

Chapter 3 Human Reproduction Process

The Male reproductive system

1. Penis	a. Urination 1. Corpus cavernosum- spongy tissue that fills with blood to make penis erect
	b .Sexual intercourse
	2. Glans- the head, end of penis
	3. Foreskini.Covers glans, ii Maybe removed surgically in an operation (circumcision)

	ii. may be removed surgically in an operation (circumcision)
2. Scrotum	a. Located behind penis b. Contains two testes c. Temperature sensitive (Sperm must be made in cooler conditions i.e, 2-3,° C lower than body temperature)
3. Testes	a. Sperm is produced by the seminiferous tubules due to FSH
	b. Testosterone is produced by Leydig cells due to LH
	1. Causes the development of the male sex organs at ~8 weeks after conception.
	2. Responsible for facial, armpit, and pubic hair, bone growth and muscular development
	c. Testes formed in the abdomen before birth. Descend through the "inguinal canal" during fetal or post-natal life. Sometimes it may take months/years to reach right place. Possible site for hernia.
4. Epididymis:	Stores sperm until they have matured.
5. Vas deferens:	Tube that leads from the epididymis to the urethra. Many sperm cells are stored here too.
6. Prostate gland:	Provides an alkaline fluid that can protect sperm from harsh vaginal acids.
6. Prostate gland:	Produce food for sperm. Food "Fructose"
8. Cowper's gland:	Produces clear lubricating fluid

The Female Reproductive System

Ovary:

- i) Each ovary contains immature ova (eggs) in follicles.
- ii) Females born with lifetime supply of eggs(250,000-400,000 in each ovary)
- iii) Ovaries release ovum -. Almost all ova degenerate between birth and puberty.
- iv) Approx. 400 eggs will be ovulated over woman's life.
- v) Egg is the largest human cell.
- vi) Ovaries are located lower abdomen. 1 left and 1 on the right.

Fallopian tubes

- i) Two thin tubes attached to the upper sides of uterus
- ii) Tubes terminate near the ovaries but are not attached
- iii) "Fimbriae" are finger-like structures on the end of each tube
- iv) Tubes conduct egg to uterus by use of small hairs called "cilia"
- v) **Fertilization** of ovum takes place in the **ampullary-isthmic junction of the fallopian tubes**. Egg viable for only 24-48 hours after ovulation.

Uterus:

- i) **Pear-shaped** organ located in lower abdomen
- ii) **Muscles** (myometrium) stretch to allow baby to develop. Oxytocin starts labor contractions.
- iii) **Lining of uterus** (endometrium) thickens with blood-rich tissue due to progesterone
- iv) **Endometrium** supports embryo/fetus during growth
- v) **Placenta** It is the interface between baby and mother. If not pregnant, lining breaks down and is discharged from body through vagina. This is menstruation (period)
- vi) **Cervix connects uterus to vagina**. Like a door that opens during ovulation. Cervical mucous closes the door at all other times.

Vagina:

Birth canal:

- i) **Menstrual** blood leaves the body
- ii) Organ of intercourse
- iii) Muscular stretches to allow a baby to grow
- iv) Vaginal opening partly remains closed by thin membrane of tissue called hymen. May be stretched or torn during any physical activity

Cervix:

- i) Located at inner end of vagina
- ii) Opening of uterus into vagina
- iii) Mucous prevents bacteria and viruses from entering uterus
- iv) Lets sperm into uterus after ovulation
- v) Where baby also passes through during vaginal birth

Labia:

2 layers of skin, which fold over the opening to vagina and urethra

ii) Inner labia (**labia minora**)

iii) Outer labia (**labia majora**)

1. Two folds of skin, surround vaginal area

2. Pubic hair grows on outer labia

Clitoris:

i) Small organ, 5 to 10 millimeters long

ii) Located at junction of inner labia near front of body

iii) Contains erectile tissue & sexually sensitive

Mons pubis :

Cushion like fatty tissue covered by skin and pubic hair **Gametogenesis & its hormonal regulation :**

Ref: Concept Map Page C 3

Differentiate between: Spermatogenesis and Oogenesis :

Spermatogenesis	Oogenesis
Produces male gametes (sperm)	produces female gametes (oocytes)
–occurs in the seminiferous tubules (in testes)	occurs in the ovaries
–involves meiosis –occurs throughout life after puberty	– involves meiosis occurs after puberty until menopause
may produce 400,000,000 per day	–humans normally produce one oocyte during each ovarian cycle
Primary spermatocyte divide equally to form two similar secondary spermatocytes	Primary oocyte divide unequally to form one large secondary oocyte and a small polar body
One spermatogonium produces 4 functional spermatozoa	An oogonium produces one functional ovum and 3 non functional polar bodies

2) Follicular phase (Proliferative phase) and Luteal phase (Secretory Phase)

Proliferative phase

Follicular phase

Stage of repair and

It extends from the end of menstruation to ovulation

LH and FSH increases

Secretory Phase

Luteal phase

proliferation Prepares endometrium for implantation

It extends after ovulation to menstruation

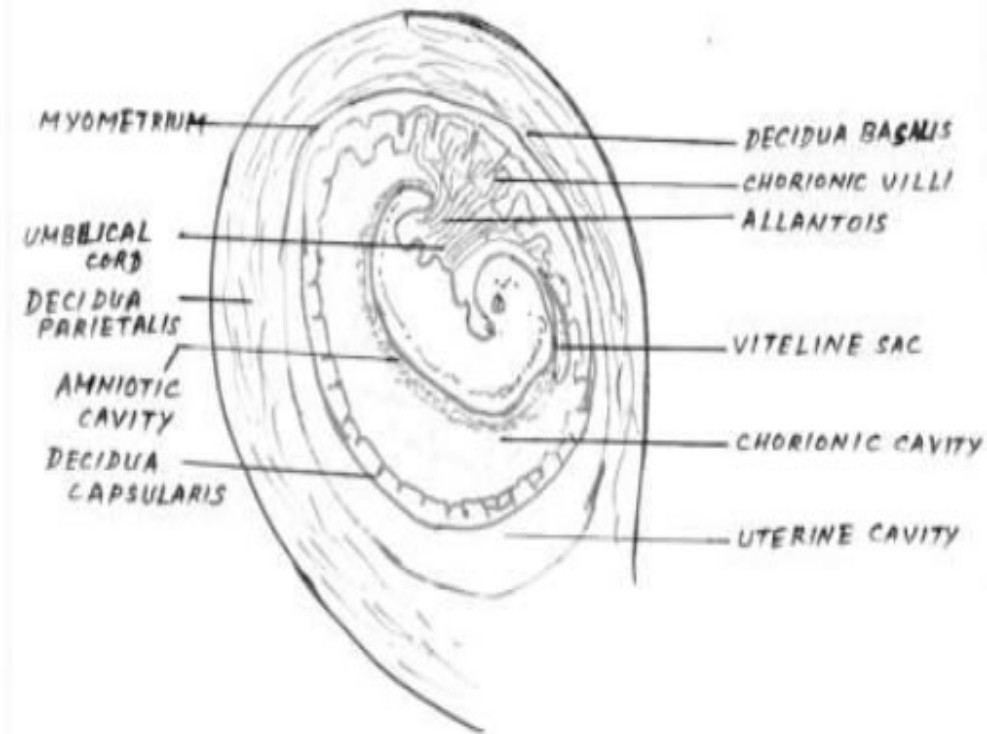
LH is high (LH surge)

Estrogen level increases
Estrogen is secreted by Graffian follicle

Progesterone level increases
Progesterone secreted by corpus luteum

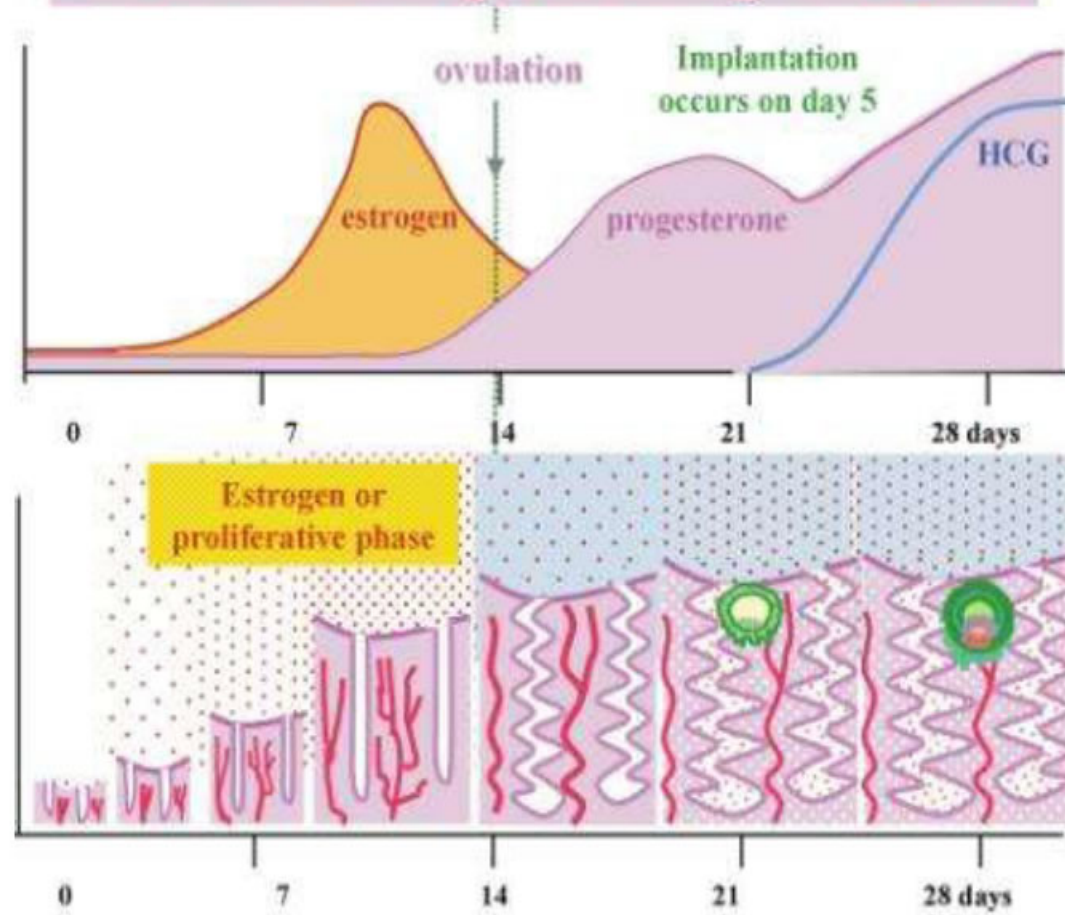
Menstrual Cycle

Menstruation →	Repair of the endometrium →	Thickening of the endometrium →	Breaking down →
	Follicular Phase FSH/Estrogen	Due to LH	Luteal Phase LH/Progesterone



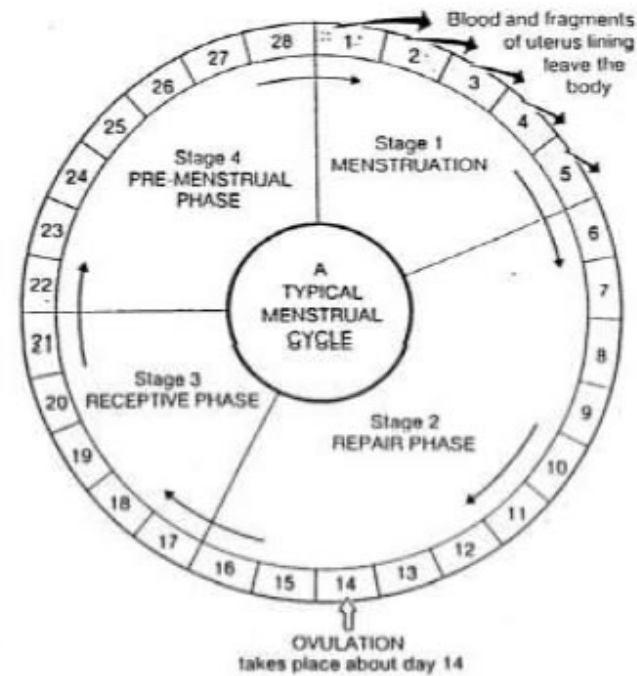
EMBRYONIC DEVELOPMENT
IN MAN.
(EXTRA EMBRYONIC MEMBRANE)

Endometrial changes following fertilization



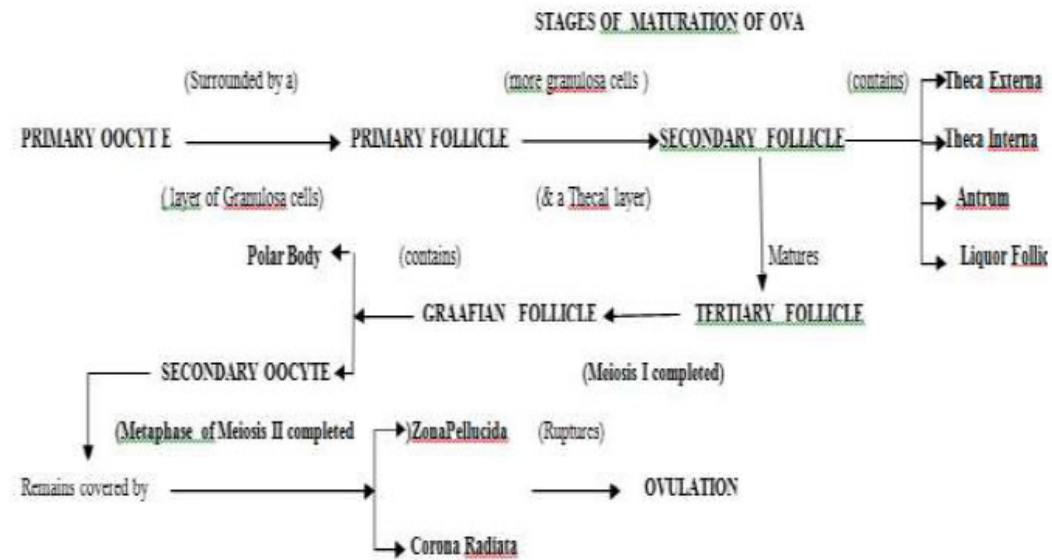
Functional Activities of FSH and LH

THE MENSTRUAL CYCLE



A typical menstrual cycle. It is usual to regard the first day of the cycle as the day when bleeding begins.

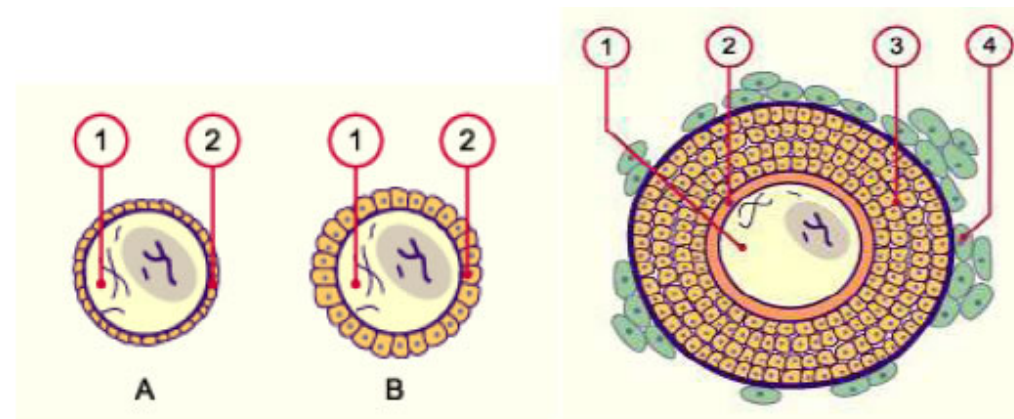
FSH and LH from the pituitary:		FUNCTION / PRODUCTION	
Hormone		In Females	In Males
FSH Controls →		Eggs + Estrogen	Spermatogenesis
LH Controls →		Ovulation + Corpus Luteum	Testosterone



From Primordial Follicle to Tertiary Follicle Primordial

follicle: The surviving primary oocytes, at birth, are surrounded by **thin, single layers cells of so-called follicular epithelial cells.**

Primary follicle The primordial follicles while developing into primary follicles the follicular epithelium that surrounds the oocyte becomes iso- to highly prismatic



- A Primordial follicle
 B Primary follicle
 1 Oocyte
 2 Follicular epithelium

- 1 Oocyte
 2 Pellucid zone
 3 Stratum granulosum
 4 Theca folliculi cells

Secondary follicles with follicular epitheliums encompassing **multiple rows** are formed called the **stratum granulosum**. **Pellucid zone**, between the oocyte and follicular epithelium becomes visible.

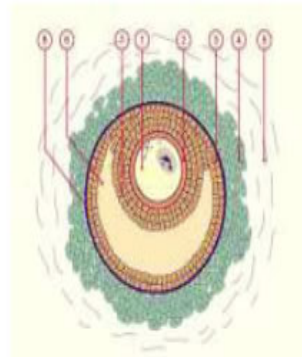
Tertiary follicle

A well-developed net of capillaries in the theca interna.

Antrum – a fluid filled cavity develops

The **theca** layer organized into Theca internal & Theca external

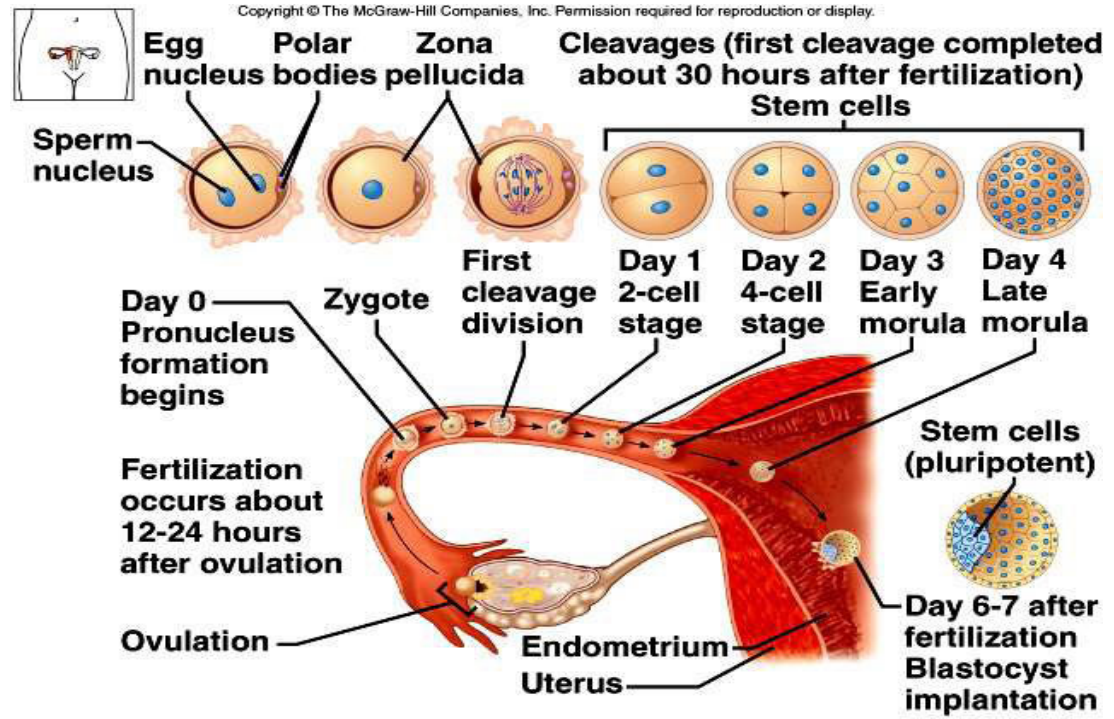
Tertiary follicle

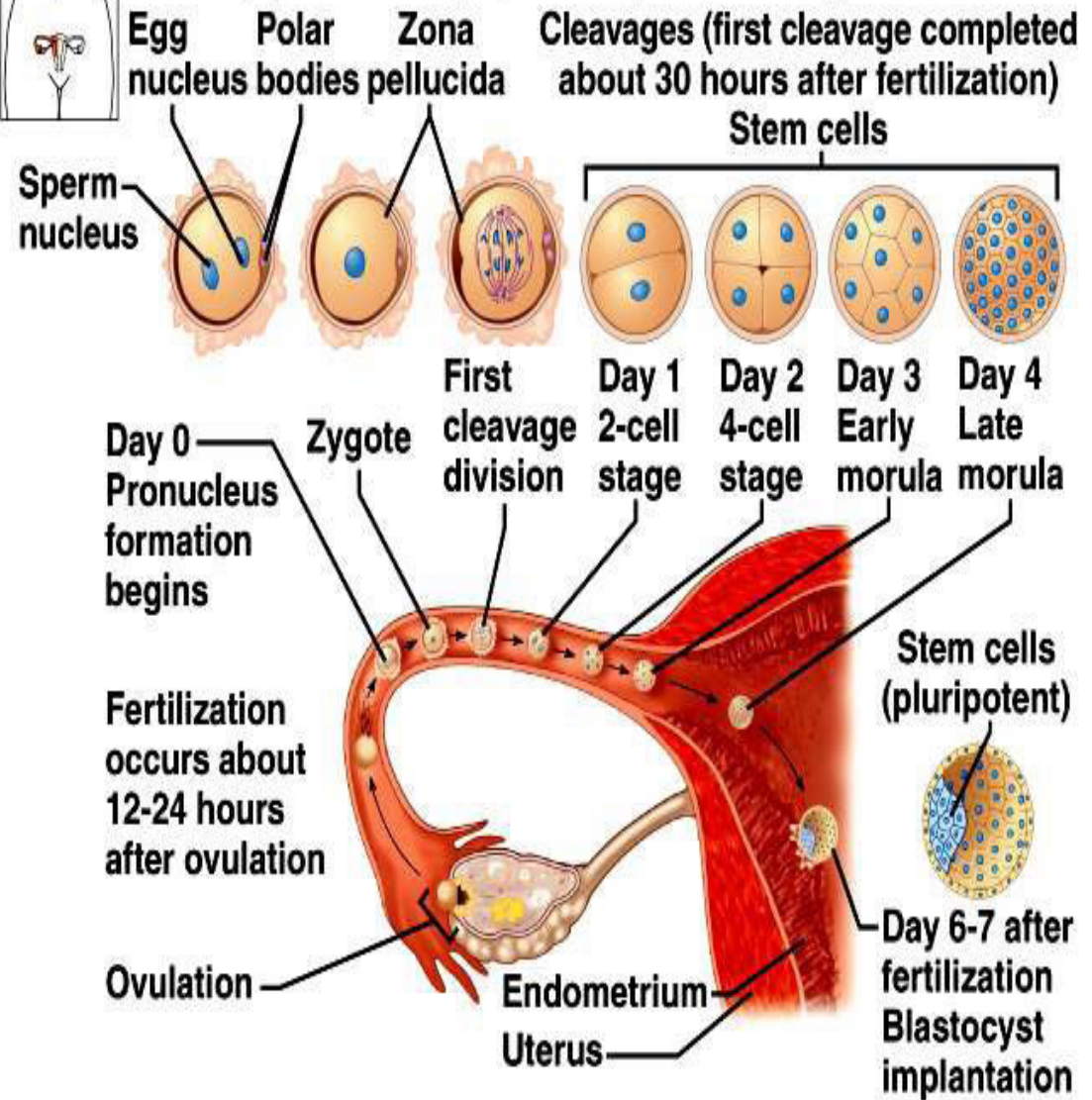
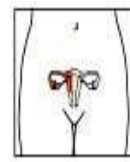


- 1 Oocyte
- 2 Pellucid zone
- 3 Stratum granulosum
- 4 Theca interna
- 5 Theca externa
- 6 Antral follicle
- 7 Cumulus oophorus (Granulosa cells, together with the oocyte)
- 8 Basal lamina between theca and stratum granulosum

Conception to Birth

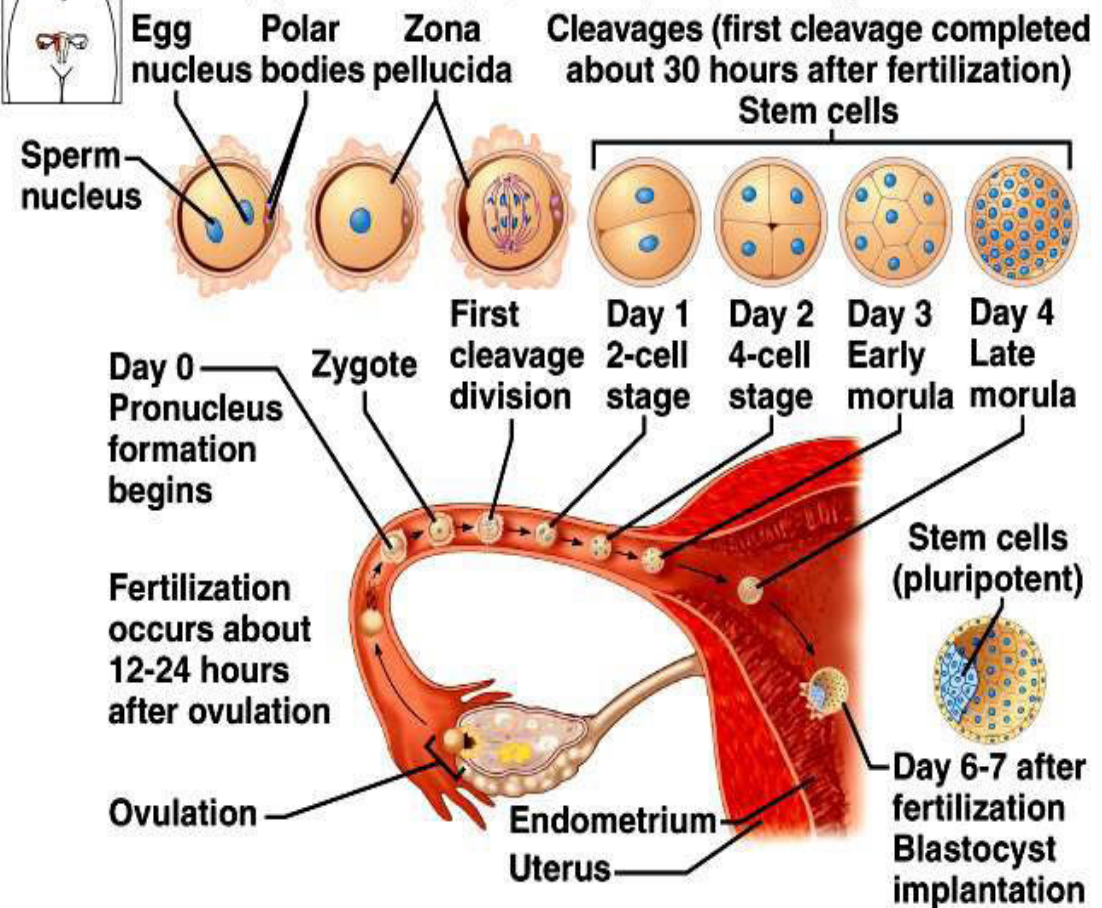
The following shows some of the many stages of human development







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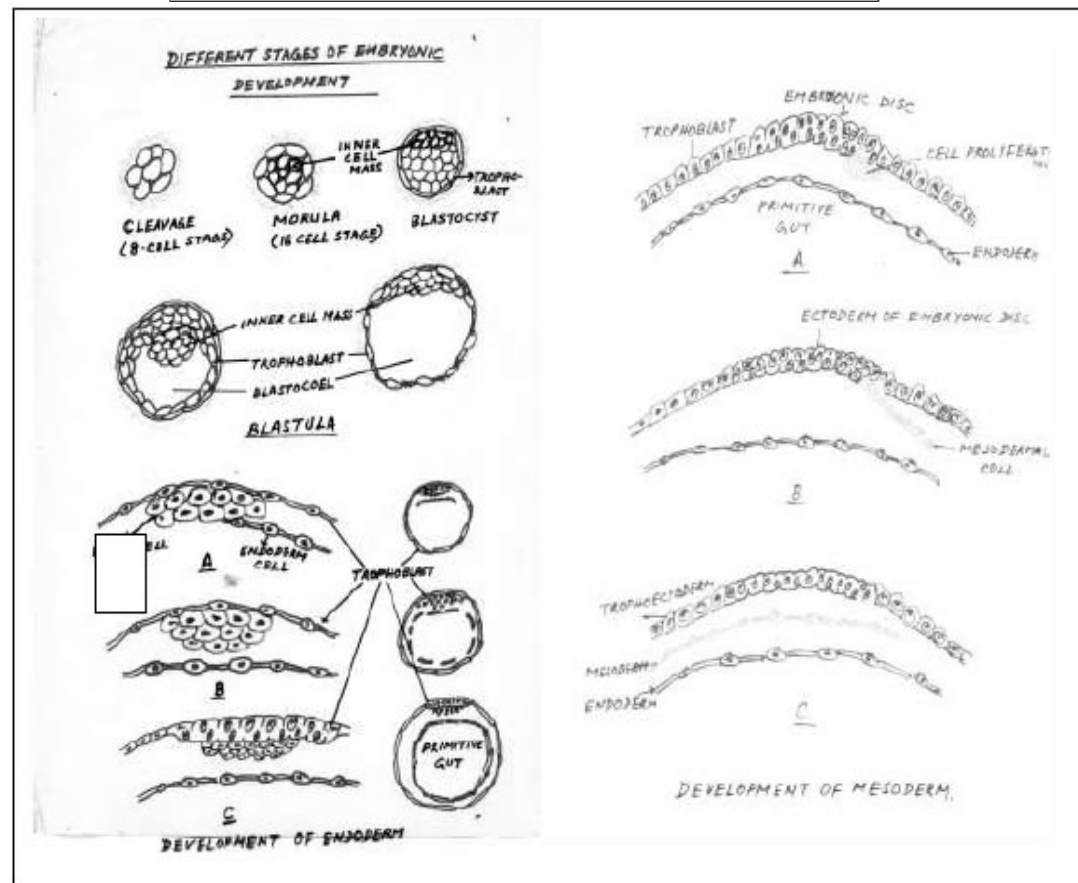
Fate of three germ layers

Ectoderm	Mesoderm	Endoderm
Nervous system	Skeleton	Digestive tract
Epidermis of skin	Muscles	Respiratory system
	Circulatory system	Liver, pancreas
	Gonads	Bladder

Mnemonics

Tubules in male reproductive	Menstrual Cycle
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system"SEVEN UP"	"FOL(d) M(a)PS"
Seminiferous tubules	Ovarian cycle:
Epididymis	Follicular phase
Vas deferens,	Ovulatory phase
Ejaculatory duct (Nothing)	Luteal phase
Urethra	
Penis	Menstrual cycle: Urethra
	Menstrual flow,
	Proliferative phase
	Secretory phase



TERMS TO REMEMBER

Acrosome- the part of a sperm cell that contains an enzyme – (This enables a sperm cell to penetrate an egg.)

Afterbirth-placenta and fetal membrane expelled from the uterus after the birth of a baby

Amniotic sac-fluid-filled membrane or sac that surrounds the developing embryo while in the uterus.(protects baby from hard shocks, keeps it at a constant temperature.)

Birth-the process of being born. Process by which baby moves from the uterus into the outside world

(Parturition)

Blastocyst = blastula = early stage of an embryo; a liquid-filled sphere whose wall is composed of a single layer of cells; during this stage (about eight days after fertilization) implantation in the wall of the uterus occurs.

Cervix- lower part, or neck, of uterus. (Opening to the uterus.)

Clitoris-small, sensitive organ in front of the vagina

Coitus-synonym for sexual intercourse

Conception-fertilization of an egg cell by a sperm cell

Corpus Luteum - After ovulation, this crater-like structure produces progesterone and estrogen. The corpus

luteum is the old RUPTURED GRAFFIAN follicle. It means —yellow body.

Cowper's glands - 2 glands that secrete an oily liquid, which cleans and lubricates the urethra of the male

Egg cell-a female sex cell (female gamete or ovum or secondary oocyte)

Ejaculation-the discharge of semen from the penis

Embryo-the unborn child developing in the uterus between the second and eighth weeks of life

Endometrium - the lining for the uterus – site for blastocyst implants and develops.

Epididymis-the tightly coiled tube at the back of each testis that holds newly created sperm – (each epididymis is like a nursery where sperm mature and learn to swim.)

Erection- condition of penis when it fills with blood and becomes firm, enlarged, and erect.

Fallopian tubes -tubes leading from each ovary to the uterus. Tubes carry the egg from ovary to the uterus.

Fertilization occurs here. (Also known as the **oviducts**.)

Fimbria - **A fimbria** (plural **fimbriae**) Latin word, literally means "fringe." a fringe of tissue near the ovary leading to the fallopian tube

Fertile- able to conceive a child

Fertilization union of sperm and egg. Conception.

Fertilized egg- egg after sperm has united with it. Zygote.

Fetus-unborn child developing in the uterus after the first eight weeks of life

Follicle - In ovaries. Each holds and nourishes an egg until ovulation. Nest. Becomes corpus luteum after ovulation.

Foreskin – A sheath of skin that surrounds the penis.

Follicle Stimulating Hormone - secreted from pituitary gland in both men and women. In women, FSH promotes the development of eggs and estrogen. In men, FSH promotes the development of sperm cells.

Fraternal twins-babies that develop from two eggs, each fertilized by a sperm cell; may or may not be of the same sex

Gamete – a sex cell. Sperm cells and egg cells are gametes.

Genitals-the reproductive or sex organs, especially the external organs

Germ Cell- egg or sperm cell (Gamete). In humans, germ cell contains 23 chromosomes

Hormones-chemical substances produced by the endocrine glands; they act in other parts of the body and affect maturation, growth, and behavior; LH, FSH, GH, Testosterone, Estrogen, Progesterone are all hormones.

Hymen-a thin bit of tissue, or membrane that may partially cover the opening of the vagina

Identical twins-babies that develop from a single fertilized egg that separates into two halves; identical twins are always of the same sex

Labia-two folds of skin surrounding the entrance of vagina

Labor-the muscular contractions that expel a baby from uterus during childbirth

Leydig Cells – when prompted by LH, Leydig cells create testosterone.

LH - Luteinizing Hormone - Secreted from pituitary gland, causes ovulation and formation of corpus Luteum in women. In men, LH causes Leydig cells to produce testosterone.

Menstrual cycle - periodic building up and sloughing off of lining of uterus approximately every twenty-eight days

Menstruation-the periodic discharge of blood and waste material (unfertilized secondary oocyte / ova and the degenerating endometrium lining) from the uterus

Miscarriage- expulsion from the uterus of a fetus before it is developed sufficiently to live Also called spontaneous abortion

Myometrium – muscles of the uterus that stretch to accommodate the growth of the baby. These muscles contract during labor and push baby out.

Orgasm-the peak of sexual excitement when the male ejaculates semen,

Ovary- female sex glands; they produce egg cells, estrogen and progesterone.

Ovulation-the discharge, or release, of an egg cell / secondary oocyte from the ovary

Ovum-scientific name for an egg cell / secondary oocyte

Oxytocin - hormone, released from the pituitary gland , stimulates contraction of the myometrium of the uterus during labor and facilitates ejection of milk from the breast during nursing.

Penis-the male sex organ through which sperm cells leave the body; it also discharges urine

Placenta- network of blood vessels and other tissues by which the unborn child is attached to the wall of the uterus.grows out of the endometrium The umbilical cord is attached to it. It is the interface between mother and developing fetus.

Pregnancy-the process in a woman from conception to birth

Pregnant-the condition of a woman with an embryo or fetus in her uterus

Progesterone – pregnancy hormone, which is first produced by the corpus luteum and then by the placenta.

- ♦ increases lining of endometrium.
- ♦ maintains pregnancy
- ♦ helps develop mammary glands.

Prostate gland- surrounds the upper end of male urethra and produces part of the fluid that mixes with the sperm to form semen. Prostate fluid alkaline helps to protect sperm from vaginal acids.

Scrotum- pouch of loose skin containing the testes. Houses and air-conditions the testicles by moving and sweating.

Semen-the mixture of sperm and fluids released during ejaculation. Semen comprised of sperm,fructose, prostate fluid and oil from Cowper's gland.

Seminal vesicles-small saclike organs opening into each vas deferens near the upper end of the urethra; produce part of the fluid that mixes with the sperm to form semen; provide food (fructose) for the sperm.

Seminiferous tubules - tubes in testes that produce sperm

Sexual intercourse- entry of penis into vagina and subsequent release of semen; also called coitus

Sperm-the male sex cell (male gamete or spermatozoon), which contains 23 chromosomes in human.

Spermatozoon-scientific name for sperm

Spontaneous abortion--synonym for miscarriage

Testes- male sex glands; produce sperm cells and testosterone;

Testicles-synonym for testes

Testosterone – male hormone that regulates development of penis, muscles, body hair, change of voice.

Umbilical cord- ropelike structure connecting embryo or fetus to placenta within the uterus.

Urethra-the tube through which urine is expelled from the bladder in both males and females and through which semen leaves the male body

Uterus = womb - the hollow pear-shaped organ in which a baby develops before it is born;

Vagina- passage from the uterus to the outside of the body, accepts the penis during intercourse. It is the birth canal & menstrual fluids leave through it Vas deferens- tube extending from each epididymis to the urethra in males

Womb-synonym for uterus

Yolk sac-a structure that develops for the nutrition of embryo during early embryonic life and then ceases to function

Zygote - The cell formed by the union of two gametes. [fertilized ovum before cleavage.]

IMPORTANT NOTES

- An adult male produces over 10^{12} to 10^{13} sperms each day.
- Human female oögonial development by mitosis is completed by 25 weeks of foetus and no oögonia are

formed after birth.

- Sperm entry into the ovum stimulates MPF (M phase promoting factor) & APC (Anaphase promoting complex) for completion of Meiosis II.
- During Spermatogenesis, spermatogonium produces four sperms while in oogenesis, oogonium produces one ovum and two polar bodies.
- Human Sperm contains Clupeiin proteins.
- Yolk nucleus: A mass of mitochondria and golgi bodies near nucleus is called as yolk nucleus and controls vitellogenesis.
- Maximum level of estrogen – 12th day, LH-13th day, Progesterone – 21st day, Corpus luteum formation – 19th day of menstrual cycle.
- Menstrual cycle is absent during pregnancy, lactation periods and permanently during menopause.
- Two ovaries alternate in ovulation.
- 13 mature eggs are released per year, so about 416 eggs (13x32 years) are ovulated during whole reproductive period of human female.
- Menstruation is also called —Weeping of uterus for the lost ovum" or" Funeral of unfertilized eggs".
- In human embryo, yolk sac degenerates since eggs is microlecithal, which shows evolutionary significance.
- Placenta acts as a physiological barriers and an ultra-filter between foetal and maternal blood.
- Progesterone is also called pregnancy hormone since its secretions controls pregnancy.
- Teratogens are physical, chemical, biological agents which may cause malformation in developing embryo.
- Period between fertilization and parturition is called gestation periods. Varies between 266 days up to 280 days (49 weeks)

Questions

1) Zygote undergoes mitosis to form 16 celled embryo. What is the stage known as? (1)

Hint-Blastomeres.

2)Name the important mammary gland secretions that help in resistance of the new born baby. 1)

Hint-Colostrum

3) Fill in the boxes

Spermatogenesis → → Secondary spermatocytes →

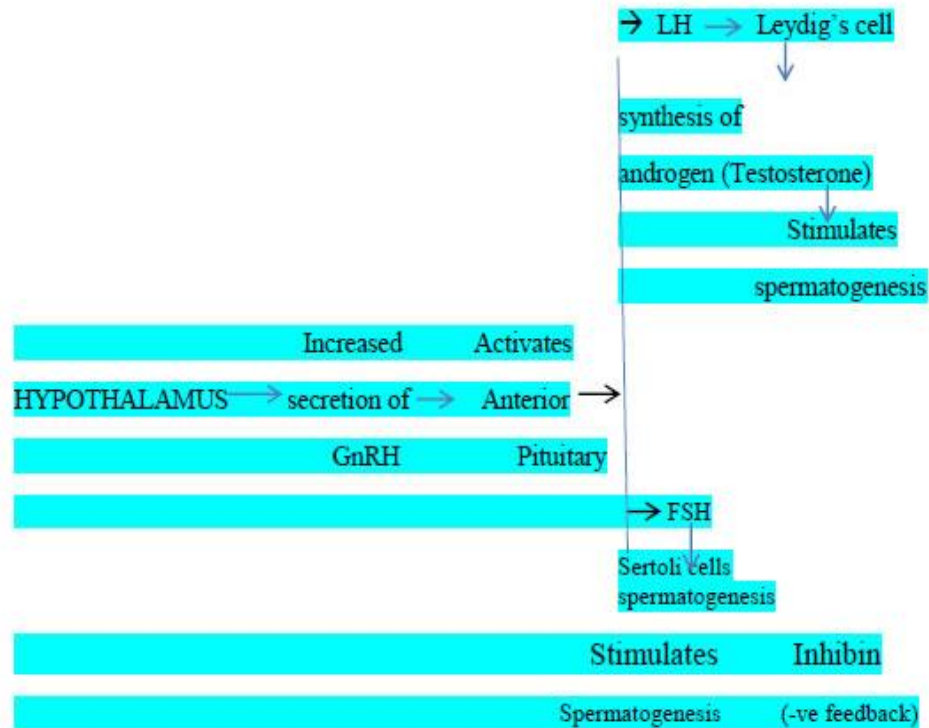
4) Why does fertilization take place in fallopian tube and not in the uterus.(2)

Hint-ovum and sperms must be transported to the ampullary –isthmic region simultaneously for fertilization.

5) Which cell organelle is present in the neck of the sperm? What is its significance? (2)

Hint-Acrosome, enzymes.

6) Give Hormonal regulation for spermatogenesis? (5) Hint-



7) Give hormonal control for Oogenesis?(5) Hint-

