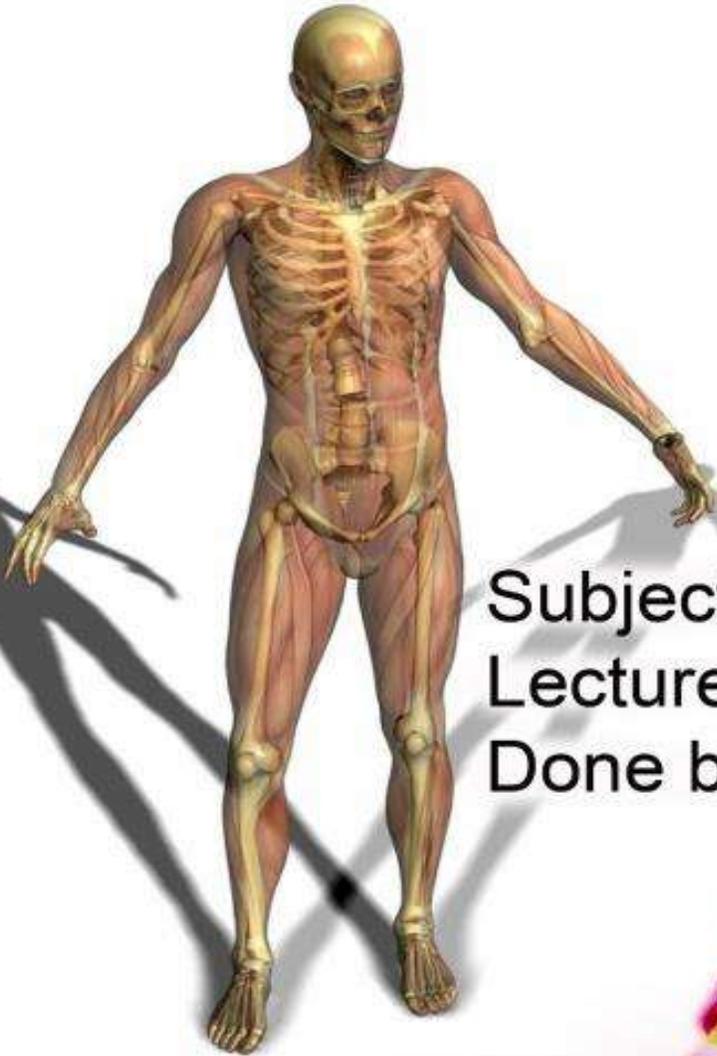




ANATOMY

Sheet



Subject : *Embryology*

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lecture # : 14

Date : Mar/6th/2013

Embryology

3rd Lecture

- Quick Revision:

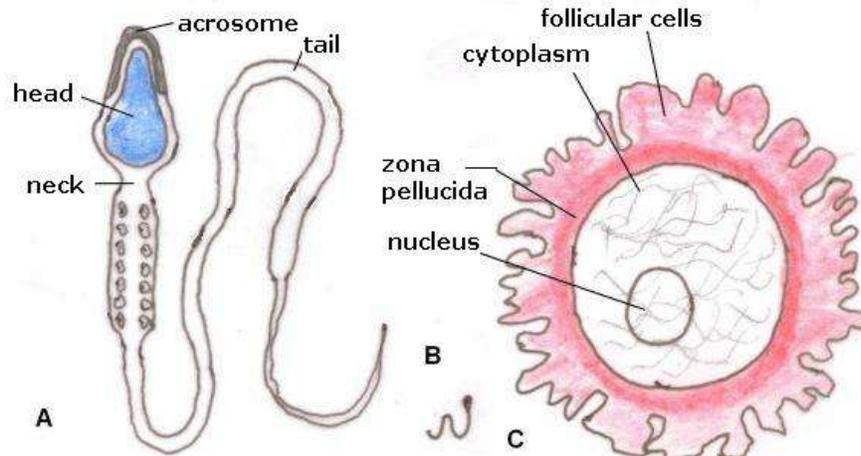
Types of cell division	
<u>Mitosis</u>	<u>Meiosis</u>
Somatic cells	in sex cells (ovaries & testes)
gives 2 daughter cells	gives 4 daughter cells
the 2 resulting cells are identical	the 4 resulting cells are non-identical
diploid (2n)	haploid (1n) ---> (gametes)
46 chromosome in each cell	23 chromosome in each cell

.....

- Gametogenesis:

- It is the process in which germ cells are formed (gametes).
- It **involves** the **chromosomes** and **cytoplasm** of the gametes; it prepares them for **fertilization**.
- During Gametogenesis **chromosomes** are reduced to **half of their number** and their **shape is changed** (this is why the sperm is longitudinal and the ovum is rounded).

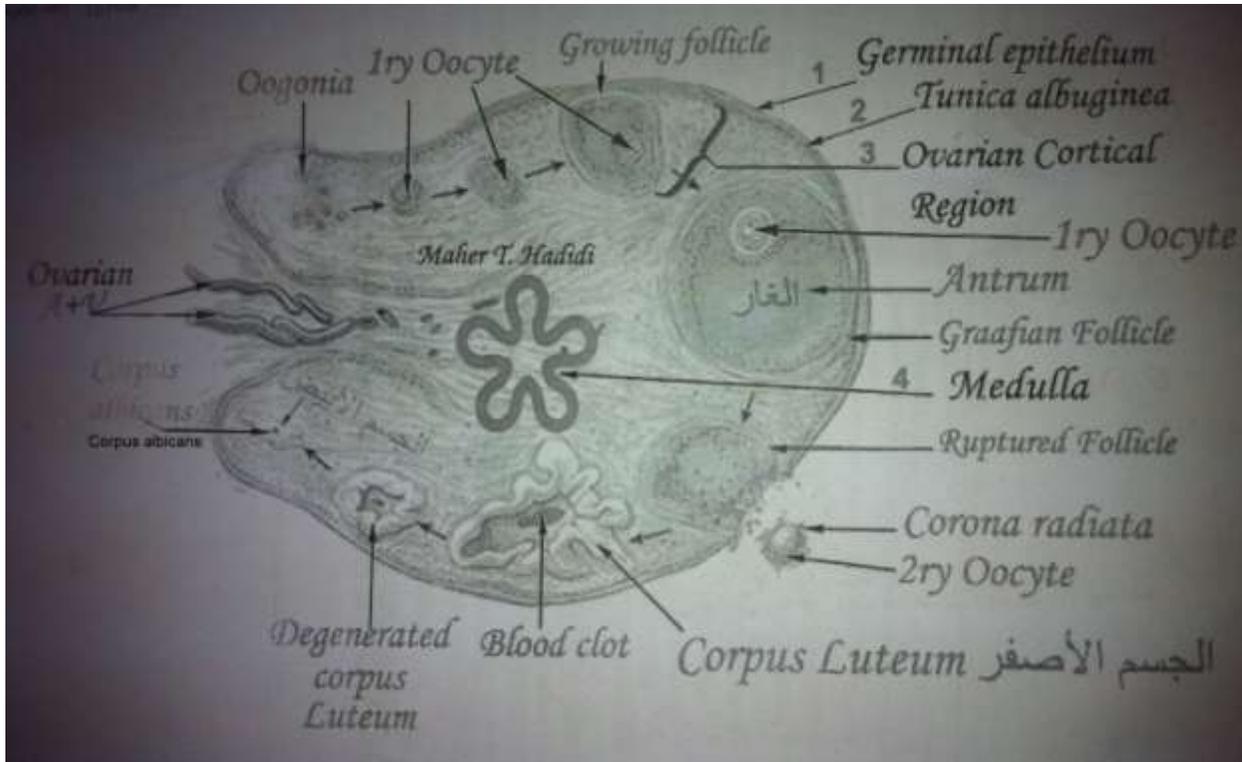
- Gametes:



- Male gamete (sperm).
- Female gamete (ovum).
- Gametes are **highly specialized** sex cells.
- Each gamete contains **half the number** of chromosomes (**1n**) (**haploid**)
- The number of chromosomes is reduced to half during meiosis.
- Sperm cells carry the paternal genes, while ova carry maternal genes.
- These genes will be transferred to the zygote. The zygote contains a mixture of paternal and maternal genes.
- Male and Female gametes unite during fertilization resulting in a new cell called the **zygote**.
- The zygote has a mixture of genes from the parents (**paternal and maternal genes**). PM

*The Ovary:

-This is the ovary of a mature female:



- Shape: Ovarian
- Location: below the fallopian tube
- Ovarian Layers: 1) Germinal epithelium (covering capsule from the outside)
 - 2) Tunica albuginea
 - 3) Ovarian cortical (cortex, the most important)
 - 4) Medulla (the core)
- When we observe it as a cross section we find:

Centrally the **medulla**, then the **ovarian cortical**, then the **tunica albuginea**, then the **germinal epithelium**.

- Within the ovarian cortex the oocytes or ova are found at **different stages of maturation.**

*cortex is singular, corticēs is plural

*ovum is singular, ova is plural

- The **oogonia** are formed in a female when she is a **5 weeks** old fetus while she is being carried by her mother (during pregnancy).
- The **secondary oocytes** are formed when the female is about 12-15 years old (when she reaches **puberty**). 2ry oocytes are secreted at **day 14** of the female reproductive cycle during **ovulation.**

* Oogenesis:

- The Transformation of the oogonia (primitive ovum) starting at 5th week of pregnancy into a mature ovum at puberty.
- The ovary has **2 functions**:
 - 1) Produces estrogen and progesterone hormones.
 - 2) Produces a mature ovum ready for fertilization. (this is its **main function**)
- Maturation **occurs** in the **cortical regions** of the ovary (**ovarian cortical, tunica albuginea, germinal epithelium**), which contain oocytes at **various stages** of development (maturation).
- Oogenesis is a **continuous (repetitive)** monthly ovarian cycle during the female reproductive period, which is about 33 years from puberty **till menopause** (12-45 years in average).
- During this period of time (the 33 years) oogenesis is **only** stopped by **pregnancy or by some diseases.**
- Oogenesis **begins** nearly at the end of the **5th week** of pregnancy when the primordial germ cells arrive to the developing ovary then **undergo multiple mitosis** and transform into **oogonia** (immature, primitive ovum). If a

woman gets exposed to radiation during pregnancy, the fetus might turn out to be retarded or missing a limb.

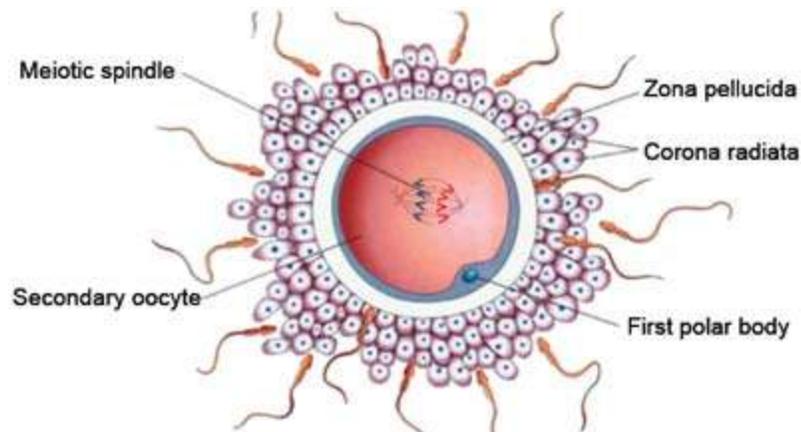
- **By the end of the 3rd month**, oogonia **multiply by mitosis** then enlarge to **primary oocytes** that are **surrounded by a singular layer of flat epithelial cells** which are then called **primordial follicle**.
- 5th week → Oogonia
3rd month → oogonia multiply by mitosis and enlarge to form primordial follicle (primary oocytes (enlarged oogonia) surrounded by a singular layer of flat epithelial cells).
- Still mitosis continues.
- **By the 5th month**: primary oocytes reach **7 million** in number (which is the highest number).
- **By the 7th month**: Most degenerate except few enlarge as **primary oocytes** which **enter prophase meiosis I** and are arrested there.
- **At birth**: All primary oocytes **complete** prophase meiosis I then are arrested in the **diplotene stage** (طور السكون) until puberty. **THEY DO NOT MATURE UNTIL PUBERTY.**

7 months	at birth
enter prophase meiosis I	complete prophase meiosis I

- During the **diplotene stage** the number of primary oocytes is **about 2 million** (which means **at birth** they are **about 2 million**), but most degenerate during childhood and **only 40,000** remain until **puberty** **depending** on the female's **life style** (type of food, environment, pollution, etc.)
- **At Puberty**: In each ovarian cycle about **20 1ry oocytes** will start to reach maturity, but **only 1** is able to reach maturity and ovulate.

5 months	at birth	puberty	1 primary oocyte is ovulated in each ovarian cycle out of 20 that start maturation.
7 million	9 million	40,000	

- During a **female fertile life** which is about 33 years, only ~ **400 1ry oocytes will be ovulated**.
- Ovulation occurs at day 14 of the female reproductive cycle, before ovulation is called preovulation.
- **Preovulation:** 1ry oocytes completes Meiosis I then it's transformed into 2ry oocyte.
- **At ovulation:** a **2ry oocytes** is expelled out **at day 14** of the female reproductive cycle, this is stimulated by LH hormone (Luteinizing hormone). The ovum is secreted with covering **2 layers** (Corona radiata, Zona pellucida) which protects it and keeps it viable). Zona pellucida is transparent.



- The ovulated **ovum** enters the uterine tube in anticipation to be fertilized and stays viable **for only 24 hrs** or it will degenerate and die.
- The **sperm** stays alive for 48 hours.
- The aim of the ovulated ovum is: to reach the endometrium while it is in the secretory phase, because it's the best time for implantation of the 2ry oocytes.

- **The secretory phase (starts at day 14 of the cycle):**

- The glands are secreting well.
- The epithelium is thick.
- It's a good media for implantation of the 2ry oocytes.
- otherwise the implantation won't occur perfectly.

*stages of maturation:

- 1) During fetal life a primordial follicle is formed. (1ry oocytes + uni-layer of flat cells)
- 2) Cubodial cells are formed (single layer).... Zona pellucida.
- 3) Cubodial cells divide by mitosis to form granulosa cells. (Multiple cells)
- 4) Granulosa cells multiply quickly.
- 5) Their fast growth separates the cells from each other forming small spaces.
- 6) These spaces unite giving one large space which is called the cave and in Latin it's called Antrum.

Every layer of the cells has a function to keep the oocyte viable. Each primary oocyte is covered by zona pellucida and corona radiata.

*Corpus Luteum: is yellow because it contains fat. (It is responsible for the 2nd stage of the period and it secretes progesterone.)

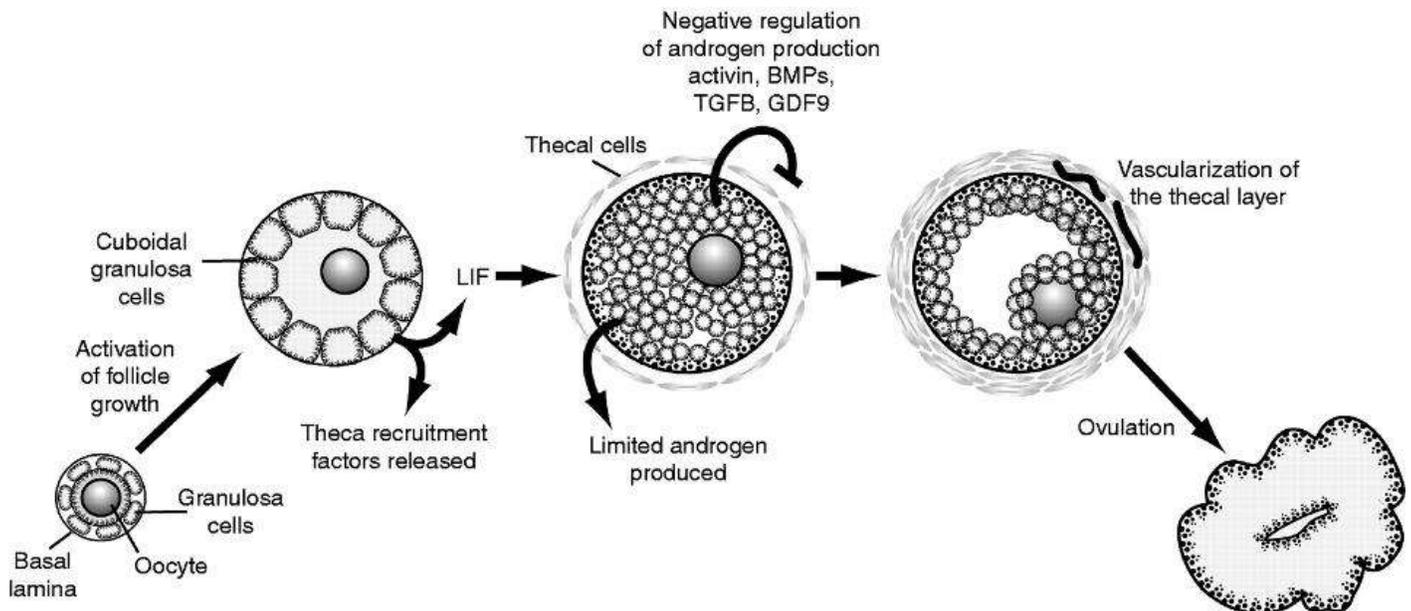
*Corpus Luteum turns into Corpus Albicans which is white in color because the fatty tissue transform into fibrous tissue).

* First half of period is controlled by estrogen, which is secreted by granulosa cells.

*Why does bleeding occur? Because progesterone is shut off, so the blood vessels supplying the endometrium become narrow and no blood will be supplying the endometrium which causes necrosis. Necrosis will contribute to shedding the endometrium. Shedding of the endometrium causes bleeding.

* Pregnant women must not undergo radiation to prevent mutations in the fetus.

* Females must be aware of the type of food they eat because it affects the 1ry oocytes in the diplotene stage.



Primordial	Primary	Preantral	Antral	Corpus luteum
<ul style="list-style-type: none"> - No theca - Flattened GCs - Precursor thecal cells in surrounding stroma <ul style="list-style-type: none"> • No LHR expression • No ability to produce steroids 	<ul style="list-style-type: none"> - Cuboidal GCs - Signals from follicle to stroma to recruit thecal cells 	<ul style="list-style-type: none"> - Thecal cells recruited and begin to differentiate; produce LH receptors, steroidogenic enzymes and small amounts of androgens - GCs secrete activin, BMPs, GDF9, inhibin, TGFB to control androgen production 	<ul style="list-style-type: none"> - Thecal cells mature and become steroidogenic under control of LH - Increasing amounts of androgen produced, converted to estradiol in GCs 	<ul style="list-style-type: none"> - Thecal cells luteinize - Transient endocrine gland - Change function to produce progesterone