyte

The secondary oocyte generated will be arrested in the metaphase of meiosis II and will be ovulated at this stage, considered mature, to the fallopian tubes. Finally, the secondary oocyte will be able to complete meiosis if fertilization by a sperm occurs. If this occurs, the secondary oocyte will produce a fertilized egg (zygote) and the second polar corpuscle.

Otherwise, if not fertilized, the secondary oocyte will degenerate.

Process of Oogenesis


Oogenesis
Follicle development
Mitosis
Oogonium
2n
Primary oocyte arrested in prophase I
2n
Before birth
Childhood – ovary inactive
From puberty to menopause
2n
Primary oocyte
Meiosis I
n
First polar body (dies)
n
Secondary oocyte
n
Meiosis II (completed only if fertilized)
Secondary oocyte, arrested in metaphase II, ovulated
n
Second polar body (dies)
2n
Zygote
Primordial follicle
Primordial follicle
Primary follicle
Growing follicle
Mature follicle
Ovulation
Corpus luteum

II. Oogenesis

A. Oogonia

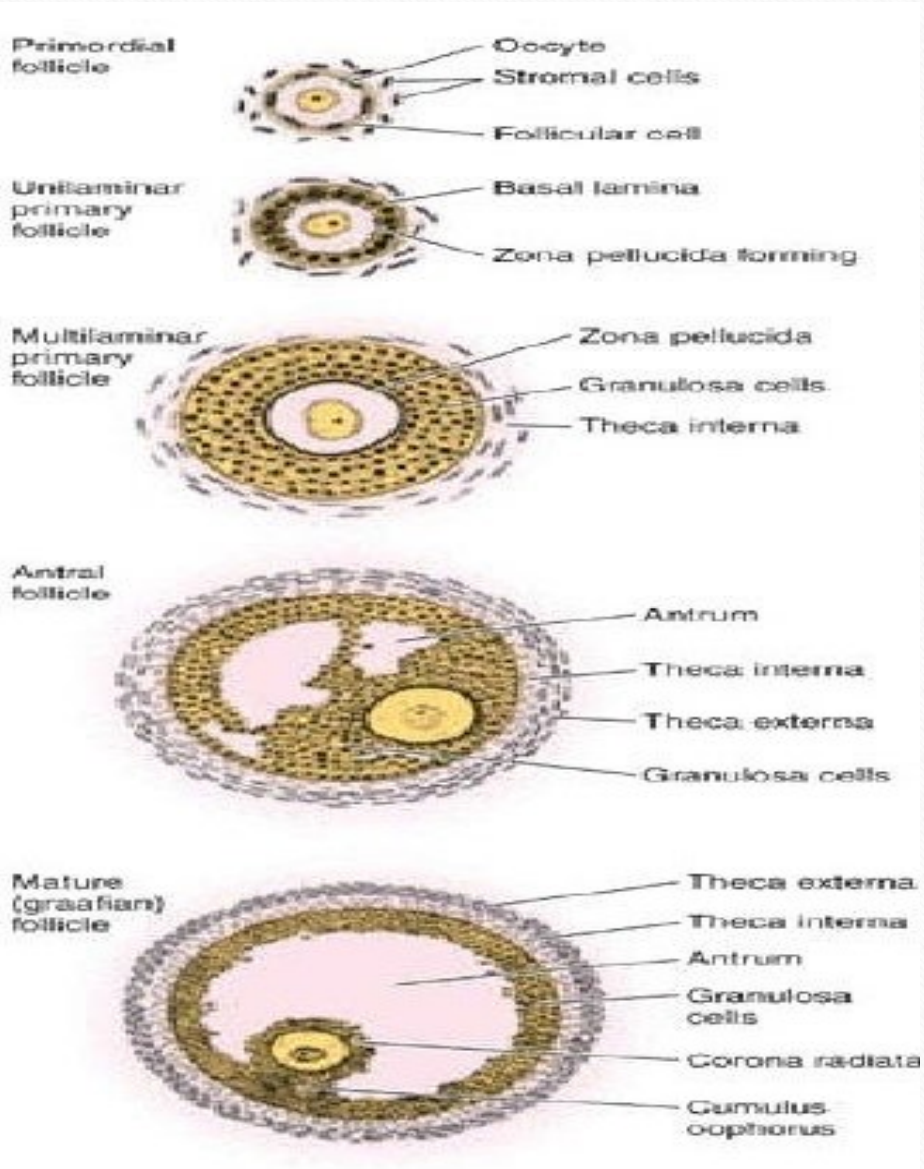
1. migrate to ovary from yolk sac
2. mitosis until 5 mo.

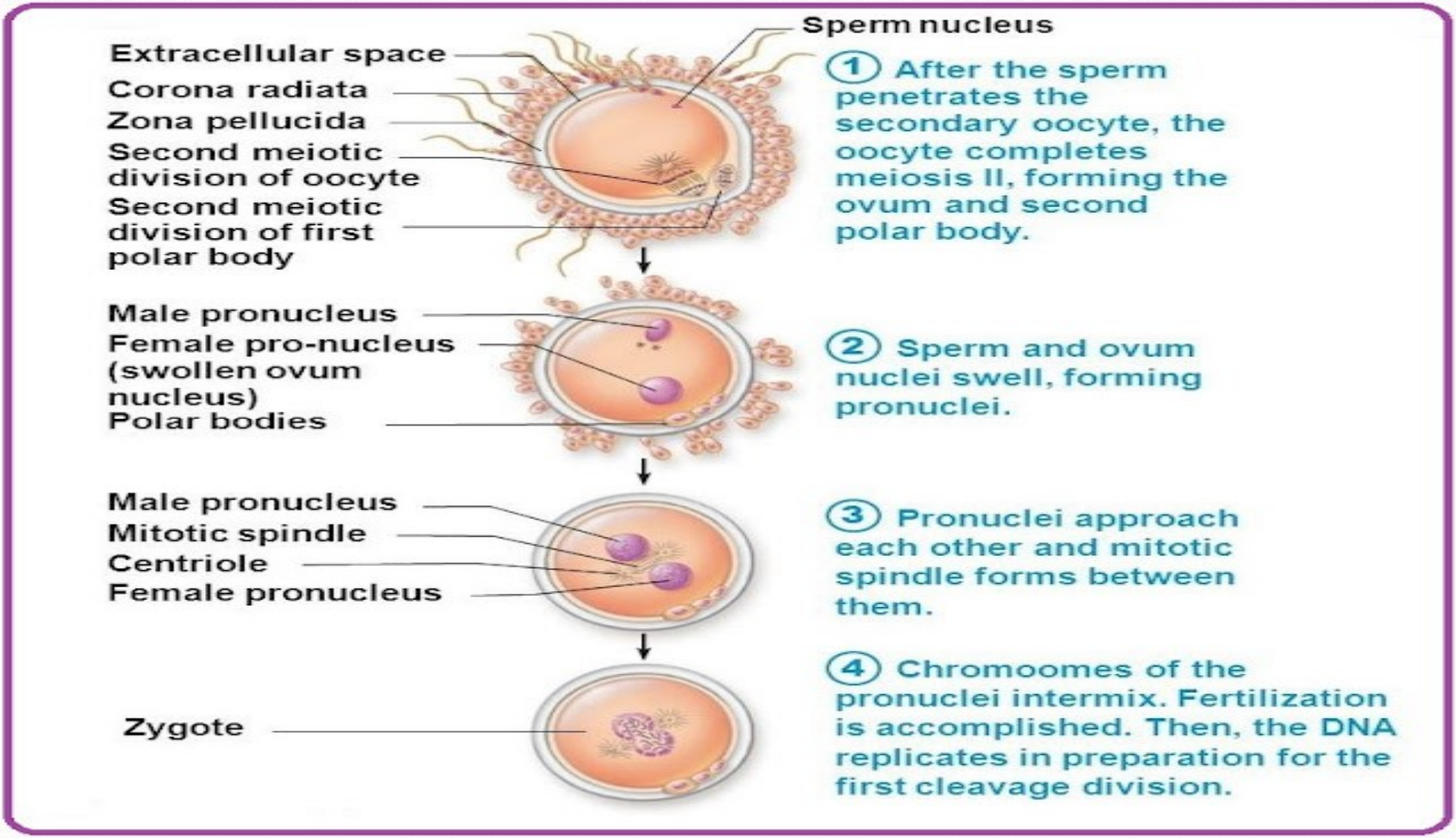
B. Primary oocytes

1. prophase of 1st meiotic div.
2. 3rd-7th mo.

C. Secondary oocyte

1. just before ovulation
2. first meiotic div.
3. first polar body + oocyte
4. ovum viable for 24 hrs.




Sperm nucleus
Extracellular space
Corona radiata
Zona pellucida
Second meiotic division of oocyte
Second meiotic division of first polar body
1 After the sperm penetrates the secondary oocyte, the oocyte completes meiosis II, forming the ovum and second polar body.
Male pronucleus
Female pro-nucleus (swollen ovum nucleus)
Polar bodies
2 Sperm and ovum nuclei swell, forming pronuclei.
Male pronucleus
Mitotic spindle
Centriole
Female pronucleus
3 Pronuclei approach each other and mitotic spindle forms between them.
Zygote
4 Chromoomes of the pronuclei intermix. Fertilization is accomplished. Then, the DNA replicates in preparation for the first cleavage division.

Menstrual cycle

- The first menstrual period (menarche) happens about two to three years after the breasts begin to develop. Again, it's different for everybody, but most females get their first period between the ages of 10 and 16.
- **Follicular phase**
- Every month, the uterus thickens in preparation for a fertilized egg. When there's no fertilized egg, estrogen and progesterone levels stay low. This prompts your uterus to shed its lining. The day you start to bleed is day 1 of your cycle, or the follicular phase.
- The pituitary gland starts to produce a little more FSH. This spurs growth of follicles in your ovaries. Within each follicle is an egg. As sex hormone levels drop, only a single, dominant follicle will continue to grow.
- As this follicle produces more estrogen, the other follicles break down. Higher levels of estrogen stimulate an LH surge. This phase lasts about two weeks.

Ovulatory phase

Next comes the ovulatory phase. LH causes the follicle to rupture and release the egg. This phase lasts about 16 to 32 hours. Fertilization can only occur for about 12 hours after the egg has left the ovary.

Luteal phase

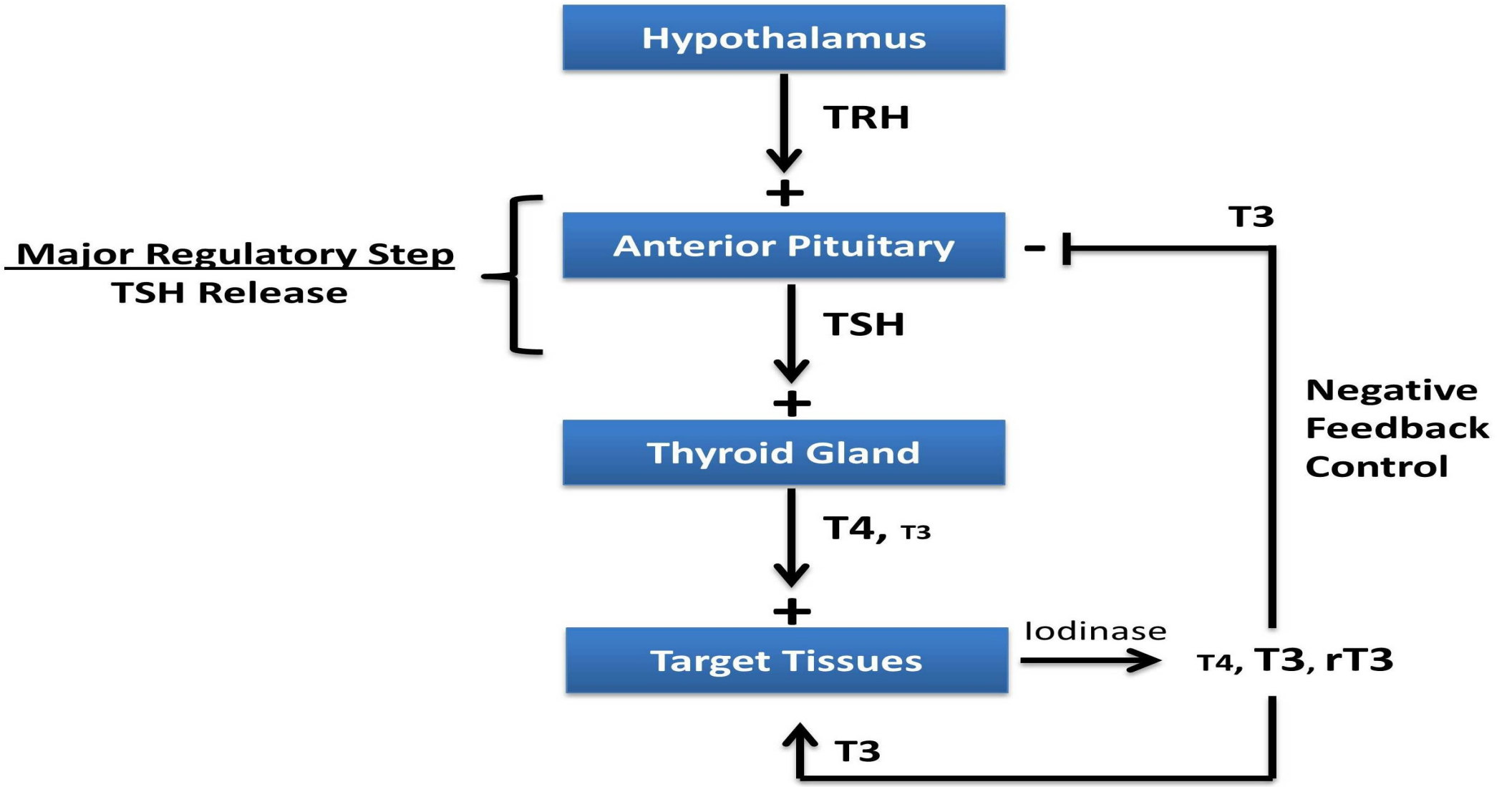
The luteal phase starts after ovulation. The ruptured follicle closes and the production of progesterone increases. This gets the uterus ready to receive a fertilized egg.

If that doesn't happen, estrogen and progesterone decrease again and the cycle starts all over.

The entire menstrual cycle lasts around 25 to 36 days. Bleeding lasts between 3 and 7 days. But this, too, varies quite a bit. Your cycle may be quite irregular for the first few years. It can also vary at different times of your life or when you use hormonal contraceptives.

Hormonal regulation

- The rate of hormone biosynthesis and secretion is often regulated by a homeostatic negative feedback control mechanism. Such a mechanism depends on factors that influence the metabolism and excretion of hormones. Thus, higher hormone concentration alone cannot trigger the negative feedback mechanism. Negative feedback must be triggered by overproduction of an "effect" of the hormone
- Hormone secretion can be stimulated and inhibited by:
- Other hormones (*stimulating*- or *releasing* -hormones)
- Plasma concentrations of ions or nutrients, as well as binding globulins
- Neurons and mental activity
- Environmental changes, e.g., of light or temperature

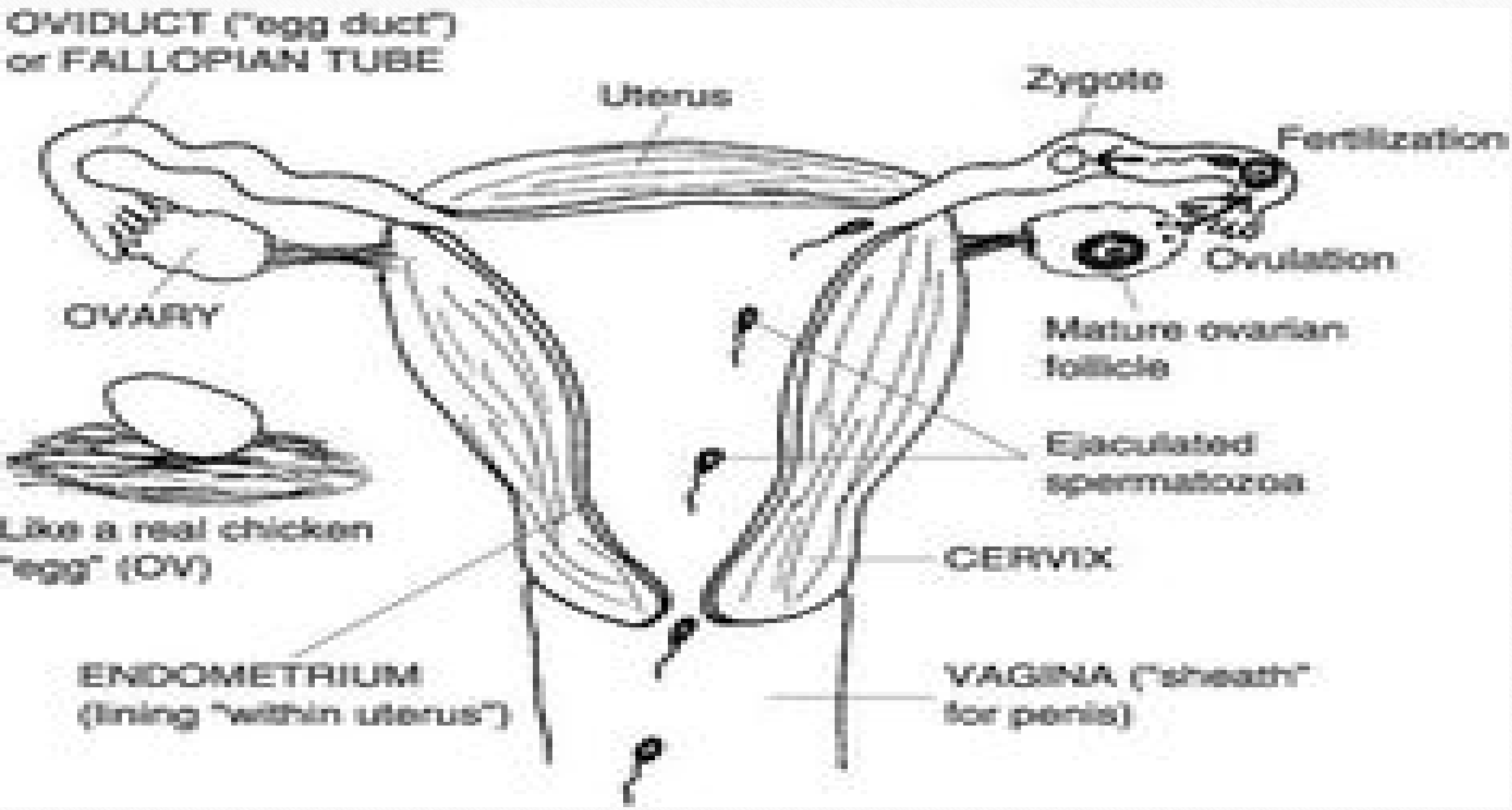

Hypothalamus
TRH
+
Major Regulatory Step
TSH Release
Anterior Pituitary
T3
-
TSH
+
Thyroid Gland
Negative
Feedback
Control
T4, T3
+
Target Tissues
Iodinase
T4, T3, rT3
T3

Transport of Ovum and sperm in female genital tract

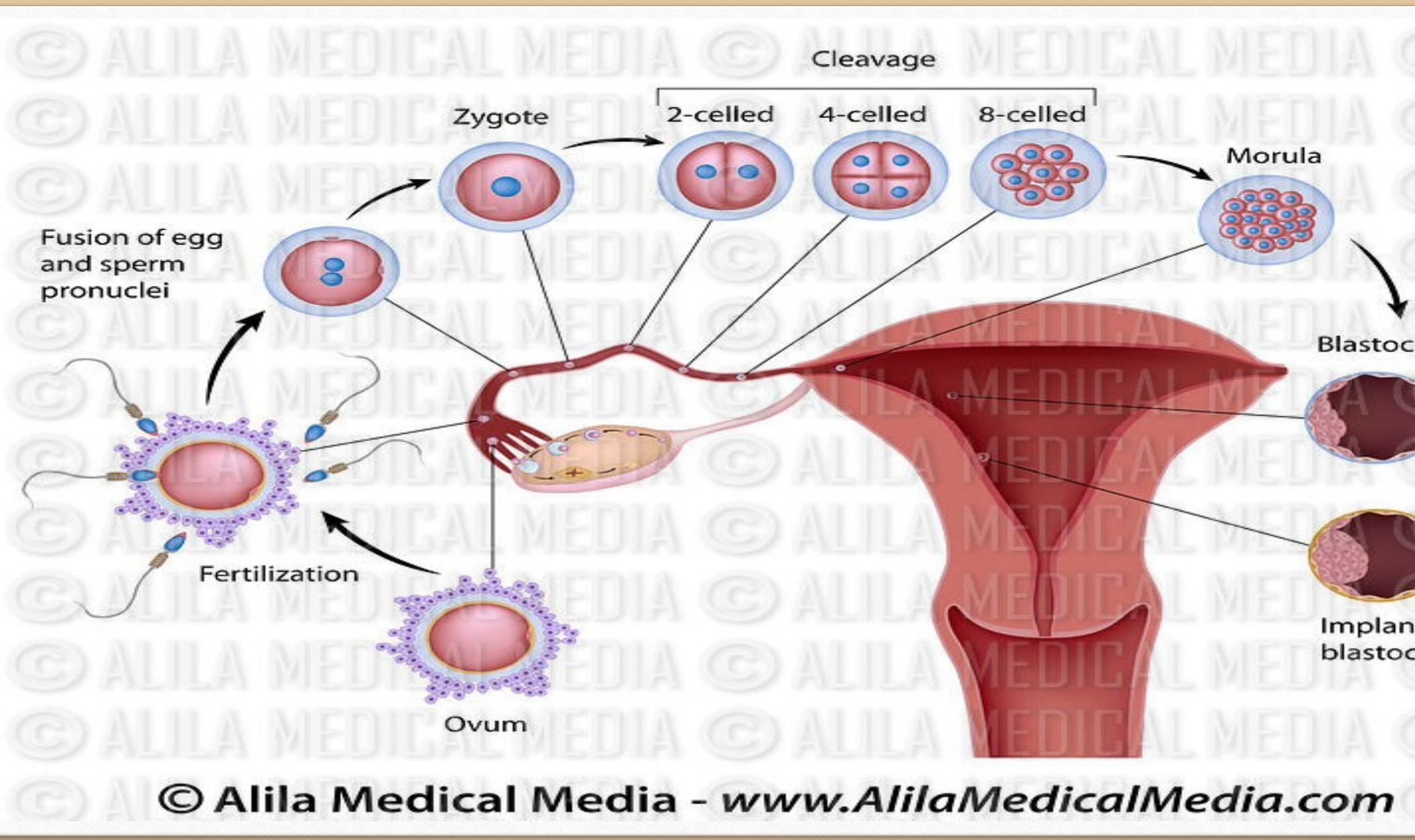
- Sperm transport within the female reproductive tract is a cooperative effort between the functional properties of the sperm and seminal fluid on the one hand and cyclic adaptations of the female reproductive tract that facilitate the transport of sperm toward the ovulated egg. Much of the story of sperm transport in the female reproductive system involves the penetration by the sperm of various barriers along their way toward the egg .
- During coitus in the human, semen is deposited in the upper **vagina** close to the cervix

Sperm transport occurs in both the male reproductive tract and the female reproductive tract. In the male reproductive tract, transport of spermatozoa is closely connected with their structural and functional maturation, whereas in the female reproductive tract, it is important for spermatozoa to pass to the upper uterine tube, where they can meet the ovulated egg.

- Direct measurements have shown that within 8 seconds from the introduction of semen the pH of the upper vagina is raised from 4.3 to 7.2, creating an environment favorable for sperm motility.


OVIDUCT ("egg duct")
or FALLOPIAN TUBE
Uterus
Zygote
Fertilization
Ovulation
OVARY
Mature ovarian
follicle
Ejaculated
spermatozoa
Like a real chicken
"egg" (OV)
CERVIX
ENDOMETRIUM
(lining "within uterus")
VAGINA ("sheath"
for penis)

Process of fertilization



Fertilization is the process by which male and female *gametes* are fused together, initiating the development of a new organism.

The male gamete or *'sperm'*, and the female gamete, *'egg'* or *'ovum'* are specialized sex cells, which fuse together to begin the formation of a *zygote* during a process called *sexual reproduction*.

- The sperm are ejected from the male reproductive organ called the penis.
- The sperm enters the female body through her reproductive organ (vagina).
- Then the sperm travels through the uterus and fallopian tube.
- In the fallopian tube, it meets the egg produced by the female organs.
- Fertilization takes place in the fallopian tubes.

Actually, the stages of fertilization are exactly the same in both cases: a sperm cell penetrates the egg cell. The difference can be found in the cell divisions that occur afterwards. In twin pregnancies, due to causes still unknown, the **embryo splits into two**, leading to the formation of two genetically identical babies, which means that their gender will be the same, too.

In the case of non-identical twins, the process is different. In this case, **two different eggs are fertilized** simultaneously, each one by a different sperm. Thus, fertilization and subsequent embryo development would occur as in a singleton pregnancy, although two babies will develop independently inside the maternal womb. As the name suggests, non-identical or fraternal twins are genetically different, and the gender can be different as well.

Hormonal control in Implantation

- After reaching developing blastocyst in the uterus it remain in uterine cavity for additional one to three days before it implants in endometrium.
- Thus,implantation generally occurs on about the fifth to seventh day after ovulation.
- Before implantation the blastocyst obtains its nutrition from the endometrial secretions called as ‘uterine milk’

Pregenancy diagnosis

- The duration of pregnancy has traditional been calculated by clinical in termsof 9 calendar months and 7 days or 280 days or weeks. This is called as gestational age.
- The following are presumptive symptoms of early months of pregnancy or first trimester
- 1 Amenorrhea- Absence of menstruation.
- 2 Morning sickness (Nausea and vomiting)
- 3 Frequency of urination
- 4 Breast discomfort
- 5 Uterine signs

IMMUNOLOGICAL TESTS FOR THE DIAGNOSIS OF PREGNANCY

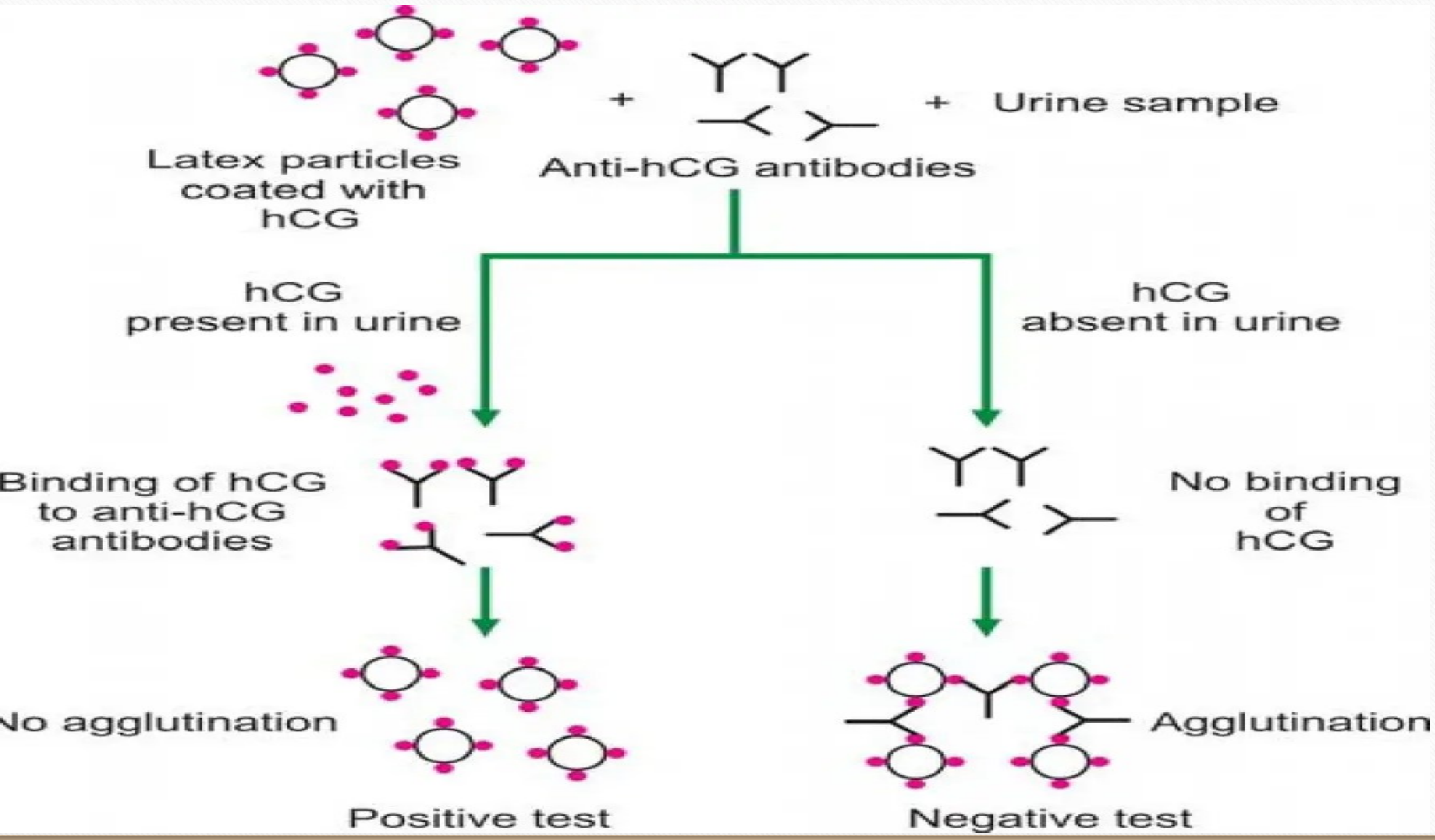
- **Agglutination inhibition tests:**
- Direct agglutination test:

  The sensitivity is 0.2 IU Hcg/ml.
- Enzyme-linked immunosorbent assay:

It is based on one monoclonal antibody that binds the hCG in urine and serum. ELISA can detect hCG in serum upto 1-2 mIU/ml and as early as 5 days before the first missed period.

- Fluroimmuno assay:

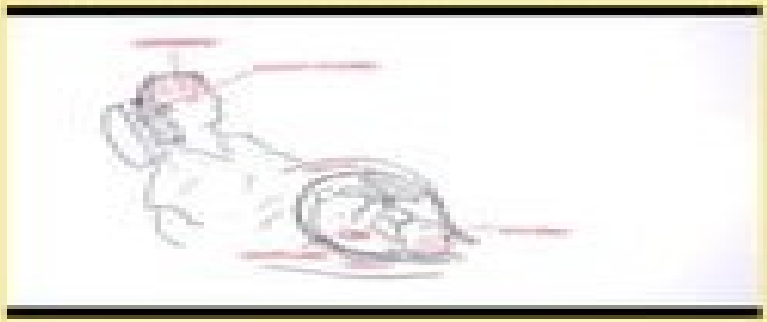
the fluroscence emitted is proportional to the amount of hCG. it can detect hCG as low as 1 Miu/ml. FIA takes 2-3 hours.

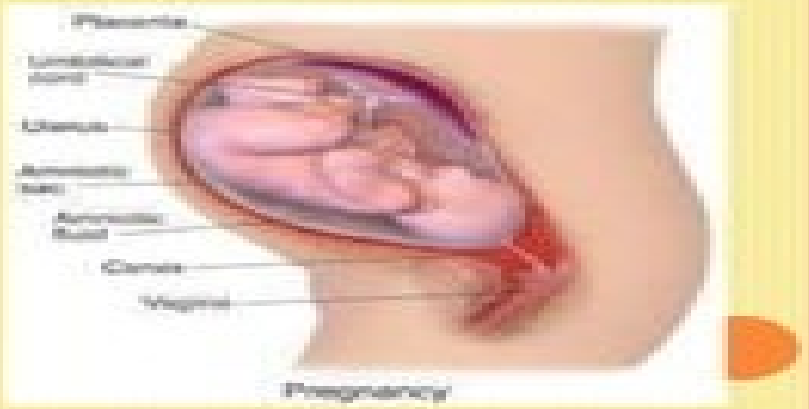

Latex particles coated with hCG
+
Anti-hCG antibodies
+ Urine sample
hCG present in urine
hCG absent in urine
Binding of hCG to anti-hCG antibodies
No binding of hCG
No agglutination
Agglutination
Positive test
Negative test

Hormonal regulation

PREGNANCY

- **Pregnancy**, also known as **gravidity** or **gestation**, is the time during which one or more offspring develops inside a woman.





MATERNAL BODY CHANGES DURING PREGNANCY.

- During pregnancy the Uterus enlarge considerably. It increases to about 1kg at full term.
- The Maternal blood volume increases to 30% during pregnancy.
- The Heart appears to enlarge during pregnancy.
- The Cardiac output also increases.
- The Breast is to estimulate to secrete milk.This is done by a hormone Prolactine.
- Oxygen consumption is increases during pregnancy to satisfy the needs of the Fetus.

HORMONAL CONTROL OF PREGNANCY

- During Pregnancy hormones play a significant role in triggering changes in the Mother and Fetus.
- Hormones maintain the linning of the Uterus and prevent Menstruation.
- Hormone increases Flexibility of the Pubic Symphysis.
- Hormone determine the timing of Birth.

These are following Hormones which are controlled in pregnancy:

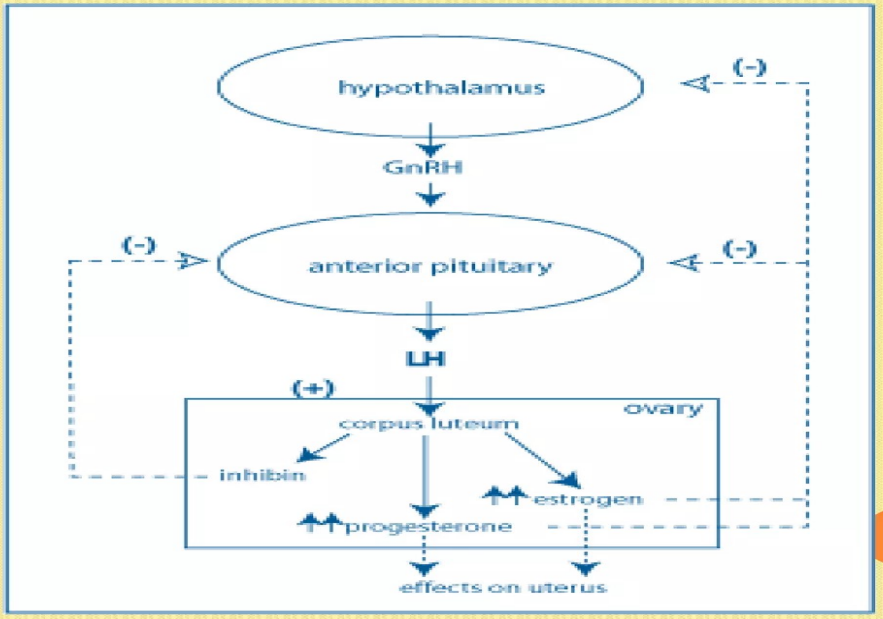
- 1Estrogen Hormone.
- 2.Progesterone Hormone.
- 3.Relaxin Hormone.
- 4.Human Chorionic gonadotropin Hormone.
- 5.Corticotropin Hormone.

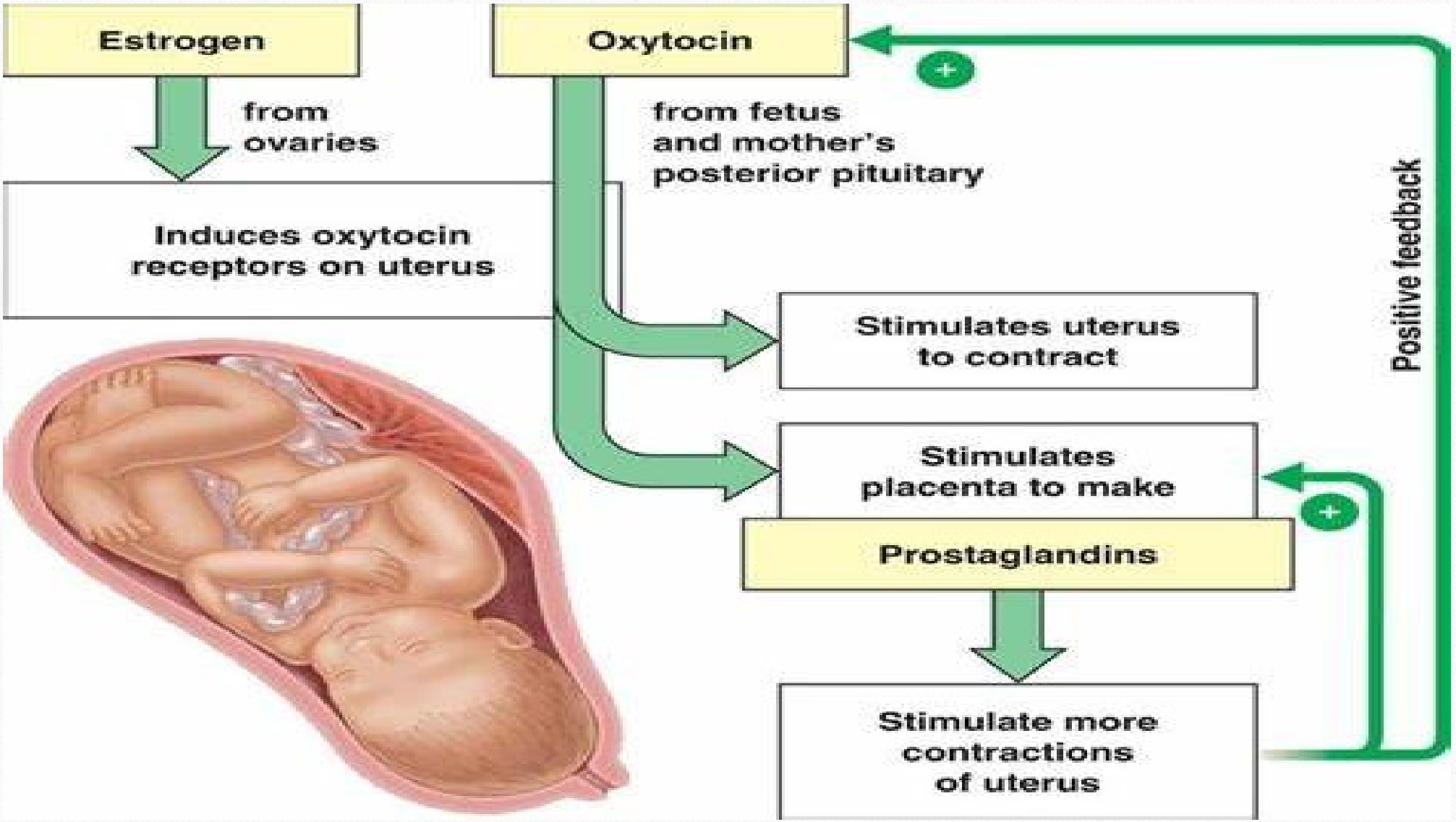
Mechanism

MECHANISM OF HORMONES IN PREGNANCY

If the egg is not fertilized, the corpus luteum degenerates, causing progesterone and estrogen levels to drop, and menstruation to begin.

If the ovum is fertilized, on the other hand, the corpus luteum remains intact and continues to maintain the hormone levels you need to keep your uterus baby-friendly. Eventually, the placenta develops the ability to secrete the necessary hormones itself, and the corpus luteum typically disappears after 3 to 4 months.



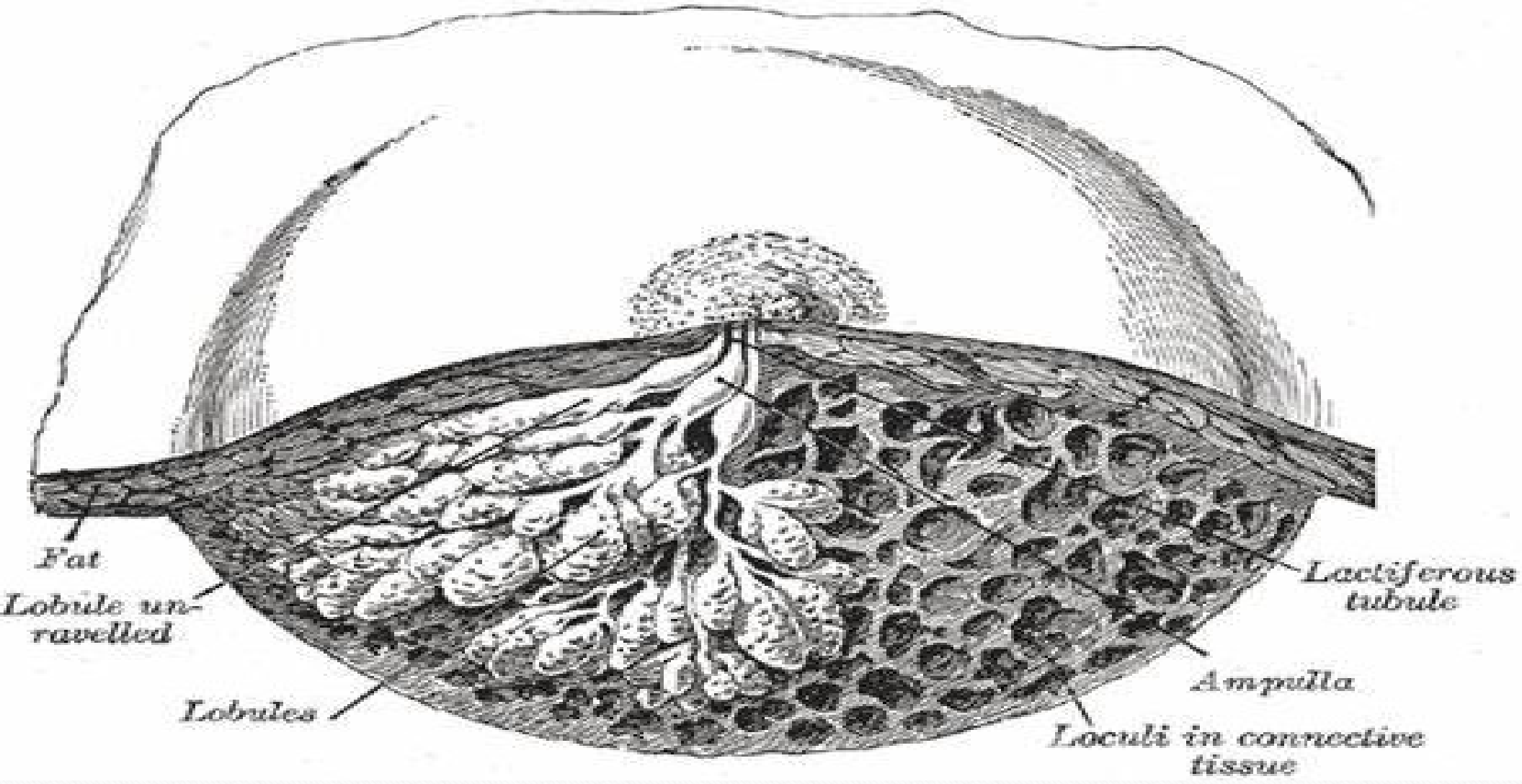

Estrogen
Oxytocin
from ovaries
from fetus and mother's posterior pituitary
Induces oxytocin receptors on uterus
Stimulates uterus to contract
Stimulates placenta to make
Prostaglandins
Stimulate more contractions of uterus
Positive feedback
+
+

Parturition

- At the end of pregnancy, the process of the uterus contracting at regular intervals aids in the delivery of the child. This begins with the foetal ejection reflex. The term “foetal ejection reflex” refers to the signals for an ejection that the fully formed foetus sends through the placenta. These signals cause skeletal muscles to contract.
  The gestation period is the period from conception through birthing.

Lactation

- It is the process by which the mammary glands produce milk at the end of pregnancy. Colostrum is the first form of breast milk that the glands produce. This milk is essential for the infant because it gives the newborn their initial protection against illnesses.
- This was a brief explanation of pregnancy, parturition, and lactation.


Fat
Lobule unravelled
Lobules
Lactiferous tubule
Ampulla
Loculi in connective tissue

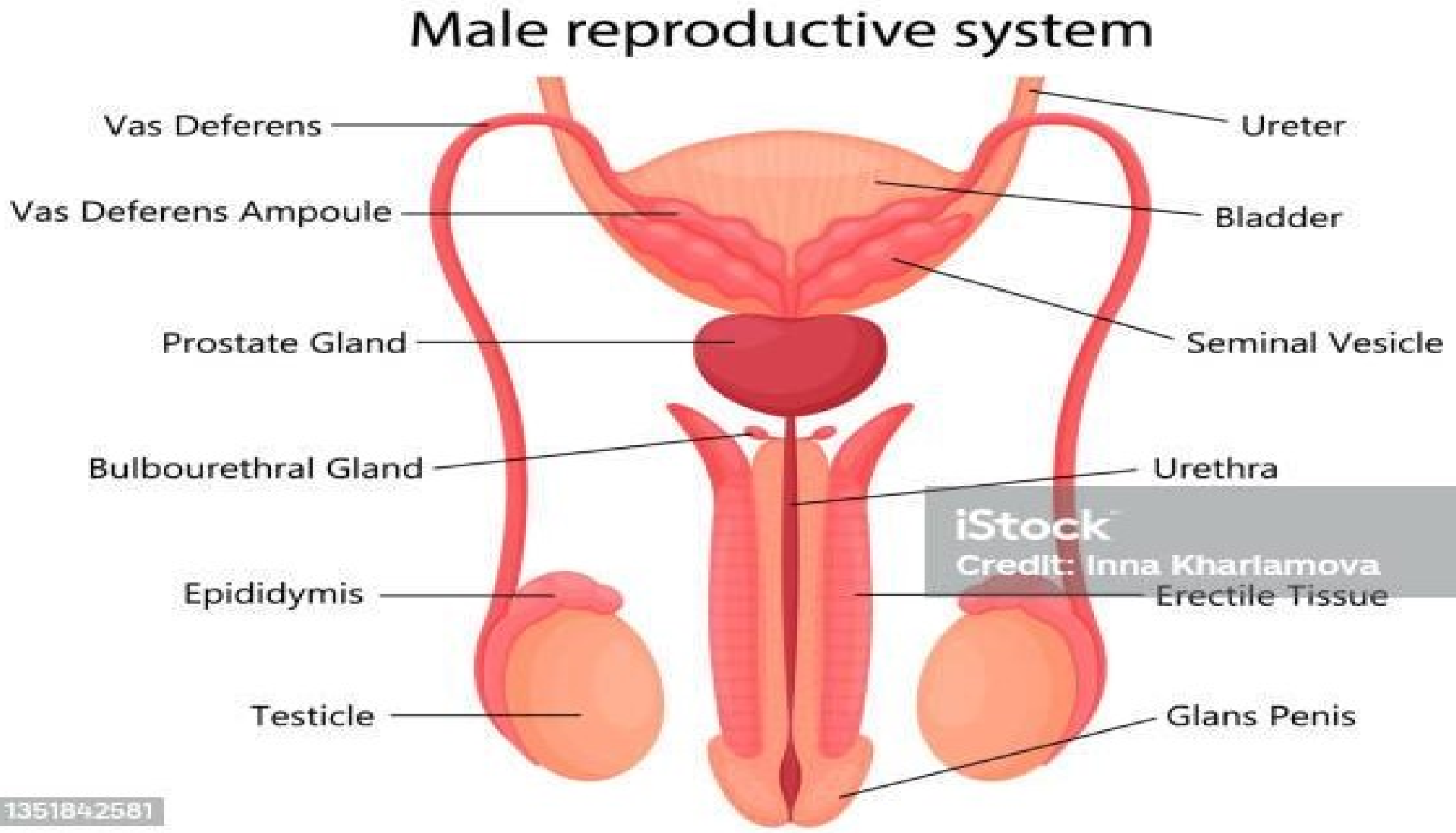
Unit III: Functional anatomy of male reproductive System

(8 hrs.)

B. Anatomy of male reproductive System

- Histology of testis
- Histology of Epididymis
- Histology of Seminal vesicle
- Histology of prostate gland
- Histology of Cowper's gland

Male Reproductive System


Male reproductive system
Vas Deferens
Vas Deferens Ampoule
Prostate Gland
Bulbourethral Gland
Epididymis
Testicle
Ureter
Bladder
Seminal Vesicle
Urethra
Erectile Tissue
Glans Penis
iStock
Credit: Inna Kharlamova
1351842581

Histology of testis

- The testes (testicles) are male reproductive glands found in a saccular extension of the anterior abdominal wall called the scrotum. They are in ovoid shape, sized four to six centimeters in length.
- Testes develop retroperitoneally on the posterior abdominal wall and descend to scrotum before birth.
- The scrotum is often asymmetric, with one testis extending further down than the other. After their descent, the testes remain connected with the abdomen by spermatic cords, and attached to the scrotum by the testicular ligament.

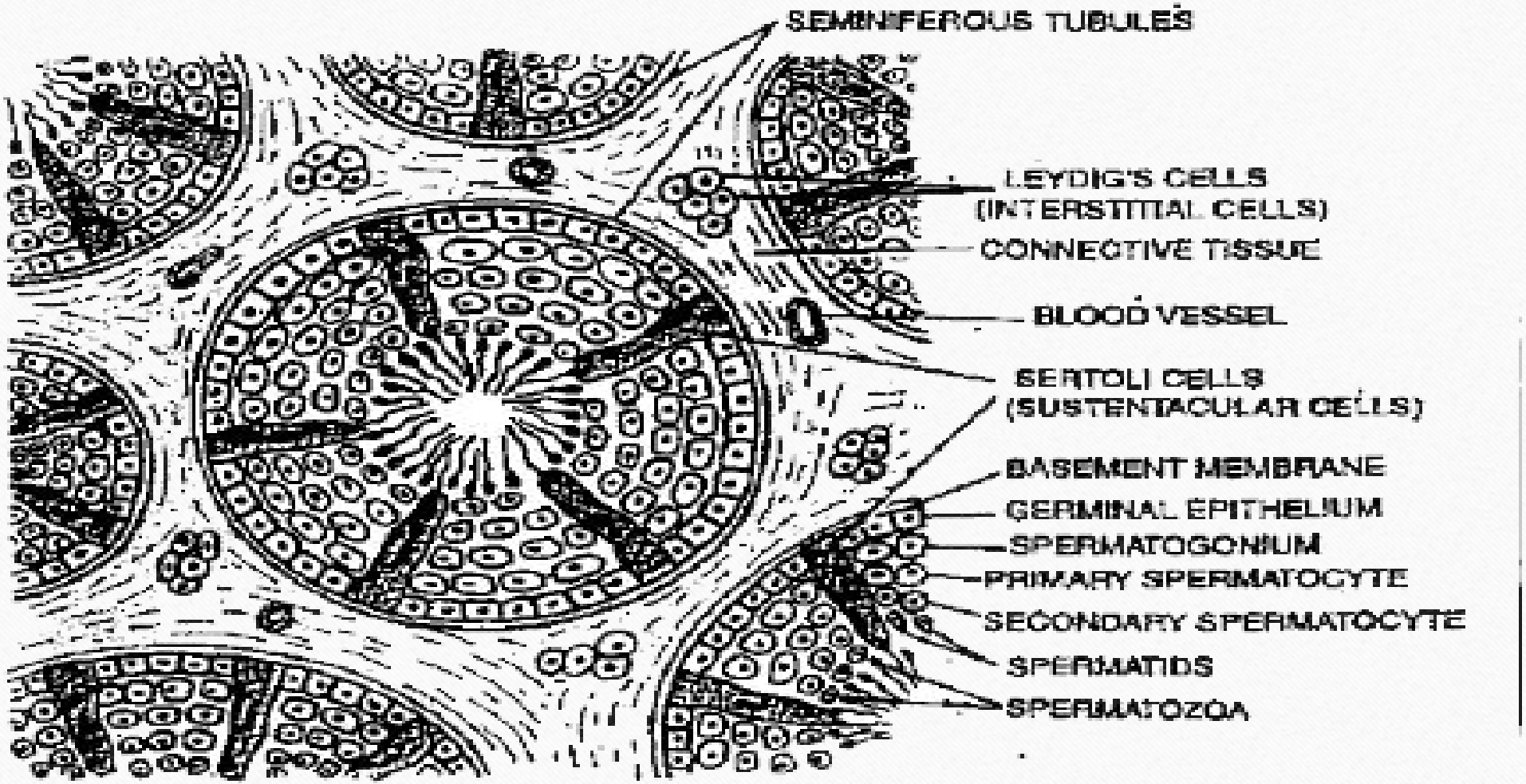
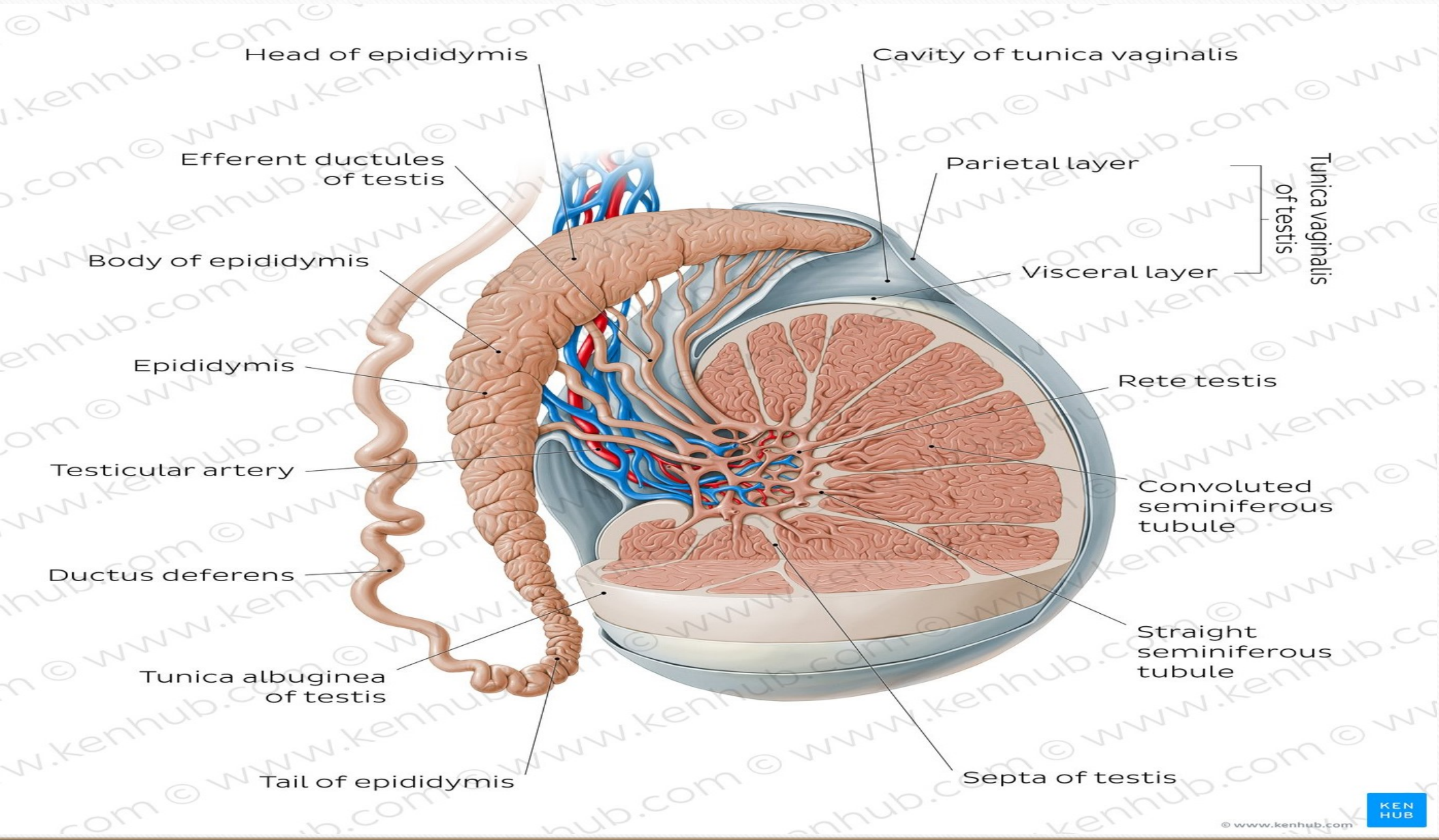


Fig. A part of transverse section of mammalian testis.

Histology of Epididymis

- The epididymis is an essential component of the male reproductive tract. It is a site of sperm storage and maturation until the time of their discharge to the ductus deferens (vas deferens).
- The epididymis is a comma shaped elongated, fine tubular structure that is compressed and raveled tightly. The degree of compression results in the epididymis appears almost solid. The epididymis is found on the posterior surface of the testes, and sits along the entire length of the posterior testes.


Head of epididymis
Efferent ductules of testis
Body of epididymis
Epididymis
Testicular artery
Ductus deferens
Tunica albuginea of testis
Tail of epididymis
Cavity of tunica vaginalis
Parietal layer
Visceral layer
Tunica vaginalis of testis
Rete testis
Convoluted seminiferous tubule
Straight seminiferous tubule
Septa of testis
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KEN HUB

Histology of Seminal Vesicle

- The seminal vesicles are accessory glands of the male reproductive system. They are a pair of contorted or twisted tubes, which are located between the bladder and the rectum. At puberty, the seminal vesicles form sacs and contribute up to 65-75% of the seminal fluid. Unlike what their name suggests, the seminal vesicles are not involved in the storage of spermatozoa.

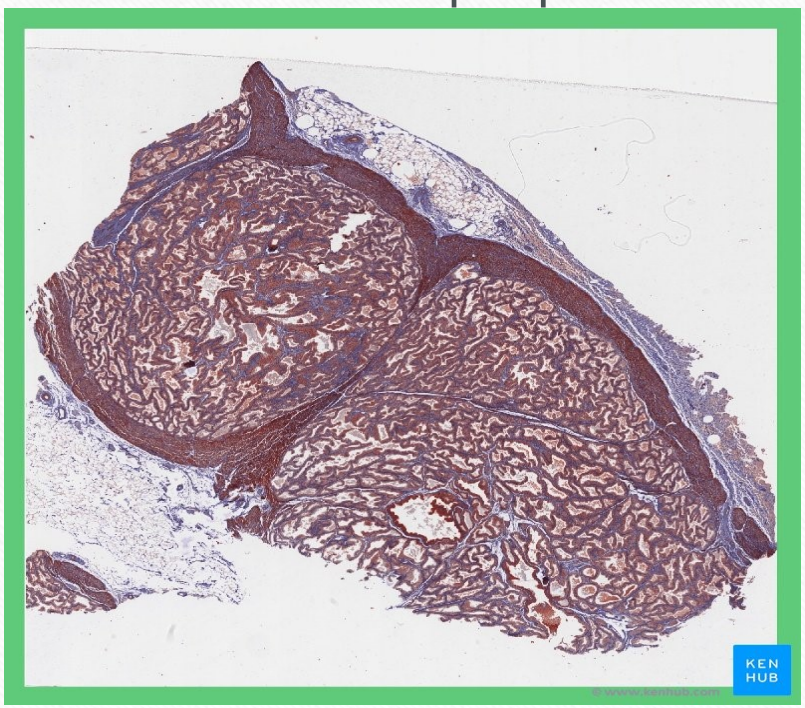
Histology of seminal vesicle

Histology of Prostate gland

- The prostate is a six-sided amalgamation of glandular and fibromuscular tissue that resides in the pelvic cavity. The typical dimensions of a healthy prostate are 4 x 3 x 2 cm (its width being the greatest), while weighing about 20 grams
- It is encapsulated by a true internal connective tissue capsule and a false external capsule, which is a continuation of the pelvic fascia. Its base sits at the neck of the urinary bladder, surrounding the proximal portion of the urethra. The urethra courses through the prostate (known here as the prostatic urethra) and exits inferiorly at the apex.

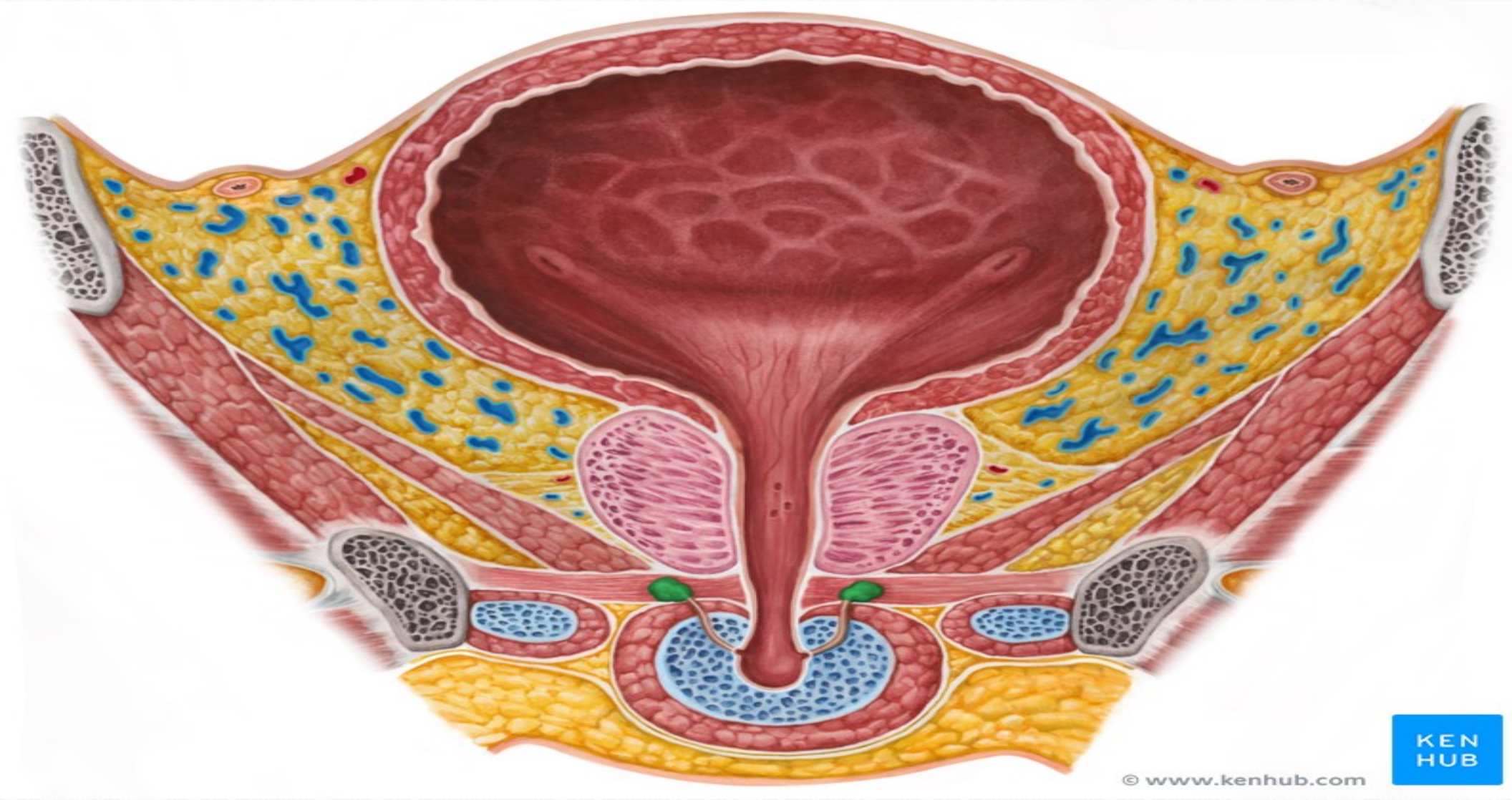
The prostate was previously described as being a lobular organ. Subsequent exploration of its anatomy has resulted in it now being divided into specific anatomical zones, rather than lobes. There are three zones of the prostate, namely the

peripheral zone, transition zone, central zone



Histology of Cowper's gland

- The bulbourethral glands are found inferior to the prostate and they sit posterolaterally to the membranous urethra (the smallest section of the urethra, which lies inferior to the prostatic urethra). In other terms, the glands sit at the base of the penis, within the deep part of the perineal pouch. They lie within the urogenital diaphragm between the two layers of fascia that form it. They can also be described as sitting at the apex (bottom) of the prostate, superior to the bulb of the penis. The glands themselves are enclosed by the muscular fibers of the urethral sphincter. Their anatomical name comes from their proximity to the bulb and urethra of the penis.
-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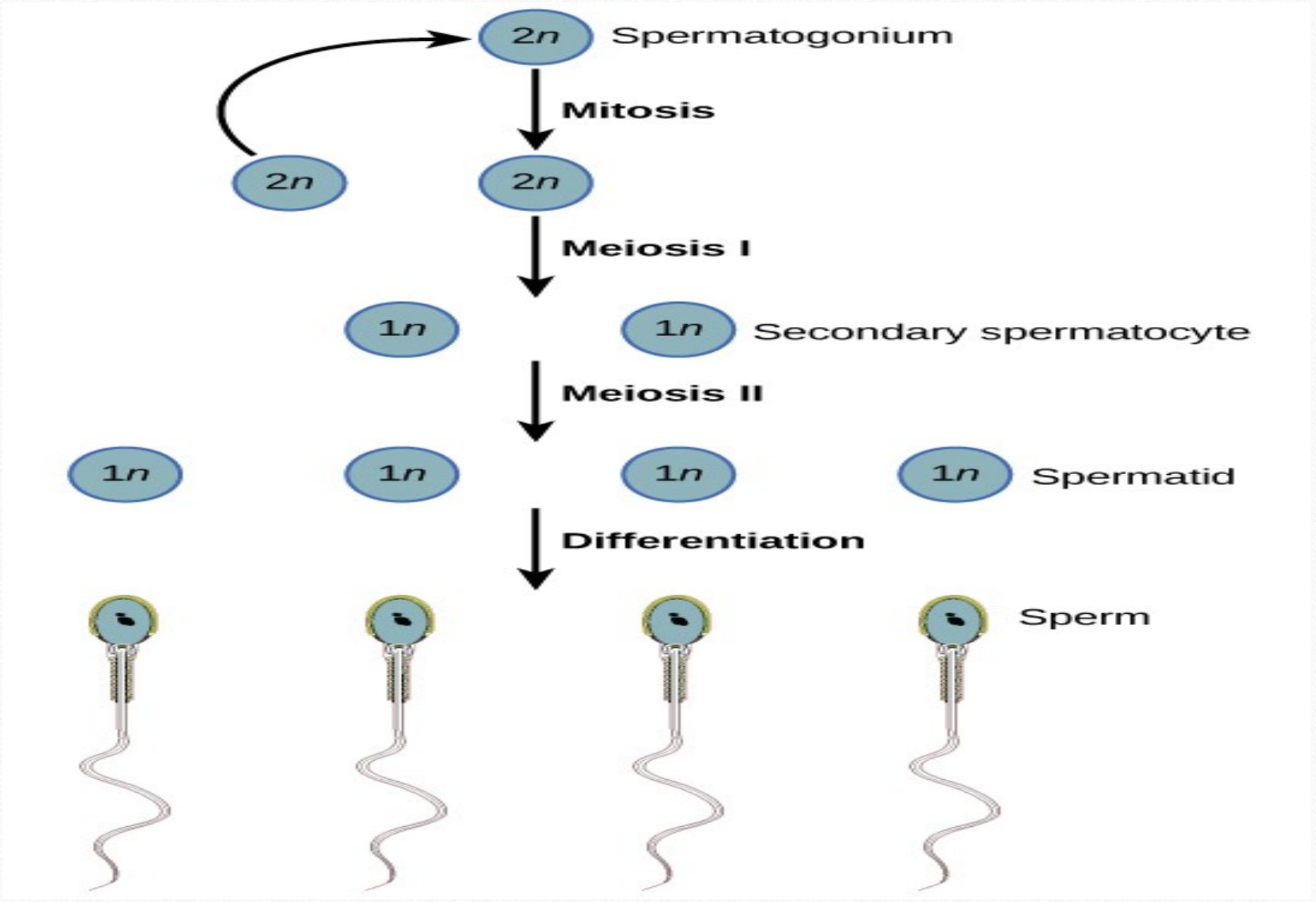
Histology of Penis

- The penis can be anatomically divided into three parts:
- **Root** – the most proximal, fixed part of the penis. It is located in the superficial perineal pouch of the pelvic floor, and is not visible externally. The root contains three erectile tissues (two crura and bulb of the penis), and two muscles (ischiocavernosus and bulbospongiosus).
- **Body** – the free part of the penis, located between the root and glans. It is suspended from the pubic symphysis. It is composed of three cylinders of erectile tissue – two corpora cavernosa, and the corpus spongiosum.
- **Glans** – the most distal part of the of penis. It is conical in shape, and is formed by the distal expansion of the corpus spongiosum. This contains the opening of the urethra, termed the external urethral orifice.

Male sex Hormone

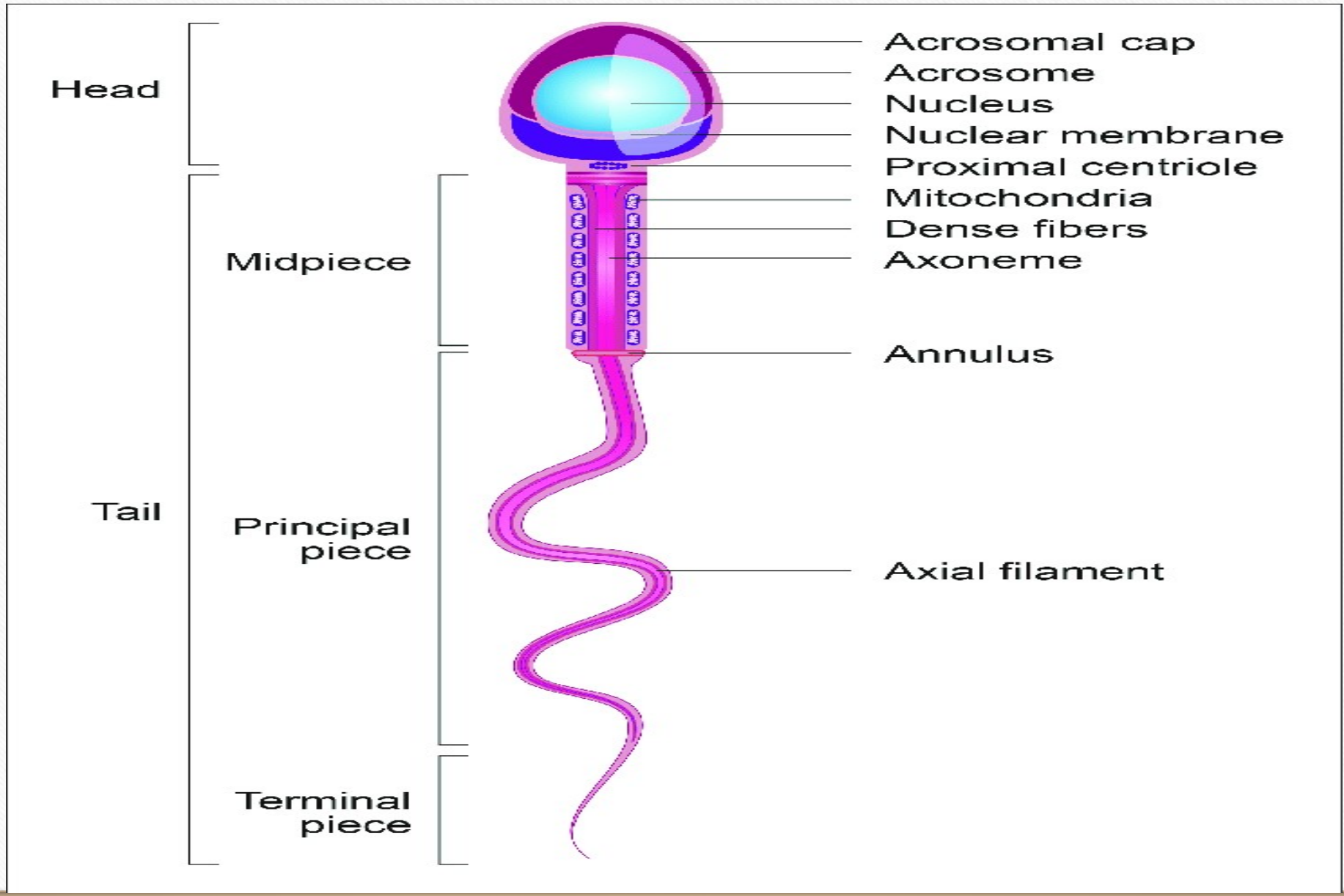
- Testosterone and dihydrotestosterone
- Androsterone
- Epiandrosterone
- Dehydroepiandrosterone

Process of Spermatogenesis


2n
Spermatogonium
Mitosis
2n
2n
Meiosis I
1n
1n
Secondary spermatocyte
Meiosis II
1n
1n
1n
1n
Spermatid
Differentiation
Sperm

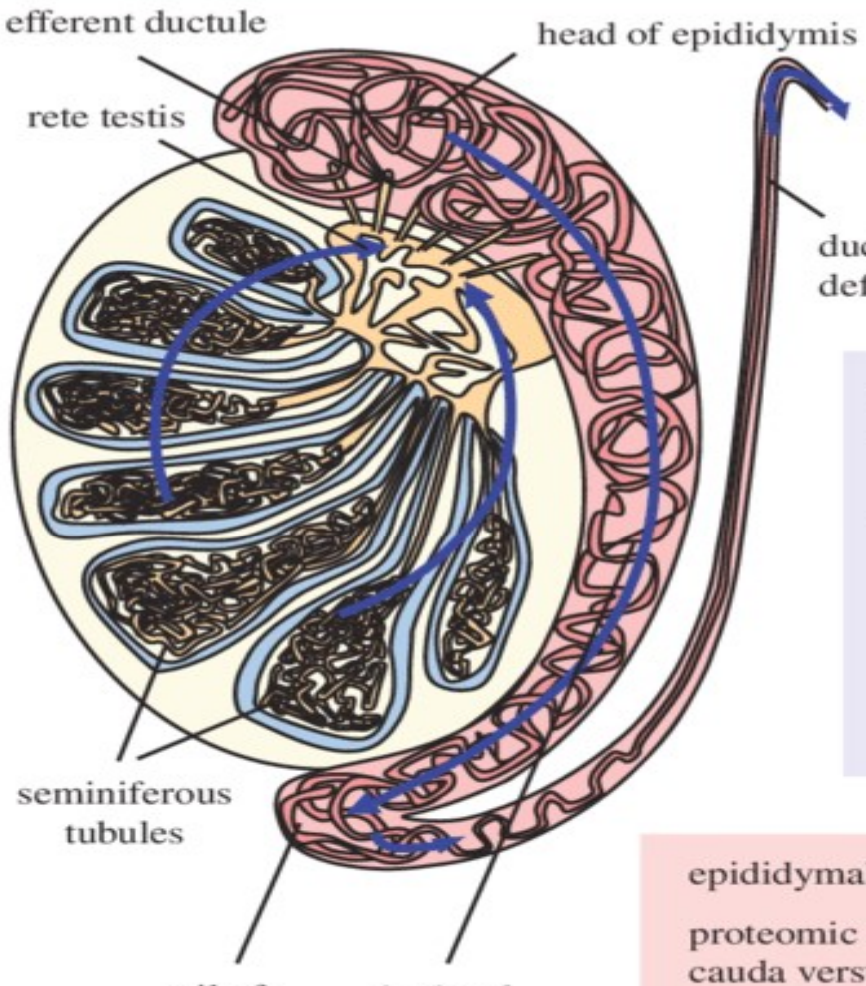
Structure of sperms

- Sperm are smaller than most cells in the body; in fact, the volume of a sperm cell is 85,000 times less than that of the female gamete.


Head
Tail
Midpiece
Principal piece
Terminal piece
Acrosomal cap
Acrosome
Nucleus
Nuclear membrane
Proximal centriole
Mitochondria
Dense fibers
Axoneme
Annulus
Axial filament

Sperm transportation in male genital tract

- The primary functions of the epididymis are **sperm transport** and sperm maturation. The epididymis serves this function across many mammalian species. As sperm travel through the epididymis they are exposed to a number of signals from the cells of the epididymis that drive their maturation.



capacitation :

— protein redistribution in the mouse[18, 19]

— protein post-translational modifications in mouse[23], bull[22] and human[20, 21]

sperm components

— RNAs in human spermatozoa[1–5]

— proteins in *Drosophilia*[6], mouse[7–10] rat[11], bull[12] and human[13–16] spermatozoa

epididymal maturation

proteomic analysis of the cauda versus caput rat spermatozoa[17]

human fertility

— proteomic analyses of sperm from subfertile men[24–26]

— autoimmune infertility[27–31]

Unit IV: Reproductive Health (4 hrs.)

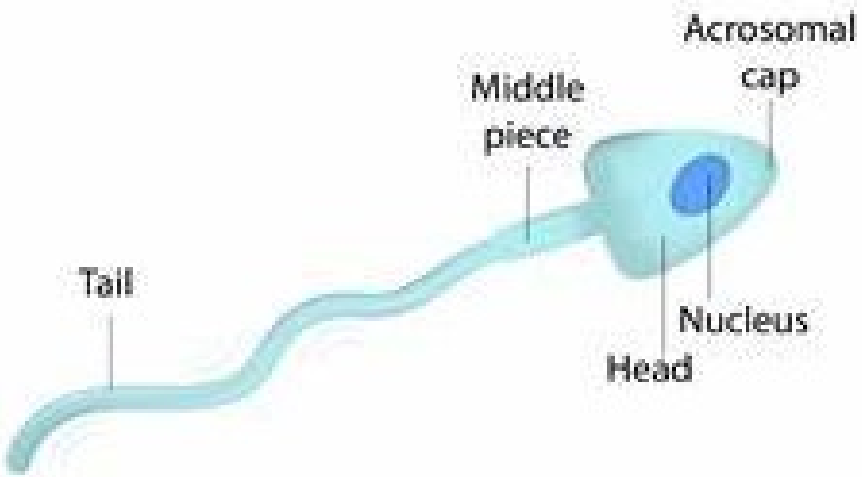
- **Infertility in Male**: causes, diagnosis and management
- **Infertility in Female**: causes, diagnosis and management
- **Assisted Reproductive Technology**: Sperm bank. Frozen embryos. Intrauterine Transfer (IUT). Zygote Intrafallopian Tube Transfer (ZIFT) Gamete Intrafallopian Transfer (GIFT). Intracytoplasmic Sperm Injection (ICSI).
- **In vitro fertilization (IVF):** Ovarian stimulation, Egg retrieval, Sperm retrieval, Fertilization and Embryo transfer

Reproductive Health

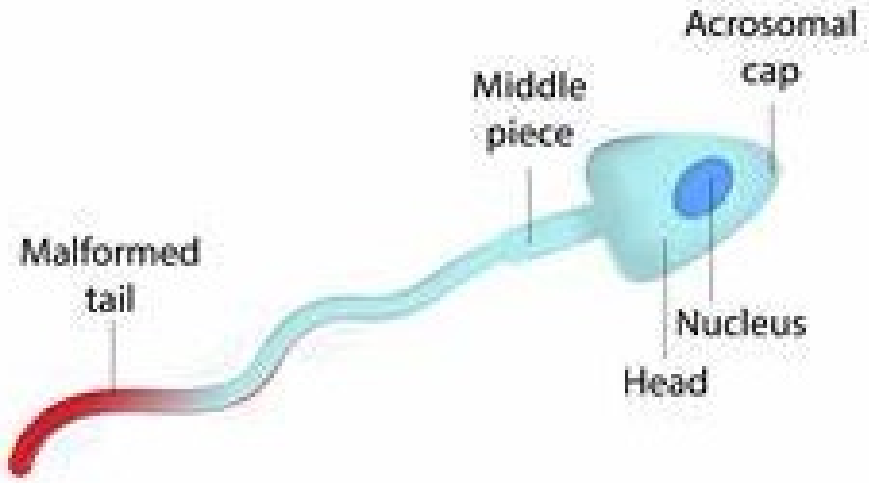
- Sometimes, we may come across a person in the society who is not able to give birth to a child.
- Such a person is called infertile and the phenomenon is called infertility.
- Infertility is found in both sexes ie man as well as woman.

Male Infertility

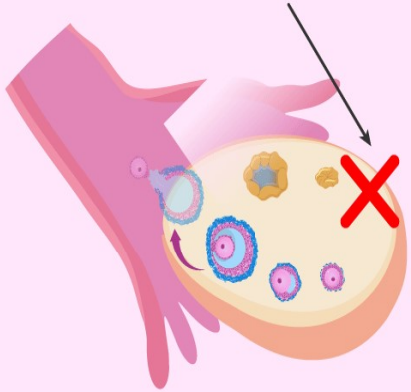
Healthy Sperm



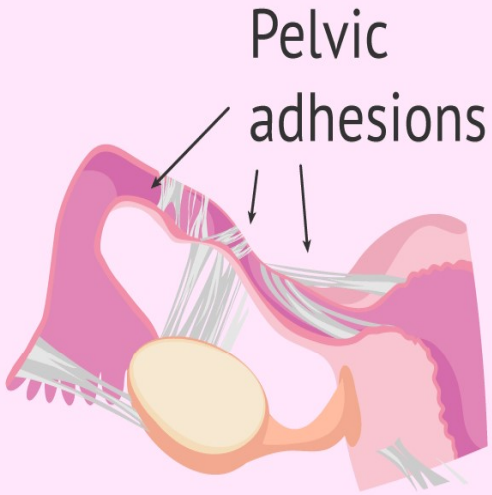
Abnormal Sperm



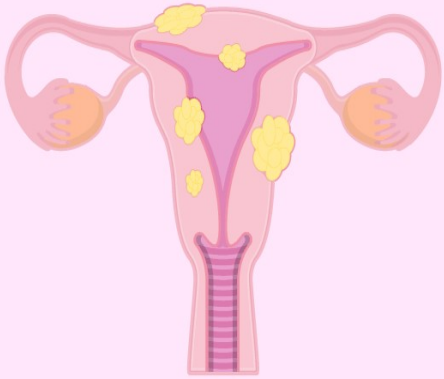
Infertility in female



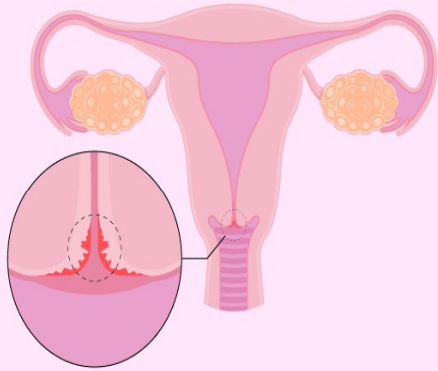
Ovarian factor



Tubal factor

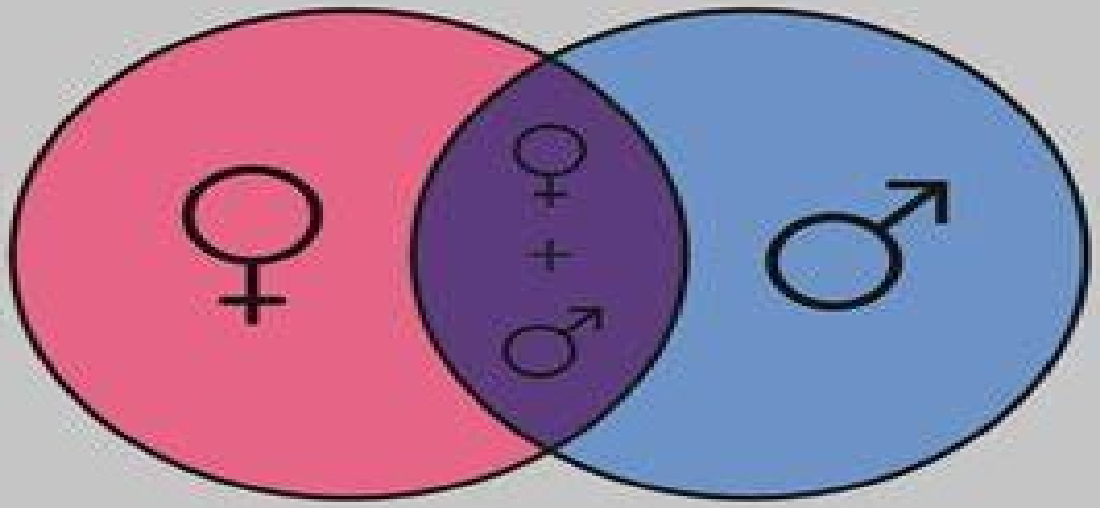


Uterine factor



Cervical factor

Causes of Infertility



One third of infertility can be attributed to female factors.
One third of infertility can be attributed to male factors.
One third of infertility are caused by a combination of factors in both partners.

Find out more at www.reproductivefacts.org

Assisted Reproductive Technology

TYPES OF

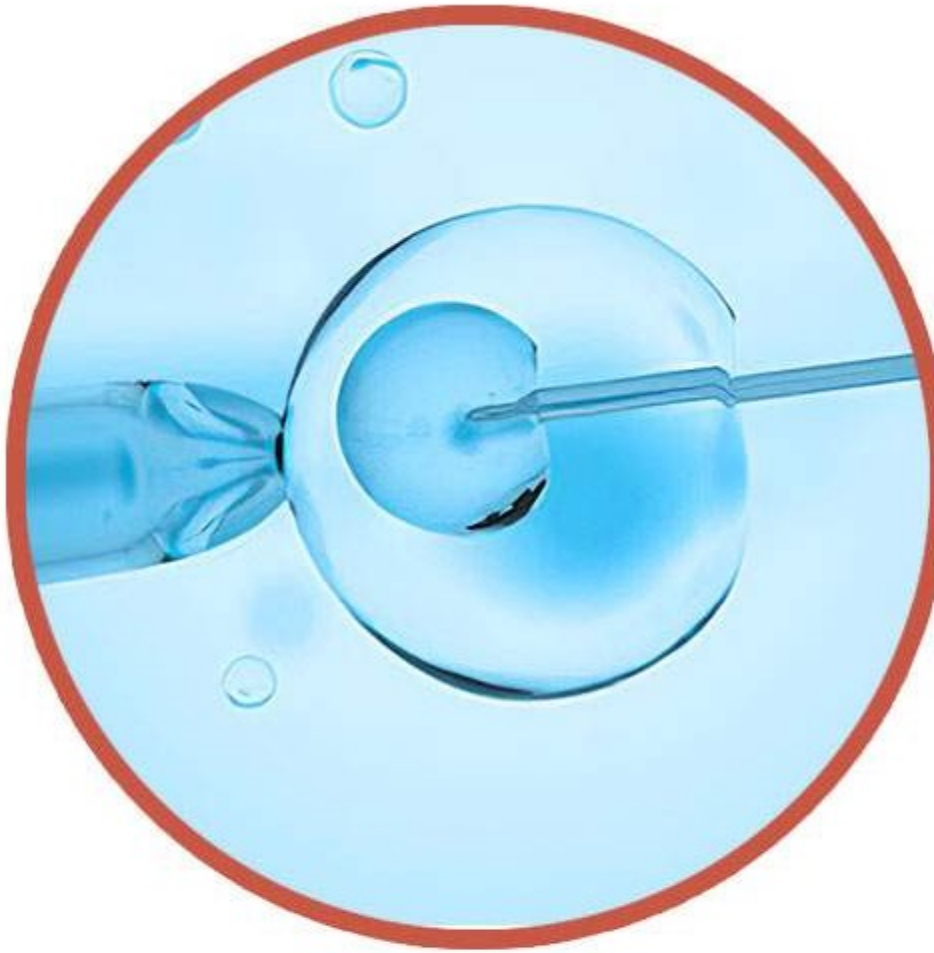
ASSISTED REPRODUCTIVE TECHNOLOGY

IVF (In-Vitro-Fertilization)

IUI (Intrauterine Insemination)

Intrafallopian Transfer

ICSI (Intracytoplasmic Sperm injection)



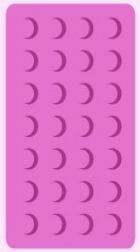
SOFAT INFERTILITY
IVF & WOMEN CARE CENTRE

Contraceptive Methods

Birth control methods

Condom

Female condom

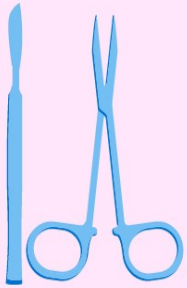


Pill

Hormonal ring

UID

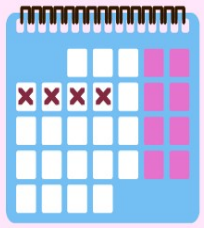
Injection



Surgical sterilization

Implant

Coitus interruptus



Calendar rhythm method

Patch

Diaphragm

Thank You