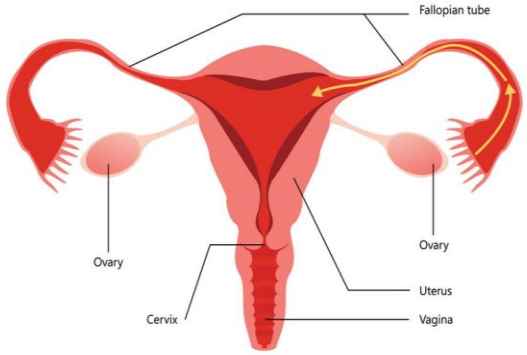
FEMALE REPRODUCTIVE SYSTEM

KHALEEL ALYAHYA, PHD, MED
www.teachanatomy.net

introduction

- The female reproductive system consists of the female sexual organs, and is involved in sexuality, fertility and propagation of the species.
- It is a complex system as it also has to support the developing fetus if pregnancy occurs.
- It is one of the few body systems where a person can function quite well if some organs have to be removed because of disease.



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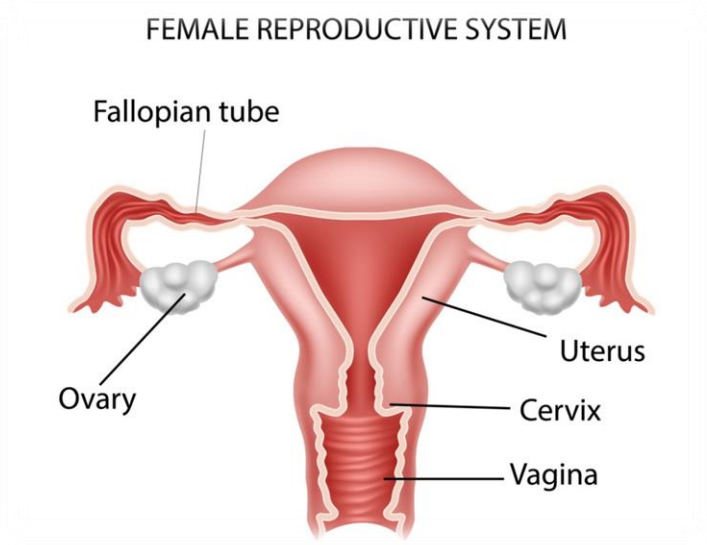
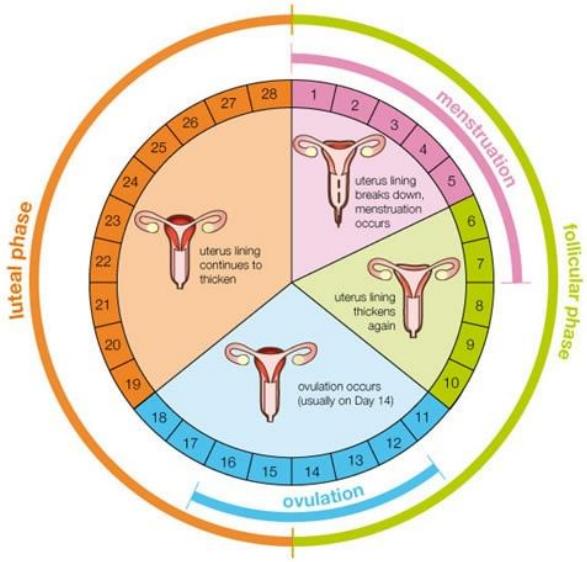
structures

- The female reproductive system is designed for procreation or reproduction.
- It does this through the production of female **gametes** or eggs, called **ova** (singular: **ovum**) or oocytes, which are released on a monthly basis by the ovaries, where they have been produced and stored.
- Each ovum is transported through one of the two **fallopian tubes** to the uterus.
- If the ovum is fertilized by sperm from a male, it will implant into the uterus which has been prepared to support fetal growth until maturity.
- In the event that the egg is not fertilized, the body will shed the lining of the uterus in a process called **menstruation**.
- The female reproductive system produces the female sex hormones, **oestrogen** and **progesterone**, that sustain this monthly cycle of creating and discarding the protective environment of the uterus for a growing fetus.
- **Menarche** is the term given to the point during puberty when the female first experiences menstruation.
- The age of menarche differs from woman to woman but is generally between the ages of 11 and 14.



functions

- In later life, around the ages of **45–55**, the female reproductive system gradually stops creating the female hormones and the reproductive cycle slows and stops.
- When there is no longer production of the oestrogen and progesterone, **ova** are no longer produced by the ovaries and a woman is said to be **menopausal**.
- The **menstrual cycle**, which involves the body's changes associated with the development of an egg and the possibility of pregnancy, is generally around **28** days in length. However, it can vary from 20–40 days.
- In some women, the length of the menstrual cycle can change or become irregular in reaction to stress, weight changes, excessive physical activity or travelling.
- The cycle begins on the first day of the menstrual period and ends the day before the next period starts.
- Each cycle has four phases: **menstrual phase**, **follicular phase**, **ovulation** and **luteal phase**.



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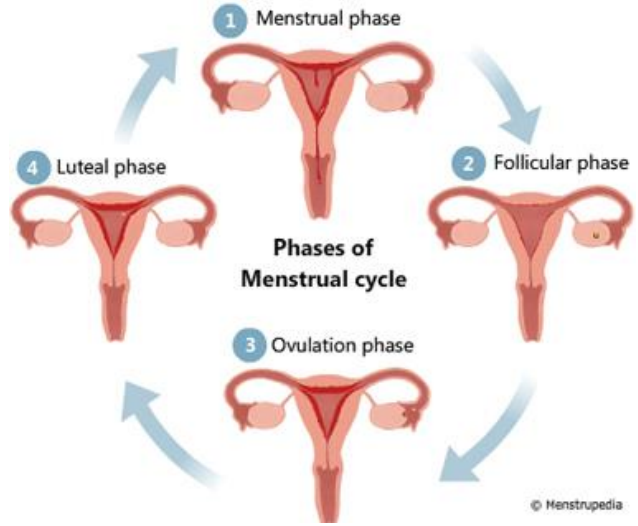
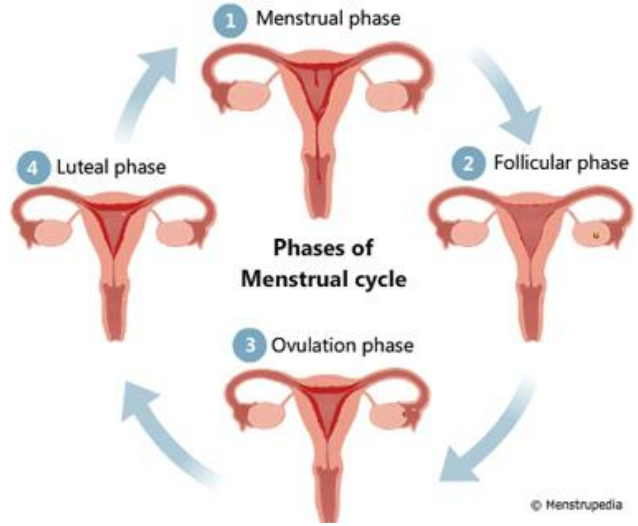
follicular phase

- During the **follicular phase**, the pituitary gland releases follicle-stimulating hormone (**FSH**) which instructs the ovary to develop between 10 and 20 follicles or groups of cells, each containing an **ovum**, or immature egg.
- The hypothalamus in the brain identifies the rising levels of **oestrogen** caused by the development of the follicles, and releases a chemical called gonadotrophin-releasing hormone (**GnRH**) which initiates release of luteinizing hormone (**LH**) and more **FSH** from the pituitary.
- The **oestrogen** also triggers a spongy thickening of the endometrium, or lining of the uterus, to around 3 mm.
- In normal circumstances only one of the follicles (the **graafian follicle**) grows into a mature egg while the others break down and are reabsorbed by the body.



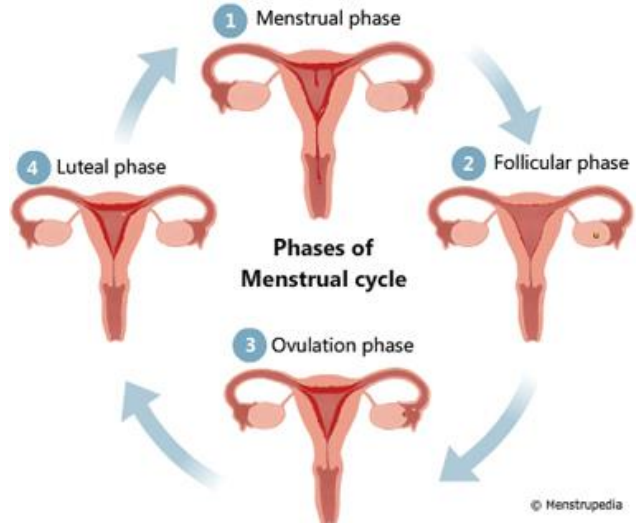
ovulation

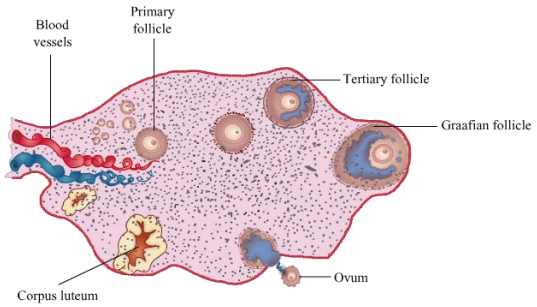
- During the first half of the menstrual cycle, the oestrogen levels rise as the pituitary gland produces more luteinizing hormone (**LH**) and follicle-stimulating hormone (**FSH**).
- The rise in the luteinizing hormone causes **ovulation**, the release of the egg from one of the ovaries.
- The ovum travels down the fallopian tube, taking about 5 days to reach the uterus if it is **fertilized**.
- If it is not fertilized, the ovum will live no longer than 24 hours, and generally between 6 and 12 hours.
- It will then shatter and get reabsorbed.



luteal phase

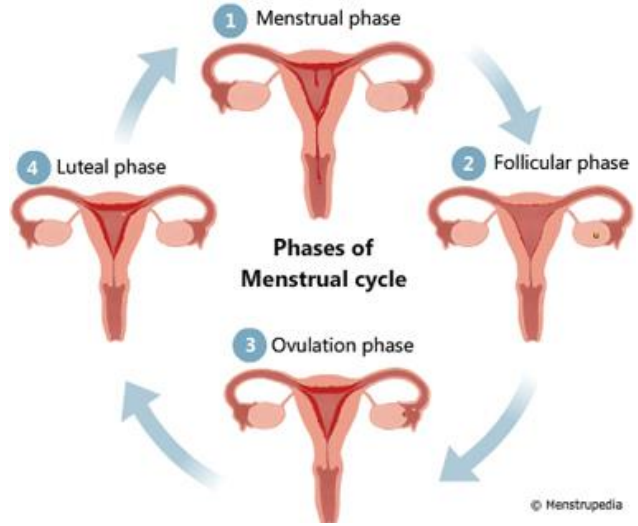
- The luteal or secretory phase refers to the time when a solid mass called the **corpus luteum** grows on the surface of the ovary from what is left of the follicle after the egg has been released.
- The corpus luteum produces hormones, particularly **progesterone**, which have an important role in preparing the endometrium to accept the fertilized ovum.
- The increase in progesterone levels also triggers the production of oestrogen by the adrenal glands and suppresses manufacture of FSH and LH.
- The reduction of these two hormones causes the corpus luteum to then deteriorate and atrophy.
- In the absence of fertilization, the progesterone levels continue to fall, initiating breakdown of the endometrial lining leading to menstruation and the start of the next cycle.
- If the ovum is **fertilized**, the resulting embryo produces human chorionic gonadotrophin (**hCG**) which preserves the corpus luteum.
- hCG is unique to the creation of the embryo and most pregnancy tests look for its presence.

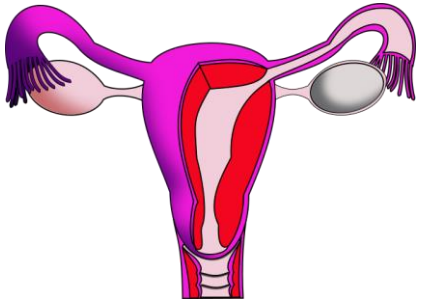




menstruation

- Menstruation is the purging of the thickened lining of the endometrium from the body through the vagina.
- Menstrual fluid contains blood, endometrial cells and mucus.
- The average length of a menstrual period is 3–7 days but the length differs from woman to woman.

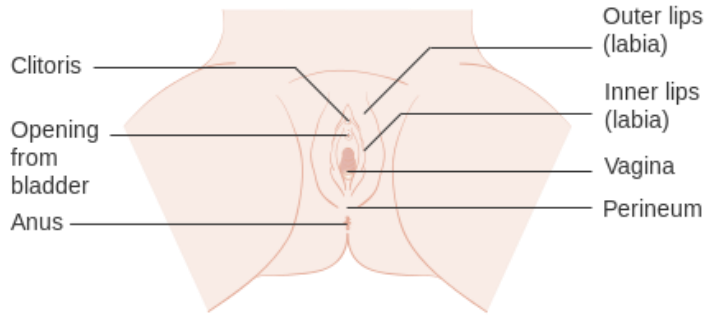




FEMALE REPRODUCTIVE ORGANS

vulva

- It is the ONLY external organ of female reproduction.
- All other organs are internal.
- The vulva is the collective name for the external genitalia, consisting of the **mons pubis**, **labia majora**, **labia minora**, **clitoris**, **Bartholin's gland** and the **perineum**.
- The opening of the urethra is also part of the vulva.



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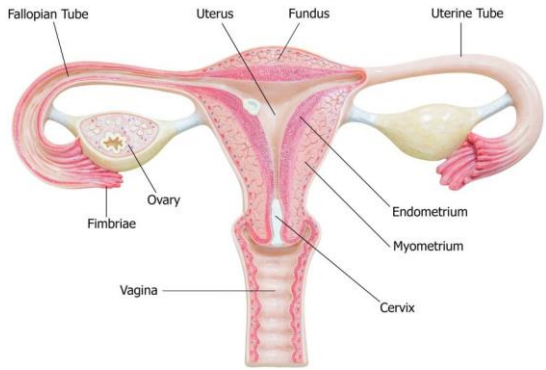
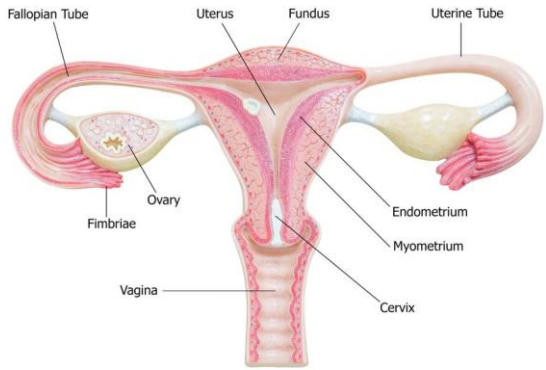
ovaries

- The right and left **ovaries** are the main female reproductive organs located just below the fallopian tubes.
- Each female infant is born with more than 1,000,000 follicles from which the mature ova grow and develop.
- By the time of menarche, around 40,000 of the follicles remain, with the rest having been absorbed by the body.
- In addition to producing ova, the ovaries release female hormones (**oestrogen** and **progesterone**).
- The oval-shaped ovaries are situated in the pelvic cavity and are attached to the uterus by ligaments.
- When a mature ovum bursts out of its follicle around every 28 days, it is picked up by the **fimbriae** at the end of the fallopian tube and swept down towards the uterus.



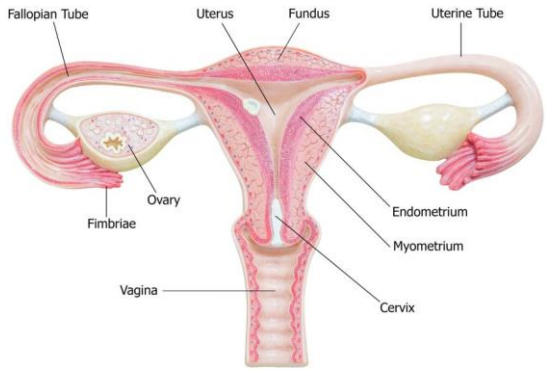
fallopian tube

- After the ovum is released from the ovary and picked up by the fimbriae, it moves to the funnel-shaped end of the fallopian tube called the **fallopian tube**.
- The ovum moves through the fallopian tube through the action of wave-like muscle contractions and the rhythmic beating of the cilia, microscopic hairs on the walls of the fallopian tubes.
- The cilia also help sperm swim towards the egg so that conception (the fertilization of an egg with sperm) occurs, most commonly in the part of the fallopian tube closest to the ovary.



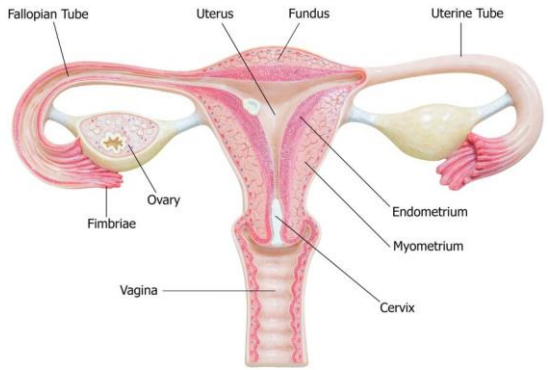
uterus

- The uterus is a hollow cavity that plays a vital role in developing a fertilized ovum.
- The body of the uterus sits low in the pelvic cavity, while above the entrance of the fallopian tubes is the uterine fundus.
- A narrow passage called the **cervix** extends from the uterus into the vagina.
- The uterus has very thick layered walls.
- The innermost layer is the **endometrium**, which is where a fertilized egg implants and grows.
- The muscular middle layer is called the **myometrium** and this layer contracts rhythmically during childbirth to help the baby move through the vagina.
- The outer layer is the **perimetrium**, a serous membrane that is attached to the peritoneum which lines the organs of the abdominal and pelvic cavities.



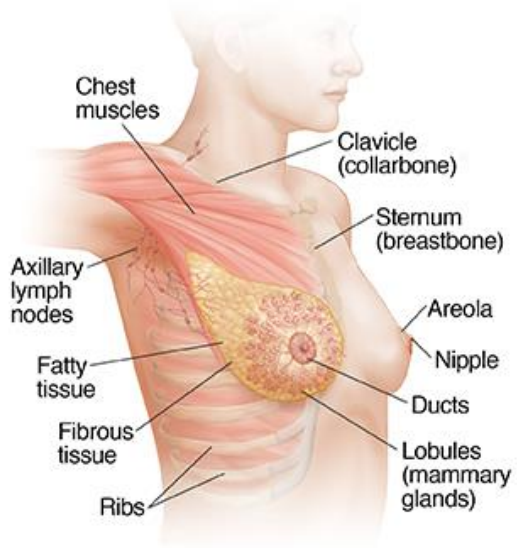
vagina

- The vagina is a fibromuscular passage that extends from the cervix to the entry of the vulva.
- The vagina accepts semen ejaculated through a male penis during sexual intercourse and also provides a path for menstrual blood to leave the body.



breasts

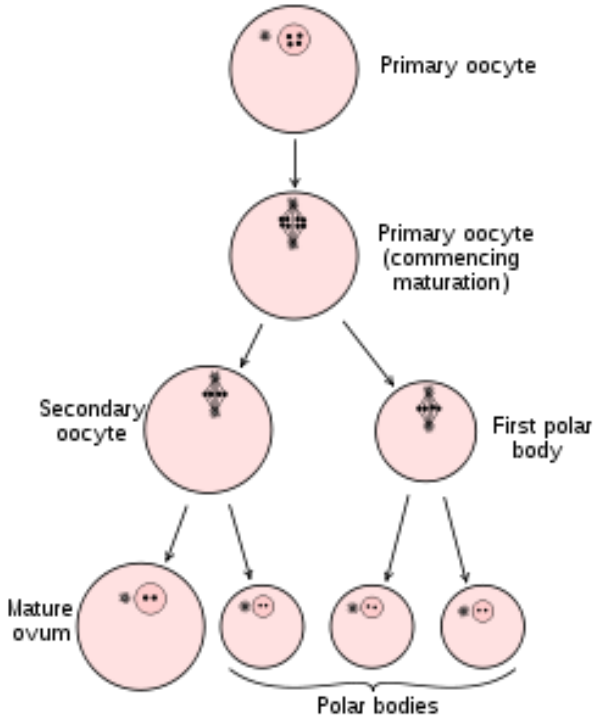
- Female breasts are specialized organs located on the anterior chest wall.
- The main function of the breast is to produce milk for feeding a baby.
- During puberty, **oestrogen** and **progesterone** promote breast growth and maturation.
- During the final weeks of pregnancy, the breasts start production of milk.
- Breasts consist of mammary or milk glands (lobules) that produce and supply the milk, lactiferous ducts that transfer the milk from the lobules to the nipple, the nipple and its surrounding pigmented area called the areola where a baby attaches to suckle, fat and connective tissue.



OOGENESIS

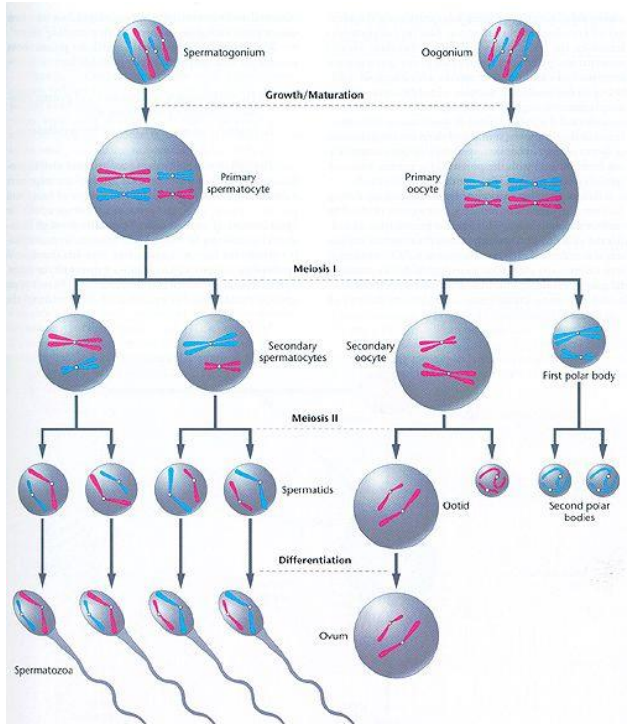
oogonia

- **Meiosis**, the special kind of cell division that occurs in the testes to produce sperm, also occurs in the ovaries to produce ova or (female gametes) are produced, and the process is called **oogenesis**.
- In the developing female fetus, **oogonia**, the female stem cells, multiply rapidly to increase their number, producing daughter cells called **primary oocytes**.
- These primary oocytes then push into the ovary connective tissue, where they become surrounded by a single layer of cells to ultimately form the **primary follicles**.
- By birth, the oogonia no longer exist, and a female's life-time supply of **primary oocytes** (approximately 1 million of them) is already in place in the **ovarian follicles**, awaiting the chance to undergo meiosis to produce functional eggs.
- Because the primary oocytes remain in this state of suspended animation all through childhood, their wait is a long one—usually from 10 to 14 years.



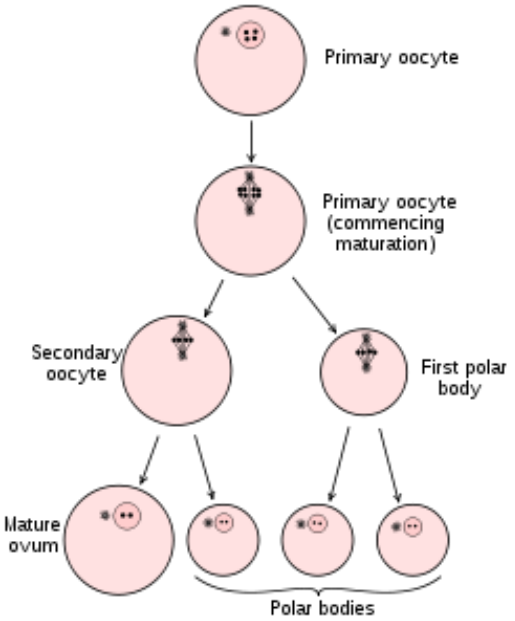
oocytes

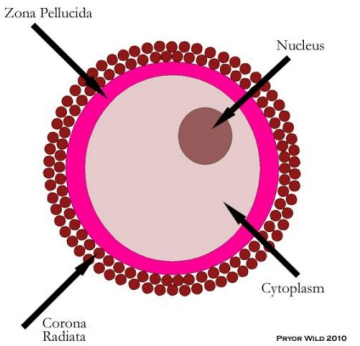
- At puberty, the anterior pituitary gland begins to release **FSH** (follicle-stimulating hormone), which stimulates a small number of primary follicles to grow and mature each month, and **ovulation** begins to occur each month.
- These cyclic changes that occur monthly in the ovary constitute the ovarian cycle.
- At puberty, perhaps 300,000 oocytes remain; and, beginning at this time, a small number of oocytes are activated each month.
- As the reproductive life of a female is about 40 years (from the age of 11 to approximately 51), and there is typically only one ovulation event per month, fewer than **500** ova out of the potential **300,000** are released during her lifetime.
- Again, nature has provided us with a generous oversupply of sex cells.

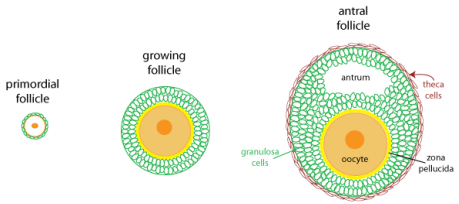


secondary oocyte

- As a follicle prodded by FSH grows larger, it accumulates fluid in the central chamber called the **antrum**, and the primary oocyte it contains replicates its chromosomes and begins meiosis.
- The first meiotic division produces two cells that are very dissimilar in size.
- The larger cell is a secondary oocyte, and the other, very tiny cell is a **polar body**.
- By the time a follicle has **ripened** to the mature (vesicular follicle) stage, it contains a secondary oocyte and protrudes from the external surface of the ovary.
- Follicle development to this stage takes about 14 days, and ovulation (of a secondary oocyte) occurs at just about that time in response to the release of a second anterior pituitary hormone, luteinizing hormone (LH).
- The ovulated secondary oocyte is still surrounded by its follicle-cell capsule, now called the **corona radiata** ("radiating crown")

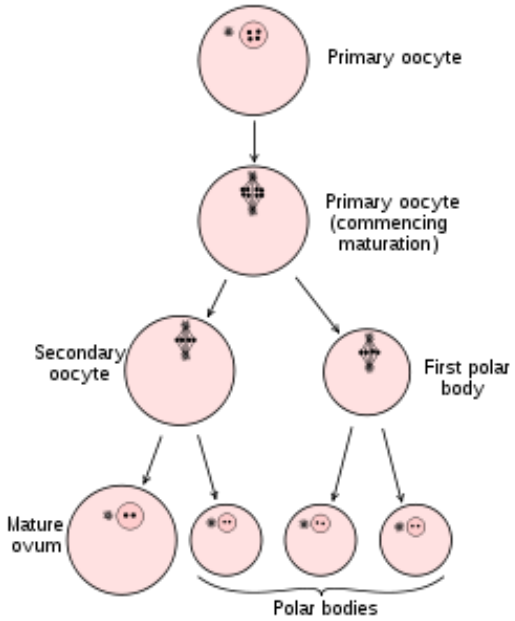






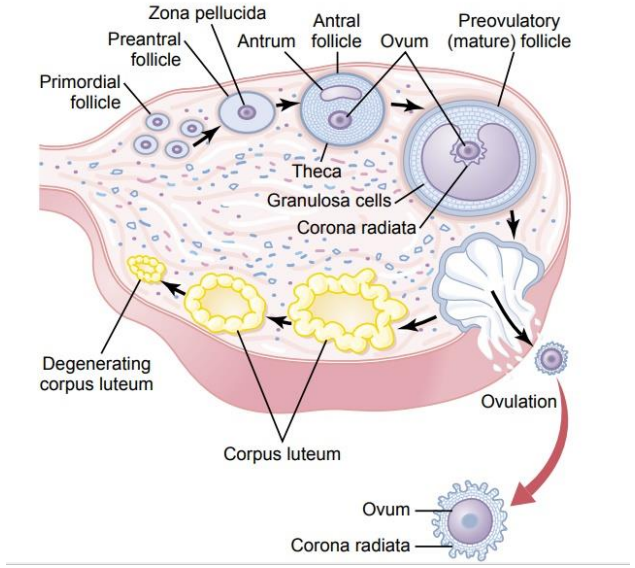
ovum

- If the ovulated secondary oocyte is fertilized by a sperm in one of the uterine tubes, the oocyte quickly completes the second meiotic division that produces the **ovum** and another **polar body**.
- Once the ovum is formed, its 23 chromosomes are combined with those of the sperm to form the zygote.
- However, if a sperm does not penetrate the secondary oocyte, it simply deteriorates without ever completing meiosis to form a functional egg.
- Although meiosis in males' results in four functional sperm, meiosis in females yields only one functional ovum and three tiny polar bodies.
- The polar bodies, produced to reduce the number of chromosomes in the developing oocyte, have essentially no cytoplasm, so they die quickly.



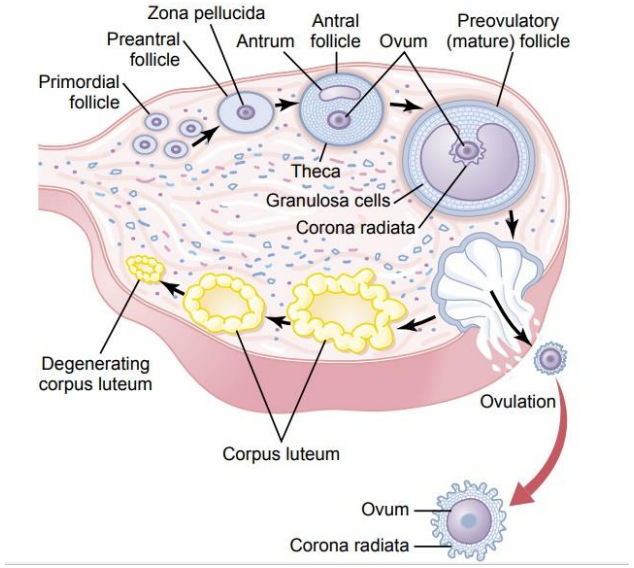
estrogens

- As the **ovaries** become active at puberty and start to produce **oocytes**, they also begin to produce ovarian **hormones**.
- The follicle cells of the growing and mature follicles produce **estrogens**, which cause the appearance of secondary sex characteristics in the young woman.
  - Enlargement of the accessory organs of the female reproductive system (uterine tubes, uterus, vagina, external genitals).
  - Development of the breasts.
  - Appearance of axillary and pubic hair.
  - Increased deposits of fat beneath the skin in general, and particularly in the hips and breasts.
  - Widening and lightening of the pelvis.
  - Menstrual cycle.
- Estrogen also has metabolic effects.
- For example, it helps maintain low total blood cholesterol levels and facilitates calcium ion uptake, which sustains bone density.



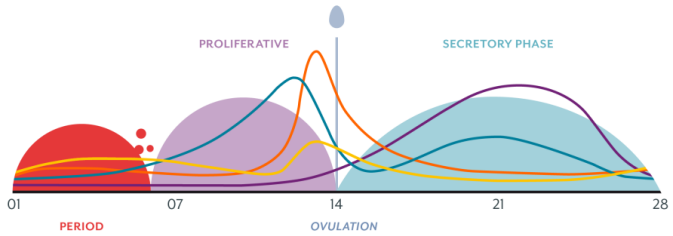
progesterone

- A second ovarian hormone, **progesterone**, is produced by the glandular **corpus luteum**.
- As mentioned earlier, after ovulation occurs, the ruptured follicle is converted to the corpus luteum, which looks and acts completely different from the growing and mature follicle.
- Once formed, the corpus luteum produces progesterone as long as LH is still present in the blood.
- The corpus luteum stops producing hormones by 10 to 14 days after **ovulation**.
- Progesterone does not contribute to the appearance of the secondary sex characteristics.
- The other major effects during pregnancy, when it helps to maintain the pregnancy and prepare the breasts for milk production.
- However, the source of progesterone during pregnancy is the **placenta**, not the ovaries.



uterine (menstrual) cycle

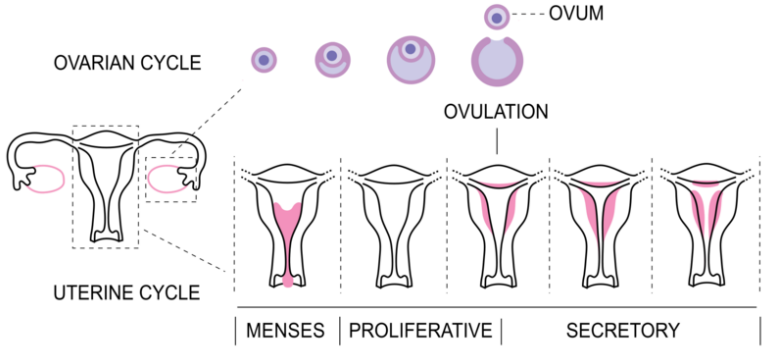
- The cyclic production of **estrogens** and **progesterone** by the ovaries is regulated by the anterior pituitary gonadotropic hormones, **FSH** and **LH**.
- It is important to understand how these “hormonal pieces” fit together.
- Both **female cycles** (the ovarian and the uterine cycles) are about 28 days long.
- **Ovulation** typically occurs midway in the cycles, on or about day 14.
- **The following are the three phases of the menstrual cycle:**



Uterine Cycle

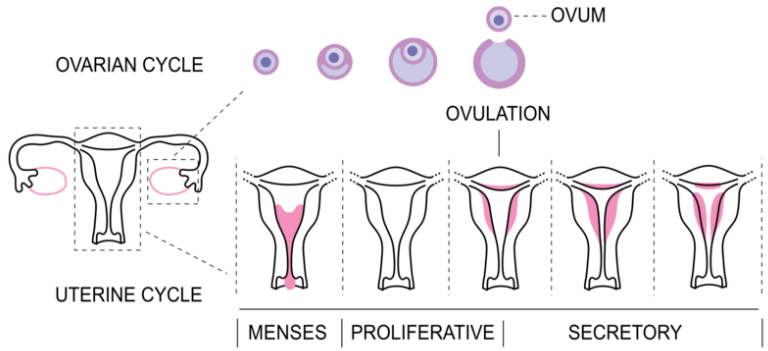
menstrual phase

- Days 1–5
- During this phase, the superficial functional layer of the thick endometrial lining of the uterus is detaching from the uterine wall.
- The detached tissues and blood pass through the vagina as menstrual flow (the “period”) for 3 to 5 days.
- The average blood loss during this period is 50 to 150 ml (or about ¼ to ½ cup).
- By day 5, growing ovarian follicles are beginning to produce more estrogens.



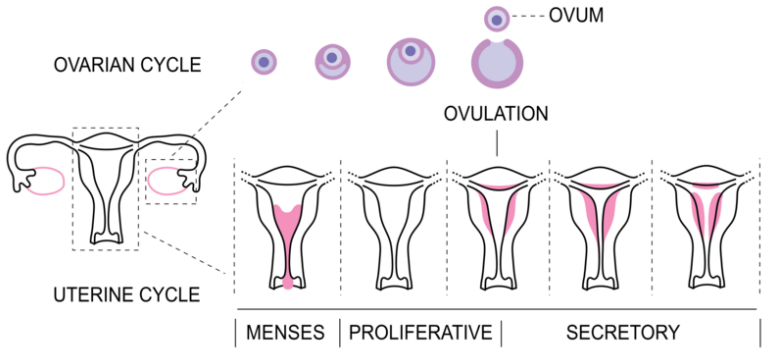
proliferative phase

- Days 6–14
- Stimulated by a rising level of **estrogens** produced by the growing **follicles** of the ovaries, the basal layer of the endometrium regenerates the functional layer, glands form in it, and the endometrial blood supply increases.
- The **endometrium** once again becomes smooth, thick, and well vascularized.
- **Ovulation** occurs in the ovary at the end of this stage, in response to the sudden rise of LH in the blood.)



secretory phase

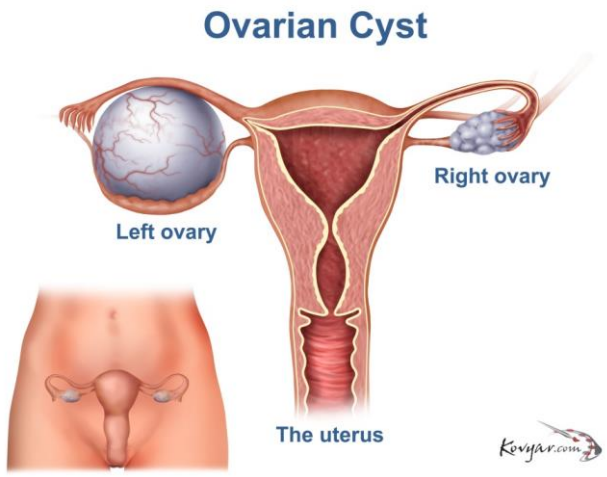
- Days 15–28
- A rising level of **progesterone** production by the corpus luteum acts on the endometrium and increases its blood supply even more.
- Progesterone also causes the endometrial glands to grow and begin secreting nutrients into the uterine cavity.
- These nutrients will sustain a developing embryo (if one is present) until it has implanted.
- If fertilization **does** occur, the embryo produces a hormone very similar to **LH** that causes the corpus luteum to continue producing its hormones.



PATHOLOGY & DISEASES

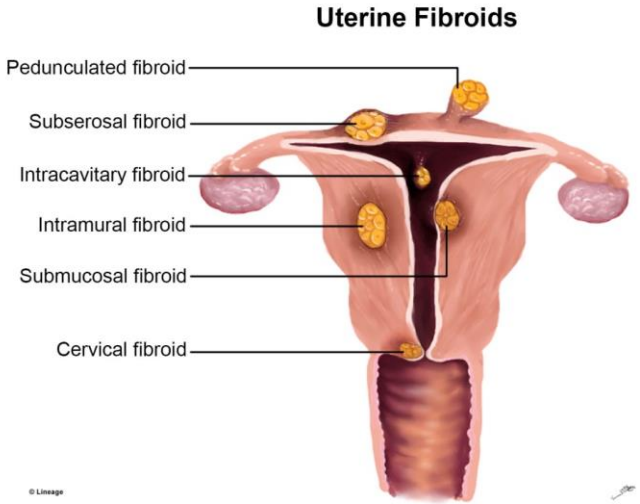
ovarian cyst

- An ovarian cyst is fluid-filled masses that may develop in the ovary.
- They are most derived from ovarian follicles, reaching approximately 2-2.5 cm.
- Most ovarian cysts are benign and develop during a woman's child-bearing years, however, some larger cysts may cause problems such as bleeding and pain, and they may require surgical removal.
- Diagnosis is by **pelvic examination**, **ultrasonography** and **laparoscopy** or as an incidental finding during another procedure.



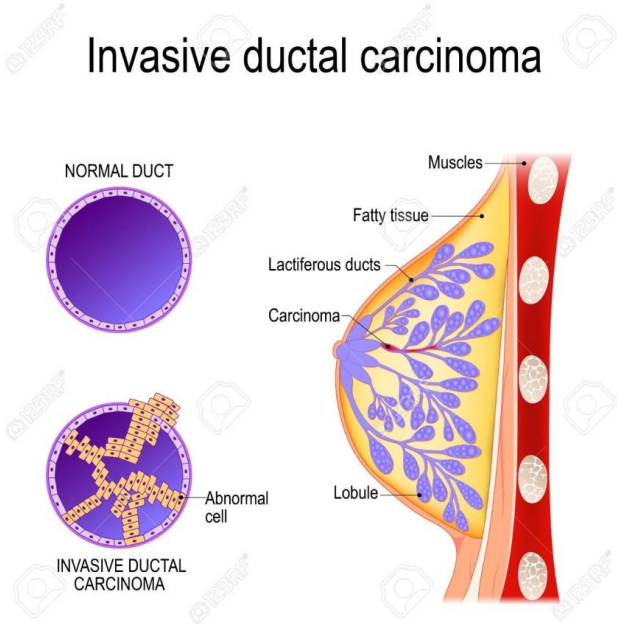
uterine leiomyoma

- A uterine **leiomyoma** (plural: leiomyomata) is the most common benign tumor in women, with around 20% of women developing one in their lifetime.
- It occurs in the smooth muscle of the uterus.
- The cause is unknown, but it is thought that it may be due to an increase in oestrogen and growth hormone.
- Leiomyomata are harmless in themselves but can cause complications such as **infertility**, **anaemia**, intestinal **obstruction**.
- In pregnancy, they may result in spontaneous **abortion**, premature labor or **dystocia**.
- Diagnosis is by blood studies, ultrasound examination, submucosal hysterosalpingography or laparoscopy.



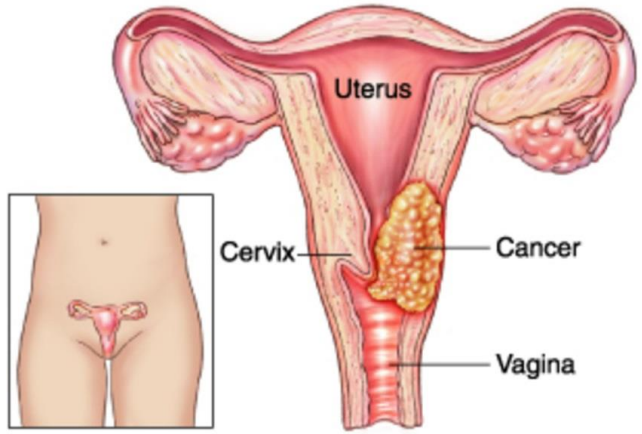
carcinoma of the breast

- Carcinoma of the breast is a malignant tumor of breast tissue.
- It is one of the leading causes of death in women.
- The most common type is invasive ductal carcinoma.
- Other types include: inflammatory carcinoma, medullary carcinoma, lobular carcinoma.
- It is common for carcinoma of the breast to **metastasise**.
- Initial spread will be to the axillary lymph nodes, then the chest wall and skin.
- Secondary spread to brain, bone and other sites can also occur.
- Breast cancer is often first diagnosed by breast self examination or mammogram.
- Diagnosis is confirmed by biopsy, needle core, needle aspiration or surgical specimen.



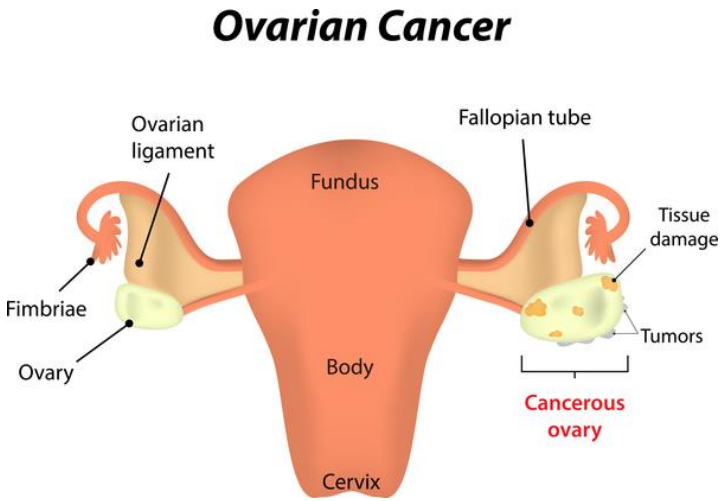
carcinoma of the cervix

- Carcinoma of the cervix is a progressive tumor that begins as dysplasia of cervical cells which, without treatment, will become an invasive carcinoma.
- It is often associated with the presence of human papillomavirus.
- Cervical cancer is usually asymptomatic in its early stages but is easily detected by a Pap smear.
- If diagnosed early, it is curable.



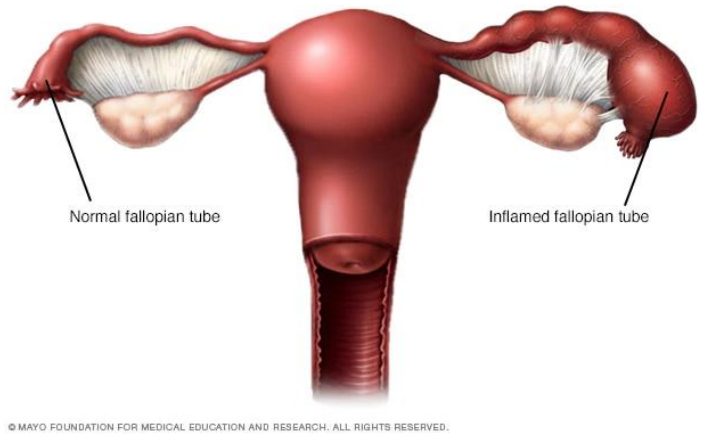
carcinoma of the ovary

- Carcinoma of the ovary is a malignant tumor of ovarian tissue.
- It is sometimes called the "**silent killer**" because it is asymptomatic in its early stages and has often metastasized to the liver, pelvis and lungs before any symptoms are experienced.
- When symptoms occur, they are non-specific, such as fatigue, lethargy and bloating.
- Diagnosis is by ultrasound and biopsy of any lesion found.



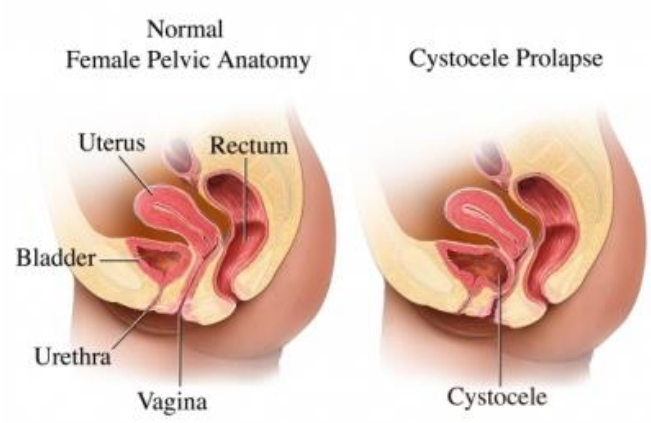
pelvic inflammatory disease

- Pelvic inflammatory disease is a **bacterial** infection of the female genital tract that may involve the uterus, ovaries, fallopian tubes and adjacent organs.
- It usually starts in the vagina often as part of a sexually transmitted infection such as **gonorrhoea**, and moves up into the uterus, then on to the other organs.
- Complications include peritonitis, scarring and adhesions, infertility and an increased risk of an ectopic pregnancy.



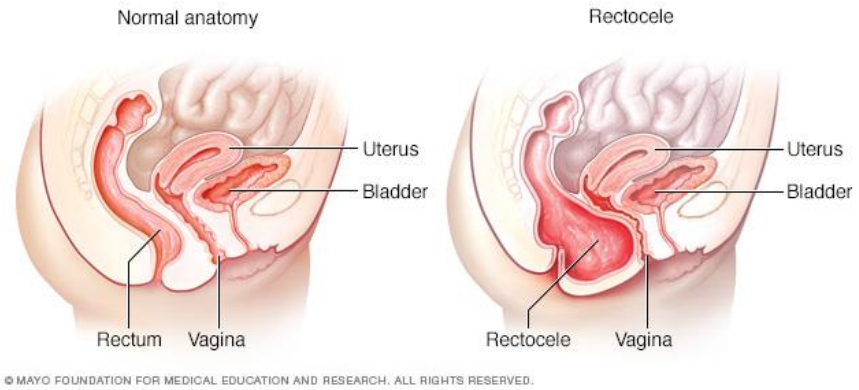
cystocele

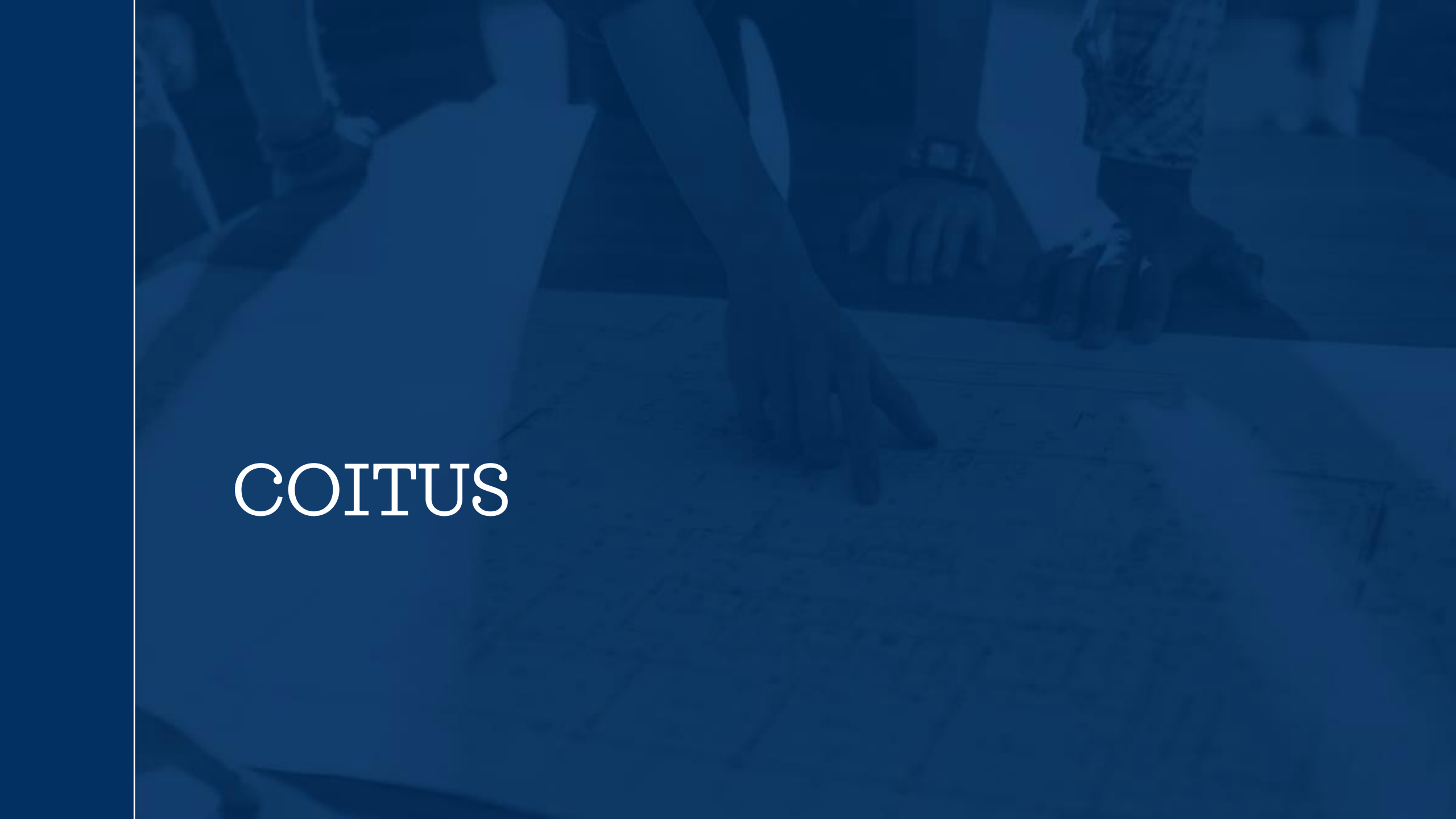
- A **cystocele** is a herniation of the urinary bladder into the vagina as a result of trauma or lax pelvic floor muscles and ligaments.
- Symptoms include urinary frequency, incontinence and pelvic pressure.



rectocele

- A **rectocele** is a herniation of the rectum into the vagina as a result of a weak vaginal wall after pregnancy and childbirth.
- Symptoms include dyspareunia and difficult defecation.



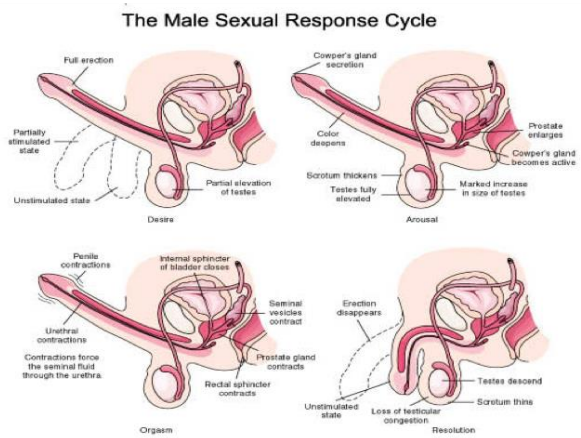

COITUS

introduction

- Coitus is the initial stages that occur in humans that allow for the establishment of pregnancy. Sexual intercourse that results in the deposition of sperm in the vagina at the level of the cervix is known as coitus.
- For coitus to occur humans need to be sexually aroused.
- Sexual arousal is then followed by a series of phases.
  - Excitement phase
  - Plateau phase
  - Orgasmic phase
  - Resolution phase

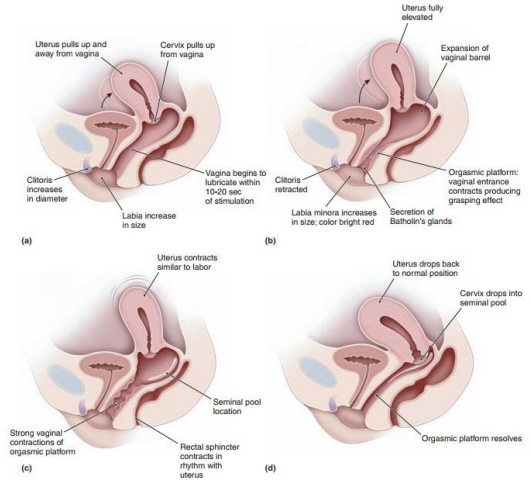
male sexual response

- The changes that occur to allow coitus involve genital and systemic alterations in both sexes.
- The first part of sexual stimulation in a male results in the production of an erection.
- An erection may be produced due to psychogenic or somatogenic stimuli.
- Psychogenic stimuli cause stimulation of efferent nerves to the penis via the limbic system from sensory cues such as images.
- Somatogenic stimuli cause this same stimulation but through sensation such as touching the penis.
- The plateau phase in males results in an increase in the penile erection, increase in the size of the testicles and a rise in heart rate and blood pressure.
- The orgasmic phase has two parts: emission and ejaculation.
  - Emission is where several structures contract in order to mix the contents of ejaculate.
  - Ejaculation is where semen is then expelled from the prostatic urethra due to muscular contractions.
- The final part of the sexual response cycle is the resolution phase and in males this is split into two stages. The first stage results in the penis reducing from full erection to 50% larger than its unstimulated size and the second, longer phase, results in the penis reducing to its normal unstimulated size.



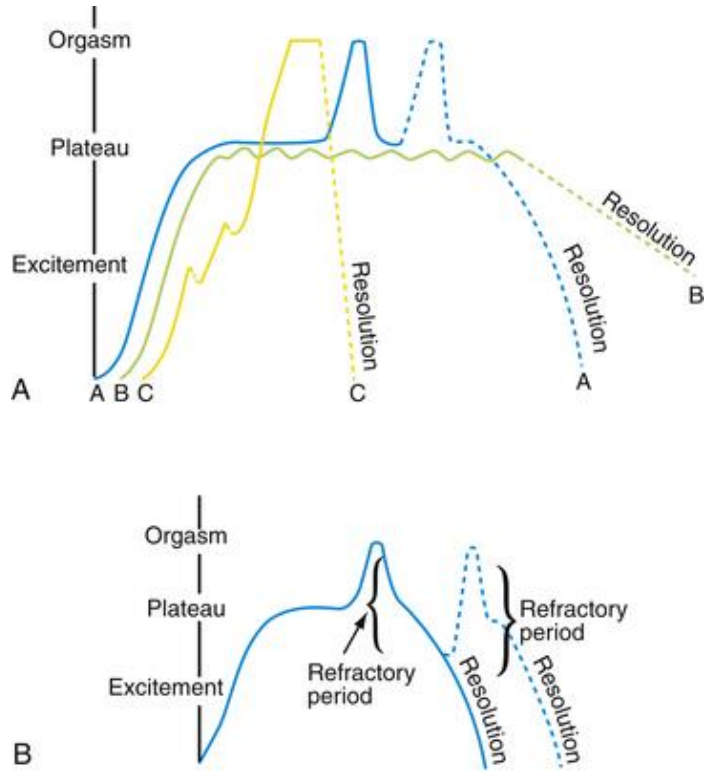
female sexual response

- The autonomic nervous system that controls the four parts of coitus is the same in males and females, however the responses of the genital organs are different.
- The excitement phase results in anatomical changes that increase the circumference of the vaginal diameter at the level of the pelvis and lubricate the vagina for penile entry.
- Following the excitement phase, the plateau phase results in the labia minora becoming red in appearance as well as the respiratory rate, heart rate and blood pressure increasing.
- Within females, the orgasmic phase does not include emission and ejaculation.
- The orgasm includes contraction of the lower third of the vagina and can extend to whole vagina and uterus.
- The final phase of resolution encompasses several changes that result in the return of the structures to normal unstimulated states.



male vs. female sexual responses

- There are several differences in the physiological sexual response of males and females:
  - Emission and ejaculation do not occur in the female.
  - Females are capable of several orgasms and the orgasm may last relatively longer than that of a male.
  - Females are able to reach the plateau phase and sustain it then return to an unstimulated state without orgasm.

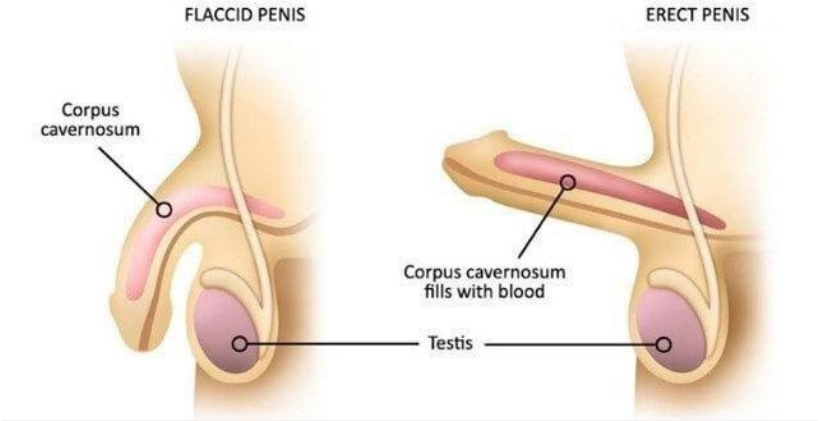


sexual dysfunction

- It can be caused by a change in desire or arousal.
- The most common type of sexual dysfunction is when there is a problem with desire.
- There are several types of sexual dysfunctions caused by an abnormality in desire:
  - Hypoactive: little of no interest in sex.
  - Aversion: revulsion or fear of sex.
  - Hyperactive.
  - Nymphomaniac.
  - Kluver Bucy syndrome.
    - It is a rare behavioral impairment that is associated with damage to both of the anterior temporal lobes of the brain.
    - It causes individuals to put objects in their mouths and engage in inappropriate sexual behavior

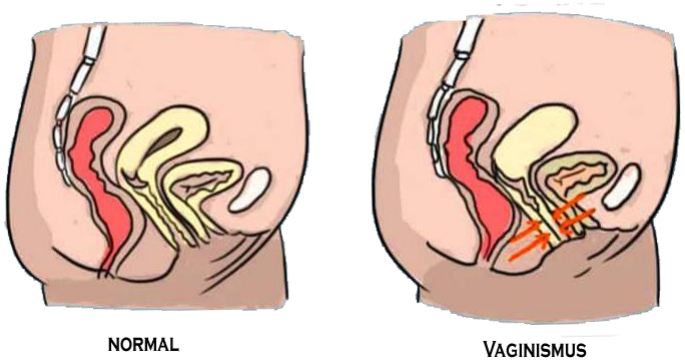
impotence

- The problem with arousal in male is called impotence.
- Impotence can be caused by descending inhibition of spinal reflexes due to psychological problems, tears in fibrous tissue of corpora cavernosa, vascular abnormalities (atherosclerosis and diabetes) and certain drugs.
- Viagra (sildenafil) can be prescribed for males and works by inhibiting cGMP breakdown and results in an increased nitric oxide action that produces an erection.
- Sperm abnormalities may be another reason for sexual dysfunction, and this could be a low level of sperm within the ejaculate (oligospermia) or sperm morphological defects.



vaginismus

- Vaginismus is a condition that may affect individuals with vaginas.
- It is described as involuntary contraction of the vaginal musculature, which usually results in the failure of penetration.
- This can be as a result of a number of psychosocial factors in an individual's life including stress, previous abuse, or substance misuse.



QUESTIONS?

alkhaleel@ksu.edu.sa
www.teachanatomy.net