

HUMAN

REPRODUCTIVE SYSTEM



Male



Female

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CH :- REPRODUCTION

Asexual

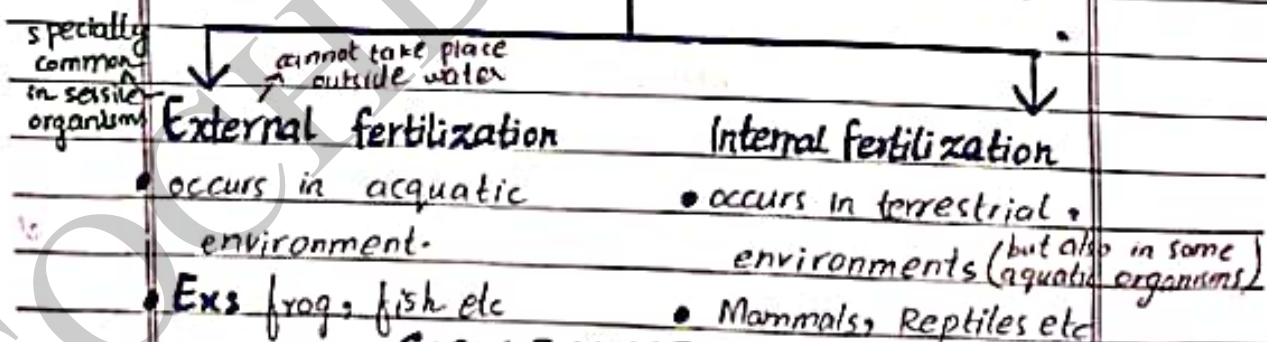
- Only one parent.
- No gametes produced
- Meiosis is absent.
- Offsprings identical to parent.
- Most common in plants and microorganisms.
- Rapid production of large number of offsprings.

Sexual

- Usually two parents.
- Gametes are produced.
- Meiosis is present.
- Offsprings have genetic variations from parents.
- Occurs in majority of higher plant and animal species.
- Less rapid increase in number.

- Evolution of sexual reproduction led to the differentiation of sexes.
- Animals might be $\begin{cases} \text{unisexual} \\ \text{bisexual (hermaphrodite)} \end{cases}$

{ TYPES OF FERTILIZATION }



SIGNIFICANCE OF (STB) SEXUAL REPRODUCTION:- Important to avoid genetic monotony i.e: development of identical progeny generation after generation.

- This helps organisms in adaption to changing environment and thus promotes specie's survival.
- In our common life, it is beneficial for distinguishing people from one another.

Date: _____

Day: _____

TYPES OF ORGANISMS

OVIPAROUS

- development is external
- Female lays eggs in which embryo is present.
- Ex: reptiles & birds

VIVIPAROUS

- development is internal
- Female gives birth to fully developed offspring.
- Ex: Mammals

OVOVIVIPAROUS

- Development is internal.
- Completely developed offspring is laid inside an egg.
- Ex: duckbill platypus, spiny anteater

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~ { REPRODUCTION IN MAN } ~

- In humans, fertilization is internal
- Reproductive system is different from other systems in two respects:
 - It does not become functional till puberty while all other systems are fully functional at birth or right after.
 - Other systems exhibit slight differences in male and female while reproductive system is entirely different.

also called seminal fluid/genital fluid

Semen is a white sticky mixture of sperms & secretions of accessory glands. Fluid content in semen provides nutrition, protection and transport medium for sperms. Normal sperm count is $20-150$ million sperms/ml of semen and the amount of semen propelled out of male duct system during ejaculation is $2-5$ ml.

due to
urine

Necessities of sexual reproduction:-

- i) Gametogenesis (spermatogenesis, oogenesis)
- ii) Mating
- iii) Fertilization

Date: gametes are derived from germ cells in the gonads Day: _____

~{ MALE REPRODUCTIVE SYSTEM }~

It consists of following four parts:-

• Gonads

fluid secreted
by sex diff.
cells

→ Testes (small solid oval bodies)

A pair is present

Situated outside abdomen in a

nourish

skin pouch called scrotum b/w the thighs

• Accessory ducts

until

they are

in tubules

→ epididymis, ductus deferens

(vas deferens), ejaculatory duct

and urethra (urinogenital duct)

↳ bcz it's common for
urine and semen

• Accessory glands

→ seminal vesicles (pair), prostate
glands and bulbourethral glands

• Copulatory organ

→ It is penis (used to transfer sperm
into female reproductive tract)
consists mainly of tissues that
can fill with blood to cause erection.

external genitalia → testes and copulatory organ

• Testes consist of 250-300 lobules.

• Each lobule contains 1-4 tightly coiled
seminiferous tubules.

~{ PASSAGE OF SPERMS }~

Seminiferous tubules (site of production) → rete testis → efferent
ductules

about 6m (20ft)
long

→ vas deferens
(main duct which
forms epididymis)

epididymis (coiled on outer surface of testis)
stores and transports sperm

also called
urethra

→ ejaculatory duct → urethra

37B Ques:- Human testes are packed with about 500 seminiferous tubules which produce about 30 million sperms everyday.

Date: _____

Day: _____

Testes are located outside the body, bcz the process of spermatogenesis is most effective at 35°C that's 2°C cooler than normal body temperature.

{ FUNCTION OF MALE REPRODUCTIVE SYSTEM }

- production and maintenance of sperms.

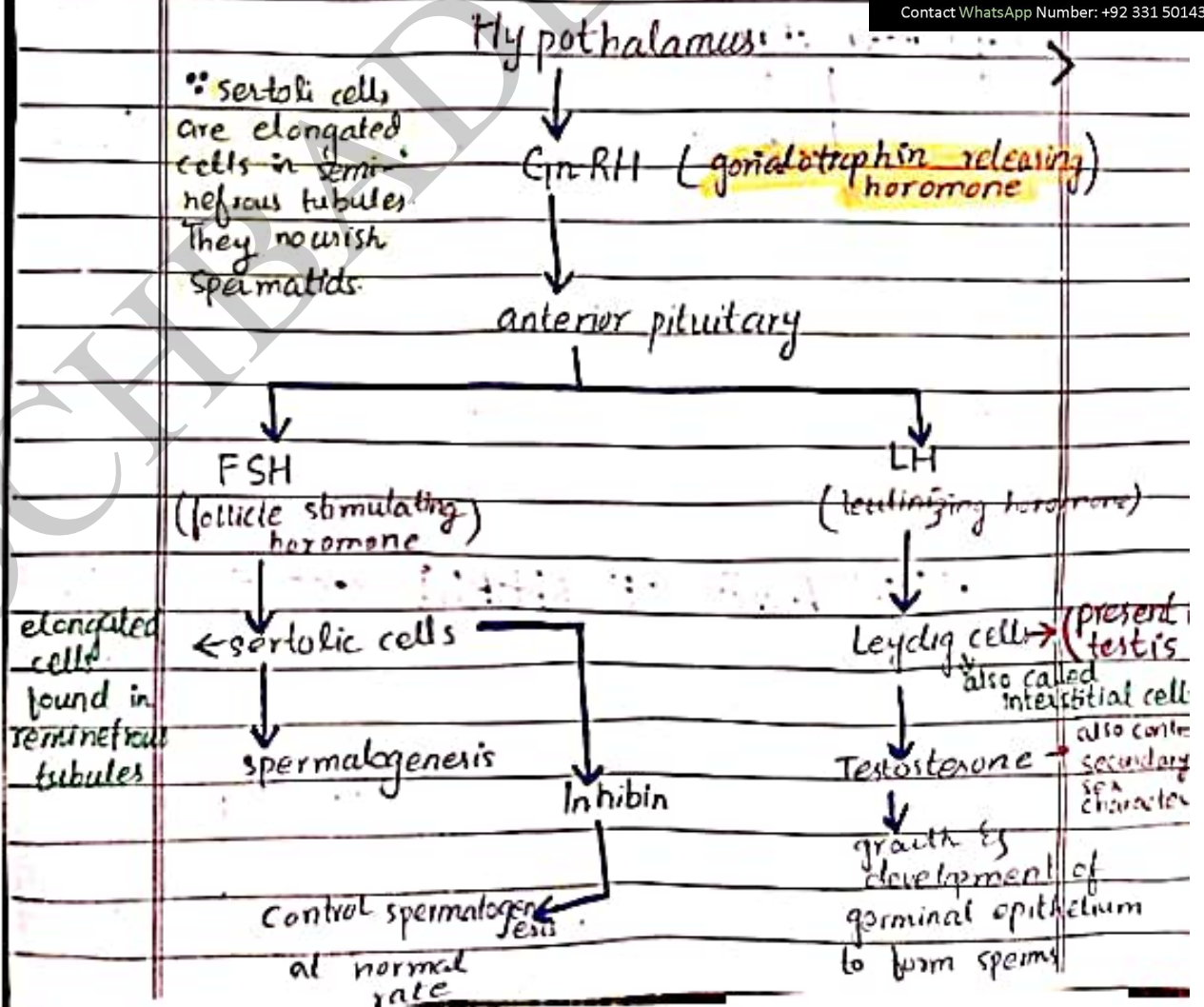
{ HORMONAL CONTROL OF MALE REPRODUCTIVE FUNCTION }

- hormones from hypothalamus and pituitary control spermatogenesis.

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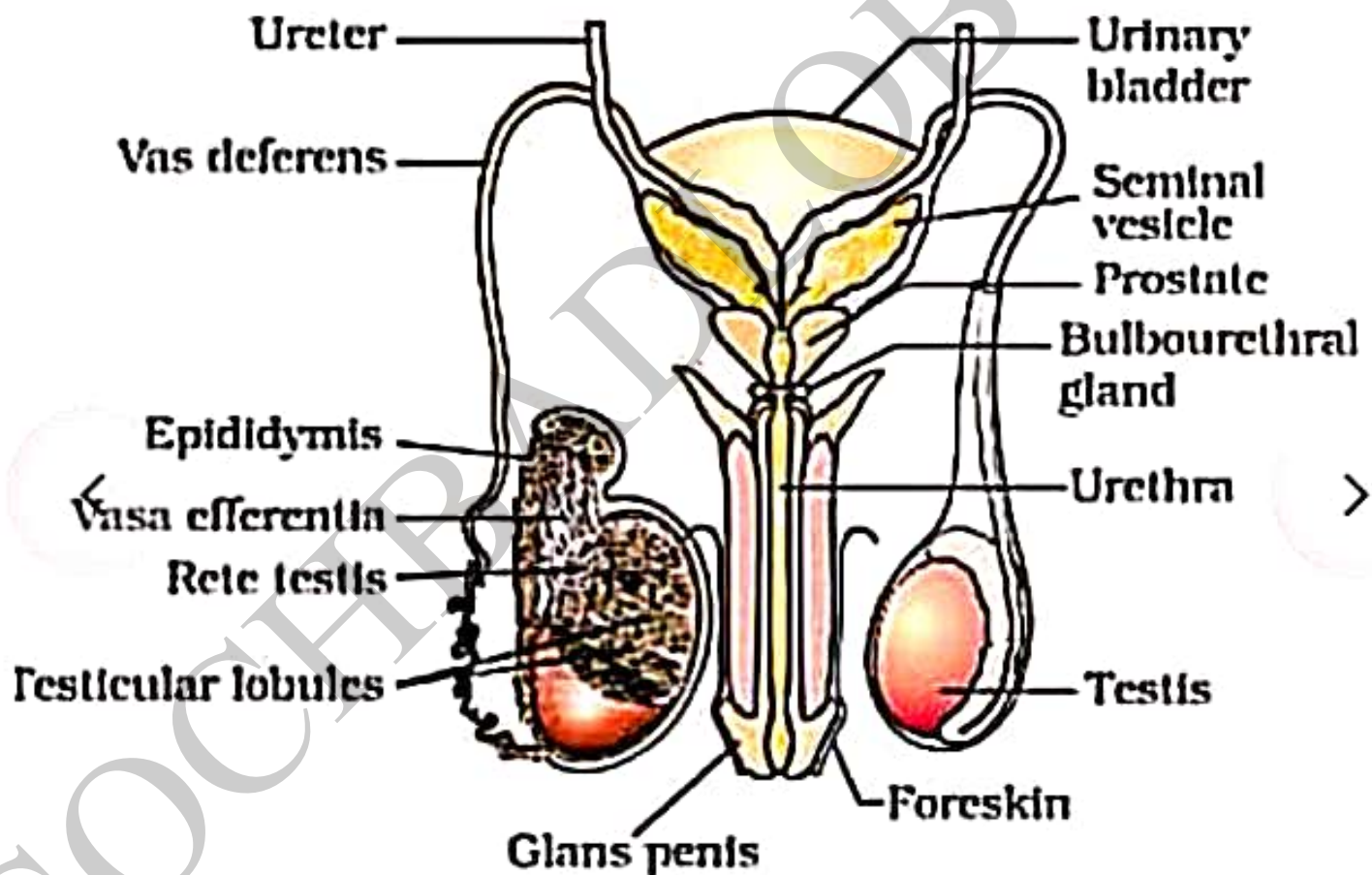
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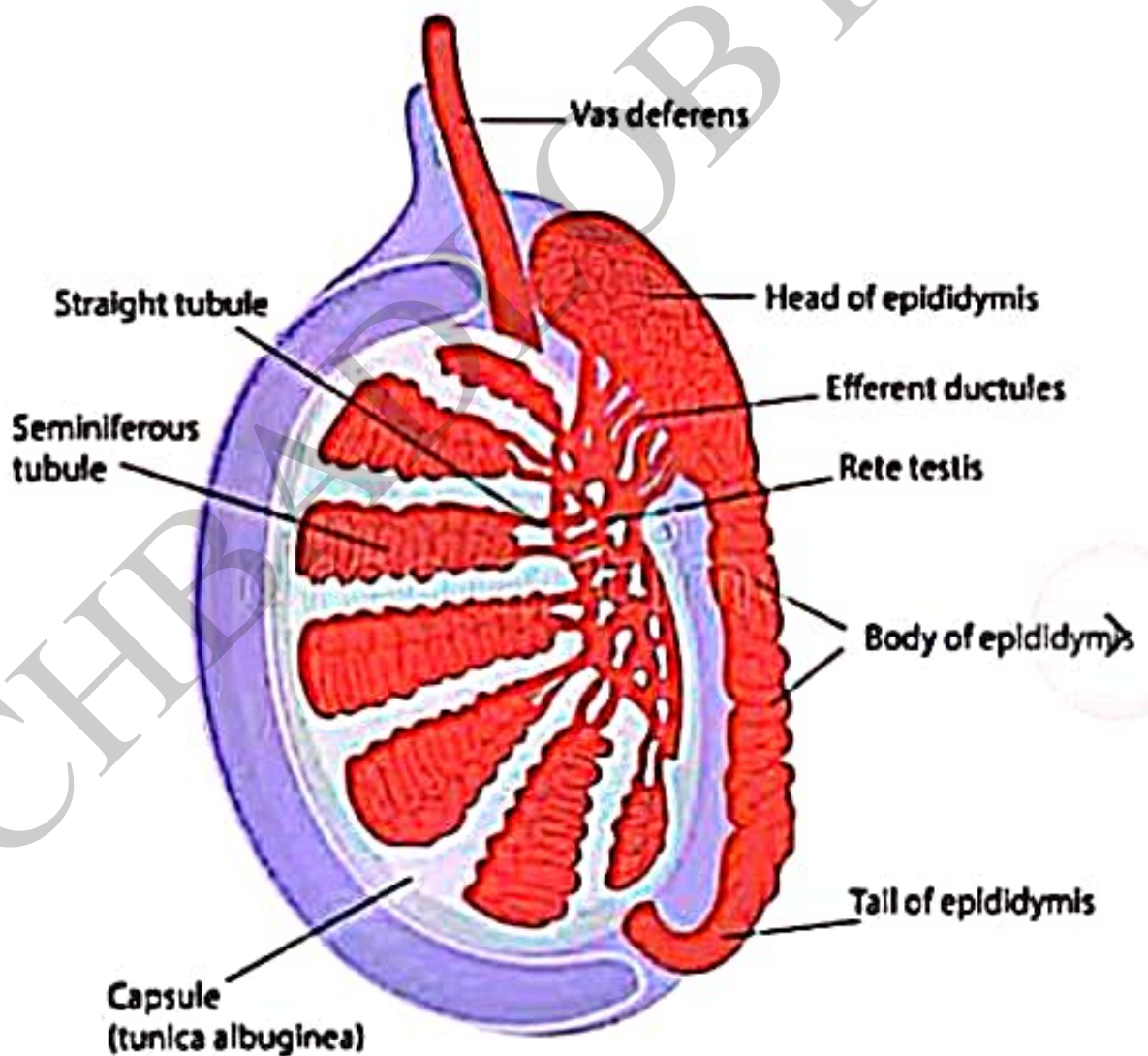
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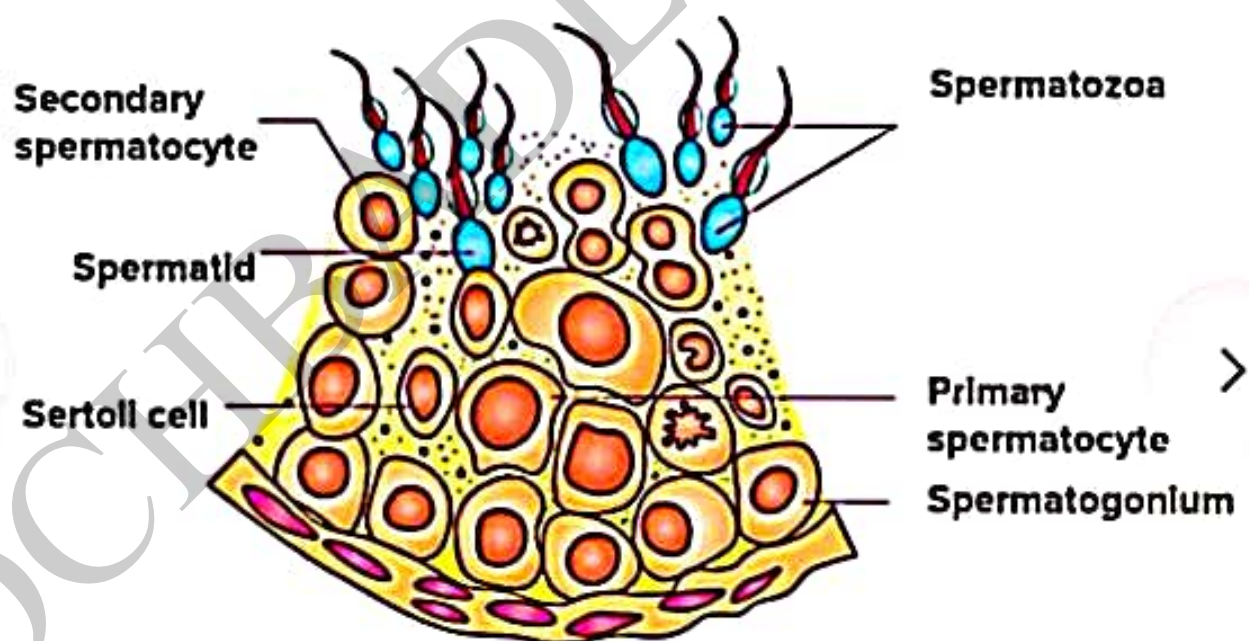
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Day: _____

{ FEMALE REPRODUCTIVE SYSTEM }

ROLE:- Production of egg (female gamete)
• Nurturing the developing embryo

{ STRUCTURE }

It consists of:

1) Gonads

→ Ovaries ^{solid sovoid structures}
3-5 cm long, 2-3 cm wide

- a pair of ovaries
- Present on the sides of uterus
- Held in place within the peritoneal cavity by several ligaments
- Inside ovary, ovarian follicles are present.
- In which, immature egg (oocyte) is present.
- In adult females, an egg is released each month (i.e. ovulation)
- After ovulation, ^{ruptured} follicle → glandular corpus luteum

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2. OVIDUCT [FALLOPIAN TUBES] :-

- Initial part of female duct system.
- Each oviduct is 10cm long
- **Function:** Receive ovulated oocyte, site of occurrence of fertilization, carry the developing ovum towards uterus.
- fertilization takes place in proximal part of oviduct (PTB)
- One side of each oviduct opens ^{on} into the body cavity near the ovary of its own side by a ciliated fallopian funnel and other end opens in uterus.

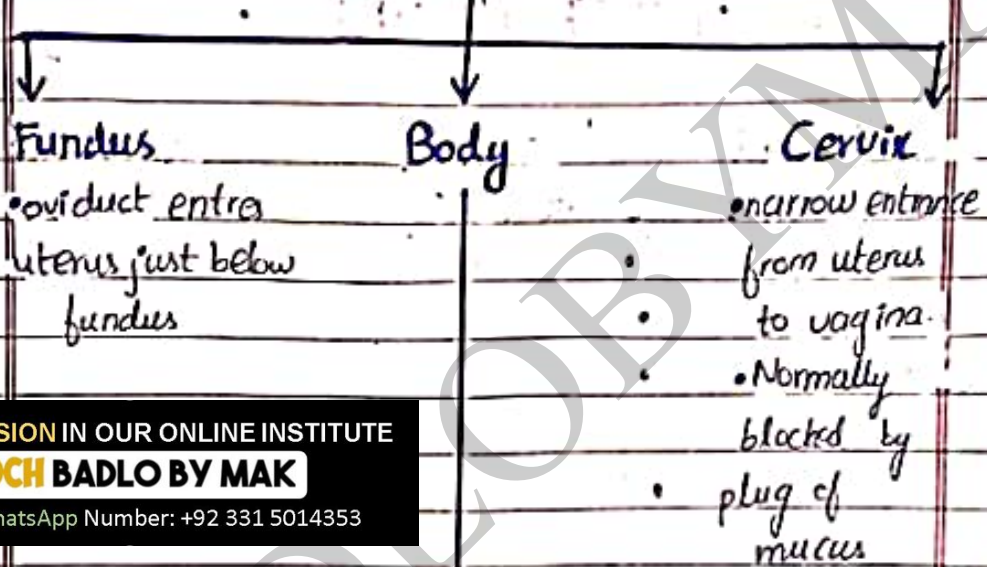
Date: _____

Day: _____

3. UTERUS: (located in pelvis, anterior to rectum)

- Also called womb.
- hollow, muscular ^{and distensible} organ, shaped like an inverted pear.

It has three portions:-



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Perimetrium

- outermost
- thin covering layer

Myometrium

- middle thick, muscular layer
- composed of smooth muscles
- contract to cause labour pain.

Endometrium

- inner spongy lining
- embryo is implanted in endometrium.

4. VAGINA: (muscular tube)

urethra & vagina have independent openings to exterior

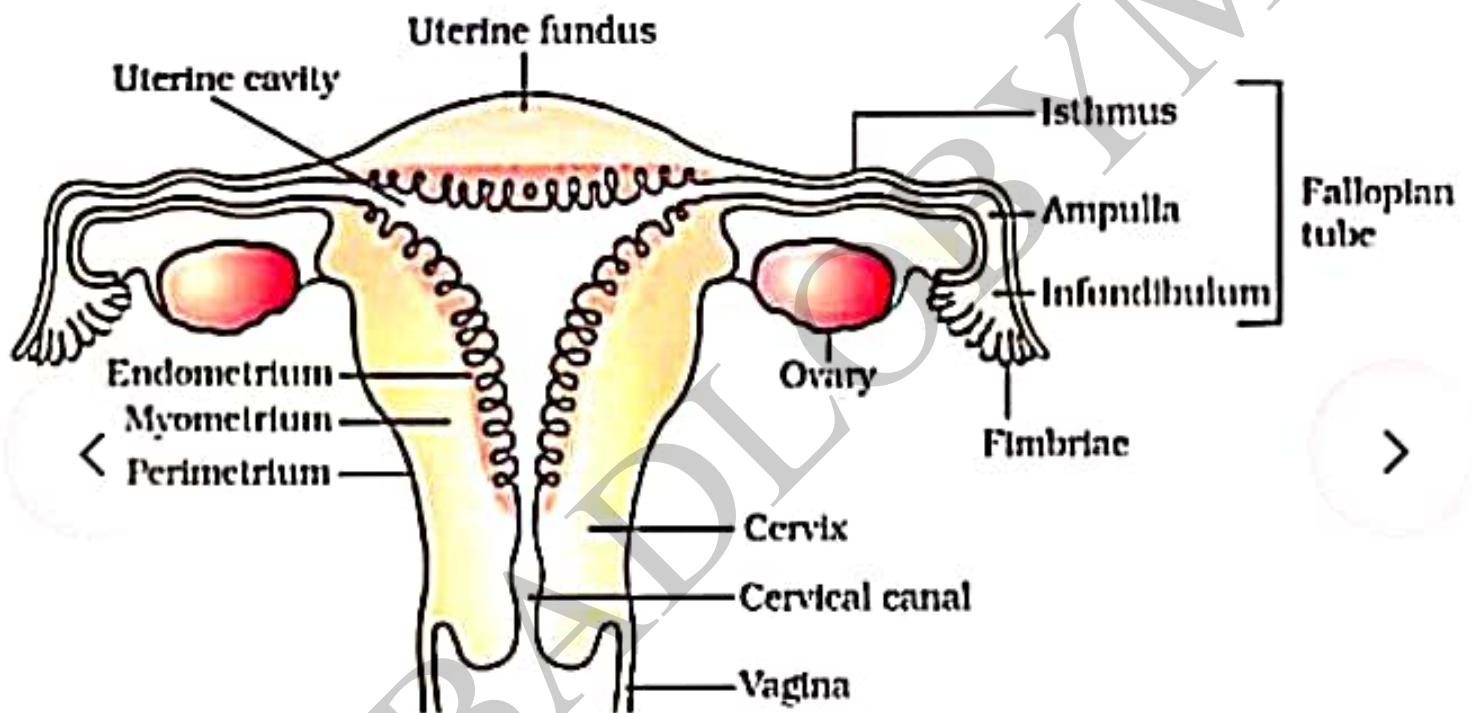
↳ also called birth canal

- 8-10 cm long tube
- extends from cervix to body exterior
- acts as a passageway for child birth and menstrual flow
- urethra is embedded in its anterior wall

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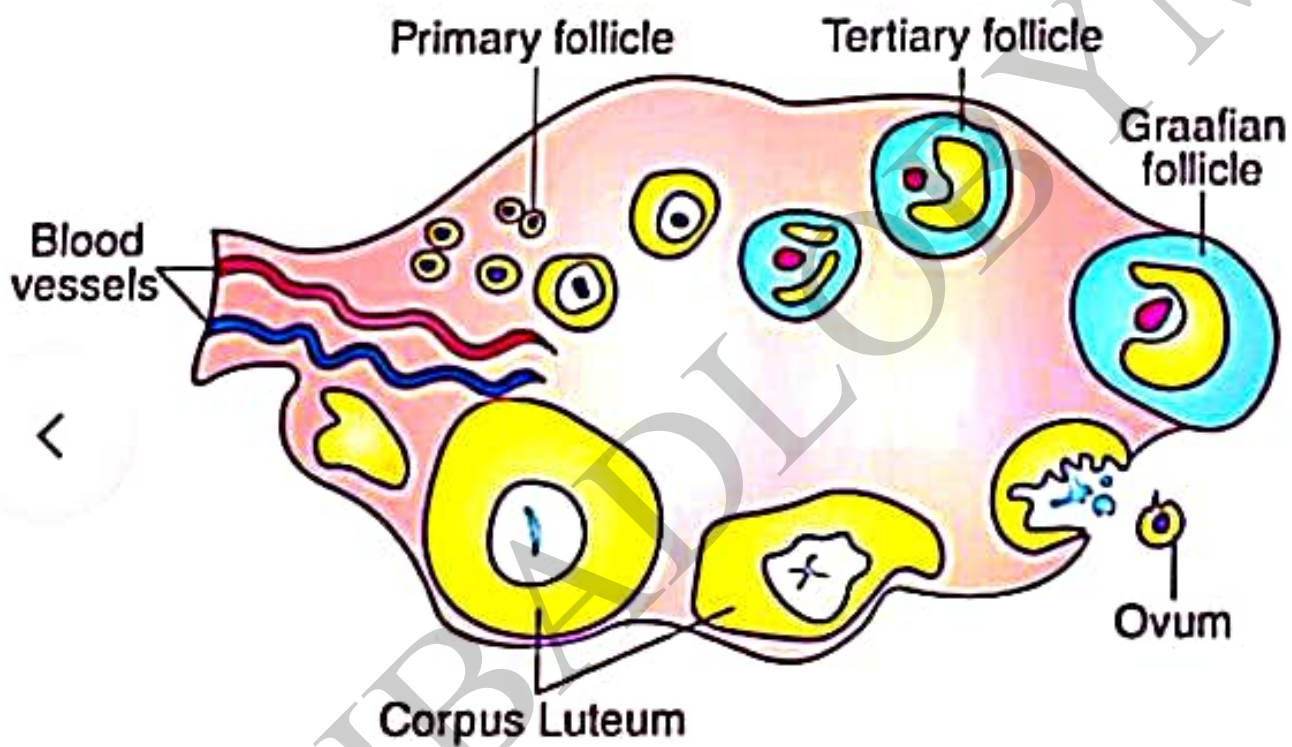
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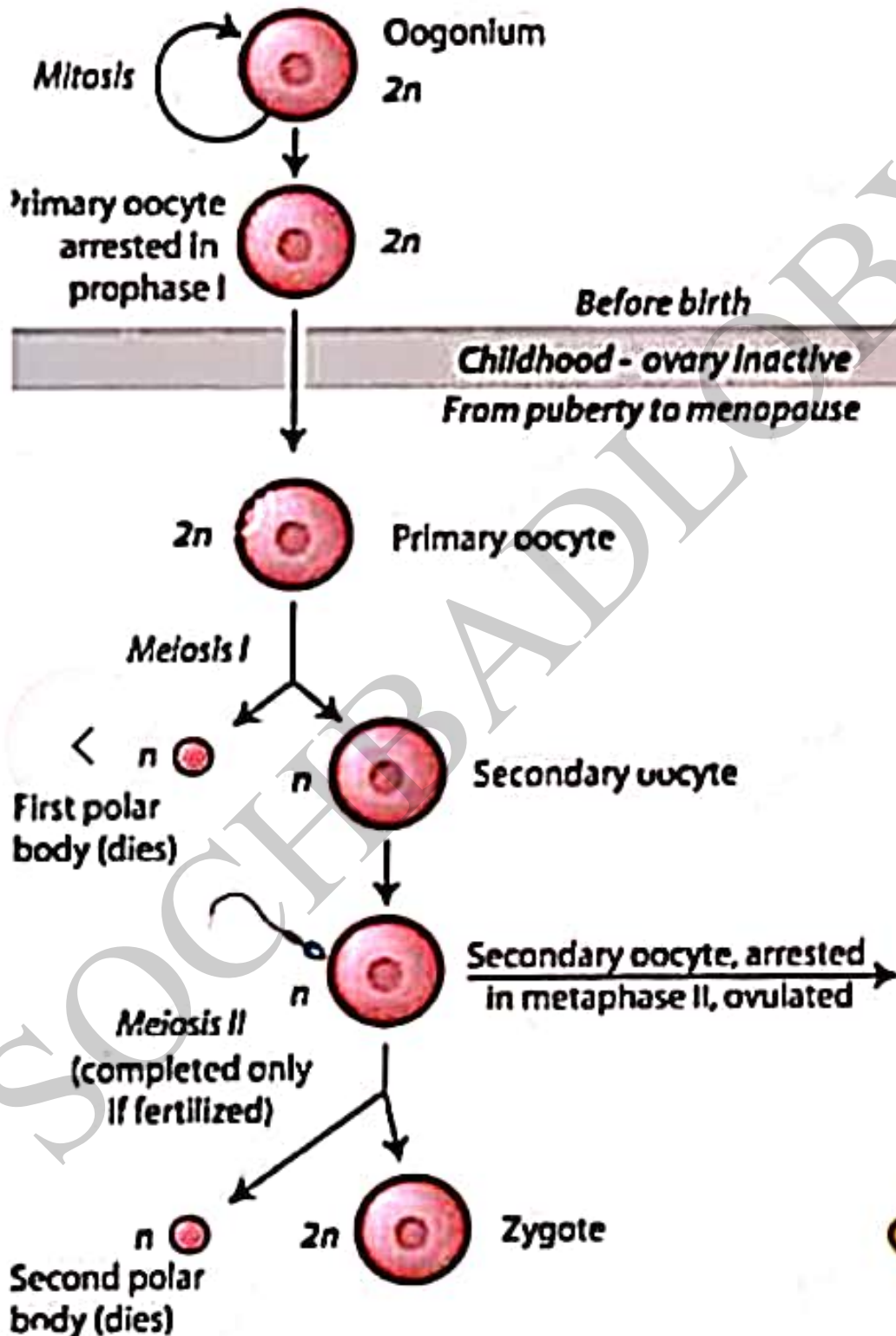


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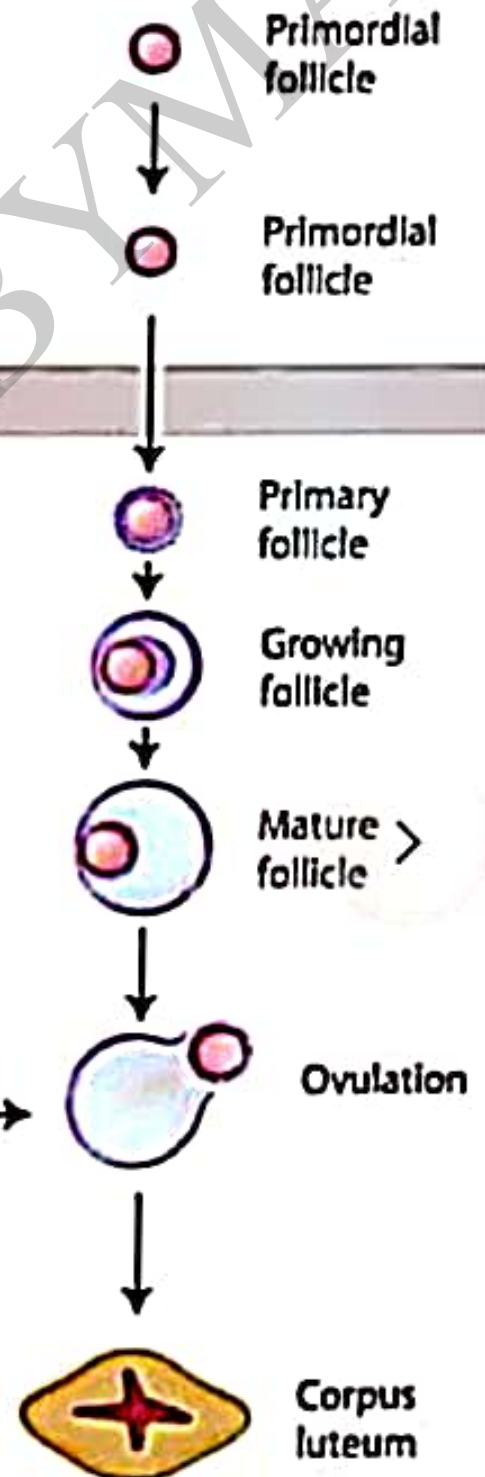
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Oogenesis



Follicle development



- In females, production of egg is a cyclic activity whereas in males, spermatogenesis is a continuous activity.
- Menstrual cycle involves changes in the structure and function of the whole reproductive system.

Date: _____

Day: _____

↑ prepares the uterus for a possible pregnancy

{ MENSTRUAL CYCLE }

FACT (STB):

At the onset of puberty, a human female has about 200,000 oocytes and during her fertile years, only 450 of these develop to mature eggs.

Female reproductive cycle is called menstrual cycle. It has two major phases.

Ovarian cycle:

- Includes events that occur in ovaries.

uterine cycle:

- Includes events that occur in uterus.

Based on changes and hormonal regulation, the menstrual cycle can be divided in three phases:-

MENSTRUAL PHASE

- days 1-5

PROLIFERATIVE PHASE

- days 6-14
- also called pre-ovulatory phase

SECRETORY PHASE

- days 15-28
- also called post-ovulatory phase

{ MAJOR EVENTS OF MENSTRUAL CYCLE }

1. MENSTRUATION PHASE:-

- Due to lack of progesterone, endometrium detaches from uterus.
- This process is accompanied by bleeding for 3-5 days. In PTB, it's 3-7 days
- The detached tissue and blood pass out through the vagina as menstrual flow.

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Date: _____

Day: _____

- At the beginning of this phase, ovarian hormones are at their lowest values.
- Towards the end of menstruation, FSH levels begin to rise i.e. gonadotrophins begin to rise.

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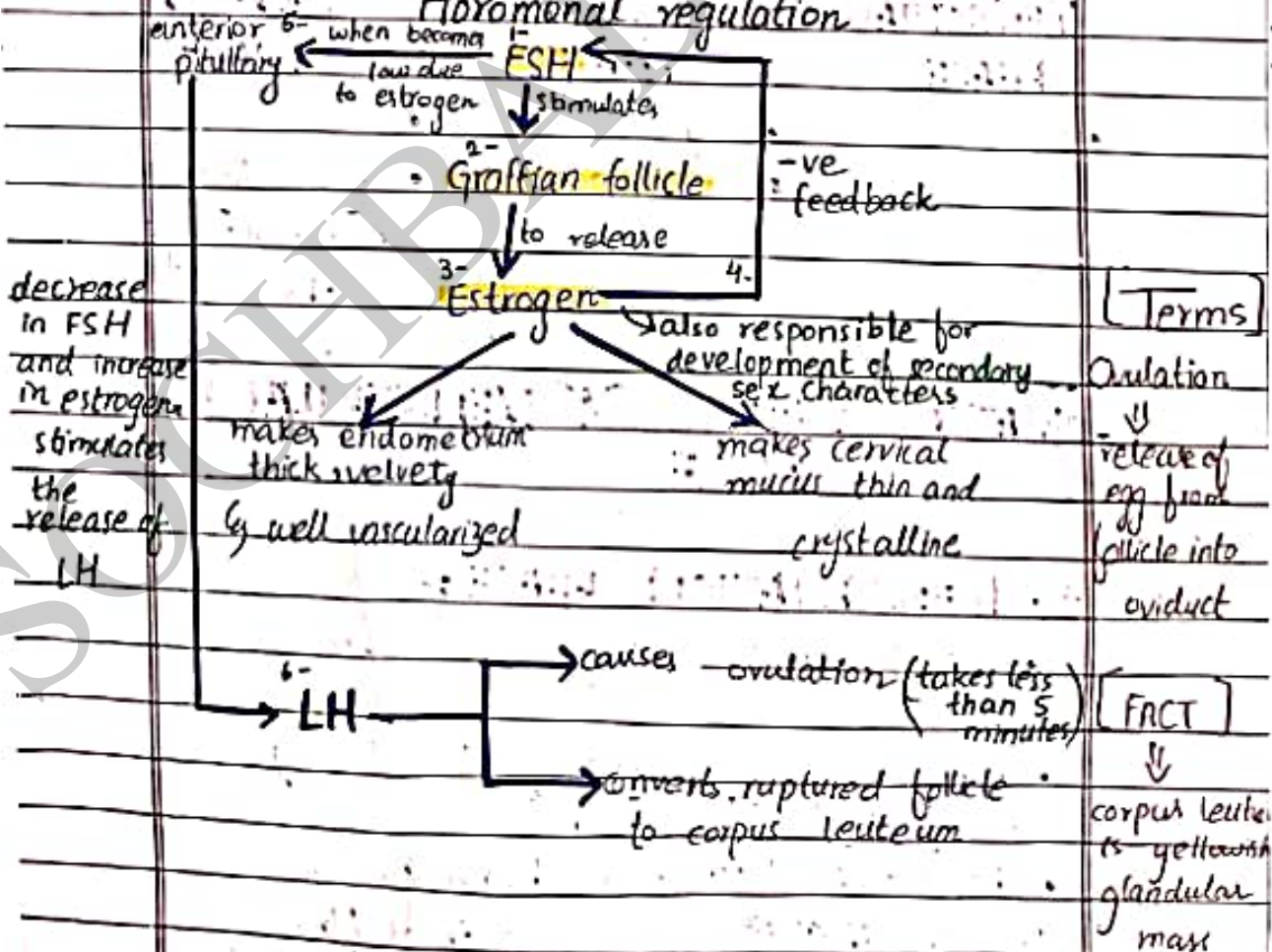
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2. PRO-LIFERATIVE PHASE:-

- Due to rise in FSH level, a few ovarian follicles are stimulated.
- These compete with one another for dominance.
- As a result, all but one of these follicles disintegrate i.e. follicle atresia.
- The one follicle that remains is called mature follicle or Graafian follicle.
- Oogenesis occurs inside Graafian follicle.

Hormonal regulation :-



In 12% of all ovulations, more than 1 oocyte is ovulated. This phenomenon increases with age. This results in the birth of fraternal or non-identical twins.

Date: _____

Day: _____

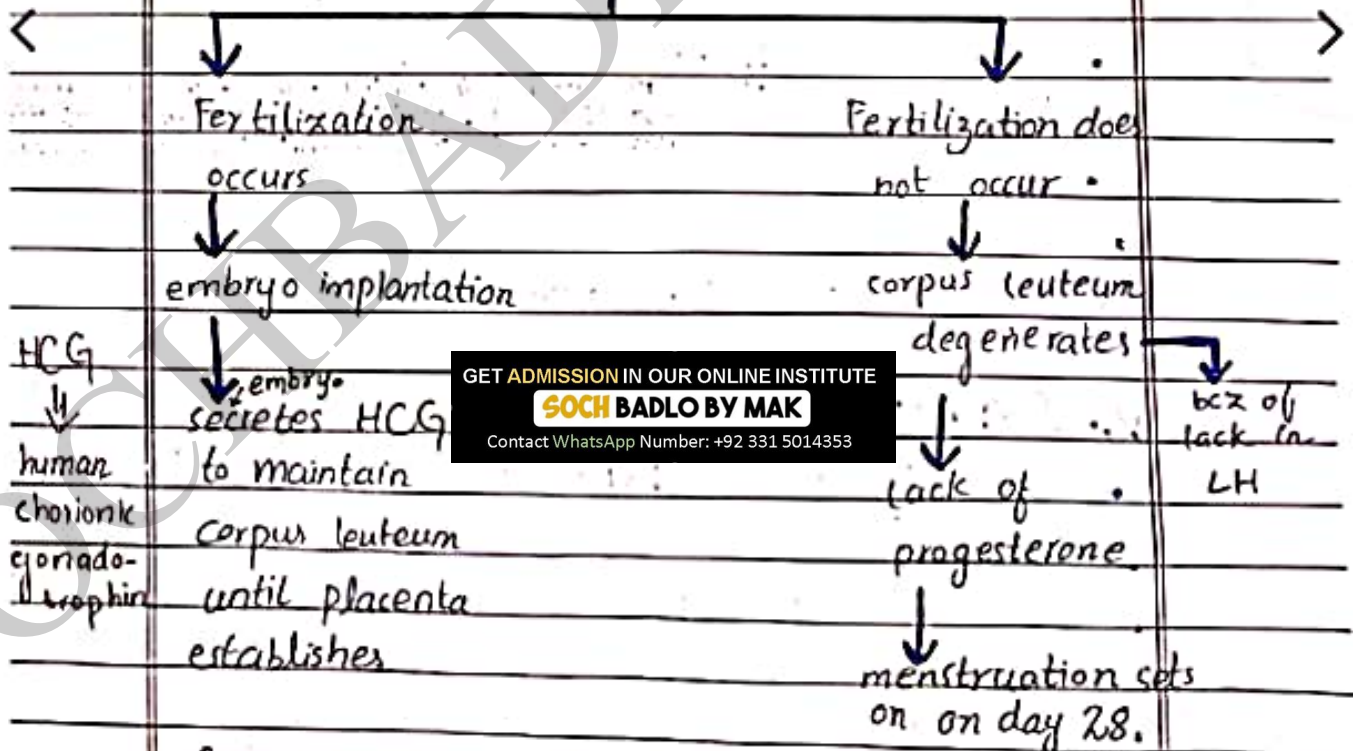
3. SECRETORY PHASE:-

- Endometrium prepares for implantation of embryo.
- Corpus luteum $\xrightarrow{\text{secretes}}$ progesterone $\xrightarrow{\text{acts on}}$

thick $\xleftarrow{\text{makes it}}$ Endometrium $\xleftarrow{\text{causing}}$

arteries to elaborate converting the functional layer to a glandular secretory layer (uterine glands) $\xrightarrow{\text{enlarge, coil and secrete}}$ sustains embryo until it is implanted $\xleftarrow{\text{glycogen in uterine cavity}}$

Now, there are two possibilities,



- Cyclic menstruation is an indicator of normal reproductive life of a female that extends b/w menarche (first menstruation) and menopause (end of menstrual cycle).

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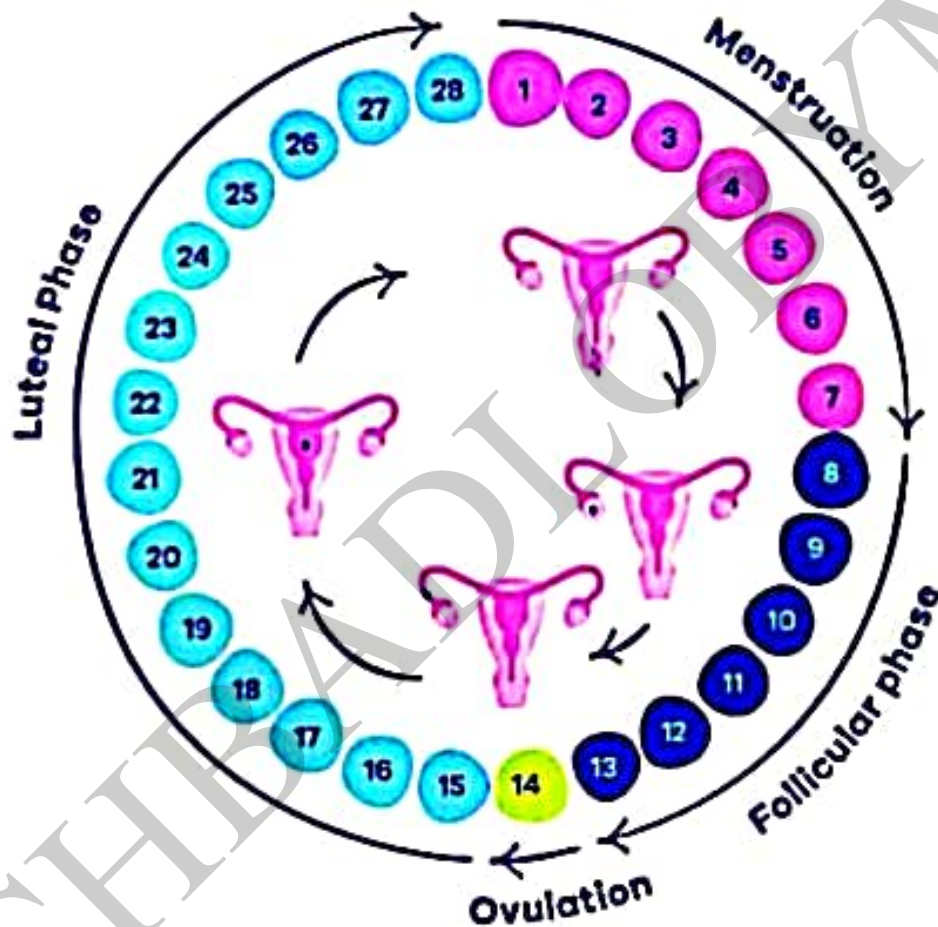
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Endocrine Gland	Hormone	Function
<u>Anterior Pituitary</u> 	FSH	• Stimulates follicular growth in ovaries • Stimulates estrogen secretion (from developing follicles)
	LH	• Surge causes ovulation • Results in the formation of a corpus luteum
< <u>Ovaries</u> 	Estrogen	• Thickens uterine lining (endometrium) • Inhibits FSH and LH for most of cycle • Stimulates FSH and LH release pre-ovulation >
	Progesterone	• Thickens uterine lining (endometrium) • Inhibits FSH and LH

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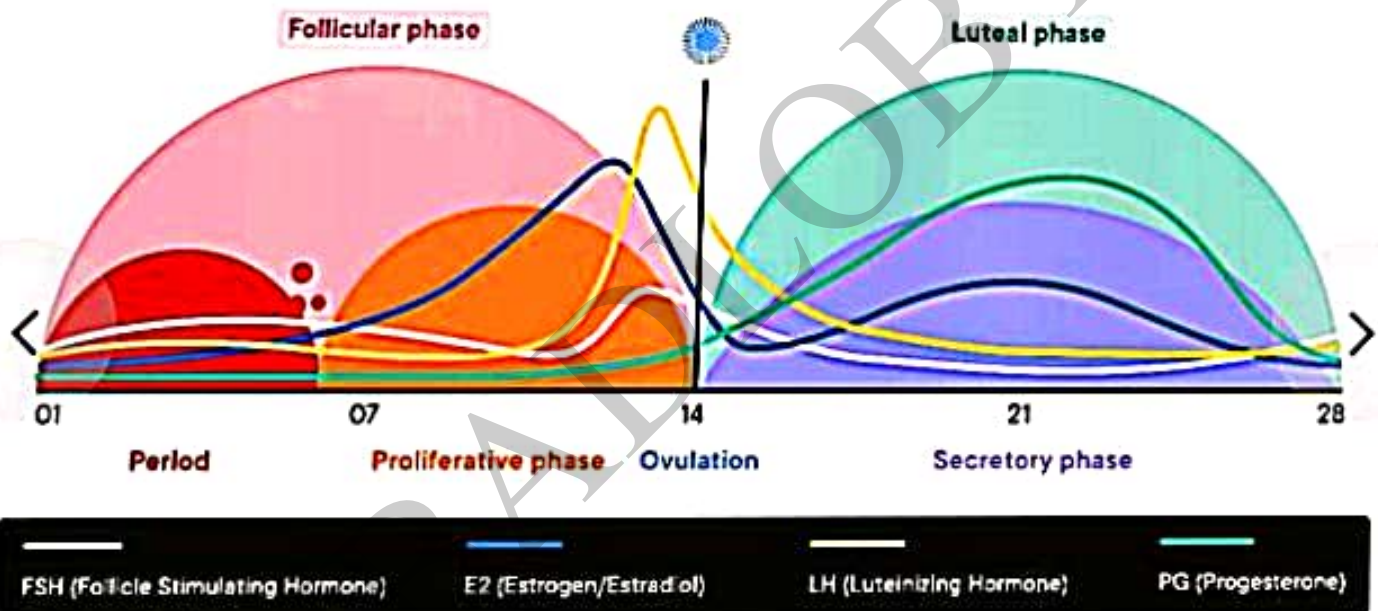


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Complete Menstrual Cycle

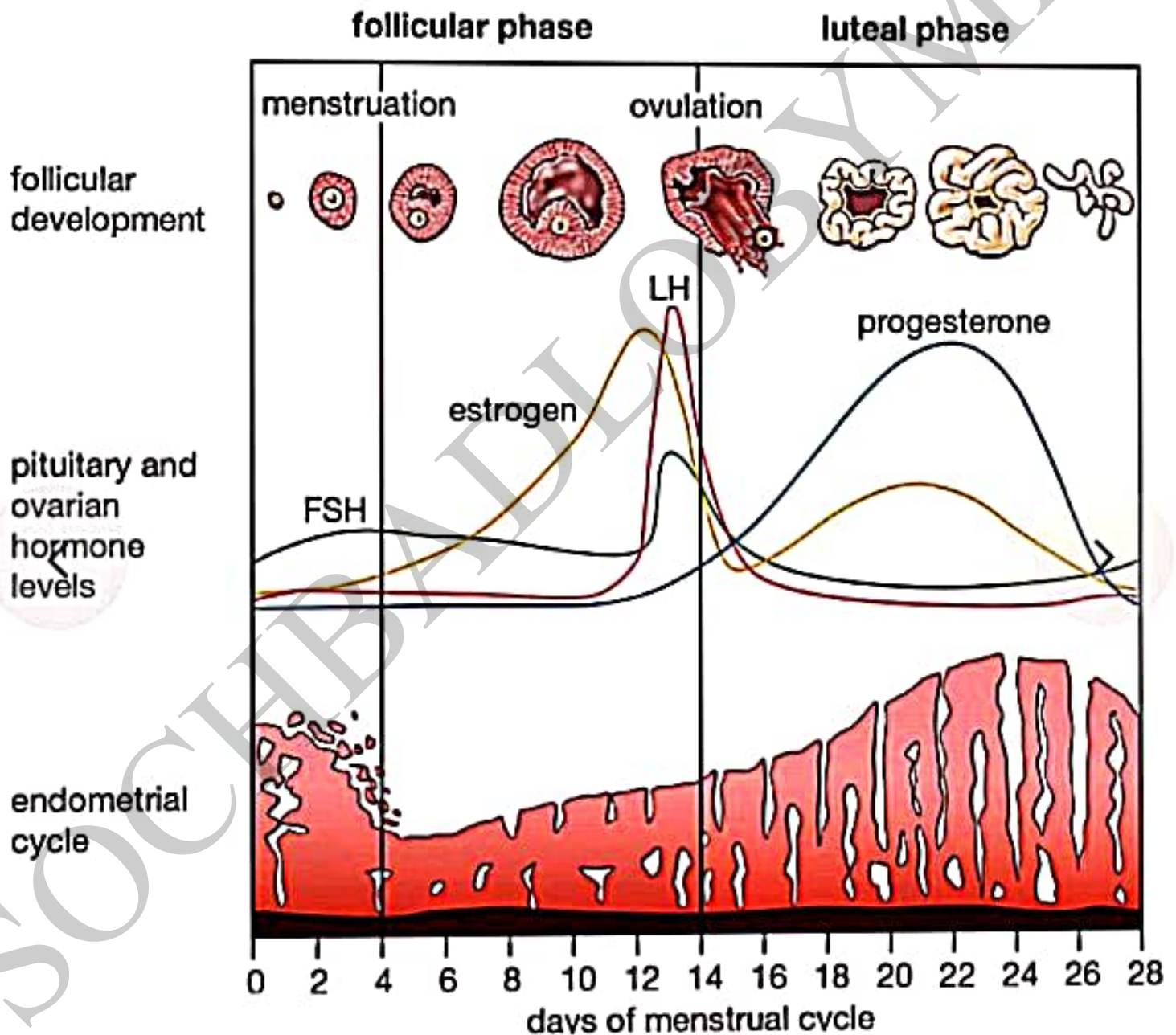


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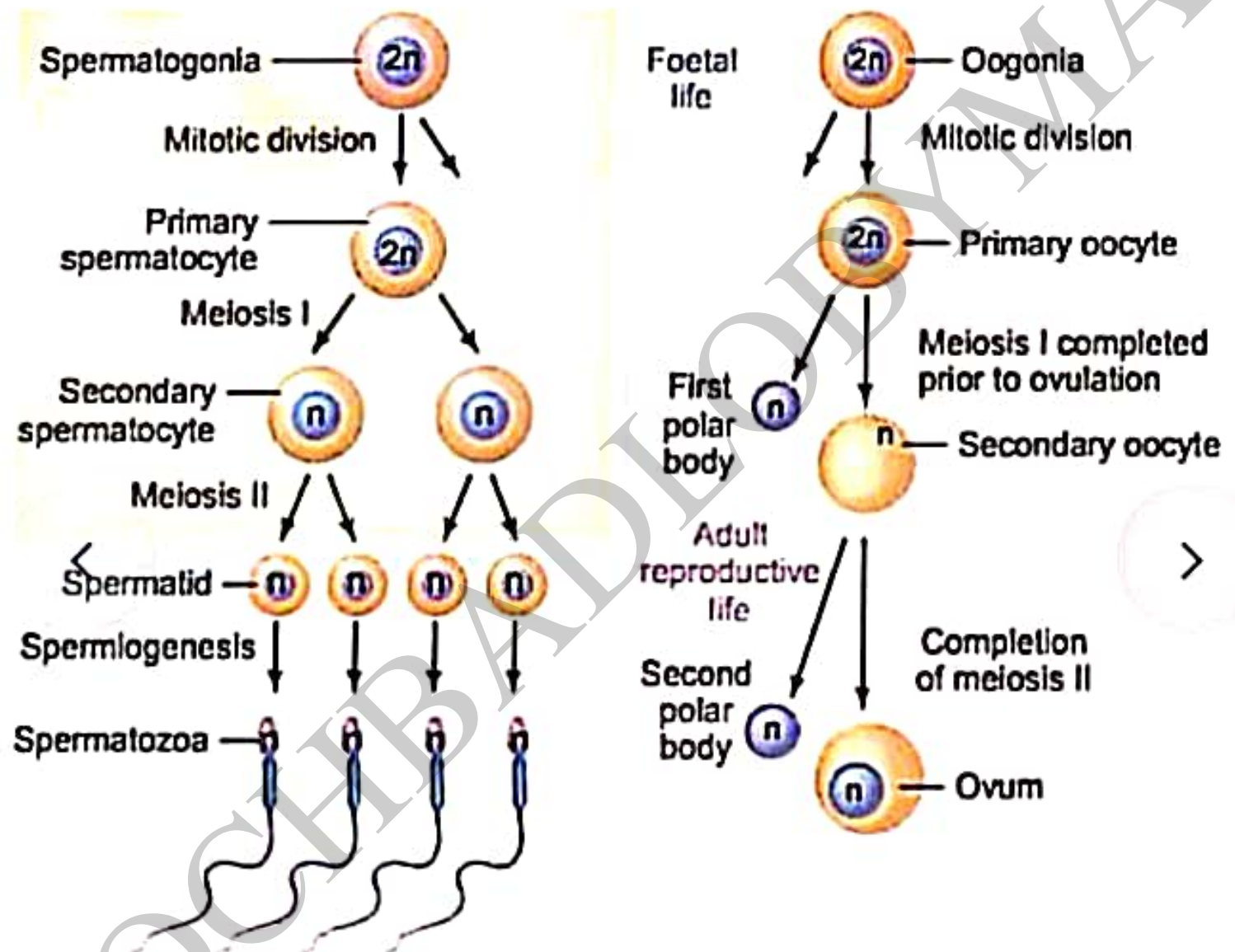
The menstrual cycle



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PTB:- Oestrous cycle:- reproductive cycle found in all female mammals except humans. In this, estrogen production prepares uterus for conception partly and also follicle develops ova. At this stage, female needs a physical stimulus of mating for ovulation. She exhibits the desire for mating and is said to be on heat.

malnourishment
emotional

stress
disturb
the
menstrual
cycle

Gynaecology → study of disfunction and diseases of female reproductive system.

Obstetrics → speciality dealing with pregnancy and childbirth.

A physician specializes in both.

STDs

SEXUALLY TRANSMITTED DISEASES

Caused by pathogens that are passed from one human to another by sexual contact or by the transfusions of blood.

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1) GONORRHOEA:-

- caused by gram +ve bacterium *Neisseria gonorrhoeae*.
- Symptoms:- affects mucous membrane of urogenital tract. cause wounds in genital tubels; infected males experience a burning sensation during urination with discharge of thick white pus from urethra.
- new borns may get serious eye infections
- Highly contagious.
- In females, oviducts are damaged and blocked.

2. SYPHILIS:-

- Caused by a spirochate (spirally twisted) bacterium

Treponema pallidum

- Causes damage to reproductive organs, eye, bones, joints, CNS, heart and skin; cause large number of lesions
- Prolonged antibiotic treatment is a possible remedy.

Oestrous cycle ensures that mature egg is available for fertilization.

Date: _____

Day: _____

3. GENITAL HERPES:-

- Caused by herpes simplex Type 2 virus.
- Causes infection of genitalia, genital sores and ulcers ^{and around} infected areas.
- In pregnant women, virus can be transmitted to infant during child birth causing damage to eyes and CNS.
- Use of antibiotics protect from the complications of this infection but the disease itself is not cured.

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PHASES OF MENSTRUAL CYCLE ACCORDING to STB:-

i) Menstruation or M phase:-

- extends from days 1 - 5.

ii) Follicle phase or F phase:-

- starts just after menstruation
- ends with release of ovum
- lasts about 7 days (day 6-12).

iii) Ovulation or O phase:-

- Most short phase
- Lasts not more than 3 days (day 13-15)
- During this, ovulation occurs.

iv) Corpus luteum or L phase:-

- longest phase, lasts about 12-14 days (day 16-28).

Date: _____

Day: _____

ADDITIONAL INFO FROM KPK :-

- There are about 10-20 vasa efferentia.
- In epididymis, the sperms are stored temporarily, nourished and then gain the ability to swim.
- ^{vas deferens} It starts from epididymis, moves deep into pelvic cavity and then joins with the duct of seminal vesicle to form the short ejaculatory duct which enters prostate and empties in urethra.
- Urethra is terminal portion of male duct system. opens to outside at external urethral orifice.

~ {ROLE OF ACCESSORY GLANDS} ~

1. Seminal vesicles:- provide an alkaline fluid containing fructose, ascorbic acid and a coagulating enzyme called vesiculase, and other substances that enhance sperm motility thus improving fertilizing power.
2. Prostate gland:- It encircles urethra just below the bladder. Its secretion is milky, slightly acidic containing citrate (as nutrient source), several enzymes especially hyaluronidase.
3. Cowper's gland :- Secretes mucus and an alkaline fluid in urethra which neutralize the acidity of urine in urethra.
4. Bulbourethral glands:- produce thick and clear mucus.

~ {Role of prostaglandins in semen} ~

Decrease viscosity of mucus blocking cervix, stimulate reverse peristalsis, facilitating sperm movement through female reproductive system.

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Date: _____

Day: _____

~ {SPERM} ~

- The sperm/spermatozoon/animal seed is a very small haploid cell.
- It has a head, neck, midpiece and tail.

↓
contains nucleus
having haploid
set of chromosome

• adhering to top of
head is acrosome

• lysosome like
acrosome, made by
Golgi apparatus

contains hydrolytic
enzyme hyaluronidase
that enables egg
penetration

↓
very short
contains a
pair of
centrioles
the microtubules
of one of
the centrioles
elongate and
run the entire
length of
the tail. It

forms axial
filament of
tail.

↓
contains
many
mitochondria
arranged
spirally
around the
axial
filament

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UTERINE TUBE (OVIDUCT):-

It has:-

• Sheath of
smooth
muscles

• ciliated
cells

• non-ciliated
cells

↓
beating of
cilia along
with muscular
peristalsis
carries oocyte
towards
uterus.

↓
produce secretion
that keep the
egg and sperm
(if present)
moist and
nourished