ANATOMY AND PHYSIOLOGY OF FEMALE REPRODUCTIVE ORGAN

DR AHED MANSOUR ALQAMMASH
OB/GY CONSULTANT

INTRODUCTION

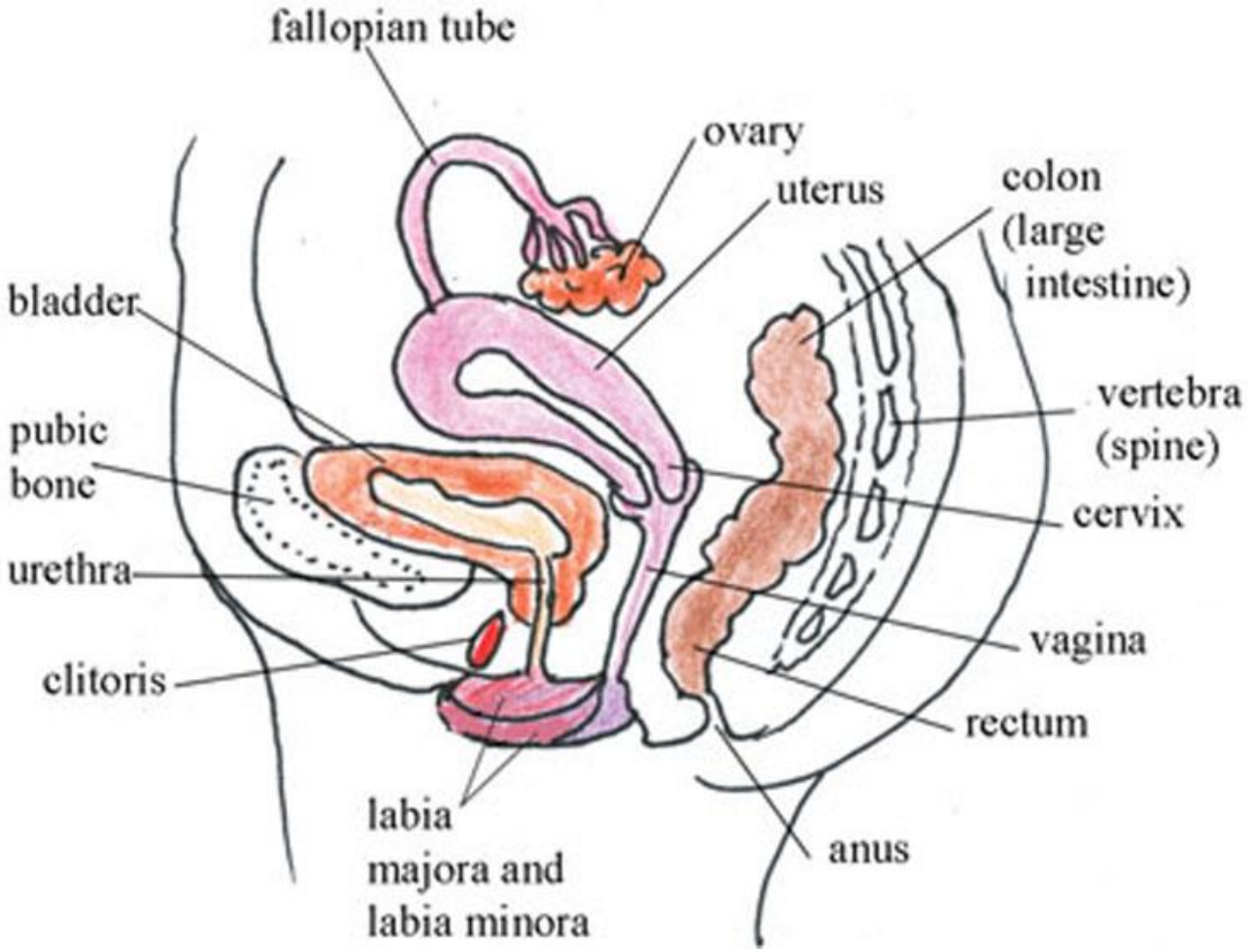
- The female reproductive system includes the ovaries, fallopian tubes, uterus, vagina, vulva, mammary glands and breasts. These organs are involved in the production and transportation of gametes and the production of sex hormones. It also facilitates the fertilization of ova by sperm and supports the development of offspring during pregnancy and infancy.

THE FEMALE GENITAL ORGAN CONSISTS OF INTERNAL AND EXTERNAL ORGANS: .

Internal female genital organs

1. Vagina
2. Uterus
3. Fallopian tubes
4. Ovaries

INTERNAL FEMALE GENITAL ORGAN



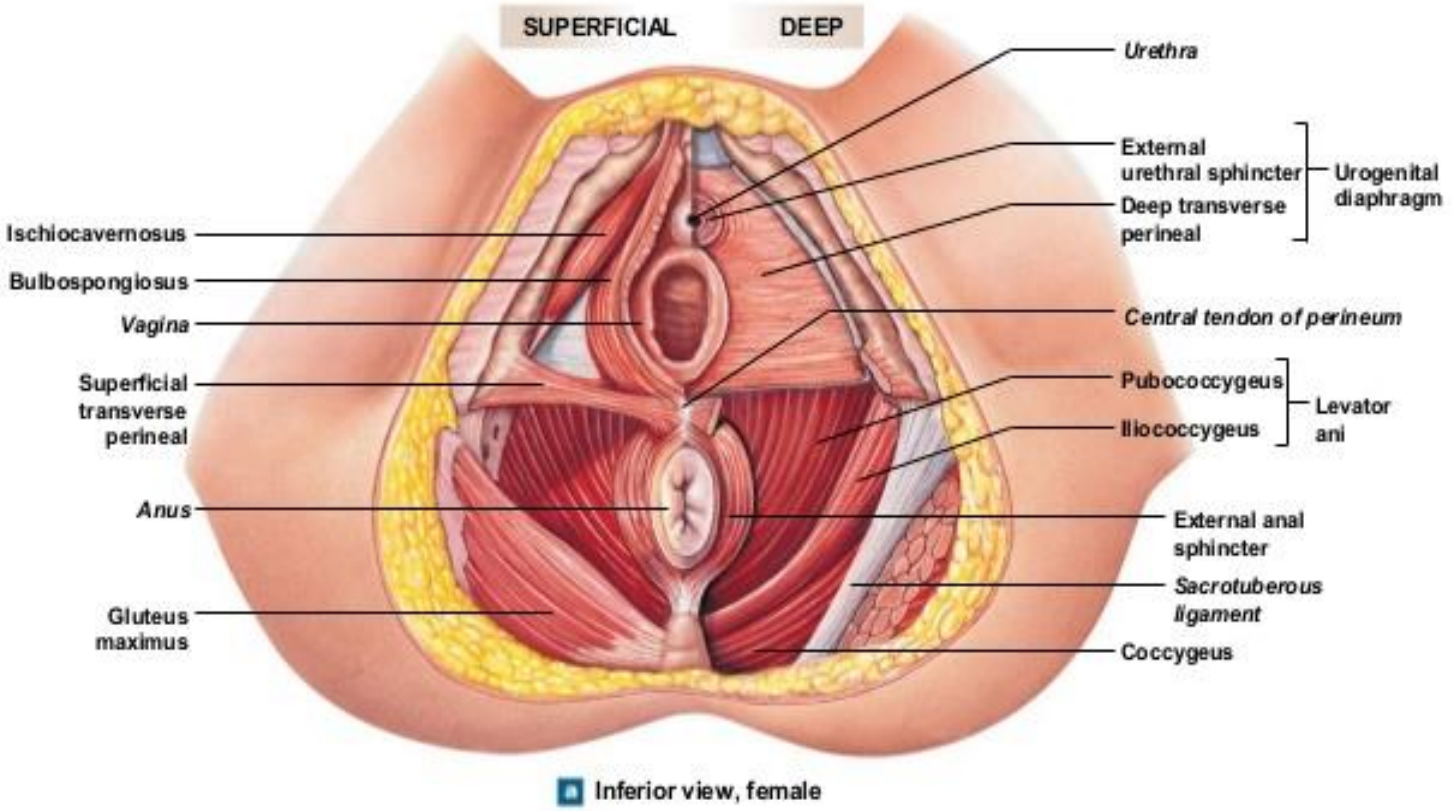
Vagina

- This is a **fibromuscular** sheath lined with **stratified squamous epithelium**.
- It forms the inferior portion of the **female genital tract** and the **birth canal**.
- It communicates **superiorly with the cervical canal** and extends to the vestibule of the vagina
- Its **anterior** and **posterior** walls are normally in **apposition**, except at its **superior end** .
- The vagina is located **posterior to the** urinary bladder and **anterior to the** rectum and passes **between the medial margins** of the levator ani muscles.
- It **pierces** the urogenital diaphragm
- The **posterior fibres** of the sphincter urethrae muscle are attached to the vaginal wall.
- The uterus lies almost at a **right angle** to the **axis of the vagina** (anteverted position).
- The **vaginal recess** around the cervix is called the **fornix** (L. arch).

The Sphincters of the Vagina

- There are **3 muscles** that can compress the vagina and act like sphincters:
- The **pubovaginalis muscle**, the anterior part of the levator ani;
- The urogenital diaphragm;
- The **bulbospongiosus muscle**.

Figure 10.13a Muscles of the Pelvic Floor



- ***Blood Supply of the Vagina***
- The **vaginal artery** is usually a **branch of the uterine artery**
- The **internal pudendal artery** and **vaginal branches** of the **middle rectal artery**
- The vaginal veins form **vaginal venous plexuses** along the **sides** of the vagina and within its **mucosa**.
- Drainage is into the **internal iliac veins.**

- ***Innervation of the Vagina***
- The vaginal nerves are derived from the **uterovaginal plexus**.

Uterus

- This is a **hollow, thick-walled, pear-shaped muscular organ** located between the bladder and the rectum.
- It is **7 to 8 cm** long, **5 to 7 cm wide**, and **2 to 3 cm thick**.
- The uterus normally **projects supero anteriorly** over the urinary bladder..
- The uterus consists of **2 major parts**:
- The **expanded superior 2/3** is known as the **body**;
- The **cylindrical inferior 1/3** is called the **cervix**
- The uterus is usually **bent anteriorly** (**anteflexed**) between the **cervix** and **body**.
- The entire uterus is normally **bent anteriorly** (**anteverted**).
- It is **retroverted** in **some women**.

- ***The Fundus of the Uterus***
- The **fundus** of the uterus is the **rounded superior part** of the **body**.
- It is located **superior** to the line joining the points of entrance of the uterine tubes.
- The regions of the body **where the uterine tubes enter** are called the **cornua**.

- ***The Cervix of the Uterus***

- The **rounded vaginal part** communicates with the vagina via the **external ostium** of the uterus .
- The ostium is bounded by **anterior** and **posterior lips** formed by the **cervix**.

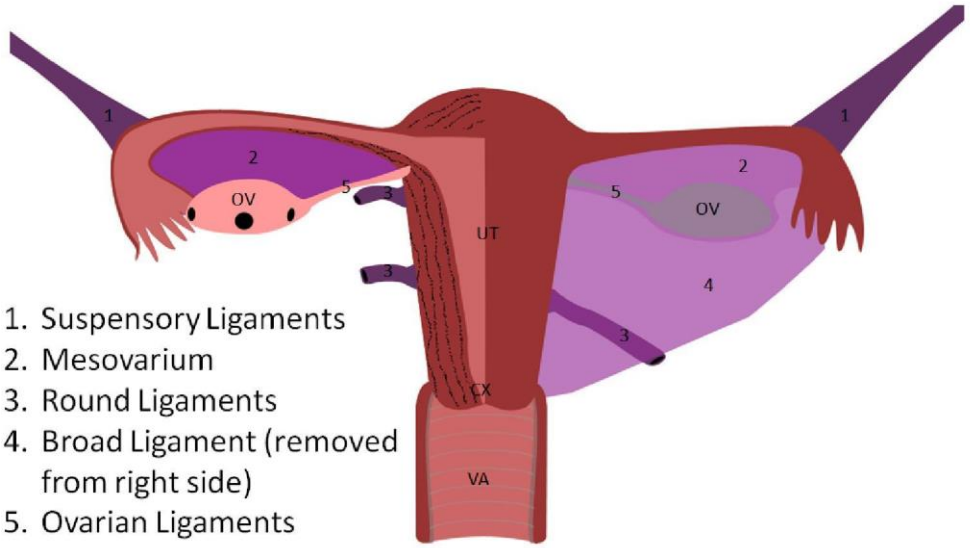
.

- ***Ligaments of the Uterus***
- Transverse Cervical Ligament (Cardinal Ligament)
- This extends from the **cervix** and **lateral parts** of the **vaginal fornix** to the lateral wall of the pelvis
- The Uterosacral Ligaments .These pass **superiorly** and **slightly posteriorly** from the **sides of the cervix** to the **middle of the sacrum**.
- They are **deep** to the peritoneum and **superior** to the levator ani
- **hold the cervix** in its **normal relationship** to the **sacrum**.

- The Round Ligament of the Uterus
- These ligaments are **10 to 12 cm** long and extend for the **lateral aspect** of the **uterus**.They leave the **abdominal cavity** through the inguinal canal and insert into the labia majora.

- The Broad Ligament
- This is a **fold of peritoneum** on its **anterior** and **posterior surfaces**.
- It extends from the **sides of the uterus** to the lateral walls and floor of the pelvis.
- The broad ligament **holds the uterus in its normal position**.

Uterine Ligaments

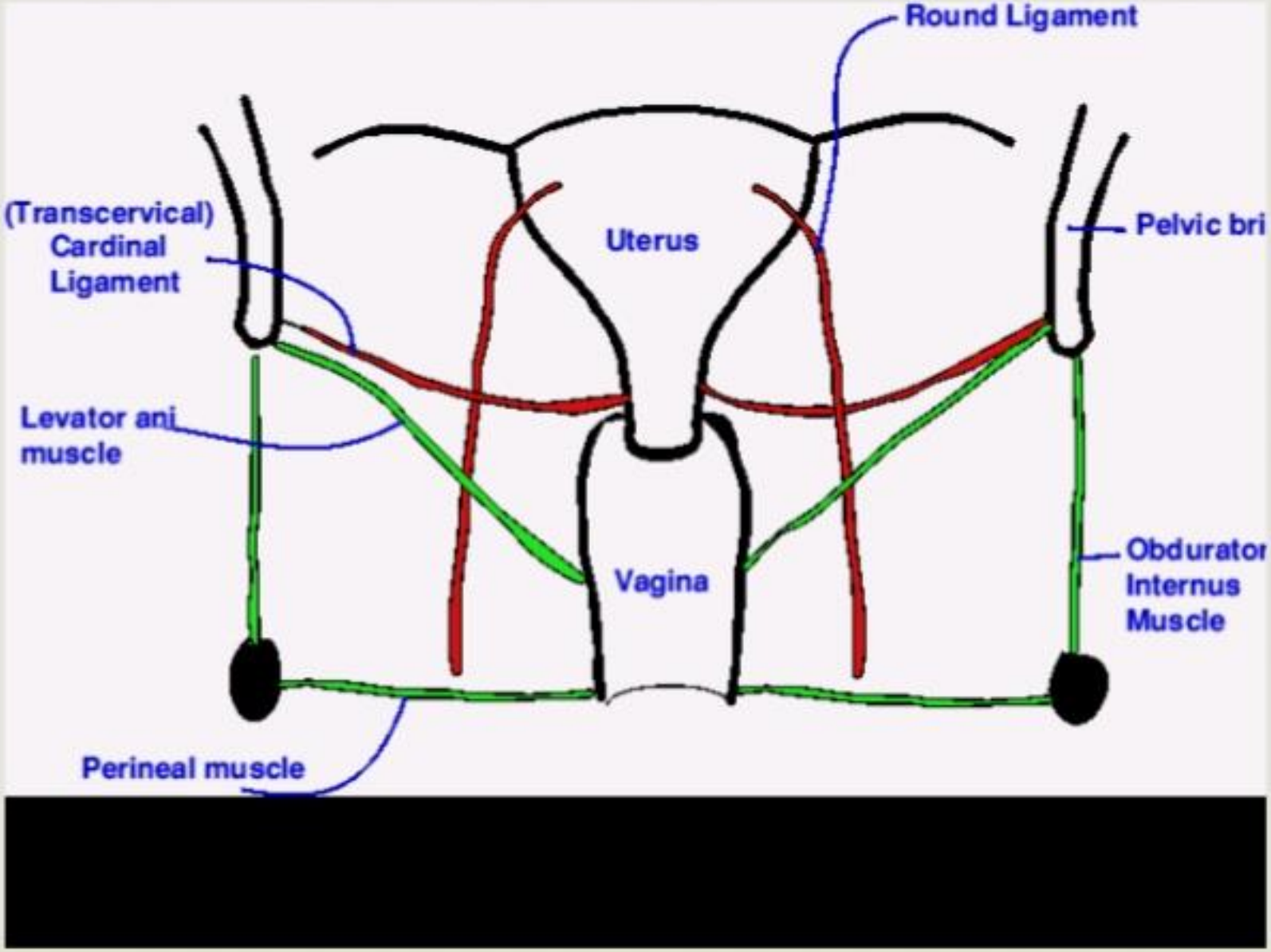


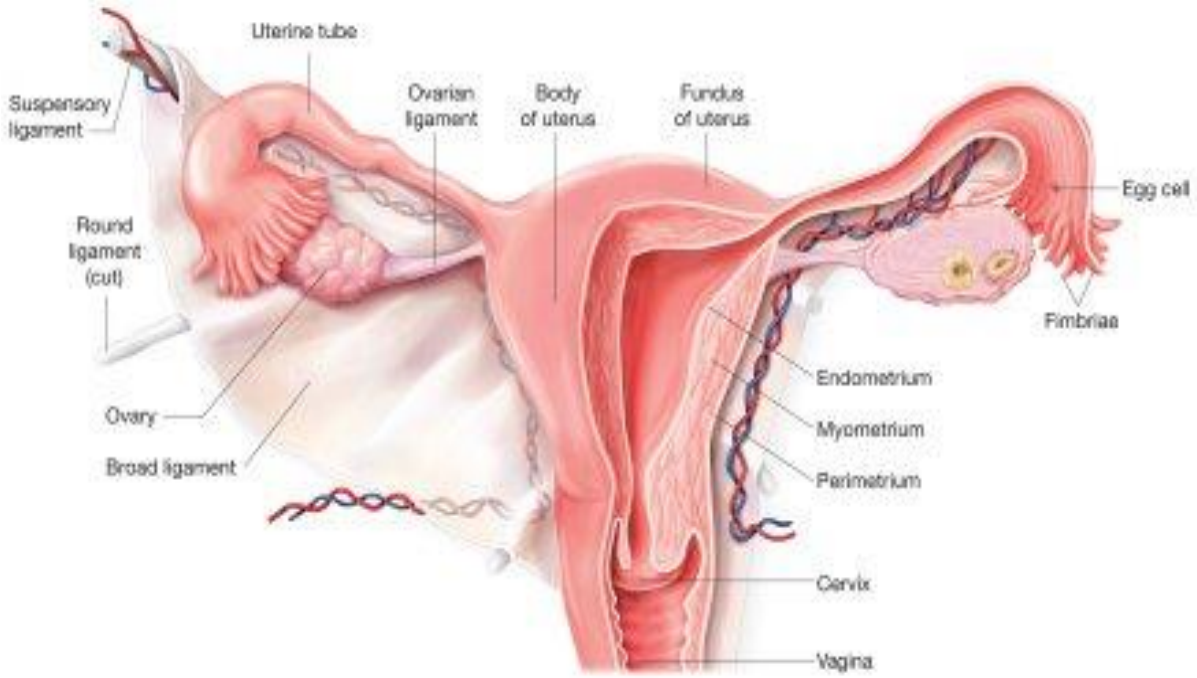
1. Suspensory Ligaments
2. Mesovarium
3. Round Ligaments
4. Broad Ligament (removed from right side)
5. Ovarian Ligaments

- ***The Principal Support of the Uterus***
- This is the pelvic floor, formed by the **pelvic diaphragm**.
- The two levator ani muscles, the two coccygeus muscles, and the muscles of the urogenital diaphragm are particularly important in supporting the uterus.
- ***The Relationships of the Uterus***
- **Anteriorly** urinary bladder by the **vesicouterine pouch**.
- **Posteriorly** separated from the sigmoid colon by a layer of peritoneum.
- The uterus is separated from the rectum by the **rectouterine pouch** (of Douglas).
- The **inferior part** of this **pouch** is closely related to the **posterior part** of the **fornix of the vagina**.
- **Laterally** the relationship of the ureter to the **uterine artery** is very important.
- The **ureter** is **crossed superiorly** by the **uterine artery** at the **side of the cervix**.

- ***blood Supply of the Uterus***
- This is derived mainly from the **uterine arteries**, which are branches of the **internal iliac arteries**.
- The uterus is also supplied by the **ovarian arteries**, which are branches of the **aorta**.
- The **uterine veins** drains into the **internal iliac vein**.

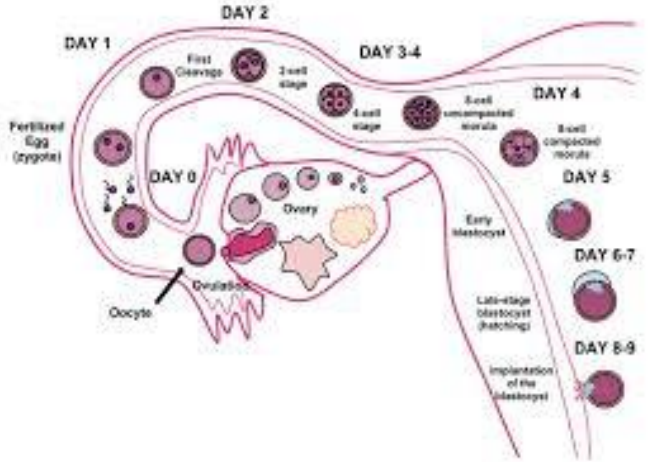
- ***Innervation of the Uterus***
- The nerves of the uterus arise from the **inferior hypogastric plexus**, largely from the **anterior** and **intermediate part** known as the **uterovaginal plexus**.

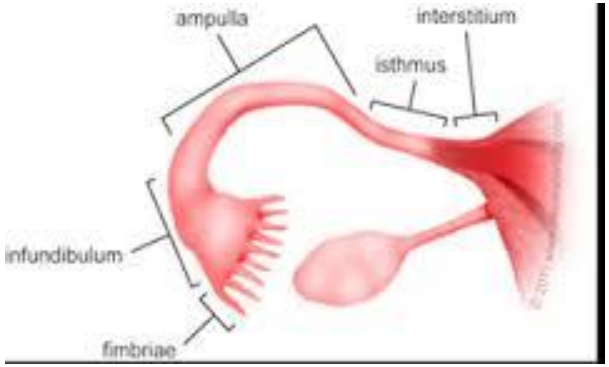

Round Ligament
(Transcervical)
Cardinal
Ligament
Uterus
Pelvic bri
Levator ani
muscle
Vagina
Obdurator
Internus
Muscle
Perineal muscle


Uterine tube
Suspensory ligament
Ovarian ligament
Body of uterus
Fundus of uterus
Egg cell
Round ligament (cut)
Fimbriae
Endometrium
Ovary
Myometrium
Broad ligament
Perimetrium
Cervix
Vagina

Uterine Tubes

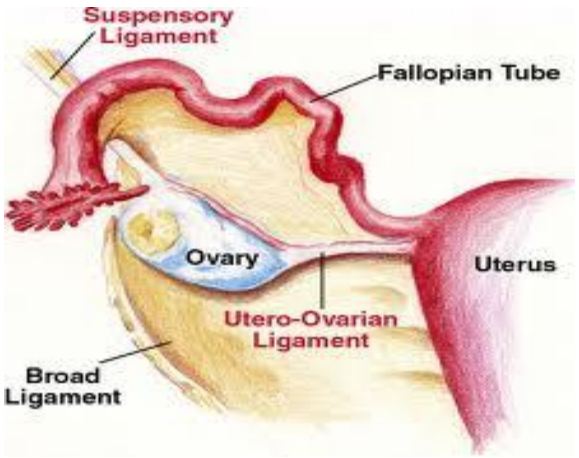
- These are **10 cm long** and **1 cm in diameter**.
- They **extend laterally** from the **cornua of the uterus**.
- The uterine tubes carry **oocytes** from the **ovaries** and **sperm cells** from the uterus to the **fertilisation site** in the **ampulla of the uterine tube**.
- The uterine tube also conveys the **dividing zygote** to the **uterine cavity**.
- Each tube opens at its **proximal end** into the **cornua** or **horn of the uterus**.
- At its **distal end**, it opens into the **peritoneal cavity** near the ovary..
- The uterine tube is divided into **4 parts**: infundibulum, ampulla, isthmus, and intramural or uterine parts.

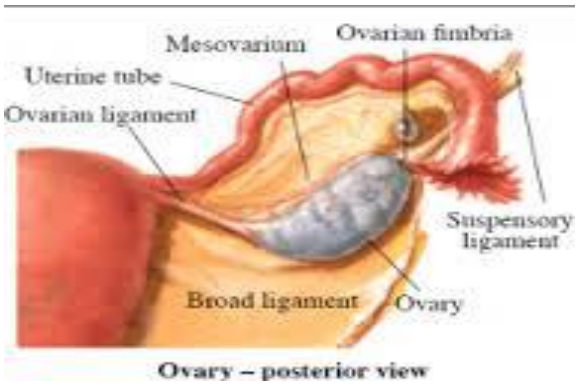

DAY 1
DAY 2
DAY 3-4
DAY 4
DAY 5
DAY 6-7
DAY 8-9
DAY 0
Fertilized Egg (zygote)
First Cleavage
2-cell stage
4-cell stage
8-cell compacted morula
Ovary
Oocyte
Ovulation
Early blastocyst
Late-stage blastocyst (hatching)
Implantation of the blastocyst


ampulla
interstitium
isthmus
infundibulum
fimbriae

Ovaries

- the ovaries are **oval, shaped, pinkish-white glands** about **3 cm long, 1.5 cm wide.**
- **Before puberty** the surface of the **ovaries is smooth** and **becomes progressively scarred** and **distorted** owing to **repeated ovulations**.
- The **anterior border** of the **ovary** is attached to the **posterior border of the** broad ligament the **mesovarium**.
- **connected** to the lateral wall of the pelvis by the **suspensory ligament of the ovary**..
- The **suspensory ligament** contains the **ovarian vessels** and **nerves**.
- Each ovary is also attached to the uterus by a **band of fibrous tissue**, the **ligament of the ovary**, which runs in the **mesovarium of the broad ligament**.
- The surface of the ovary **is not covered by** peritoneum.





The ovarian arteries arise from the abdominal aorta.

The **right ovarian vein** ascends to the **IVC**, whereas the **left ovarian vein** drains into the **left renal vein**

EXTERNAL FEMALE GENITAL ORGANS

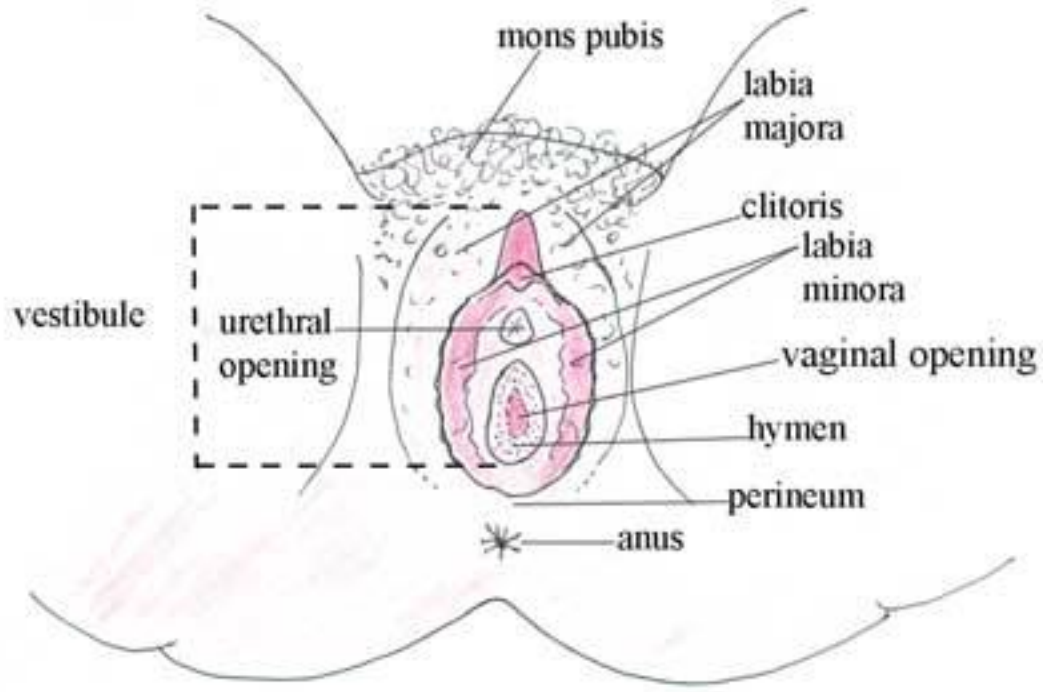
Mons Pubis

- The mons is a **rounded fatty elevation** located **anterior** to the **pubic symphysis** and **lower pubic region**.
- It consists mainly of a **pad** of **fatty connective tissue deep to the skin**.
- The amount of fat **increases during puberty** and **decreases after menopause**.
- covered with **coarse pubic hairs** during **puberty**, which **also decrease after menopause**.

Labia Majora

- The labia are **two symmetrical folds of skin,** which **provide protection** for the urethral and vaginal orifices.
- These open into the vestibule of the vagina.
- **about 2.5 cm from the anus**.

- The labia majora **meet anteriorly** at the **anterior labial commissure**.
- They **do not join posteriorly** but a **transverse bridge of skin** called the **posterior labial commissure** passes between them.
-


mons pubis
labia
majora
clitoris
labia
minora
vestibule
urethral
opening
vaginal opening
hymen
perineum
anus

Labia Minora

- The labia minora are **thin**, **delicate folds** of **fat-free hairless skin**.
- They are located **between the** labia majora.
- The labia minora contain a **core of spongy tissue** with many **small blood vessels** but **no fat**.
- The **internal surface** of each **labium minus** consists of thin skin and has the typical pink colour of a mucous membrane.
- It contains **many sensory nerve endings**.
- **Sebaceous** and **sweat glands** open on both of their surfaces.
- The labia minora **enclose the** vestibule of the vagina and lie on each side of the orifices of the urethra and vagina.
- They meet **just superior** to the clitoris to form a **fold of skin** called the **prepuce** (clitoral hood).

Vestibule of the Vagina

- The vestibule is the **space between** the labia minora.
- The urethra, vagina, and **ducts of the** greater vestibular glands open into the vestibule.

- ## *Clitoris*
- The clitoris is an erectile structure found beneath the anterior joining of the labia minora. Its width in an adult female is approximately 1 cm, with an average length of 1.5–2.0 cm. The clitoris is made up of 2 crura, which attach to the periosteum of the ischiopubic rami. It is a very sensitive structure, analogous to the male penis. It is innervated by the dorsal nerve of the clitoris, a terminal branch of the pudendal nerve.
- ## *Vestibule and urethra*
- Between the clitoris and the vaginal introitus is a triangular area, which extends to the posterior fourchette. The urethral (urinary) meatus is found, approximately 1 cm anterior to the vaginal orifice, and it also gives rise to the opening of the Skene glands bilaterally. A female urethra ranges in length from 3.5 to 5.0 cm.
- ## *Hymen*
- The hymen is a thin membrane found at the entrance to the vaginal orifice. Often, this membrane is perforated before the onset of menstruation, allowing flow of menses. The hymen varies greatly in shape.

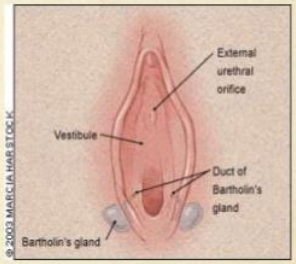
- ***Skene and Bartholin glands***
- The Skene glands secrete lubrication at the opening of the urethra. The greater vestibular (Bartholin) glands are also responsible for secreting lubrication to the vagina, with openings just outside the hymen, bilaterally, at the posterior aspect of the vagina. Each gland is small, similar in shape to a kidney bean.

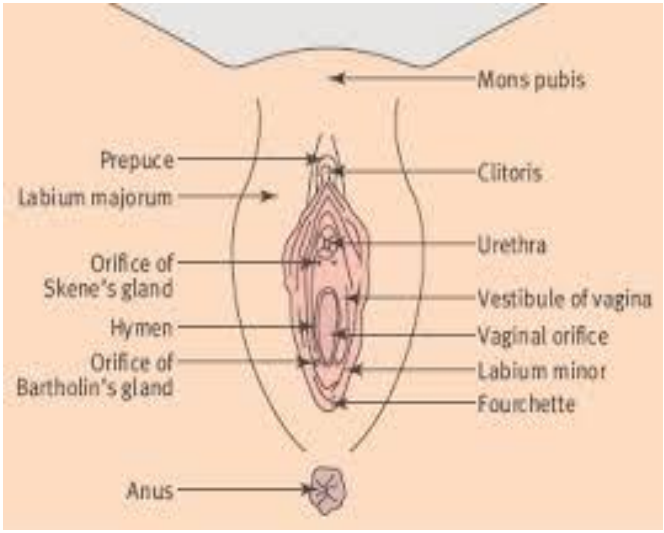
- ***Vestibular bulbs***
- Finally, the vestibular bulbs are 2 masses of erectile tissue that lie deep to the bulbocavernosus muscles bilaterally.

vestibuler glands

Skene's Glands

- **paraurethral glands**; **minor vestibular glands**
- A pair of glands situated on each side of the urethral meatus
- Its secretion help to lubricate the external genitalia during coitus





FEMALE REPRODUCTIVE SYSTEM PHYSIOLOGY

- **The Reproductive Cycle**
  The female reproductive cycle is the process of producing an ovum and readying the uterus to receive a fertilized ovum to begin **pregnancy**. If an ovum is produced but not fertilized and implanted in the uterine wall, the reproductive cycle resets itself through menstruation. The entire reproductive cycle takes about 28 days on average, but may be as short as 24 days or as long as 36 days for some women.

- **Oogenesis and Ovulation**
  Under the influence of (FSH), and (LH), the ovaries produce a mature ovum in a process known as ovulation. By about 14 days into the reproductive cycle, an oocyte reaches maturity and is released as an ovum. Although the ovaries begin to mature many oocytes each month, usually only one ovum per cycle is released.

Fertilization

Once the mature ovum is released from the ovary, the fimbriae catch the egg and direct it down the fallopian tube to the uterus. It takes about a week for the ovum to travel to the uterus. If sperm are able to reach and penetrate the ovum, the ovum becomes a **fertilized** zygote containing a full complement of DNA. After a two-week period of rapid cell division known as the germinal period of development, the zygote forms an embryo. The embryo will then implant itself into the uterine wall and develop there during pregnancy.

Menstruation

If the ovum is not fertilized in time or if it fails to implant into the endometrium, the arteries of the uterus constrict to cut off blood flow to the endometrium. While the ovum matures and travels through the fallopian tube, the endometrium grows and develops in preparation for the embryo. The lack of blood flow causes cell death in the endometrium and the eventual shedding of tissue in a process known as menstruation. In a normal menstrual cycle, this shedding begins around day 28 and continues into the first few days of the new reproductive cycle.

What happens during the menstrual cycle?

- Females of reproductive age (11-16 years of age) experience cycles of hormonal activity that repeat at about one-month intervals.

- The average menstrual cycle takes about 28 days and occurs in phases: the follicular phase (development of the egg, the ovulatory phase (release of the egg), and the luteal phase (hormone levels decrease if the egg is not fertilized).

- There are four major hormones (chemicals that stimulate or regulate the activity of cells or organs) involved in the menstrual cycle FSH, LH , estrogen, and progesterone.

Follicular phase

- This phase starts on the first day of your period. During the follicular phase of the menstrual cycle, the following events occur:

- Two hormones, (FSH) and (LH) are released from the brain and travel in the blood to the ovaries.

- The hormones stimulate the growth of about 15-20 eggs in the ovaries and. also trigger an increase in the production of the female hormone estrogen.

- As estrogen levels rise, like a switch, it turns off the production of follicle-stimulating hormone. This careful balance of hormones allows the body to limit the number of follicles that will prepare eggs to be released.

- As the follicular phase progresses, one follicle in one ovary becomes dominant and continues to mature. This dominant follicle suppresses all of the other follicles in the group. As a result, they stop growing and die. The dominant follicle continues to produce estrogen.

Ovulatory phase

- The ovulatory phase, or ovulation, starts about 14 days after the follicular phase started.
- During this phase, the following events occur:
- The rise in estrogen from the dominant follicle triggers a surge in the amount of luteinizing hormone that is produced by the brain.
- This causes the dominant follicle to release its egg from the ovary.
- As the egg is released it is captured by the end of the fallopian tubes (fimbriae). The fimbriae sweep the egg into the tube.
- Also during this phase, there is an increase in the amount and thickness of mucus produced by the cervix (lower part of the uterus.) If a woman were to have intercourse during this time, the thick mucus captures the man's sperm, nourishes it, and helps it to move towards the egg for fertilization.

luteal phase

begins right after ovulation and involves the following processes:

Once it releases its egg, the empty ovarian follicle develops into a new structure called the corpus luteum.

The corpus luteum secretes the hormones estrogen and progesterone. Progesterone prepares the uterus for a fertilized egg to implant.

If intercourse has taken place and a man's sperm has fertilized the egg (a process called conception), the fertilized egg (embryo) will travel through the fallopian tube to implant in the uterus. The woman is now considered pregnant.

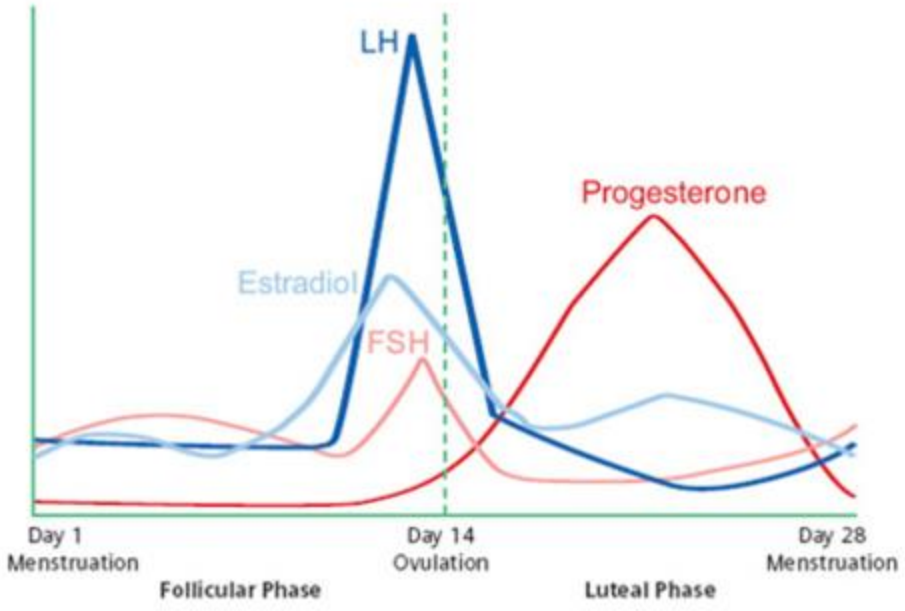
If the egg is not fertilized, it passes through the uterus. Not needed to support a pregnancy, the lining of the uterus breaks down and sheds, and the next

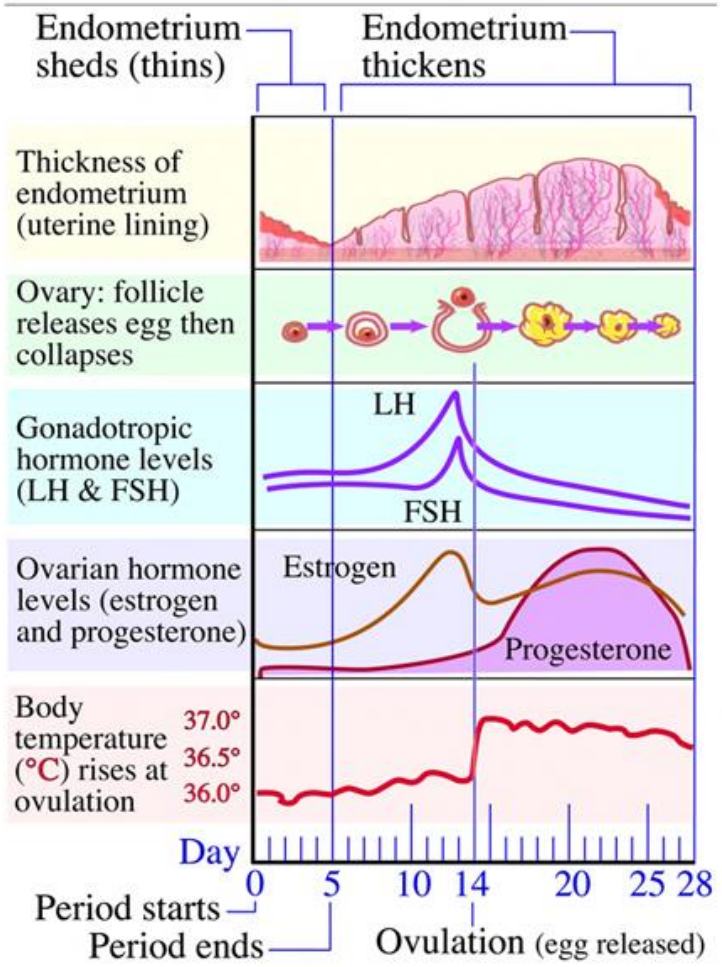
menstrual period begins.

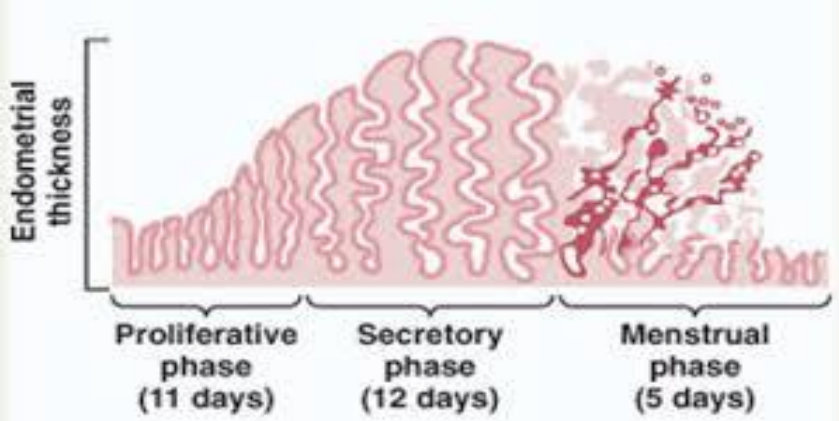
How many eggs does a woman have?

During fetal life, there are about 6 million to 7 million eggs. From this time, no new eggs are produced. At birth, there are approximately 1 million eggs; and by the time of puberty, only about 300,000 remain. Of these, only 300 to 400 will be ovulated during a woman's reproductive lifetime. Fertility can drop as a woman ages due to decreasing number and quality of the remaining eggs.

- **Pregnancy**
  If the ovum is fertilized by a sperm cell, the fertilized embryo will implant itself into the endometrium and begin to form an amniotic cavity, umbilical cord, and placenta. For the first 8 weeks, the embryo will develop almost all of the tissues and organs present in the adult before entering the fetal period of development during weeks 9 through 38. During the fetal period, the fetus grows larger and more complex until it is ready to be born.
- **Lactation**
  Lactation is the production and release of milk to feed an infant. The production of milk begins prior to birth under the control of the hormone prolactin. Prolactin is produced in response to the suckling of the nipple
- milk is produced as long as active breastfeeding occurs. As soon as an infant is weaned, prolactin and milk production end soon after. The release of milk by the nipples is known as the "milk-letdown reflex" and is controlled by the hormone oxytocin. Oxytocin is also produced in response to infant suckling so that milk is only released when an infant is actively feeding.


LH
Progesterone
Estradiol
FSH
Day 1
Menstruation
Day 14
Ovulation
Day 28
Menstruation
Follicular Phase
Luteal Phase


Endometrium sheds (thins)
Endometrium thickens
Thickness of endometrium (uterine lining)
Ovary: follicle releases egg then collapses
Gonadotropic hormone levels (LH & FSH)
LH
FSH
Ovarian hormone levels (estrogen and progesterone)
Estrogen
Progesterone
Body temperature (°C) rises at ovulation
37.0°
36.5°
36.0°
Day
0
5
10
14
20
25
28
Period starts
Period ends
Ovulation (egg released)


Endometrial thickness
Proliferative phase (11 days)
Secretory phase (12 days)
Menstrual phase (5 days)

THANKS