
Reproductive Physiology

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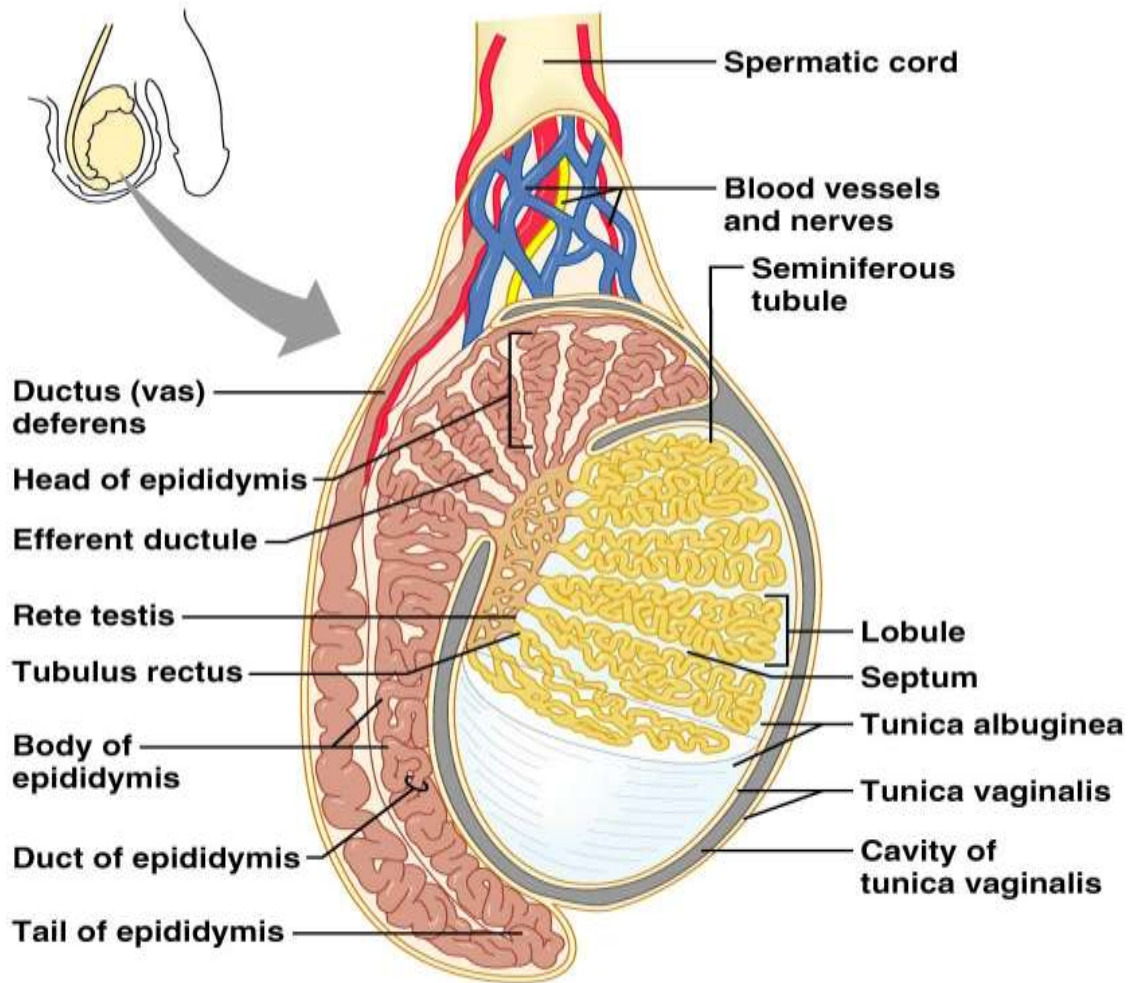
Function of the reproductive system

- **Sexual reproduction** requires a male and a female of the same species to copulate and combine their genes in order to produce a new individual who is genetically different from his parents .
- sexual reproduction relies on **meiosis** to shuffle the genes , so that new combinations of genes occur in each generation , allowing some of the offspring to survive in the constantly – changing environment .
- The male reproductive system produces , sustains , and delivers sperm cells (spermatozoa) to the female reproductive tract .
- The female reproductive system produces , sustains , and allows egg cells (oocytes) to be fertilized by sperm . it also supports the development of an offspring (gestation) and gives birth to a new individual (parturition) .

Male Reproductive System

- **Testis** : Sex organ that produces sperm in a process called **spermatogenesis** , and male sex hormones (**testosterone**).
- Developed in a male fetus near the kidneys , and descend to the scrotum about 2 months before birth.
- Each testis is enclosed by a layer of fibrous connective tissue called **tunica alumina** .
- Each testis contains about **250** functional units called lobules ; each lobule contains about 4 **seminiferous tubules** where spermatogenesis occurs .
- All somniferous tubules in a testis converge and form a channel called **rate testis** .

Testis



(a)

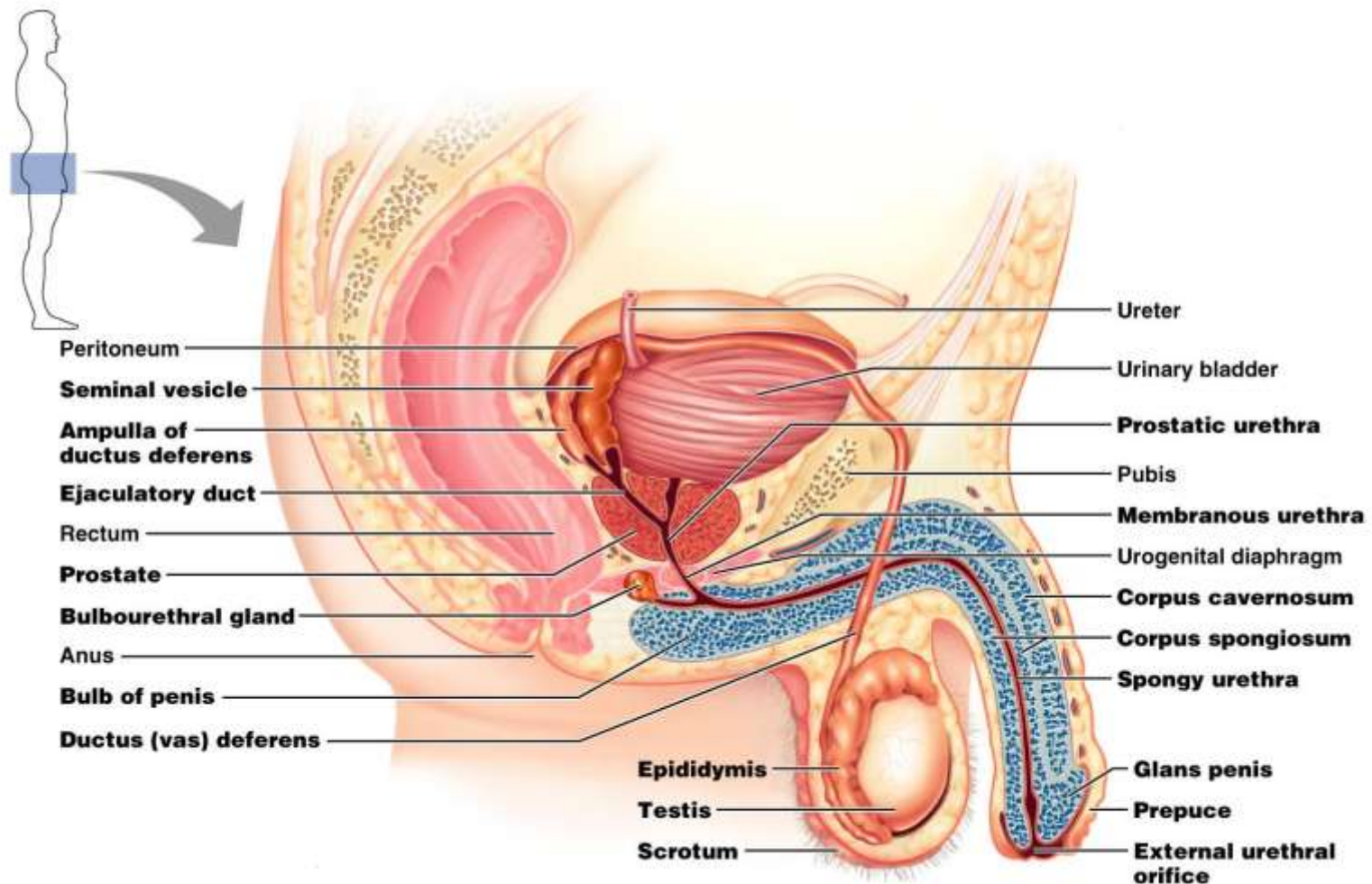
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- **Scrotum:** A pouch – like cutaneous extension that contains the two testes . Located outside of pelvic cavity to prevent overheating of testes [internal temperature of scrotum is always about 3 °F below body temperature] .
 - **Epididymis:** An expanded tubule from the rate testis where sperm is stored (for about 3 days) , matured and become fully functional.Contains cilia on its columnar epithelium that help move sperm toward vas deferens during ejaculation. .
 - **Vas deferens:** A tubule (about 10 inches long) that connects epididymis to the urethra for transporting sperm during ejaculation. Contains smooth muscle that undergoes rapid peristalsis during ejaculation .

Accessory sex glands

- **Seminal vesicles:** secrete an alkaline solution that makes up 60% of the semen volume ; this seminal fluid contains fructose (nutrient for the sperm) and prostaglandins (substances that stimulate uterine contraction during sexual excitation).
- **Prostate gland:** secretes a slightly acidic , milky white fluid that makes up about 30% of semen volume ; this fluid helps neutralize the pH of semen and vaginal secretion.
- **Bulb urethral gland:** secretes a clear lubricating fluid that aids in sexual intercourse.

Reproductive organs of the male

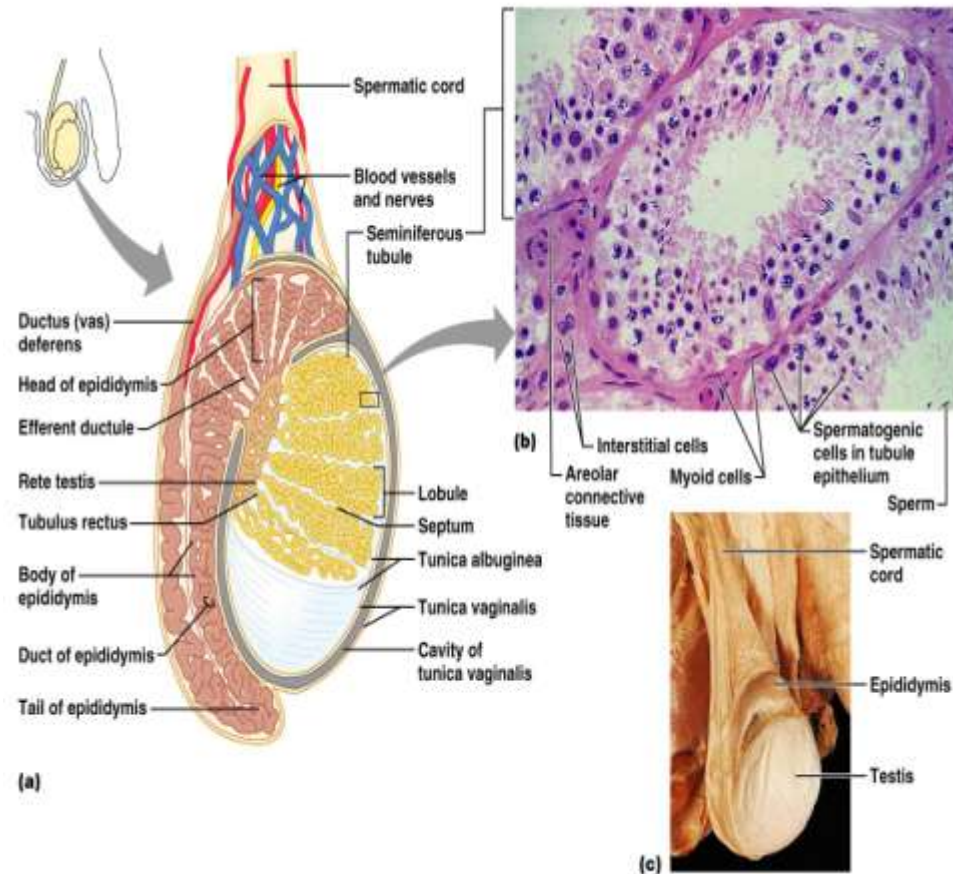


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- **Urethra:** A tubule located inside the penis for urine excretion and semen ejaculation .Contains smooth muscle that performs rapid peristalsis during ejaculation .
- **Penis:** A copulatory organ that is responsible for delivering the sperm to the female reproductive tract. Contains 2 erectile tissues called **corpus cavernosa** and **corpus spongiosum** , where the latter one enlarges and forms the glans penis due to increased blood flow during sexual excitation .
 - During sexual excitement , **parasympathetic** nerves cause vasodilatation in the penis , allowing erectile tissues to swell and erect the penis .
 - During ejaculation , **sympathetic** nerves cause vas deferens , urethra and erectile tissues to contract, forcefully expelling semen (a mixture of sex gland fluids and about 300 million sperm) outward .

Seminiferous Tubules

- About 1,000 **seminiferous tubules** in each testis conduct **spermatogenesis**.
- Between the tubules are specialized glandular cells called **interstitial cells** (or **leydig's cells**) which produce **testosterone**.
- Inside the tubules are specialized cells called **sertoli's cells** which support and nourish the sperm.

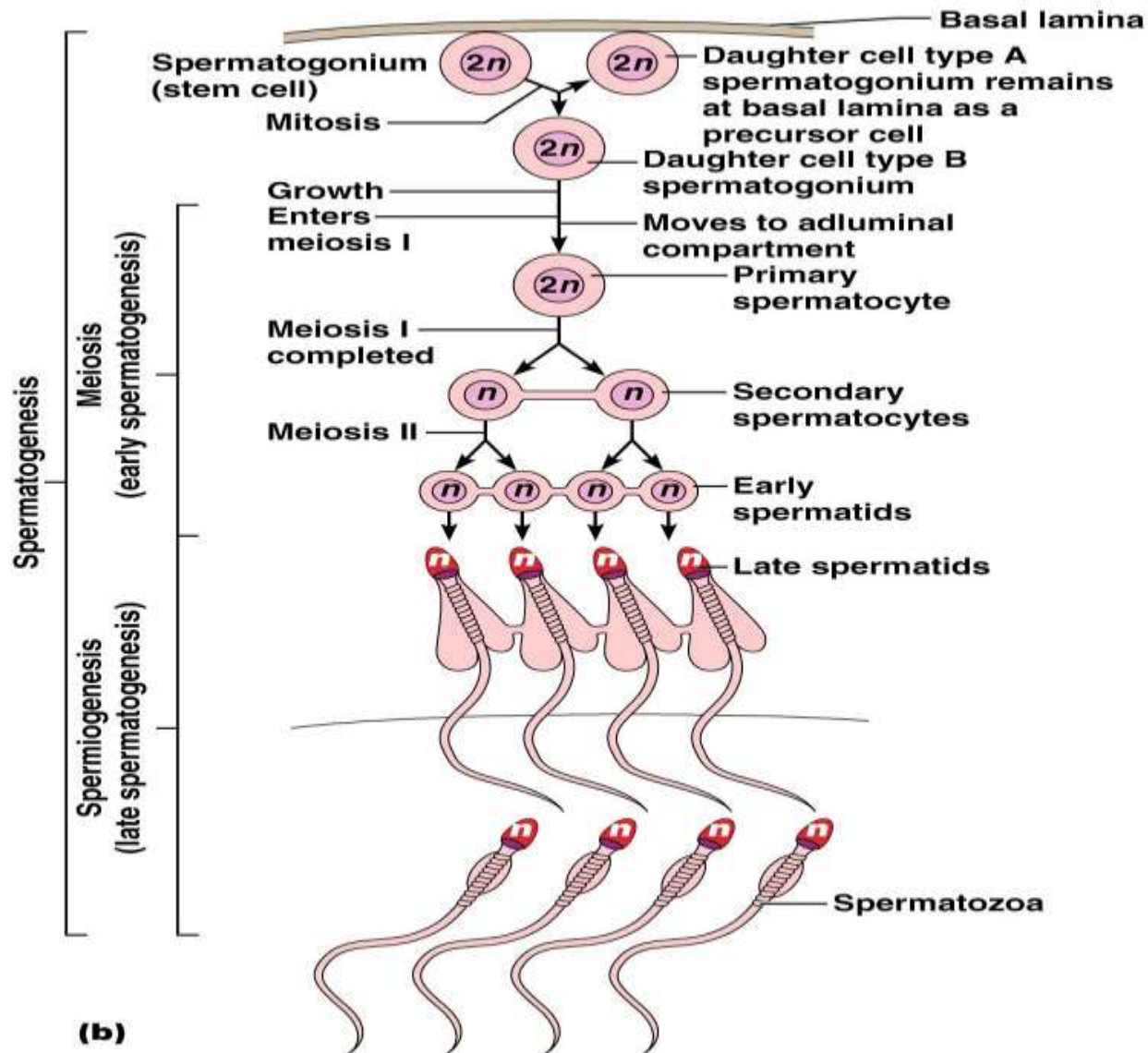


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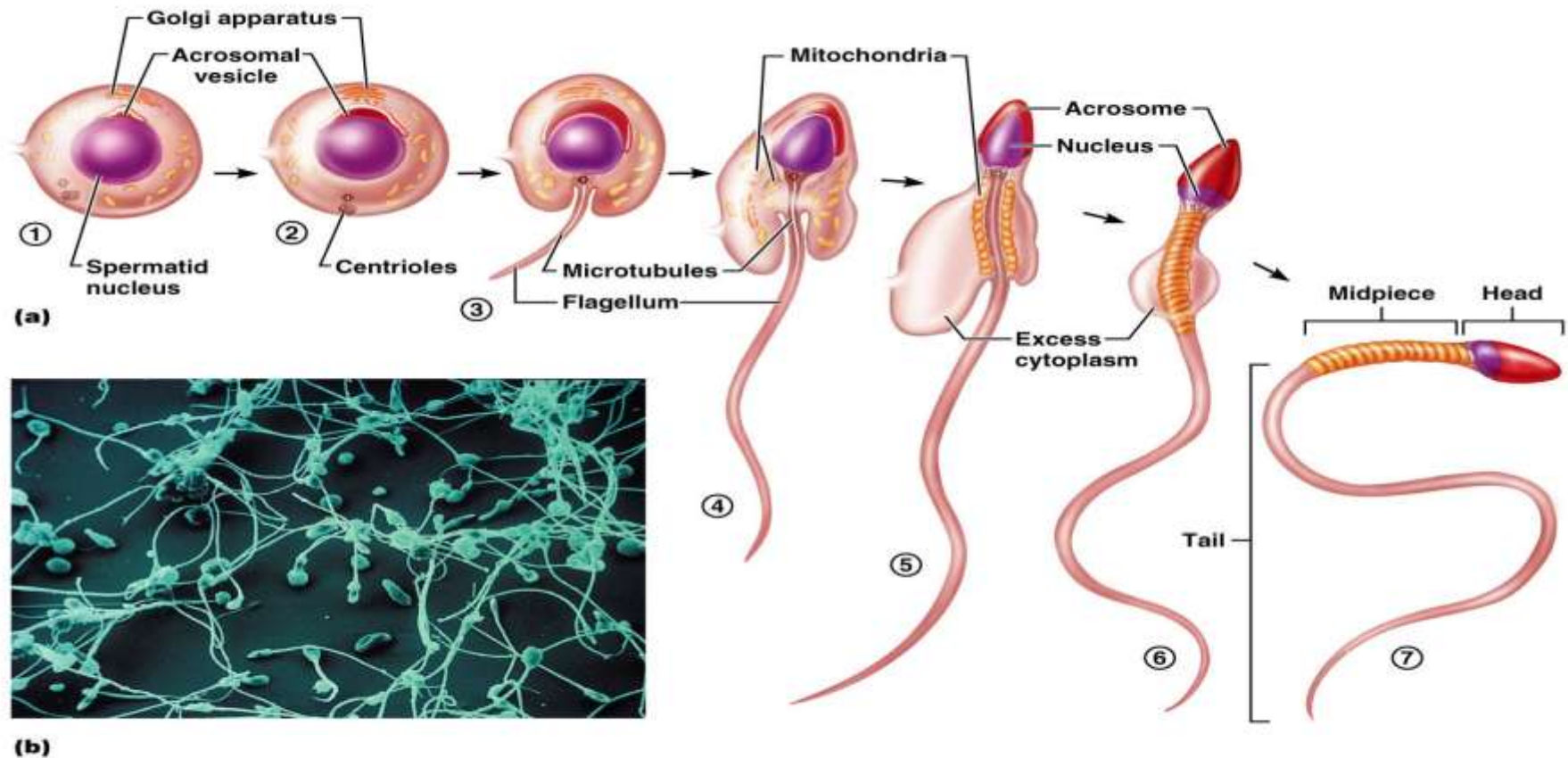
Spermatogenesis

- **Spermatogonia** (containing 46 chromosomes) undergo DNA replication and produce **primary spermatocytes** (with 46 pairs of chromosomes) .[some spermatozoid undergo mitosis to maintain a large population , so that spermatogenesis can be continuous for many decades].
- Primary spermatocytes undergo "crossing - over" to shuffle their genes ,and undergo **meiosis I** which results in **secondary spermatocytes** (each containing 46 unique chromosomes) .
- Secondary spermatocytes undergo **meiosis II** which produces **spermatids** (with 23 unique chromosomes) .
- Spermatids now transform themselves into **spermatozoa** (also containing 23 unique chromosomes) in a final event called **spermatogenesis** .

Spermatogenesis



- Each spermatozoa consists of a head (which contains the 23 chromosomes), a mid piece (which stores mitochondria for energy production) , and a tail. The head is enclosed by a structure called **acrosome** which stores enzymes called **acrosin** for breaking down the coatings surrounding the egg.



Journey of a Sperm

- at the end of spermatogenesis , spermatozoa are propelled by cilia in the inner walls of rete testis toward the epididymes (the tails of these sperm are not movable at this point) .
- inside the epididymis, certain enzymatic reactions occur that allow spermatozoa to be fully matured and functional , but not yet have the ability to fertilize the egg .
- if no ejaculation occurs during the 3- day storage time in the epididymis , phagocytes will destroy millions of older sperm in storage.
- during ejaculation , rapid peristalsis in the epididymis and vas deferens propel the millions of sperm , passing the accessory sex glands ,and be expelled through the urethra into the vagina of the female .

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- after several minutes in the vagina (about 25% of sperm is destroyed by the acidic secretion of vagina), the tail becomes functional , propelling the sperm through the cervix and into the uterus.
 - half of the sperm will swim into the left uterine tube , while the other half swim towards the right uterine tube . only one of the uterine tubes carries the egg cell.
 - sperm continue swimming toward the deeper end of uterine tube , against the expulsion force of the cilia lining the inner wall of uterine tube .
 - during this movement in the uterine tube, the acrosome is slowly activated to prepare for the release of acrostin enzyme.

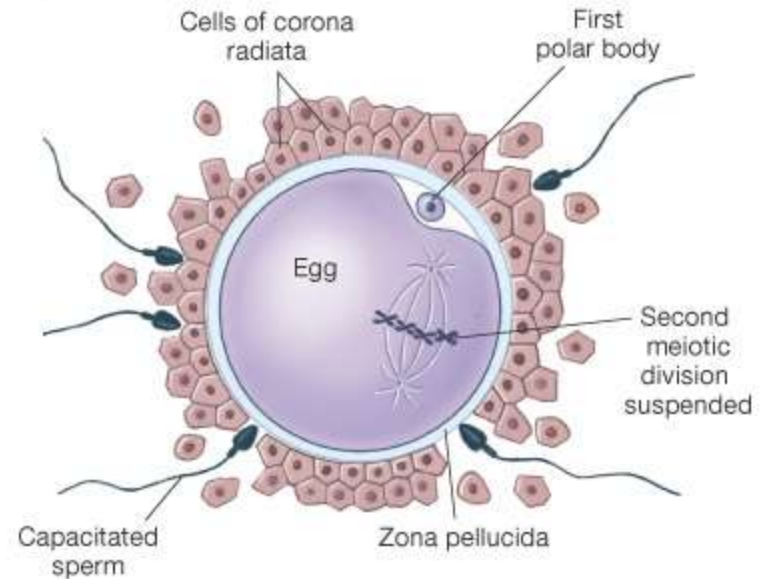
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- by the time sperm has arrived at the ampoule region of uterine tube , only about 50 sperm are viable enough to try to fertilize the egg. And usually only 1 sperm will penetrate through the coatings surrounding the egg.
 - each ejaculation emits about 2-6 ml of semen which contains about 300-400 million sperm . it takes the sperm about 2-12 hours to reach the fertilization site in the uterine tube , but many sperm can survive some where in the female reproductive tract for up to 2-3 days .
 - one of the sperm will eventually penetrate through zone pellucida ,and allow its cell membrane to fuse with the cell membrane of ovum . This causes a rapid electrical depolarization at the cell membrane of ovum, preventing other sperm entering the ovum (a phenomenon called **poly sperm**) .

Fertilization

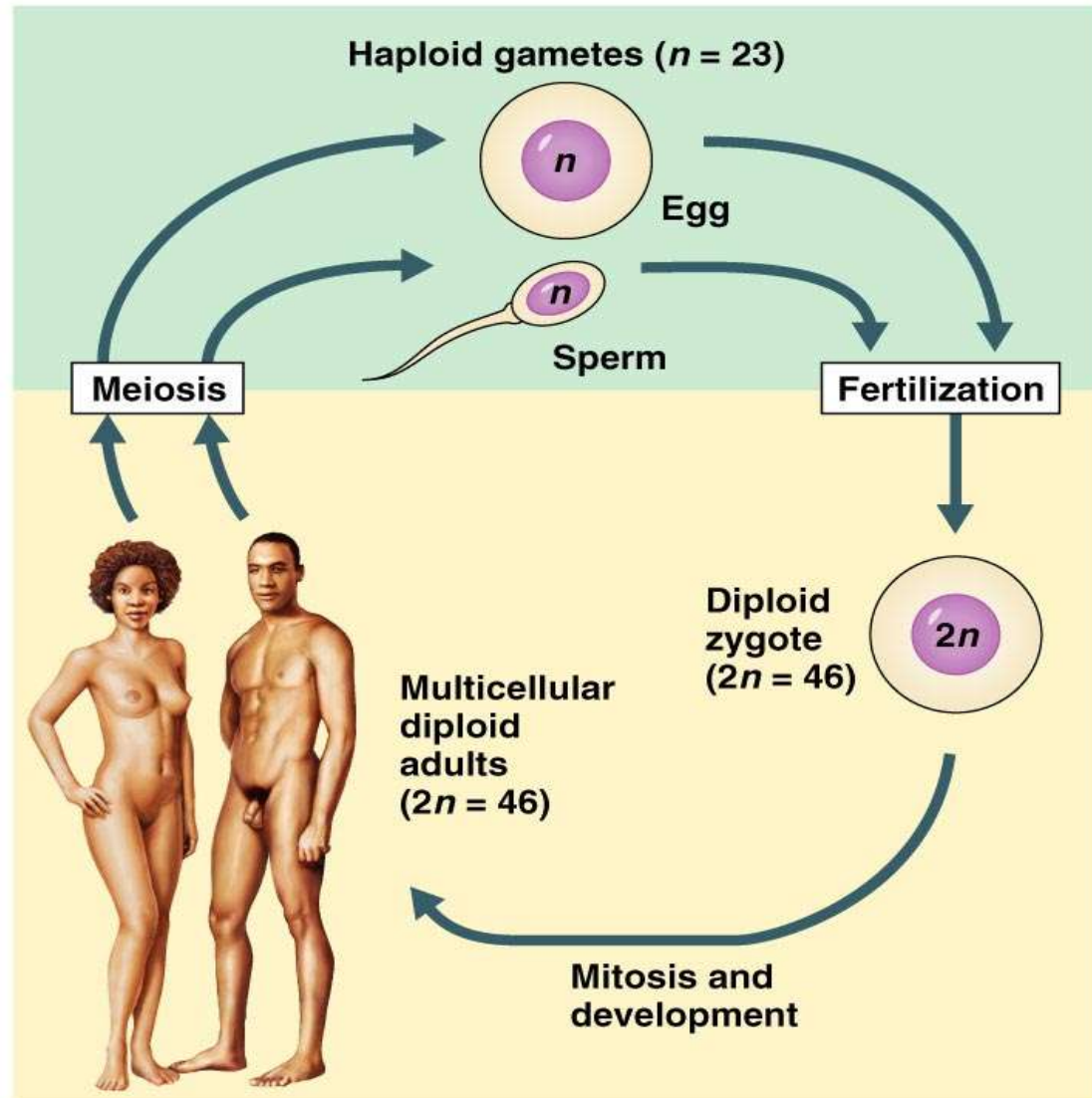
(a)



(b) Capacitated sperm release enzymes from their acrosomes in order to penetrate the cells and zona pellucida surrounding the egg.



The Human life Cycle

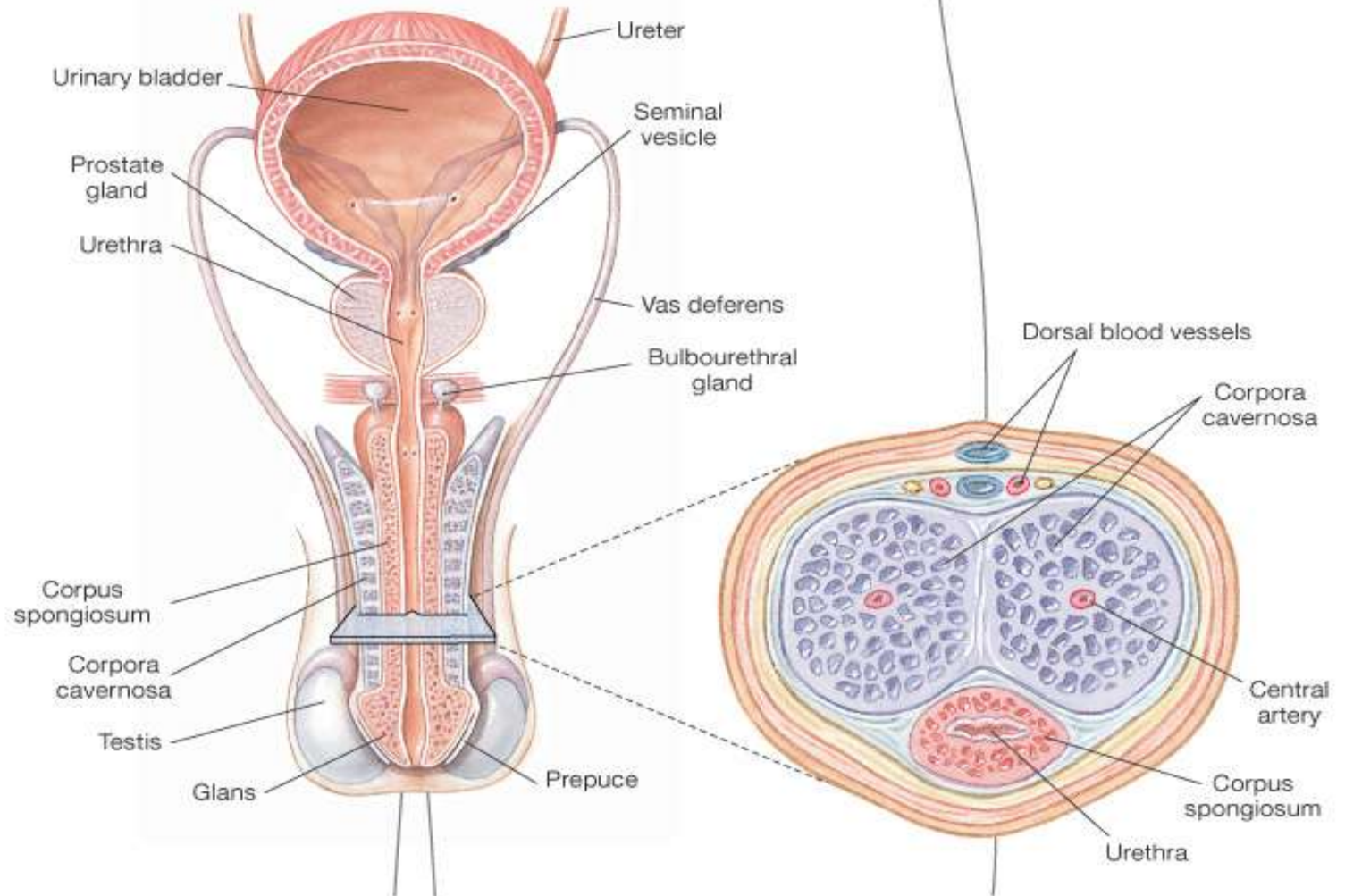


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Mechanism of penile erection

- 1. Sexual stimulation
- 2. Parasympathetic neurons release nitric oxide, causing dilation of small arterioles of penis (meanwhile veins are compressed reducing blood flow away from penis).
- 3. Blood accumulates within the vascular spaces in erectile tissue of penis .
- 4. Penis swells & become erect .

Reproductive structure in the male



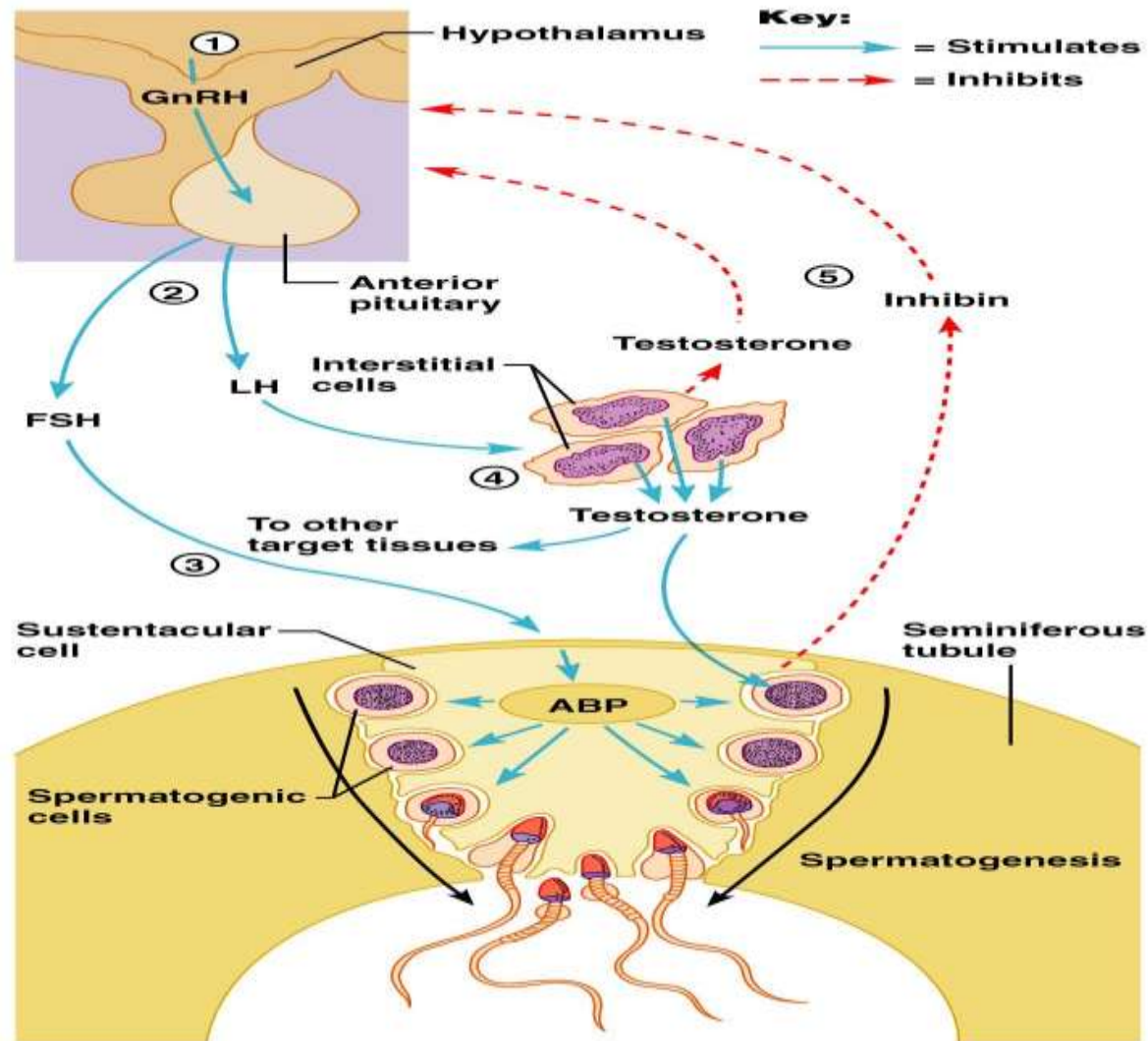
Mechanism of emission & Ejaculation ♂

- 1. Intense sexual stimulation .
- 2. Sympathetic impulses contract smooth muscles causing:
 - Peristaltic contractions in testicular ducts, Epididymis, vas deference and ejaculatory ducts .
 - Rhythmic contraction in bulbourethral, prostate, and seminal vesicles .
 - Rhythmic contractions in erectile columns of penis .
- 3. Emission-semen moves into urethra
- 4. Ejaculation- semen is forcefully expelled from urethra .

Hormonal control of ♂ reproductive function

- 1. Hypothalamic and pituitary hormones:
 - The male body remains reproductively immature until the hypothalamus releases **GnRH** (Gonadotropin – releasing hormone), which stimulates the anterior pituitary gland to release gonadotropins (**FSH**, **LH**) .
 - **FSH**- stimulates spermatogenesis .
 - **LH (ICSH)** – stimulates the interstitial cells to produce male sex hormone (testosterone) .
 - **Inhibin** prevents over secretion of FSH . (Inhibin – from sustentacular cells of seminiferous tubules).

The brain – testicular axis



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Male sex hormones

- 2. Male sex hormones are called **androgens** .
 - Testosterone is converted into dihydrotestosterone in some organs (stimulates cells of these organs) .
 - Androgens that fail to become fixed in tissues are metabolized in the liver and excreted .
 - Androgens production increases rapidly at puberty
- 3. Action of testosterone :
 - stimulates the development of the male reproductive organs and causes the testes to descend .
 - it is responsible for the development and maintenance of male secondary sex characteristics (facial hair , deeper voice , muscular development).

Regulation of male sex hormone

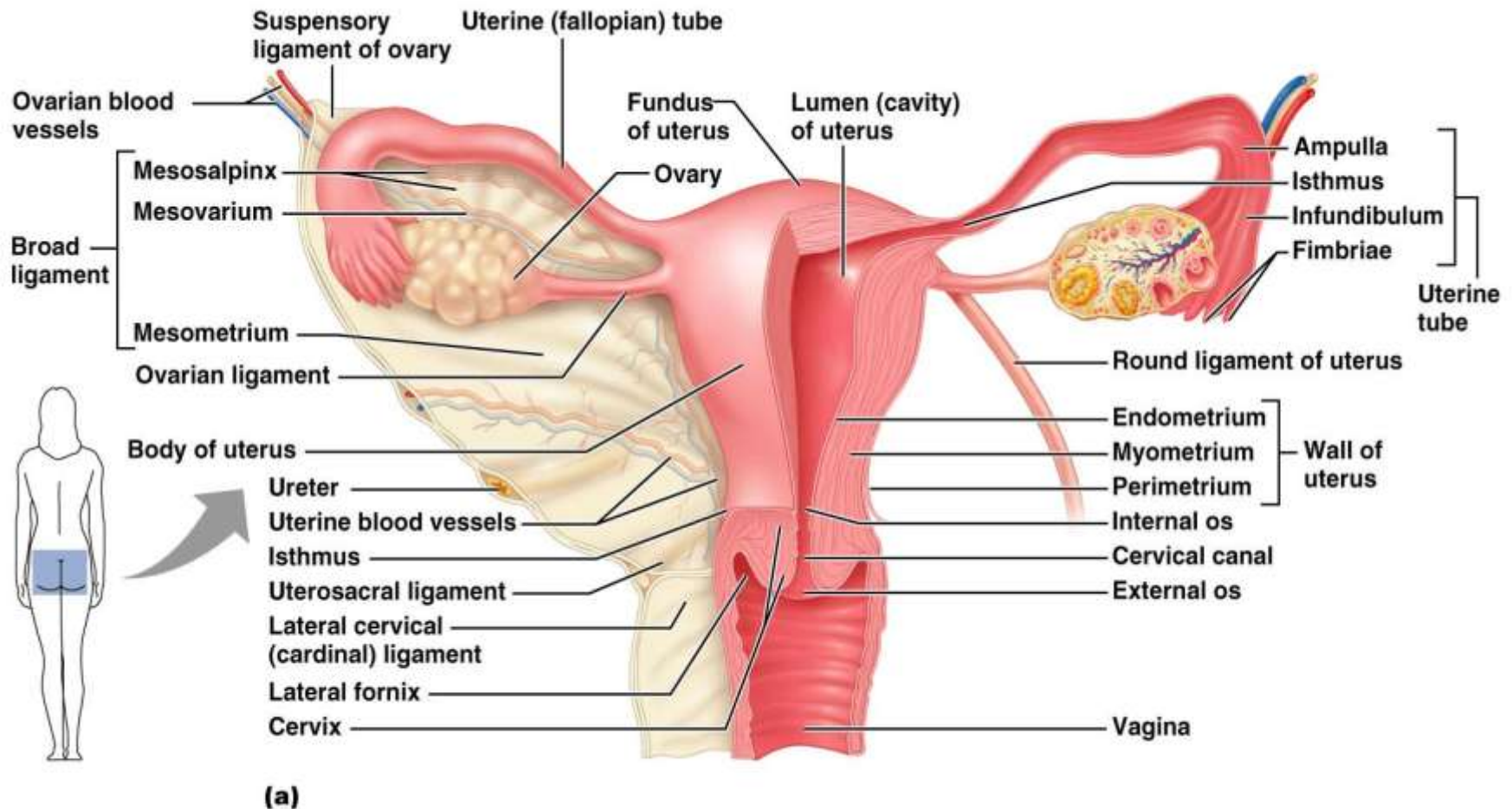
- a. Negative feedback mechanism regulates testosterone conc.
 - As the conc. of testosterone rises , the hypothalamus is inhibited , and the Ant. pituitary secretion of gonadotropins is reduced .
 - As the conc. of testosterone falls , the hypothalamus signals the ant. Pituitary to secrete gonadotropins .
- b. The conc. of testosterone remains relatively stable from day to day.

Female reproductive system

ovary :

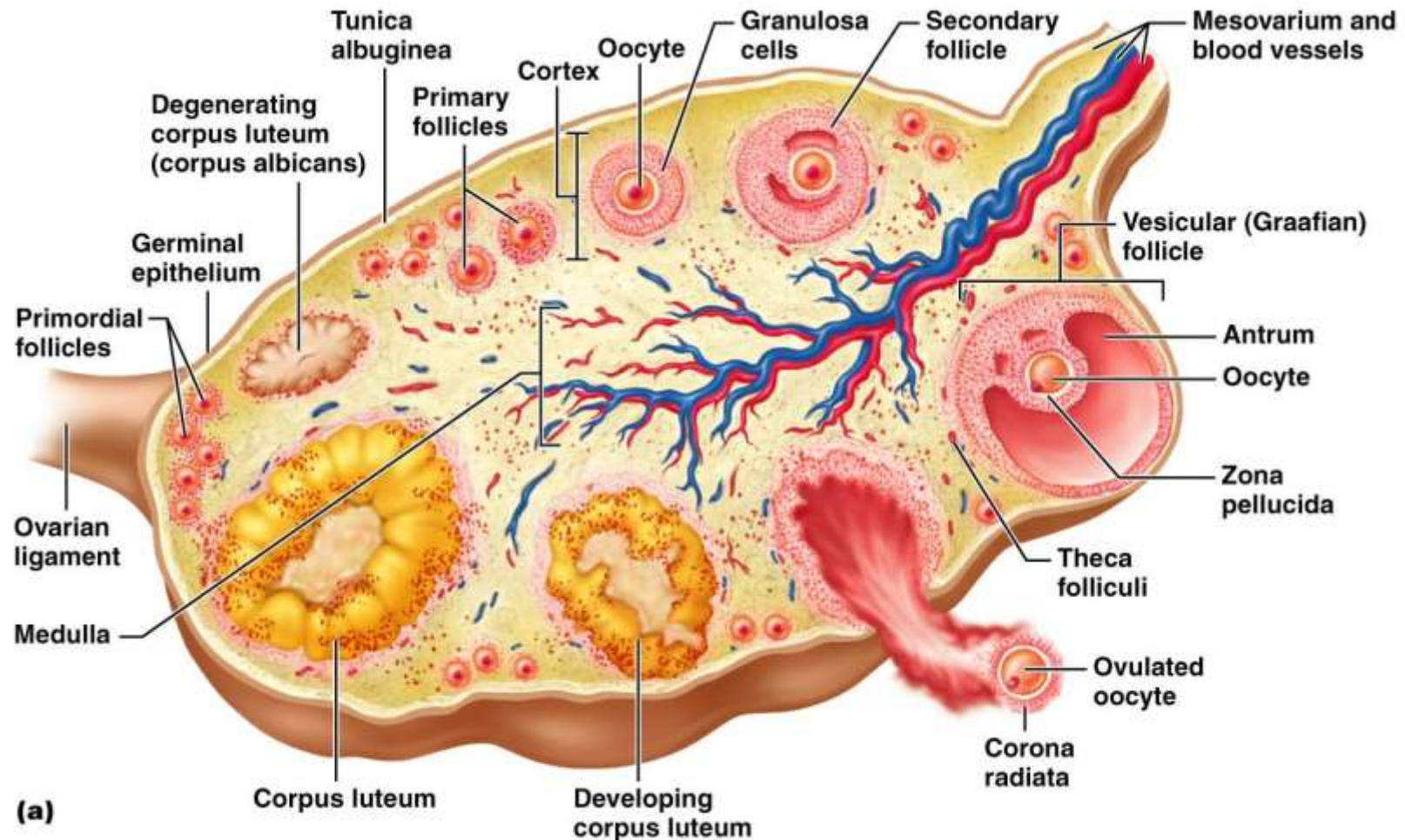
- primary sex organ that produces egg cells in a process called **oogenesis** , and also produces female sex hormones such as **estrogens** and **progesterone**.
- developed near the kidneys during fetal development ,and toward the end of pregnancy descend into the pelvic cavity .
- consists of **ovarian cortex** where the **ovarian cycle** occurs , and **ovarian medulla** where scar tissues and connective tissue are located .
- enclosed by a layer of cubical cells called **germinal epithelium**.
- bound to the uterine tubes and uterus by **ovarian ligaments** .

Internal reproductive organs of a female



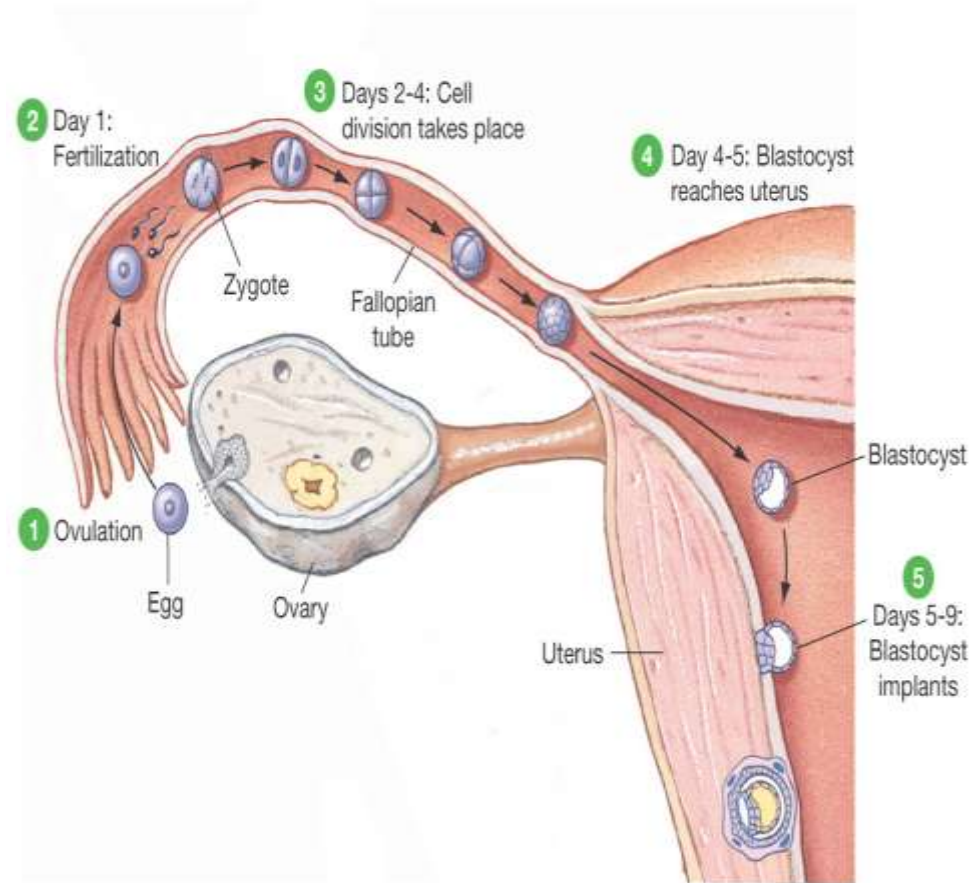
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Structure of an ovary



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- **Uterine tube** (or fallopian tube): consists of **fimbriae** , finger – like appendages that collect the ovum from the ovary during ovulation.
- **Infundibulum** channels the ovum from the fimbriae into the uterine tube .
- **Ampulla** is the curvature of the uterine tube where most fertilization occurs .
- inner wall of uterine tube is made of ciliated mucosa , where the cilia propel the ovum toward the uterus .

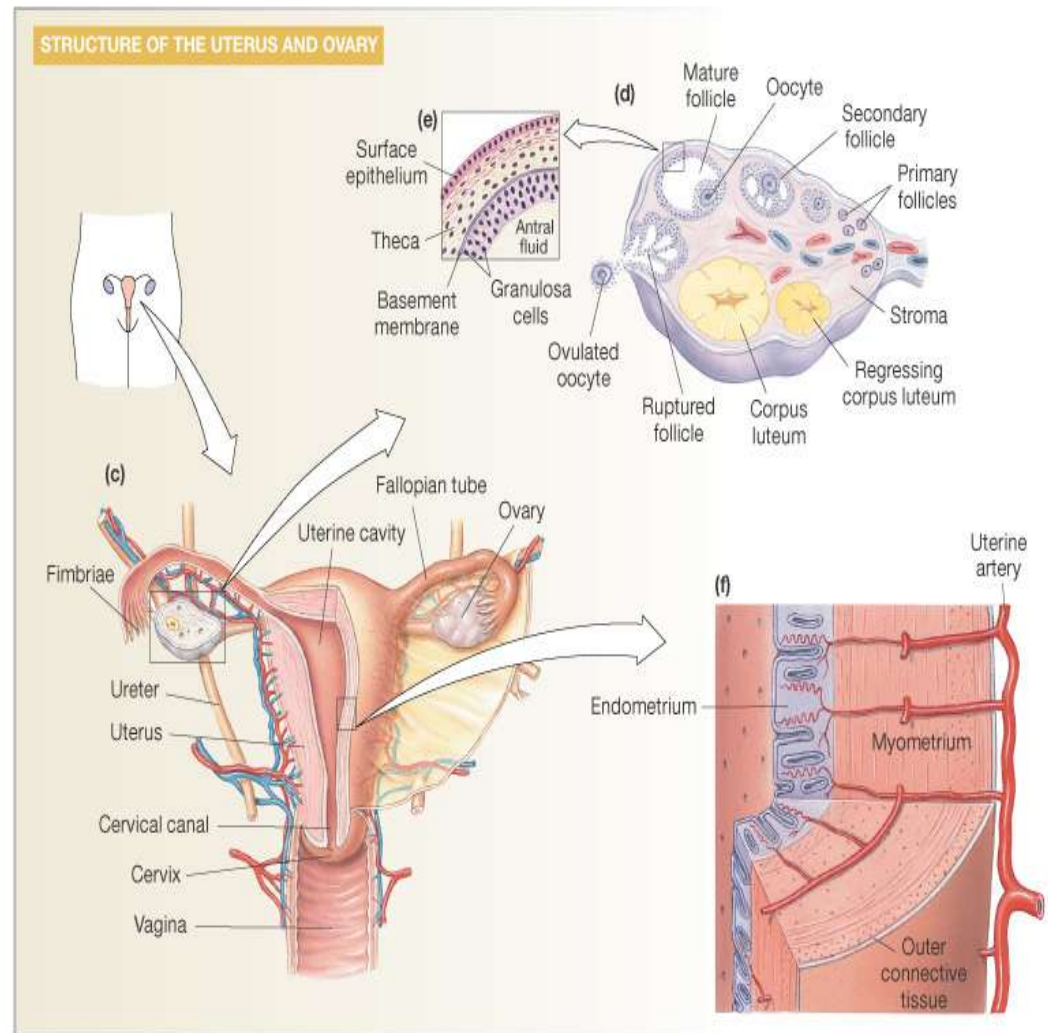


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Uterus

- a pear – shaped cavity formed by the union of the two uterine tubes .
- composed of 3 layers of tissue – **perimetrium** (fibrous connective tissue) , **myometrium** (smooth muscle), and **endometrium** (epithelial and connective tissues) .
- after fertilization , embryo adheres to the endometrial layer for further development – an event called **implantation** .
- to prepare for implantation and development , endometrium is stimulated by estrogens to thicken and becomes vascularized – a process called the **menstrual cycle** .
- myometrium ,under the stimulation of oxytocin, contracts during labor to expel the fetus into the vagina .
- the base of uterus is closed by a narrow passageway called **cervix** to prevent the entry of foreign substances

- **Vagina:** an elastic channel inferior to the cervix that serves as the "birth canal" during parturition.
- Also serves as the copulatory receptacle , where it receives the penis during sexual intercourse.
- In addition to the acids secretion from cervix , it also conveys uterine secretions (i.e. menstrual flow).



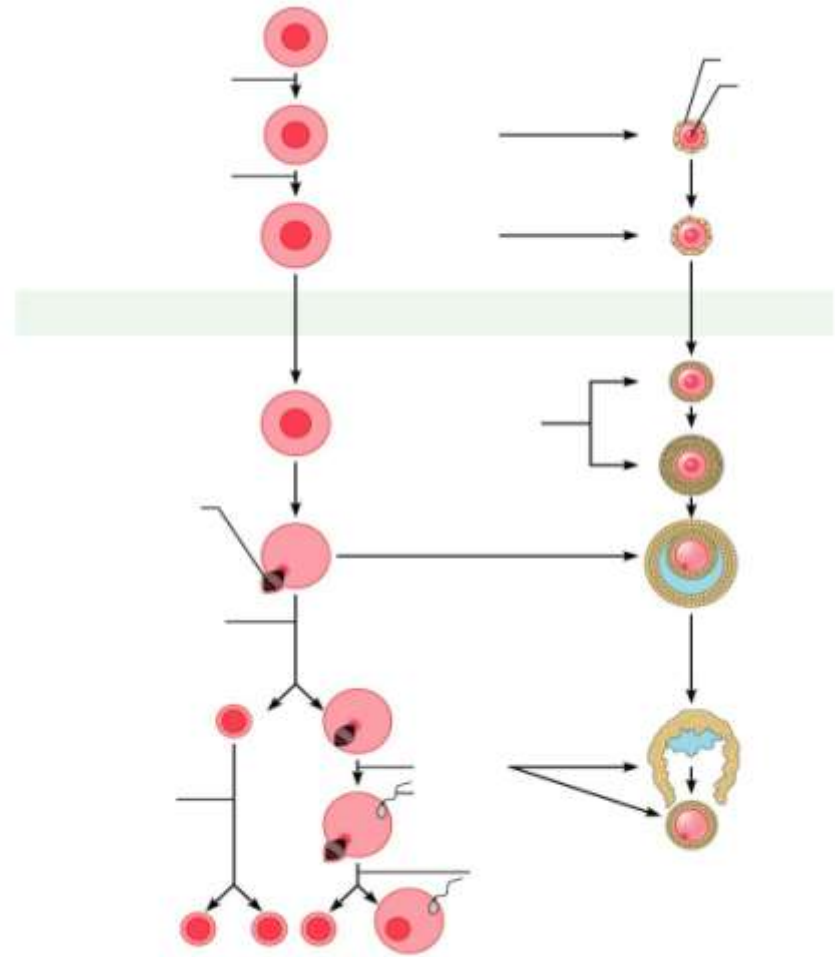
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Oogenesis

- In the ovarian cortex ,a process called **oogenesis** (formation of egg) occurs to develop a mature ovum . Before birth , several million cells called **primordial oocytes** exist in the ovaries – most of them spontaneously degenerate .
- At birth , only 1 million primordial oocytes are left ; and by puberty (age 10-11) ,only 400,000 remain in the ovaries .
- From puberty to menopause , some of these primordial oocytes (containing 46 chromosomes) undergo DNA replication and become **primary oocytes** (with 46 pairs of chromosomes) .
- Primary oocytes will then undergo "crossing - over" to shuffle their genes, and **meiosis I** will occur to divide the cells into **secondary oocytes** (containing 46 unique chromosomes) and the **first polar bodies** (also containing 46 unique chromosomes ; but will be degenerated) .

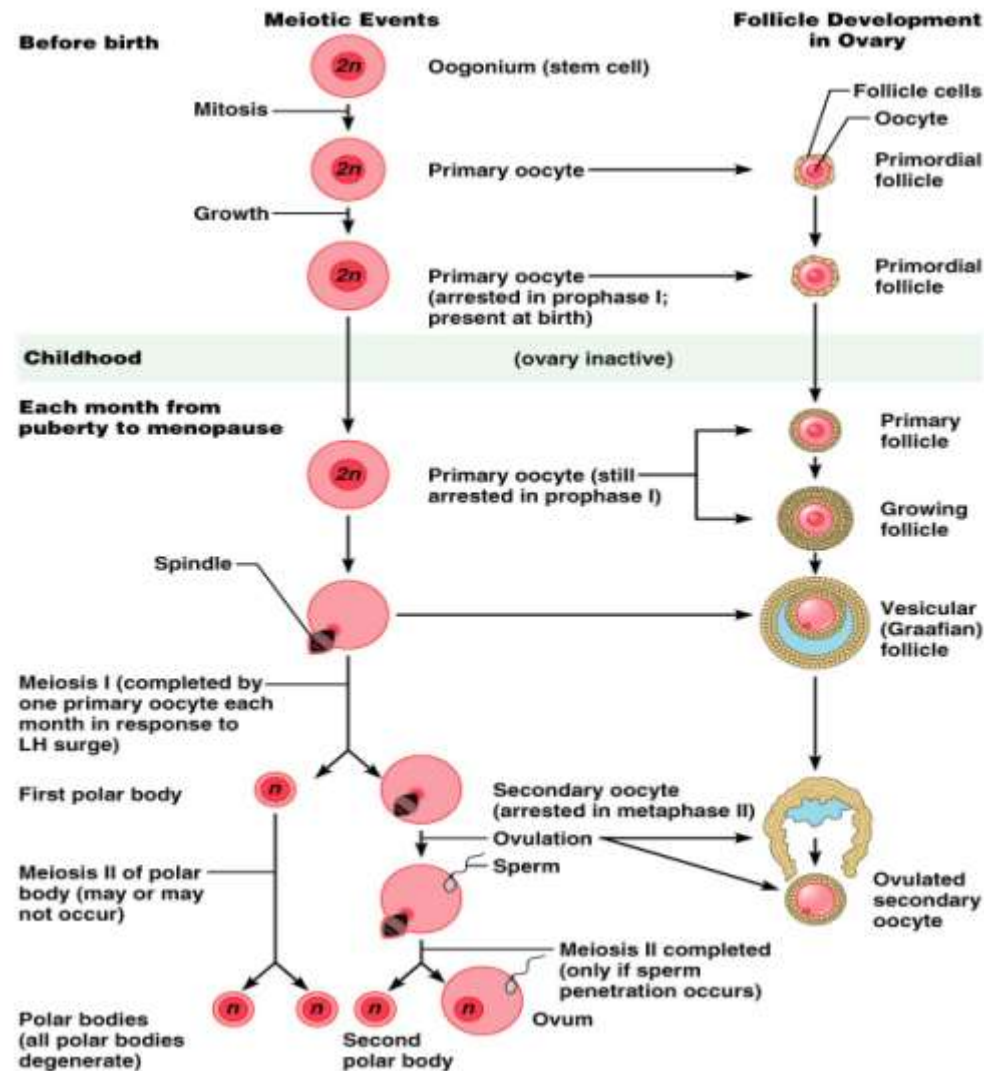
Events of oogenesis

- oogenesis now is arrested where the ovary discharges a mature secondary oocyte into the uterine tube (in a process called **ovulation**) .
- Meiosis II** is reactivated when this secondary oocyte is fertilized by a sperm (if no fertilization occurs , secondary oocyte is discarded along with the menstrual flow), instantly dividing the 46 chromosomes into 23 (inside the **second polar body**) and another 23 will be united with the 23 chromosomes released from the sperm.



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Events of oogenesis



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Mechanism of erection, lubrication, and orgasm in human female

- 1. sexual stimulation .
- 2. Arteries in the erectile tissue dilate, vagina expands and elongates
- 3. Engorged and swollen vagina increases friction from movement of penis .
- 4. parasympathetic nerves impulses from sacral portion of the spinal nerve is enhanced .
- 5. sexual stimulation intensifies .
- 6. vestibule glands secrete mucus to lubricate .
- 7. orgasm: rhythmic contraction of muscles of the perineum, muscular walls of uterus, and uterine tube .

Hormonal control of ♀ reproductive function

- Hormones from the hypothalamus , Ant. Pituitary gland and ovaries, play important roles in the control of sex cell maturation , and development and maintenance of female secondary sex characteristics .
- Female sex hormones :
 - A female body remains reproductively immature until about 10 years of age when **gonadotropin** secretion increases .
 - The most important female sex hormones are **estrogen** and **progesterone**.
 - Estrogen is responsible for the development and maintenance of most female secondary sex characteristics .
 - Progesterone causes change in the uterus .

Hormonal control of ♀ secondary sex characteristic

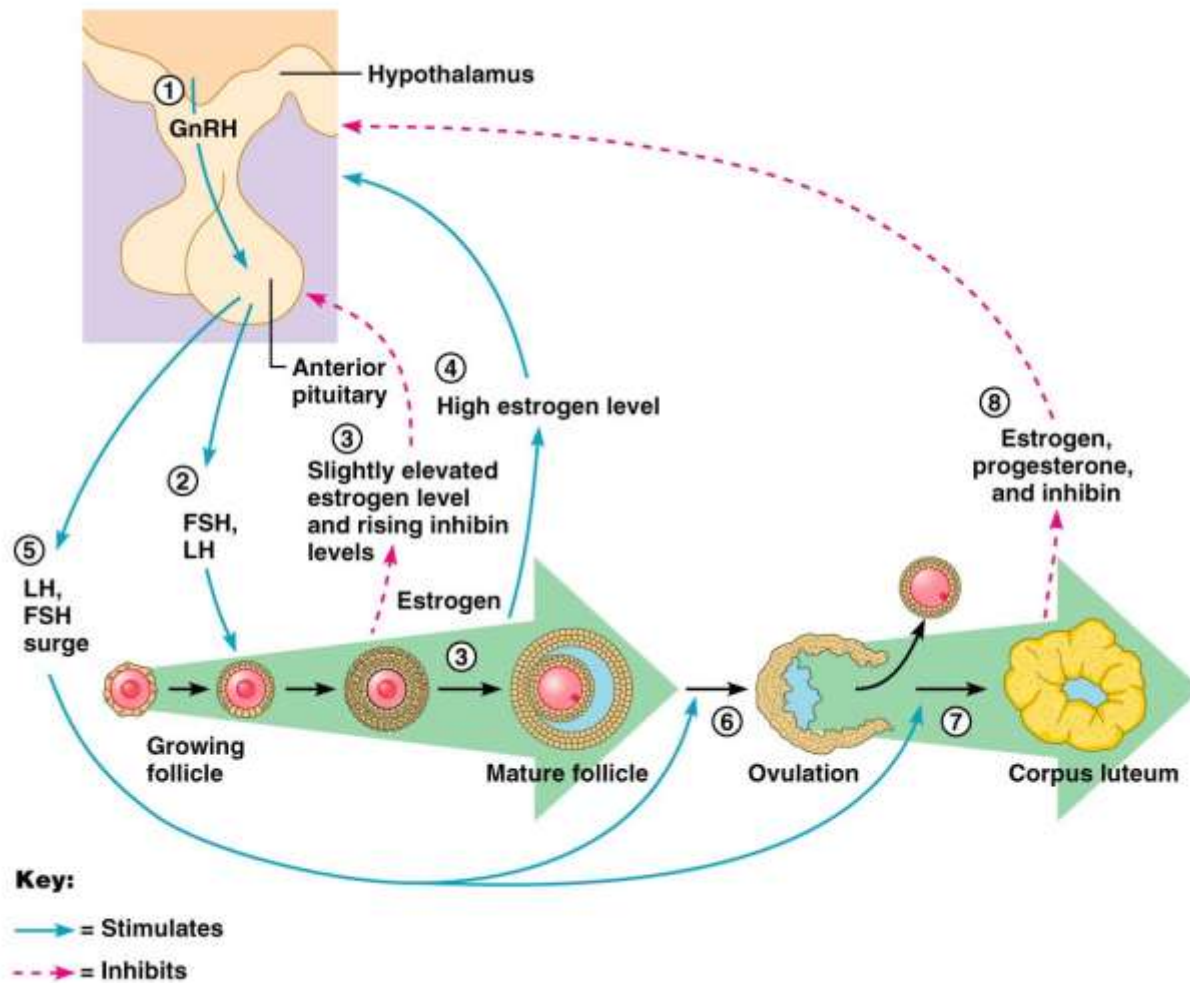
- The hypothalamus releases **GnRH** , which stimulates the Ant. Pituitary gland.
- The Ant. pituitary gland secretes **FSH** and **LH** .
- FSH stimulates the maturation of a follicle .
- Granulosa cells of the follicle produce and secrete **estrogen**; LH stimulates certain cells to secrete estrogen precursor molecules .
- Estrogen is responsible for the development and maintenance of most female **secondary sex characteristics** .
- Concentration of Androgens affects other secondary sex characteristics, including skeletal growth and growth of hair .
- **Progesterone**, secreted by the ovaries , affects cyclical changes in the uterus and mammary glands .

Ovarian cycle

- A series of event in the ovarian cortex in order to produce a mature ovum and sex hormones .
- Lasts for about 28 days , where from day 1 to 13 the mature ovum is developed and estrogens are released ,on day 14 ovulation occurs to discharge the ovum , and from day 15 to 28 scar tissues are formed and progesterone is released .
- On day **1** , **hypothalamus** secretes **Latinizing hormone releasing hormone (LHRH)** to the **anterior pituitary gland** , which in turn secretes **follicle – stimulating hormone (FSH)** to the ovaries .
- Upon receiving FSH , about 20-25 **primary follicles** develop into **secondary follicles** . [primary oocytes located inside primary follicles undergo meiosis I and become secondary oocytes , contained in secondary follicles] .

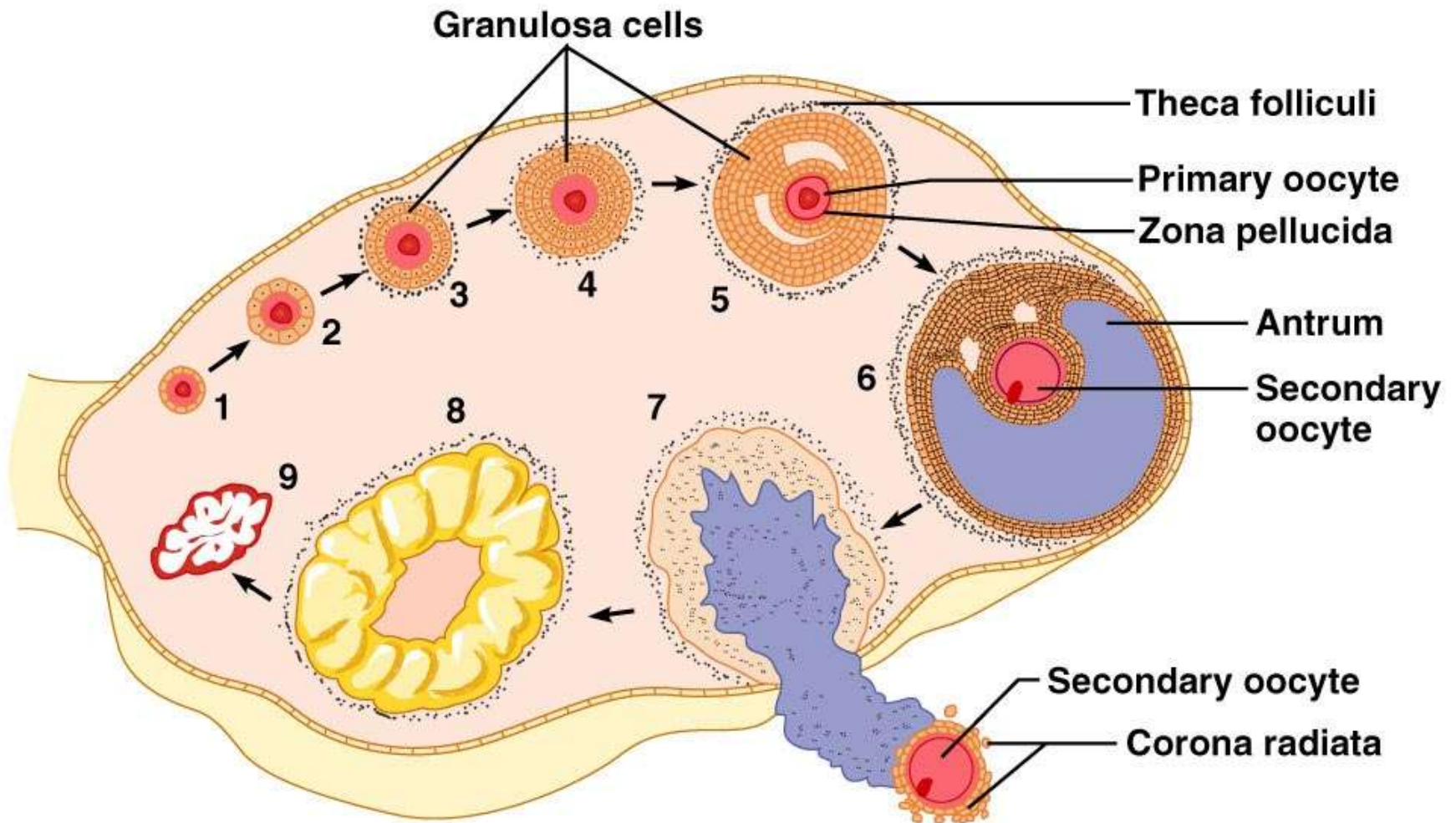
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- Follicular cells in secondary follicles begin to secrete **estrogens** (for communicating with hypothalamus and anterior pituitary and for developing the endometrium) .
 - With continuous stimulation of FSH and some **Luteinizing hormone (LH)** ,secondary follicles continue to grow larger and develop multiple layers of follicular cells (while the secondary oocytes within are unchanged).
 - By day **13** , only 1 secondary follicle will fully mature and become the **graafian follicle** (or mature follicle) which secretes a large amount of estrogens to the hypothalamus – anterior pituitary system for signaling ovulation (using a positive feedback mechanism).
 - On day **14** , large amounts of LH ("**LH surge**") will be secreted by anterior pituitary , inducing **ovulation** where the graafian follicle ruptures and releases the secondary oocyte into uterine tube .

Regulation of ovarian function



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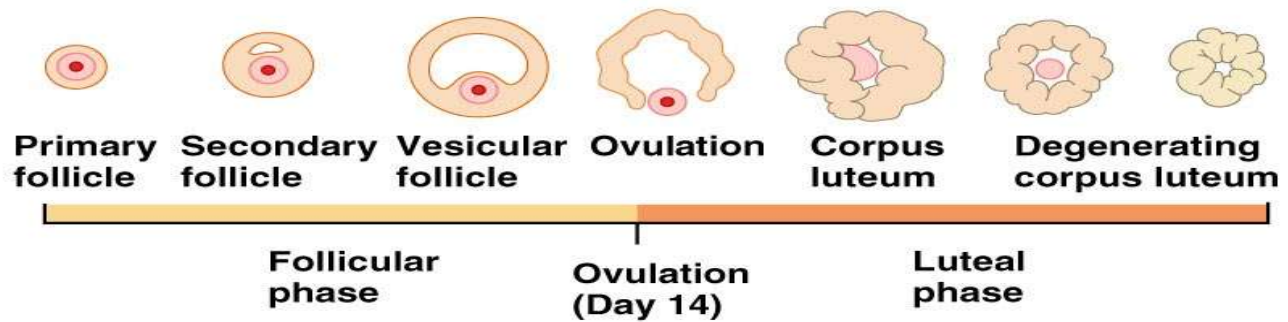
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- From days **15 to 25** , graafian follicle degenerates and becomes **corpus hemorrhagicum** ("a bleeding body") then **corpus luteum** ("a yellow body"; containing **lutein cells** that secrete **progesterone** and some estrogens to continuum stimulating the development of endometrium).
 - By day **26** , if no fertilization occurs to the secondary oocyte, resulting in a lack of **human chorionic Gonadotropin** hormone (HCG) from the embryo , corpus luteum degenerates into **corpus albicans** . [if fertilization did occur , HCG will continuously simulate corpus luteum for 2-3 months , allowing high levels of estrogens and progesterone to maintain pregnancy in the first trimester] .
 - When corpus luteum degenerates , the declining levels of estrogens and progesterone will signal the hypothalamus – anterior pituitary system to initiate another ovarian cycle.



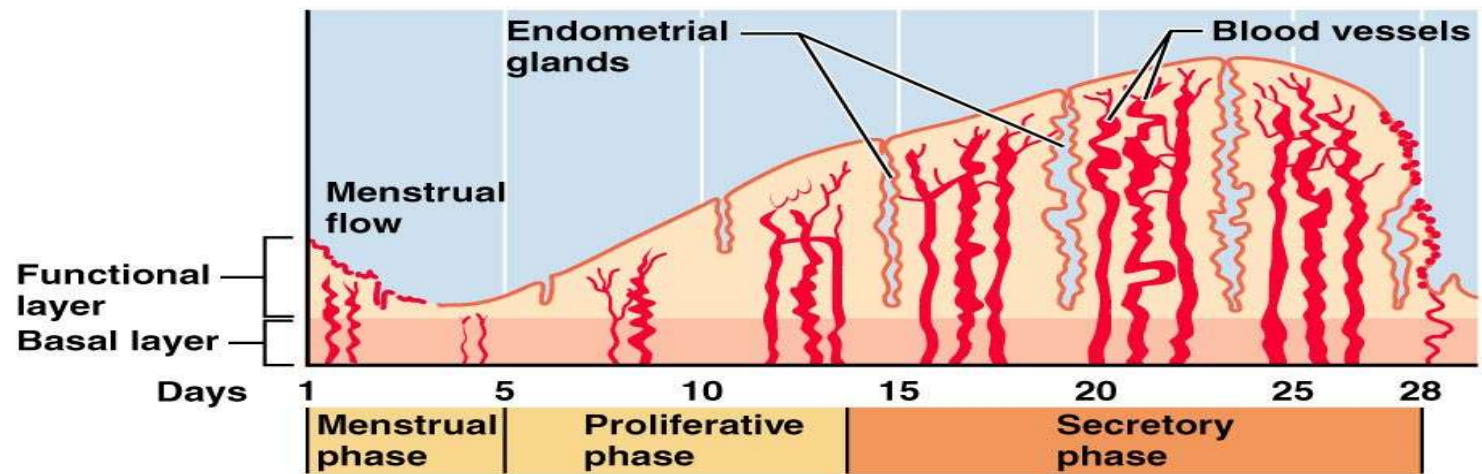
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Menstrual cycle

- A series of events that occurs in the uterus in order to prepare the endometrial layer for implantation and fetal development .
- Occurs simultaneously with the ovarian cycle , but is about 1 week behind ; and also lasts about 28 days .
- From days 1 to 6 , the **menstruation phase** occurs where the top portion of a thickened endometrial called **stratum functionalis** is shed off from the previous cycle . tissue repair occurs to prepare for a new menstrual cycle . Along with the stratum functionalist tissue , mucus , blood , and the secondary oocytes are discarded as "menses".
- From days 7 to 13 , increasing levels of estrogens from secondary and mature follicles stimulate the endometrial to thicken and visualize – in a stage called the **preovulatory phase**.



(c) Ovarian cycle



(d) Uterine cycle

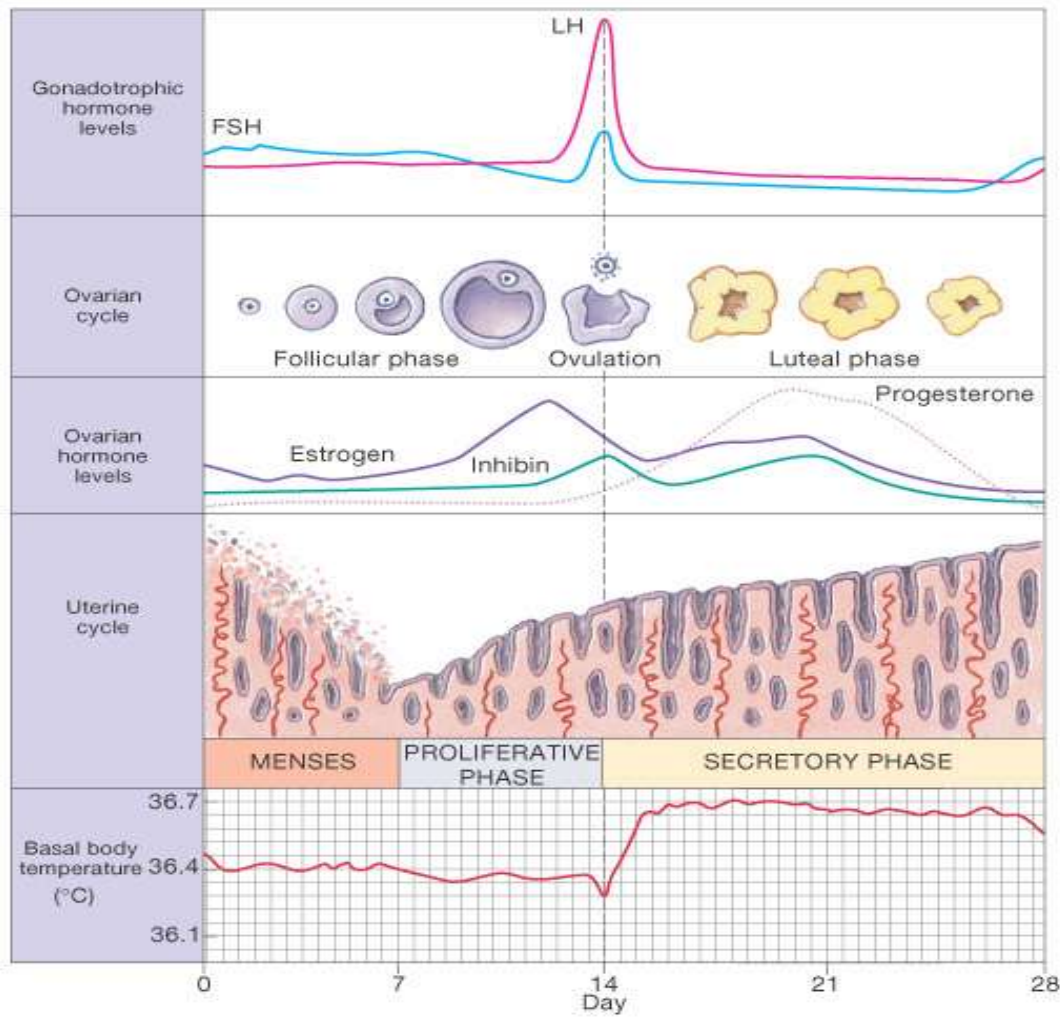
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- From days 15 to 28 , continuous secretion of estrogens and progesterone from corpus luteum causes the endometrium to continue thickening and vascularizing – the **postovulatory phase**.
 - Toward the end of this phase , if no fertilization occurs , resulting in a lack of **HCG** stimulation to corpus luteum , the declining levels of estrogens and progesterone will cause the endometrium to degenerate – ultimately shedding off the stratum functionalis layer .
 - If fertilization did occur , high levels of estrogens and progesterone from the corpus luteum (in the first trimester) and from the placenta (in the second and third trimesters) will sustain the thickness and vascularization of endometrium until the end of pregnancy.

Major events in menstrual cycle - Summary

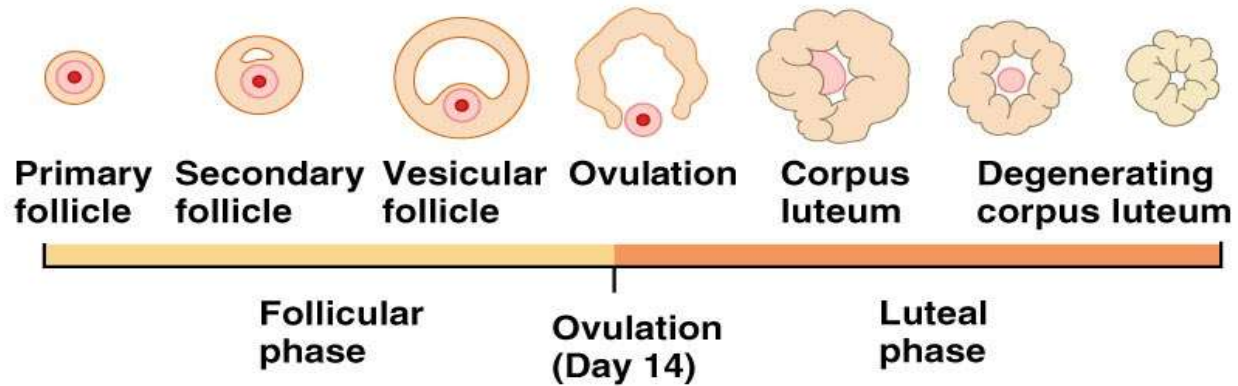
- 1. The Ant. pituitary gland secretes FSH and LH .
- 2. FSH stimulates maturation of a follicle .Granulose cells of the follicle produce and secrete estrogen . Estrogen maintains 2ndry sex traits & causes the uterine lining to thicken .
- 3. The Ant. pituitary gland releases a **surge of LH**, which stimulates ovulation . Follicular and thecal cells become corpus luteum cells which secrete **estrogen** and **progesterone**.
 - a. Estrogen continues to stimulate uterine wall development .
 - b. Progesterone stimulates the uterine lining to become more glandular and vascular .
 - c. Estrogen and progesterone inhibit secretion of FSH and LH from the Ant. pituitary gland .

The Menstrual Cycle

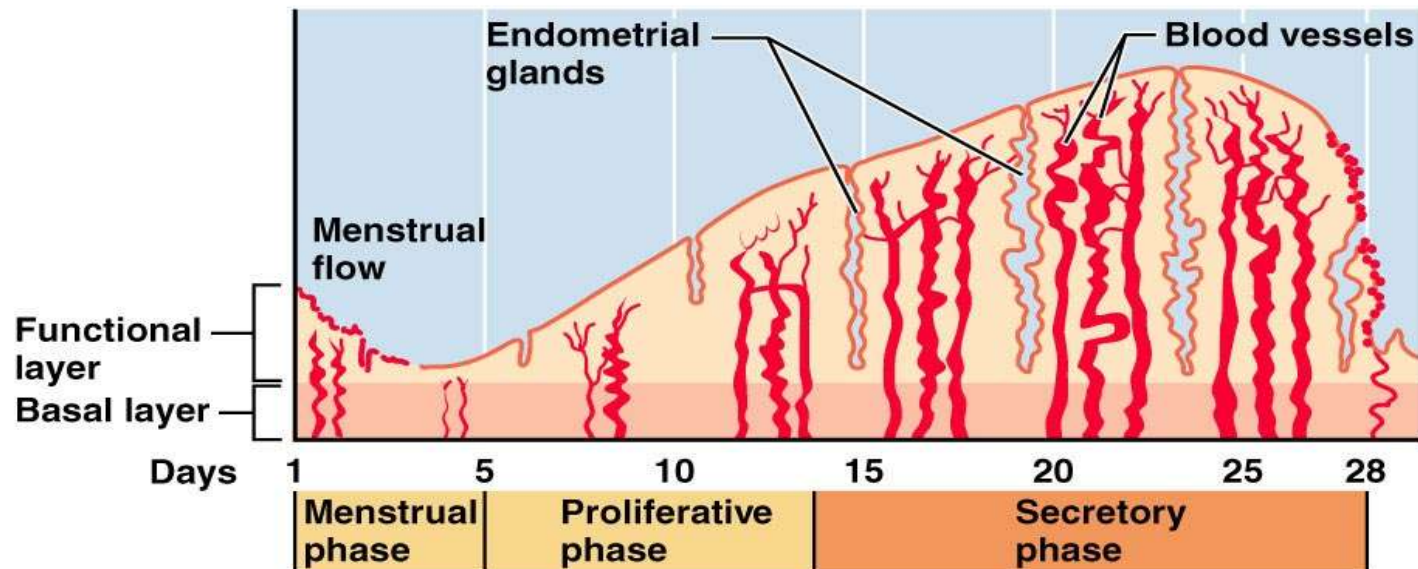


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- 4. If the egg is not fertilized , the corpus luteum degenerates and no longer secretes estrogen and progesterone (24th day of the cycle).
 - 5.As the conc. of luteal hormones decline , blood vessels in the uterine lining constrict .
 - 6. The uterine lining disintegrates and sloughs off, producing a menstrual flow (28th day of the cycle).
 - 7.The Ant. pituitary gland , no longer inhibited, again secretes FSH and LH .
 - 9. The menstrual cycle repeats .



(c) Ovarian cycle



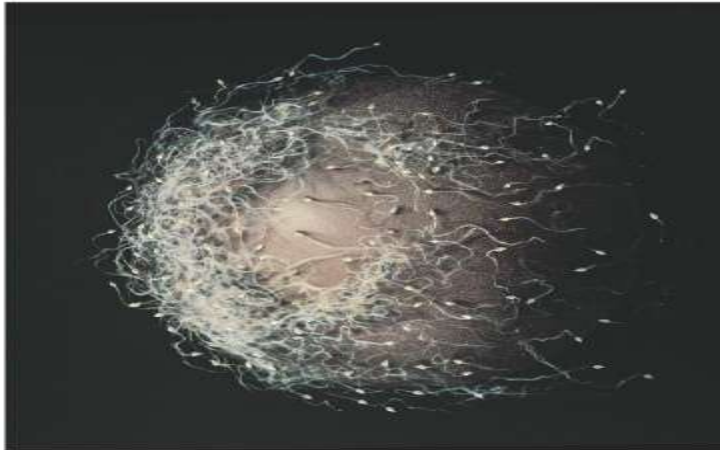
(d) Uterine cycle

Fertilization

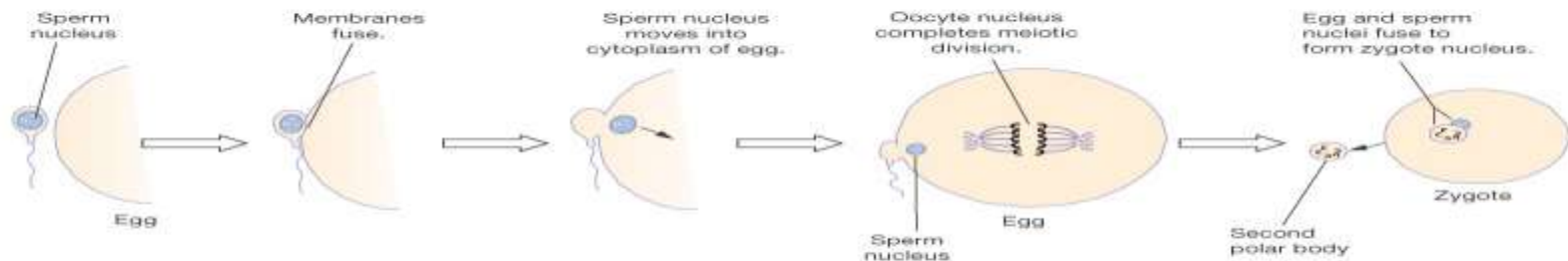
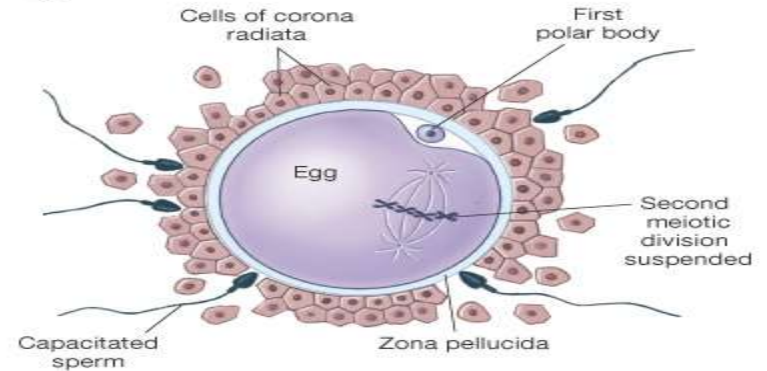
- Within an hour after sexual intercourse , sperm would have traveled from the vagina , through the cervix , into the uterus and uterine tube .
- during this journey , the **acrosome** on the head of spermatozoa would be worn off , releasing **acrosin** enzyme by the time sperm are attached to the outer coatings of the ovum .
- About 50 spermatozoa are attached to the outermost coating called **corona radiata** . using hydrolysis reaction aided by acrosin , some of these sperm reach the inner coating called **zone pellucida** .
- One of the sperm will eventually penetrate through zone pellucida, and allow its cell membrane to fuse with the cell membrane of ovum . This causes a rapid electrical depolarization at the cell membrane of ovum , preventing other sperm entering the ovum

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- **Now meiosis II** is reactivated in the cytoplasm of ovum , dividing the 46 chromosomes in the nucleus into 23 chromosomes for fertilization (uniting with another 23 chromosomes from the sperm) , and 23 chromosomes to be eliminated along with the second polar body .
 - The head of the penetrated sperm is now detached from its mid piece and tail . It will then rupture , releasing 23 chromosomes in the form of long strands of DNA molecules .
 - The chromosomes from the sperm and ovum now unite to form a complete set of genetic makeup for the offspring – 2 haploid cells (sperm and ovum) are now joined to become a single diploid celled **zygote** . Fertilization is now complete .

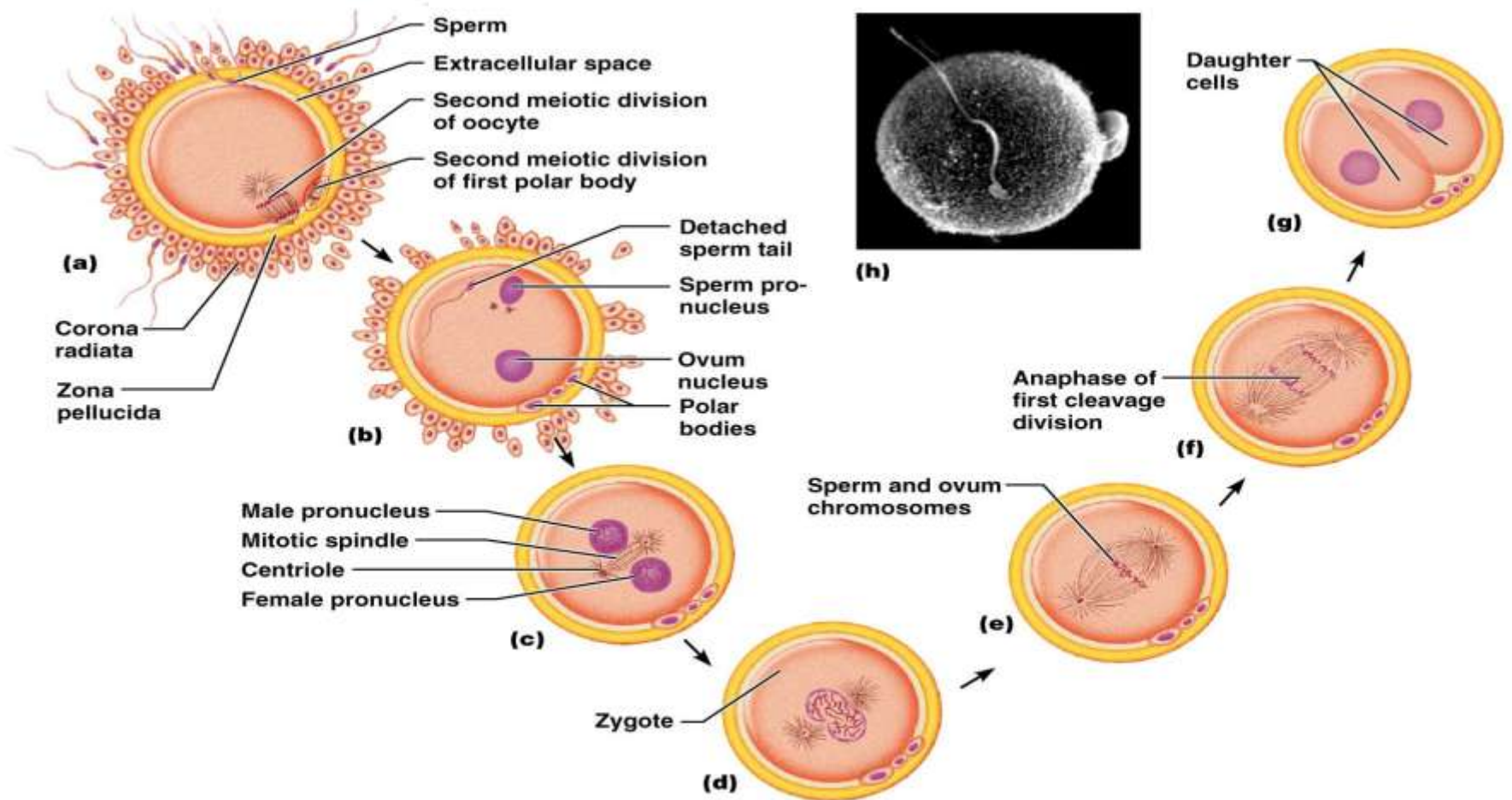
(a)



(b) Capacitated sperm release enzymes from their acrosomes in order to penetrate the cells and zona pellucida surrounding the egg.



Fertilization

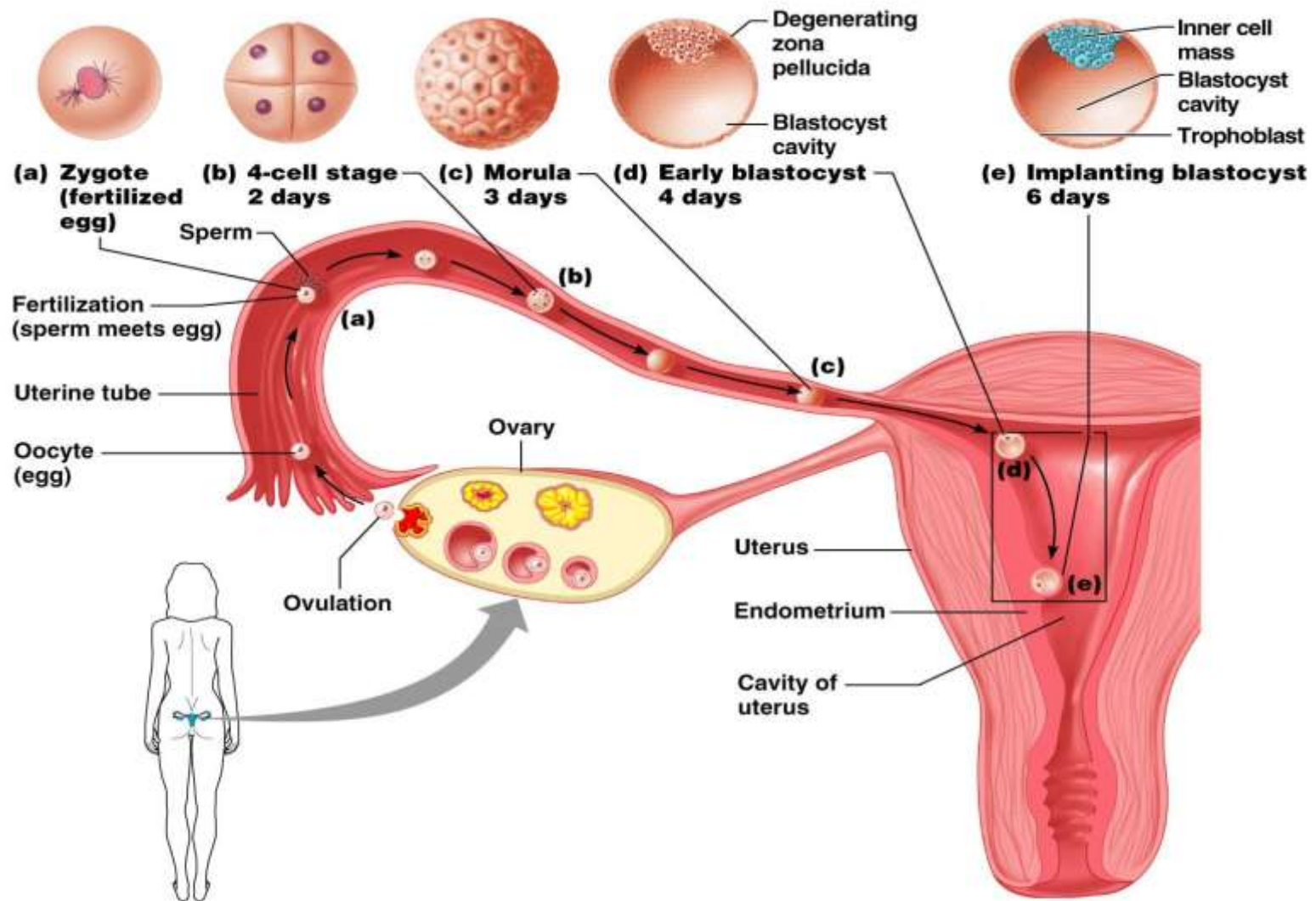


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Pregnancy

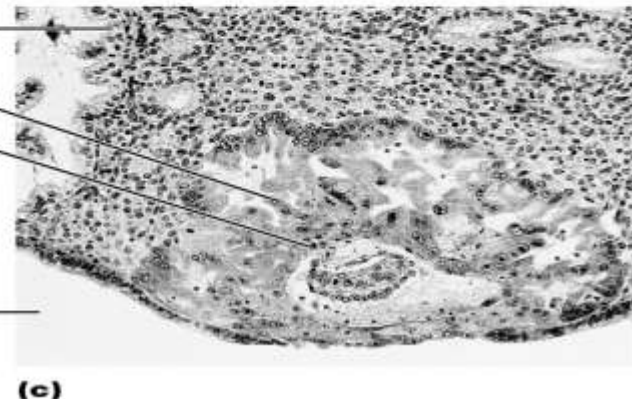
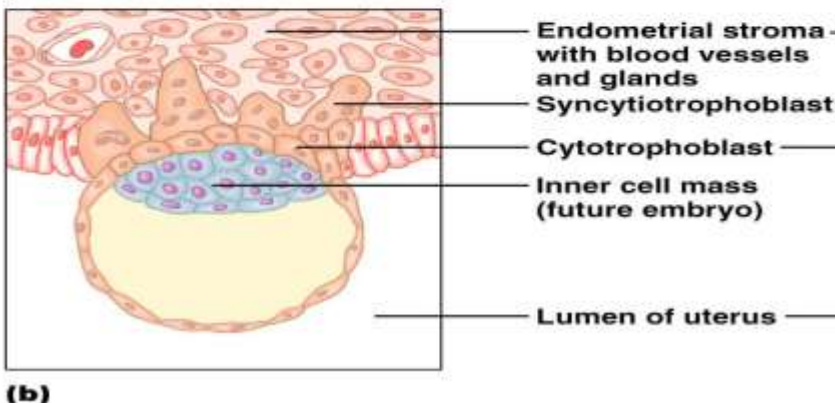
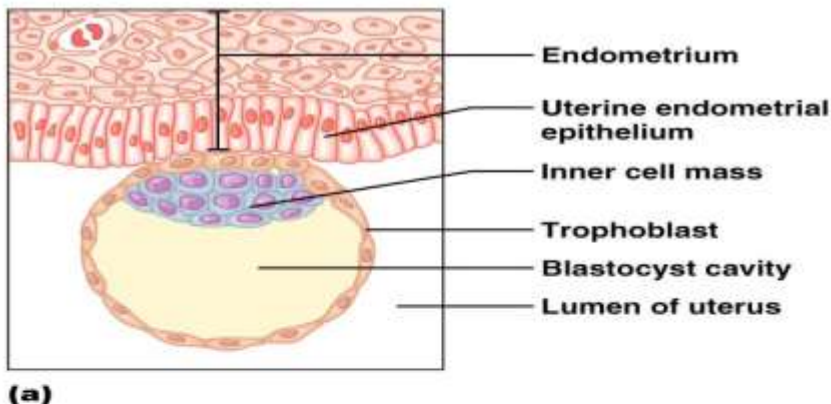
- 1. A zygote is formed about 12-24 hours after ovulation .
- 2. This single cell , still the same size as the original ovum , continues to travel through the uterine tube toward the uterus by the action of cilia along the inner lining of uterine tube .
- 3. About an hour after fertilization is complete, mitotic cell division called **cleavage** occurs , dividing the zygote into a cluster of smaller cells .
- 4. By the time cleavage has produced 16 identical cells , it is called a **morula** (which occurs about 2-3 days after fertilization).
- 5. Cleavage continues along the journey through the uterine tube , by the time this cluster of cells has arrived at the uterus (about 5-6 days after fertilization) , it is called a **blastocyst** which contains hundreds of small cells called **blastomeres** surrounding a hollow cavity called **blastocoel**.

Cleavage from zygote to blastocyst



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- 6. The blastocyst releases digestive enzymes and embeds itself onto the thickened and vascularized **endometrium** layer – a process called **implantation** which occurs about 7 days after fertilization . The blastocyst is now called an **embryo**, which continues to develop for the next 2 months until a **fetus** is formed .

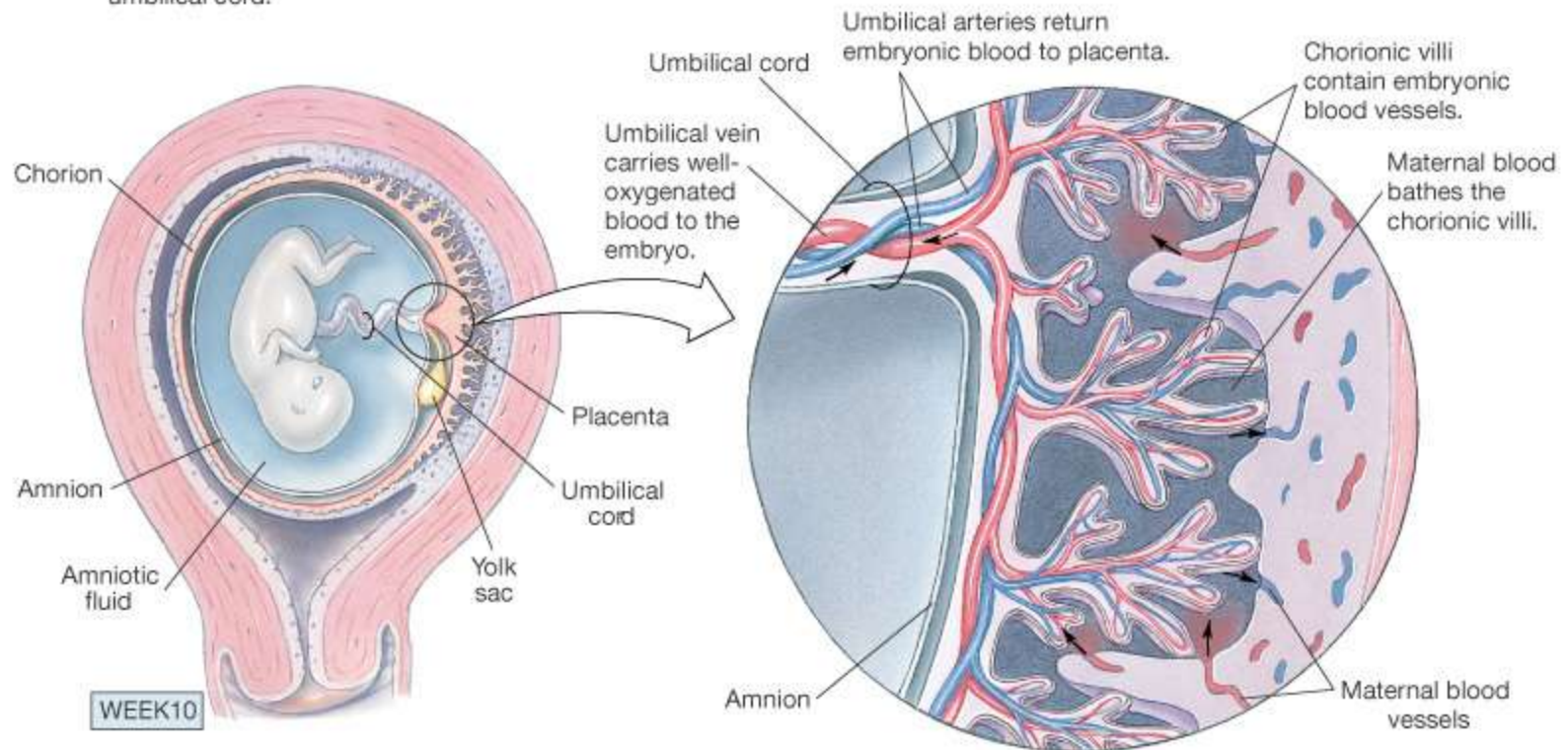


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- 7. Soon after implantation , layers of membrane begin to form outside the embryo –
 - a. **Chorion** – the innermost membrane which secretes a hormone called the **Human Chorionic Gonadotropin (HCG)** which stimulates the corpus luteum in the ovary for the secretion of estrogens and progesterone , until the placenta is fully developed and can secrete estrogens and progesterone.
 - b. **Amnion** – the middle membrane that secretes amniotic fluid for nourishing the embryo.
 - c. **Placenta** – the outermost membrane that protects the embryo and fetus, allows exchange of nutrients and wastes between fetal and maternal blood, and secretes estrogens and progesterone to maintain pregnancy .

The placenta

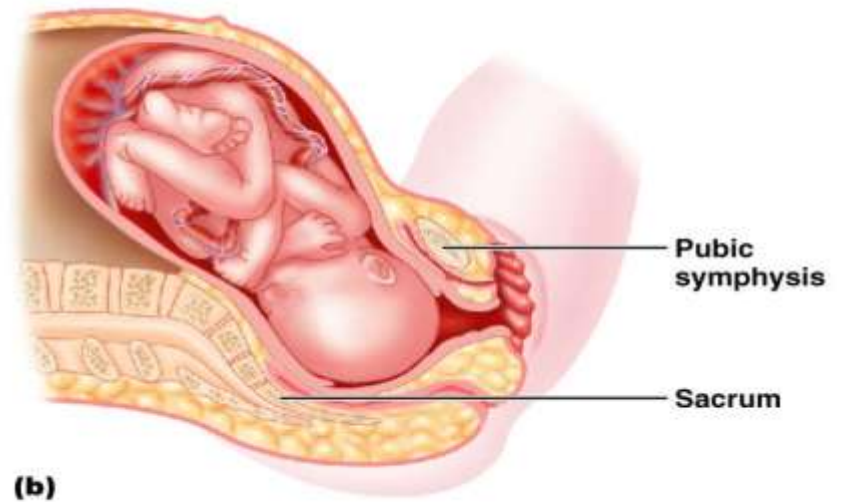
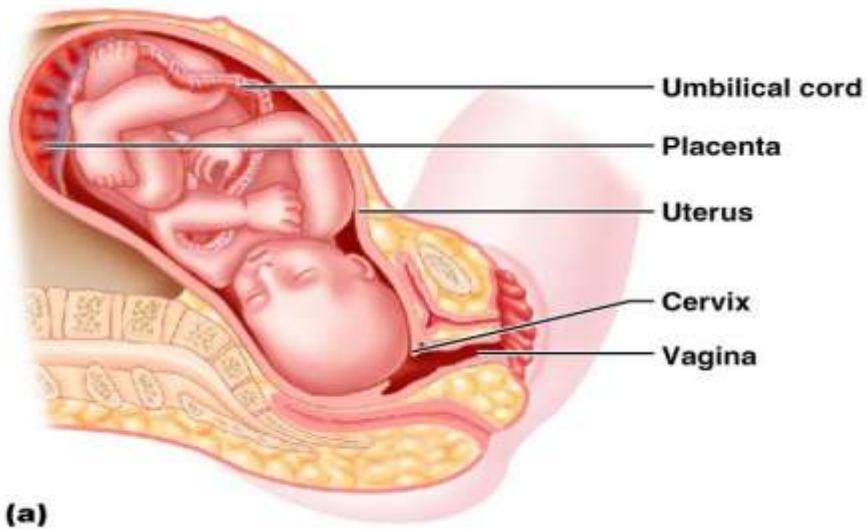
(a) The developing embryo floats in amniotic fluid. It obtains oxygen and nutrients from the mother through the placenta and umbilical cord.

(b) Some material is exchanged across placental membranes by diffusion, but other material must be transported.

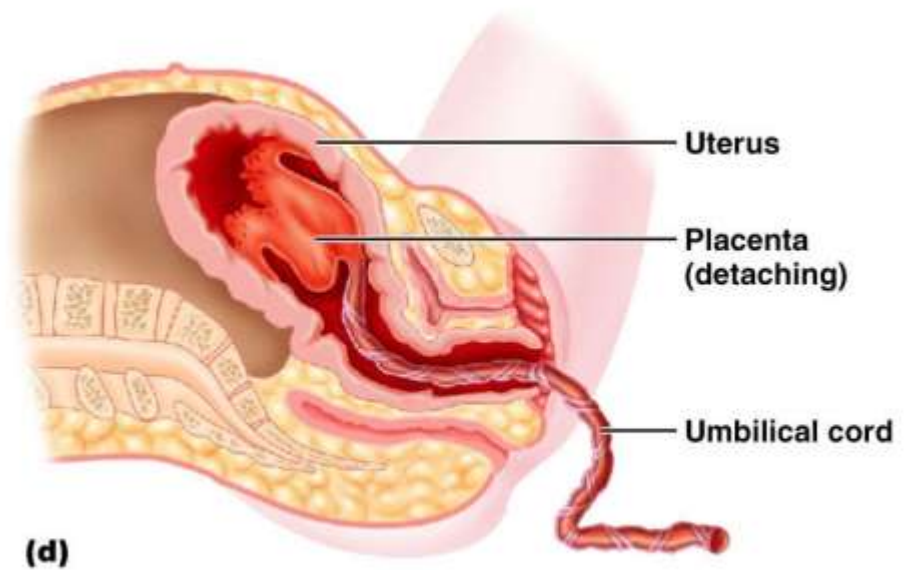
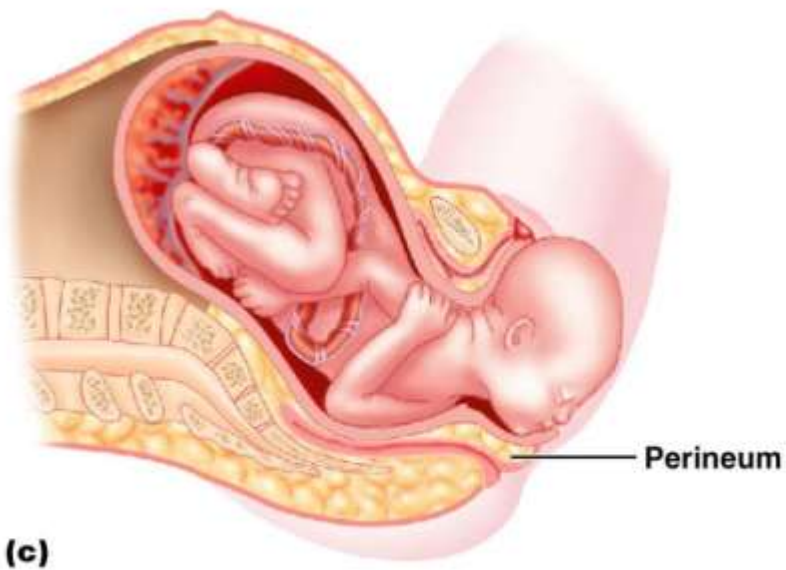


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- 8. In the first 3 months of pregnancy (or "**first trimester**") , HCG level is the highest and it declines in the last two trimesters. This is to ensure that corpus luteum is sustained and not degenerated into corpus albicans . [HCG is secreted by renal tubules into urine , allowing pregnancy to be tested positive in a typical pregnancy test . the high HCG level may be responsible for "morning sickness " and other discomfort felt by pregnant women].
 - 9. In the last two trimesters , **placental estrogens and progesterone** cause the uterus and breasts to enlarge , and during labor, cause the vagina to stretch. The sharp decline of estrogens after birth will signal new ovarian and menstrual cycles to begin. The sudden reduction of progesterone before birth removes the suppression of **oxytocin** (from posterior pituitary gland), resulting in uterine contractions during the birth process.

-
- 10. pregnancy lasts for about 40 weeks (280 days after the last menstruation or 266 days after fertilization) and ends with **partuition**.
 - a. During the last 6 weeks of fetal development , the fetus assumes the **vertex position** where the head faces the cervix .
 - b. At the end of pregnancy , the fetus moves downward and its head causes pressure onto the dilating cervix , [the hormone **Relaxin** from the ovaries stimulates the dilation of cervix and pubic symphysis].
 - c. The pressure onto the cervix signals the hypothalamus which in turn stimulates the posterior pituitary gland for the release of oxytocin.
 - d. **Oxytocin** causes the myometrium layer (made of smooth muscle) to contract involuntarily , pushing the fetus downward .
 - e. The downward movement of fetus exerts more pressure onto the cervix , a phenomenon called **positive feedback** – until the fetus is expelled from the uterus, through the cervix and vagina , to the outside.



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Hormonal changes during pregnancy - summary

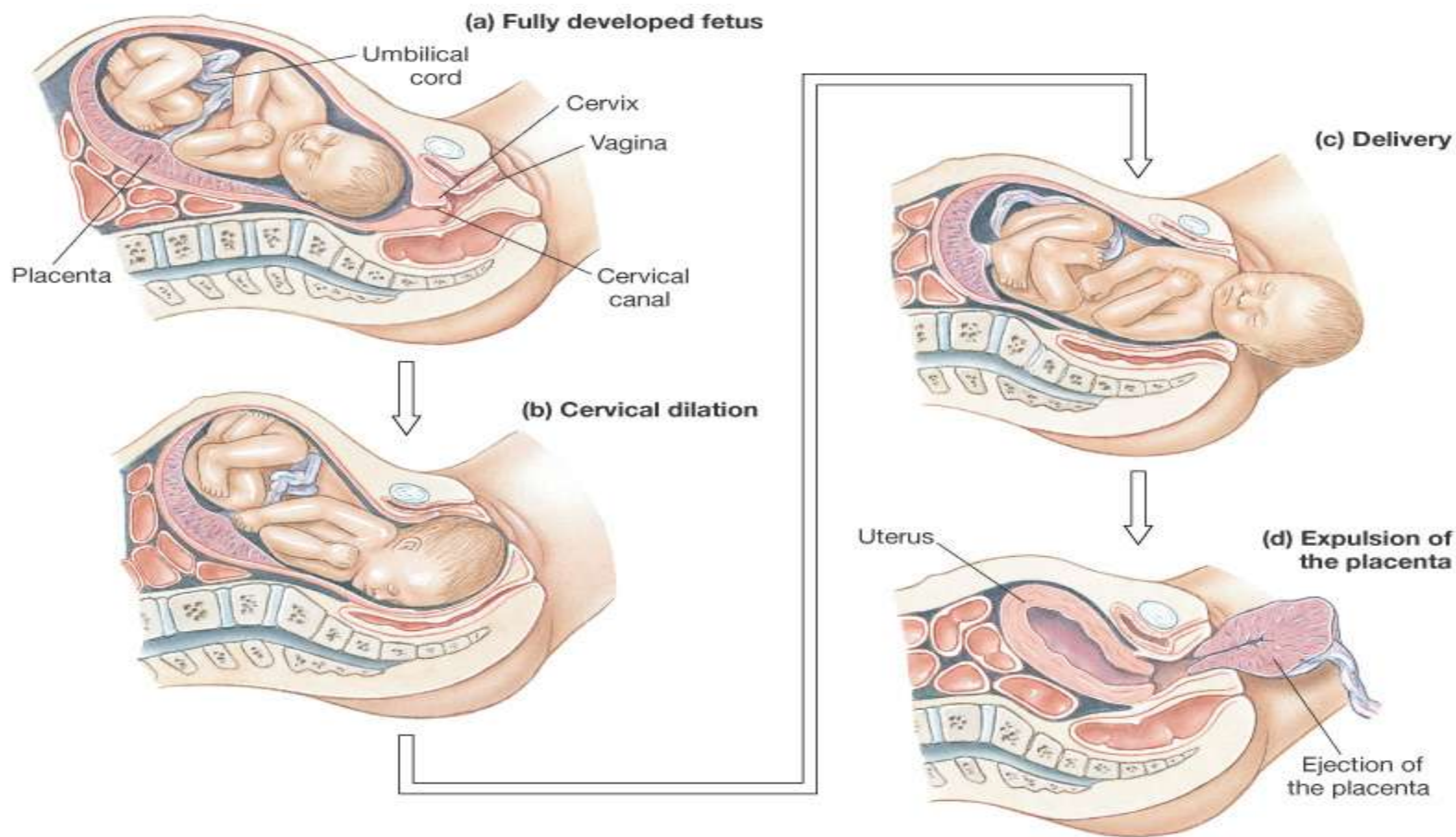
- 1. Following implantation , cells of the trophoblast (embryonic cells that helps from the placenta). begins to secrete HCG (human chorionic gonadotropin) .
- 2. HCG maintains the corpus luteum, which continues secreting estrogen & progesterone .
- 3. As the placenta develops, it secrets large quantities of estrogen and progesterone. placental estrogen and progesterone :
 - a. stimulate the uterine lining to continue development .
 - b. maintain the uterine lining .
 - c. Inhibit secretion of FSH and LH from the Ant. pituitary gland .
 - d. stimulates development of the mammary gland.

-
- e. Inhibit uterine contractions (progesterone) .
 - f. enlarge the reproductive organs (estrogen) .
- 4. **Relaxin** from the corpus luteum also inhibits uterine contractions and relaxes the pelvic ligaments .
 - 5. The placenta secretes placental **lactogen** that stimulates breast development .
 - 6. **Aldosterone** from adrenal cortex promotes reabsorption of sodium (leading to fluid retention).
 - 7. **Parathyroid hormone** from the parathyroid glands helps maintain a high conc. of maternal blood Ca^{++} (due to high fetal demand for calcium).
 - Note : Detecting HCG in a woman's urine or blood is used to confirm pregnancy .

Factors contributing to labor process

- 1. As the time of birth approaches, secretion of progesterone declines, and its inhibiting effect on uterine contractions may lessen .
- 2. Decreasing progesterone conc. may stimulate synthesis of prostaglandins, which may initiate labor .
- 3. Stretching uterine tissues stimulates release of oxytocin from the post. Pituitary gland .
- 4. Oxytocin may stimulate uterine contractions and aid labor in its later stages .
- 5. As the fetal head stretches the cervix, a positive feedback mechanism results in stronger and stronger uterine contractions and a greater release of oxytocin .

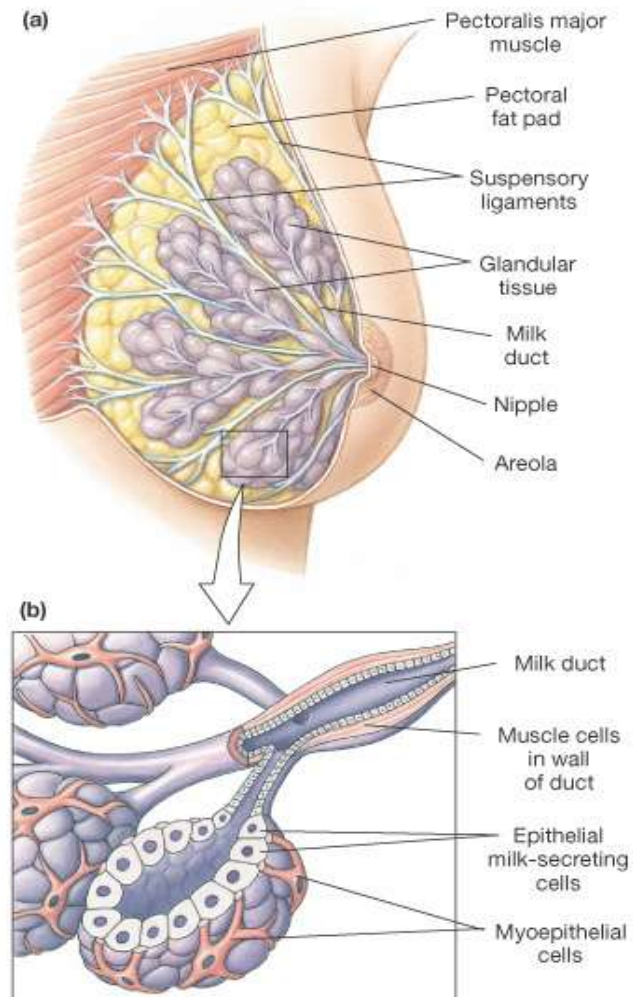
- 6. positive feedback stimulates abdominal wall muscles to contract with greater and greater force .
- 7. The fetus is forced out through the birth canal to the outside.



Hormonal control of mammary glands

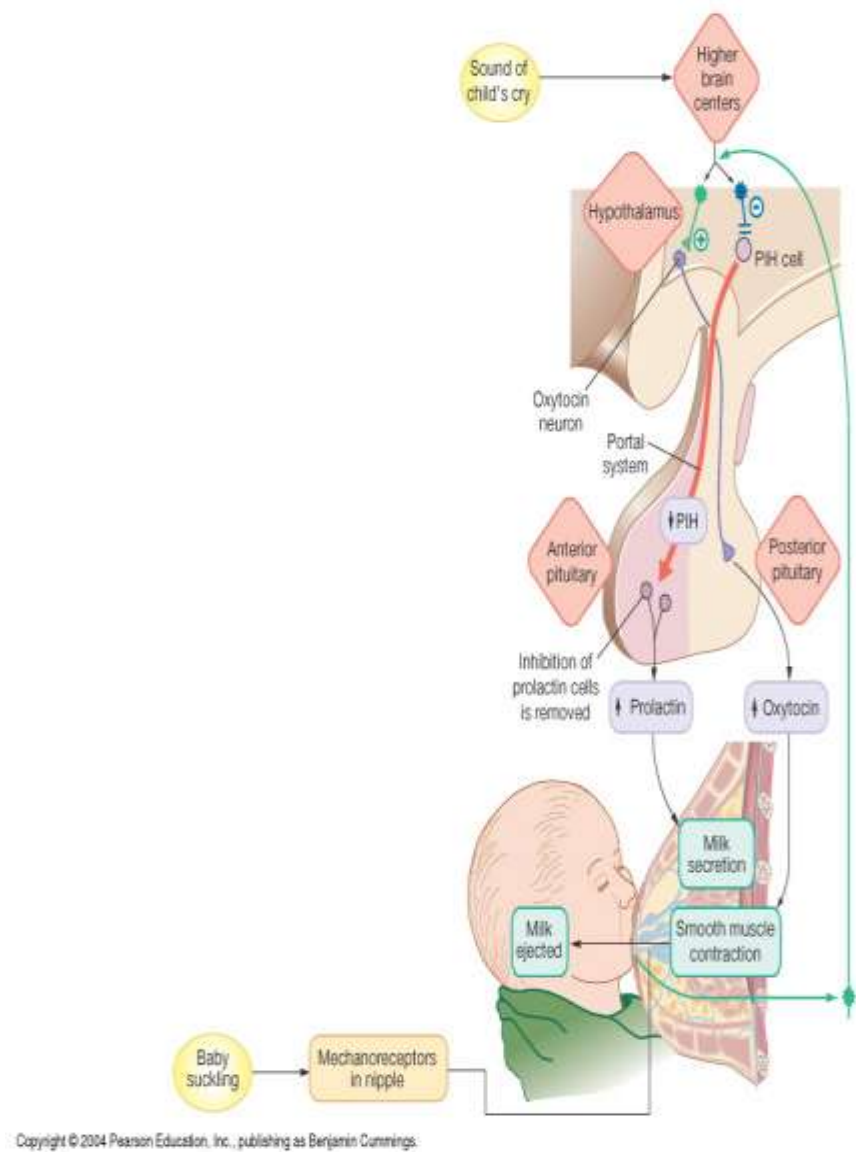
- I. **Before pregnancy** (Beginning of puberty) :
 - **Ovarian hormones** secreted during menstrual cycles stimulate alveolar glands and ducts of mammary glands to develop.
- II. **During pregnancy** :
 - **Estrogen causes** the ductile system to grow and branch.
 - Progesterone stimulates development of alveolar glands
 - Placental Lactogen promotes development of the breasts .
 - Prolactin (from Ant. pituitary) is secreted throughout pregnancy , but placental progesterone inhibits milk production (until after birth).

Structure of lactating mammary glands



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- **III. Following childbirth :**
- Placental hormonal concentrations decline , so that the action of prolactin is no longer inhibited and the breasts begin producing milk.
- Mechanical stimulation of the breasts releases oxytocin from Ant. pituitary gland.
- Oxytocin stimulates ejection of milk from ducts.
- As long as milk is removed , more prolactin is released ; if milk is not removed , milk production ceases.



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Birth Control

- 1. Birth control is a voluntary regulation of conception.
- 2. Contraception is any method used in birth control to prevent fertilization of the ovum.
- 3. The most common contraceptive methods and their success rate –
 - a. **Abstinence** (100%) done by male and female where sexual intercourse is avoided.
 - b) **Vasectomy** (99%) done by male where the vas deferens tubes are cut to prevent sperm transport.
 - c) **Tubule ligation** (99%) done by female where the uterine tubes are tied or cut to prevent ovum transport and passage of sperm.
 - d) **Birth control pills** (98%) taken by female in which daily moderate level of estrogens suppress the ovarian and menstrual cycles.

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- e) **intrauterine devices** (IUD_s) (95%) inserted under the cervix in female activates leukocytes and antibodies to be formed in the female reproductive tract , preventing sperm from entering the uterine tubes .
 - f) **condom** (90%) used by male or female is impermeable to sperm during ejaculation . [condoms also could prevent the transmission of sexually transmitted diseases] .
 - g) **diaphragm and / or foam** (80%) used by female block the entrance of sperm into the cervix .
 - h) **withdrawal method** (or coitus interrupts) (75%) done by male in which the penis is withdrawn from the vagina before ejaculation occurs.
 - i) **Rhythm method** (75%) done by female where sexual intercourse is performed only before ovulation and about a week after ovulation occurs , there are three ways to time ovulation.

Sexually transmitted diseases (STDs)

- 1. formerly called venereal diseases (VDs).
- 2. bacterial or viral infections that are spread through sexual contact .
- 3. **Gonorrhea**
 - Caused by bacterium named *Neisseria gonorrhoeae*. Bacteria invade the mucosal layer of reproductive and urinary tracts.
 - Most common symptoms in male is urethritis (infection of urethra), resulting in painful urination .
 - Symptoms in female include abdominal discomfort , vaginal discharge ,and uterine bleeding .
 - Penicillin and tetracycline antibiotic drugs are effective ,but sometimes bacteria might be resistant to these drugs.

■ 4. Syphilis

- a) caused by a bacterium named *Treponema pallidum* . It can be transmitted from mother to fetus where the fetus usually will be stillborn or die after birth .
- b) bacteria penetrate mucosal layer and skin easily ,and enter into blood and lymph .
- c) incubation period is about 12 weeks, after which a red , painless lesion appears on external genitalia .
- d) if untreated , pink skin rash will appear all over the body. Fever , joint pain , anemia , hair loss will occur if still untreated .
- e)final stage of development occurs after a 10-years latent period – bacteria invade central nervous system , blood vessels , bones , skin , and other organs – which might lead to death . penicillin is the only known treatment , but only effective during **early** stages of symptoms .

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- **5. Chlamydia**
 - Caused by a bacterium named *Chlamydia trachomatis*.
 - The most common STD in U.S.
 - Infects 3-4 million new victims each year .
 - Responsible for 25-50% of all pelvic inflammation .
 - Each year about 150,000 infants are born with the disease (in these cases , Chlamydia becomes a "congenital disease " where the fetus acquires the bacteria from mother's vagina during the birth process).
 - Symptoms are often unrecognized – urethritis , vaginal discharge , abdominal pain , painful urination and intercourse ,and irregular menstruation .
 - Infants tend to develop pneumonia .
 - Treatment is tetracycline .

■ 6. Genital herpes

- a. caused by a virus named Epstein – Barr Virus (EBV) .
- b. the most difficult STD to control or treat .
- c. most common type of genital herpes is herpes simplex virus type II (which affects mainly the lower body) .
- d. symptom is usually painful lesions on reproductive organs .
- e. can cause severe malformation of a fetus .
- f. can remain latent for years in the body with no signs or symptoms .
- g. about 25-50% of all Americans might carry this virus .



(a)

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