"There is no boundary or limit in your brain, the only hindrance is your emotions! Study! Don't give up! Aim high and you will see the fruit of your success."

Please study this summary with the slides on anatomy page on our website:

www.jumed16.weebly.com

We are sorry for any mistakes or missing material.

-Your colleagues.

References:
Dr Maher Al Hadidi lectures & slides.
Before we are Born, 8th edition.
Langman.
Wikipedia.
Reproduction and reproductive systems

The male reproductive system

Includes the scrotum, testis, spermatic ducts, sex glands, and penis. These organs work together to produce and transport sperm, the male gamete, and the other components of semen.
**Testis: (Formation of spermatids)**

A structure covered by 3 layers:

- a skin layer (scrotum)
- a layer of peritoneum which forms **tunica vaginalis**
- and a third layer; **tunica albuginea**

**Tunica albuginea** (fibrous capsule) which sends septa to divide each testis into **lobules**, each testis contains about 250 lobules, which are pyramidal in shape. Each lobule contains 1-4 tortuous **seminiferous tubules**, their function is producing spermatids (premature sperms), and the average length of seminiferous tubules inside both testicles is 500 m.

**Note:** all organs at the temperature of the body perform their function appropriately except testis which functions 3 degrees below the ideal body temperature (37), at (34).
Testis in the embryo:

At the 3rd and the 4th week of embryo, growing testis is located in the posterior abdominal wall, with time, the abdominal cavity will be formed and covered by a membrane which is called peritoneum.

The testis starts to migrate posteriorly in the abdominal wall at the third month and ends in its place at the sixth month. It continues down by taking a cover from peritoneum then it goes to the anterior abdominal wall, where is a hole, through it, the growing testis goes outside the abdomen and reaches its place. It’s still covered by peritoneum.

Supplies:

- Testicular artery (Aorta).
- Testicular vein (Inferior Vena cava).
- In addition to nerves and lymph which supply testis.

Clinical case: if the testicles still inside the abdomen and it doesn’t reach its place outside the body, it forms an undescended testicle. It happens when the mother takes drugs during pregnancy or when she doesn’t eat well; body temperature is not suitable for sperms production which results in sterility of the baby.
**Epididymis: (maturation)**

Shape: comma shaped structure

Location: covering the posterior surface of each testis,

Consists of 3 parts: head, body and tail in addition to 6 meters long, and highly convoluted tubules.

Function: sperm maturation.

**Vas deferens: (carrying of mature sperms)**

A 45 long thick walled tube which is function is carrying mature sperms from the tail of the epididymis to the ejaculatory duct.
**Seminal vesicle:**

Shape: horn shaped, consists of 15 cm long coiled tubes

Location: lying behind (posteriorly and in the base of) the urinary bladder of the male.

Function: secretion of fructose (Siemen’s energy) which makes 70 % of the seminal fluid.

Note: The only part in the body that secretes fructose is seminal vesicle, the fact that helps in rape cases by detecting fructose.

**Clinical case:** in some cases, seminal vesicle can’t secrete fructose, so sperms can’t reach ovum to fertilize it, this problem can be treated by fructose injection.

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**Prostate: fibromuscular glandular organ**

Shape: doughnut or chestnut shaped, its base above apex below,

Location: interiorly inferior to the urinary bladder, it surrounds prostatic urethra and contains 5 lobes.

Function: Secretes a milky fluid that contains:

- antibodies (seminalplazmin)
- alkali fluid (Alkaline phosphatase) to neutralize acidic vagina secretion
- prostaglandins
**Clinical case:** Acidic secretion of prostate kill sperms; sterility.

**Contraception method:**

*Highly acidic environment of vagina to prevent fertilization by killing sperms. (Vagina pills).*

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**The female reproductive system**

(Or female genital system) is made up of the internal and external sex organs that function in human reproduction. The female reproductive system is immature at birth and develops to maturity at puberty to be able to produce gametes, and to carry a fetus to full term.
**Uterus:**

**Shape:** Thick walled, pear shaped muscular organ,

**Location:** between urinary bladder and rectum.

The uterus is divided into four parts:

1. **Body:** which is about 2 inches long (5.08cm long)
2. **Cervix:** which is about 1 inch long (2.54cm long)
3. **Cavity:** the wall of this cavity is composed of: (from outside to inside)
   - **Perimetrium:** the outer serosal layer of the uterus.
   - **Myometrium:** middle layer of the uterine wall, consisted mainly of muscle cells, covered by musculosa.
   - **Endometrium:** the inner epithelial layer of the uterine wall, simple columnar epithelium, covered by mucosa.

**Note:** We can notice that there is NO submucosa in the uterus, so the bleeding occurs.

4- **Fundus:** which is part of the uterus that is located above the level of fallopian tubes.

“WHEREVER THE ART OF MEDICINE IS LOVED, THERE IS ALSO A LOVE OF HUMANITY.”
However, the endometrium of the uterus is composed of 2 layers,

- Superficial layer, which is the functional layer, and it is the layer that is shed every month (through period time).
- And basal layer. It is adjacent to myometrium and its function is to renew the superficial layer every month when it is shed off.

- Menses starts at puberty until menopause.
- The body of the uterus is a triangular shaped cavity (from a coronal section view).
- The cervical canal communicates with the uterine cavity by the internal Os, and with the vagina by the external Os.
- The body of the uterus serves as a site for the reception, retention and nutrition of the fertilized ovum.

{From puberty to menopause, the functional layer undergoes extensive changes during the menstrual cycle in response to the ovarian hormones}.

Note: The implantation normally takes place in the superior and posterior walls of the uterine body, in the functional layer of the endometrium.

Ovary:

Oval shaped and almond size structure, 4*2 Cm, which is surrounded by a fibrous capsule (modified peritoneum; so, the mature ova can be transported to outside)
The ovary, however, is composed of two parts, cortex and medulla.

- **Cortex**: The outer part, it contains ova (eggs) at different stages of formation and maturation located at the peripheral side.
- **Medulla**: The inner part, Contains the vascular tissue to nourish the ovary.

**Function of ovary:**

Ova formation, however, the ova at their first stage are called “Oogenesis”.

Secretion of female hormones, such as estrogen and progesterone.

**Note:**

Only one egg is released per month. Ovaries alternate in releasing the eggs.

**Uterine Tube:**

Also, called as Fallopian tube, the uterine tube lies in the upper border of the broad ligament, it is about 10 cm long. Parts:

- **Infundibulum**: like a funnel over the ovary.
- **Ampulla**: is the widest part.
- **Isthmus**: is the narrowest part.
- **Intramural**: within the uterine wall.
Functions of the uterine tube:

- Receives the ovum from the ovary, this occurs when the infundibulum acts as a "crab," with a crab-like movement to bring the ovum from the ovary.
- Fertilization site of the ovum, usually in the ampulla.
- Has the ability to move the fertilized ovum to the uterine cavity.
- It may act as a passageway for the sperm to reach the ovum in the ampulla.

Important notes

All cells in the body divide and reproduce either by meiosis as in the Ovaries and Testis which are known as sex organs, or by mitosis as in the cells of the whole body.

In the third or fourth week of pregnancy, the ova, which are also called “Oogonium”, are originated with a huge number to imagine 7 million ova, however, when the female baby is born and has reached puberty, this number is massively reduced to 400 thousand, with only one ovum being released each month.

During menses time, the pituitary gland gives an order to both the ovary & the uterus.

After that order, the uterus starts preparing itself for pregnancy. And the ovary is prepared to produce mature ova.

The average period time in most females is: **28 days**.

*From day one to day four*, bleeding phase. After bleeding, the lining of the uterus is shed off (epithelium, functional layer of the endometrium).

*From day 5 to 14*, renewal phase, new functional layer is produced.

At day 14 in all females this day is called proliferation phase where the mature ovum (secondary oocyte) is being released.

*From day 5 to 14* ova are under effect of one hormone which is, estrogen.
Specifically, at day 14, the ova are under effect of another hormone which is, Luteinizing hormone (LH), which will influence the endometrium to increase its thickness and secretion of necessary materials; to be prepared for implantation.

The secondary oocyte gets more blood supply when the progesterone is secreted by an order from pituitary gland (this process occurs after day 14).

Day 28: if no pregnancy occurred, which means that the secondary oocyte wasn’t fertilized by a sperm, blood vessels will be constricted and the endometrium will lose its blood supply and will be shed off.

To remember:

Day 1 to 13: estrogen.

Day 14: Luteinizing hormone (LH). *LH is secreted by the pituitary gland

Day 15 to 28: progesterone.

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Clinical case: all contraceptive pills contain both progesterone and estrogen, and when taken, the level of these two hormones will increase in the blood and the pituitary gland will no longer send orders to secret these two hormones because they are already highly concentrated in blood, so the ovary will not release the secondary oocyte.
Important concepts:

**Mitosis:** the division of the mother cell into two daughter cells genetically identical to each other.

**Meiosis:** type of cell division that produces four haploid cells.
**Crossing over**: is the exchange of genetic material between homologous chromosomes that results in recombinant chromosomes during sexual reproduction.

![Crossing-over](image-url)
Oogenesis
Ovary has 4 layers:

1- Germ epithelium
2- tunica albuginea
3- Cortex (the site of raise for the Ovum or follicles)
4- Medulla (connective tissue and blood vessels)

*refer to figure in page 4

Before the female is born:

By the end of the 5th week, Primordial cells will migrate from an area called (yolk sac) to Ovary, then they are sited at the cortex of the Ovary

3rd month:

Oogonium (ovum to be (2n)) divides mitotically, it produces primary oocytes which are in prophase of meiosis 1, surrounded by single layer of flat follicular cells (primordial follicles).

5th month:

Oogonia will reach its maximum (7 million), most of them will by degenerated (process of degeneration: atresia) before birth, about 2 million primary oocytes remains.

At birth: all primary oocytes are in prophase of meiosis 1, they will be arrested until puberty “diplotene stage”.

At childhood, degeneration of primary oocytes continues until puberty, 400,000 remains.
Only 400 secondary oocytes will be ovulated along the female reproductive cycle (about 33 years).

Puberty:

- Monthly, hormones secreted by pituitary gland stimulated the development of few primordial follicles, each month 20 primordial follicles start to raise but only 1 will complete (will be ovulated), so 1 will be used and 19 will be degenerated.
- Primordial follicles grow into primary follicles; an oocyte surrounded by several layers of cuboidal cells (granulosa), and also, surrounded by zona pellucida just below granulosa.
- Primary follicle will develop into secondary follicle, granulosa will secrete Estrogen for Uterus development and preparation for pregnancy and implantation “1st half of reproductive cycle”, it also secrets follicular fluid in antrum.
- The formation of antrum: tight junctions between granulosa cells will separate to form small cavities, small cavities unit to build up antrum.
- The innermost layer of granulosa is tightly attached to zona pellucida (to form corona radiata).
secondary follicle then enlarges enough (to form Graafian follicle now), then it completes meiosis 1 to produce: 1st polar body (degenerated due to the little amount of cytoplasm inside it), and the secondary oocyte which undergoes meiosis 2 and stops at metaphase, this pushes it near the ovary surface at day 10 (from Dr. Maher), at day 14, the secondary oocyte is expelled out the ovary.

the rest of the mature follicle after ovulation will form corpus Luteum and also its called yellow body because it will be transformed into fats, it secrets Progesterone and estrogen after ovulation, if fertilization happens, it’s called Corpus Leuteum of pregnancy, if no pregnancy happens, it will be degenerated to form Corpus Albicans.
“Epithelial layer at the Ovary is formed by modified peritoneum (covered with serous membrane. Modified to enable the Ovum to expel out (allow it to open), some women have normal Peritoneum so surgery is needed“ search for this information to be sure.

**Important notes**

- Ovum stays alive 24 hours
- Sperm stays alive 48 hours.
- The safe period is from day 12 to 16 of the period, to prevent fertilization.
- Cells of human body contains 46 chromosomes (22 pair) of Autosomes (Maternal and Paternal), 1 pair (number 23) the sex chromosome, female XX, MALE XY.
- Genital organs undergo Meiosis, in testis, to form sperm 23 single chromosomes, in ovary, to form ovum 23 single chromosomes, each one is (haploid 1n) aiming to unit (fertilization) together in Ampulla (fallopian tube) to form Zygote.