**Lec.1 Human embryology الشرع د.حلل صالح**

Reproduction is the process of formation of a new living organism.

For reproduction, presence of dimorphic gametes and sex organs are required. The gametes in males are called sperm and are produced in testis. In females, they are called ova and are produced in ovary.

The gametes are derived from primordial germ cells (PGC)/primitive sex cells. These cells do not develop in gonads. They are derived from ectoderm or epiblast (the first embryonic germ layer).

The process of formation of gametes is called gametogenesis. In males, it is called spermatogenesis and in females the oogenesis.

In a 28-day menstrual cycle, ovulation takes place at about the middle of the cycle.

**Clinical correlation**

**The chromosome theory of inheritance**

Traits of a new individual are determined by specific genes on chromosomes inherited from the father and the mother. Humans have approximately 23,000 genes on 46 chromosomes.

In somatic cells, chromosomes appear as 23 **homologous** pairs to form the **diploid** number of 46. There are 22 pairs of matching chromosomes the **autosomes,** and one pair of **sex** **chromosomes.**

If the sex pair is XX, the individual is genetically female; if the pair is XY, the individual is genetically male. One chromosome of each pair is derived from the maternal gamete, the **oocyte,** and one from the paternal gamete, the **sperm.**

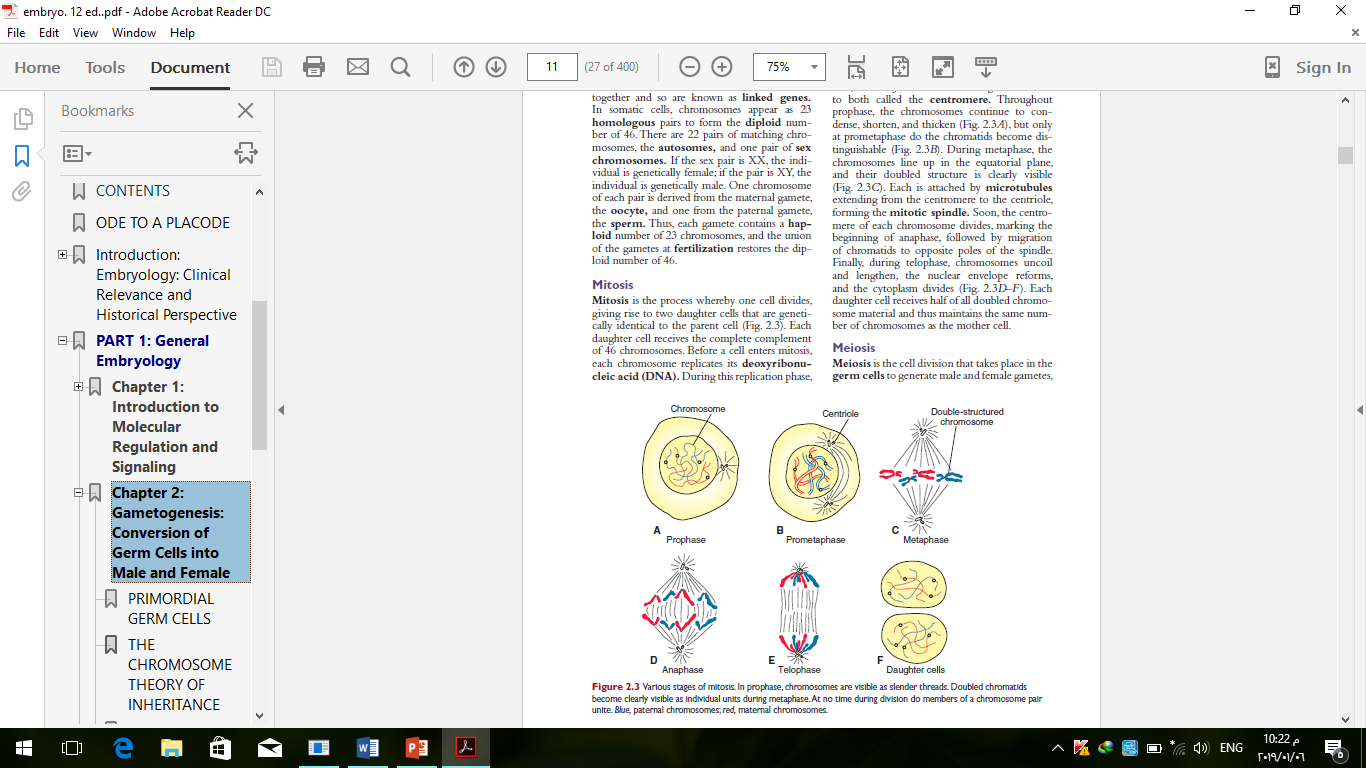
Thus, each gamete contains a **haploid** number of 23 chromosomes, and the union of the gametes at **fertilization** restores the diploid number of 46.

**Mitosis**

Both mitosis and meiosis involve division of diploid cells (2 set of chromosome)

**In mitosis:** the genetic material is duplicated and divided equally between two cells through a series of events called the cell cycle (the resultant cells are diploid cells and are genetically identical to parent cells.

Mitosis is necessary to replace dead cells, damaged cells, cells with a short half-life (all somatic cells such as blood cells, skin, fat cells …. etc



**Meiosis**

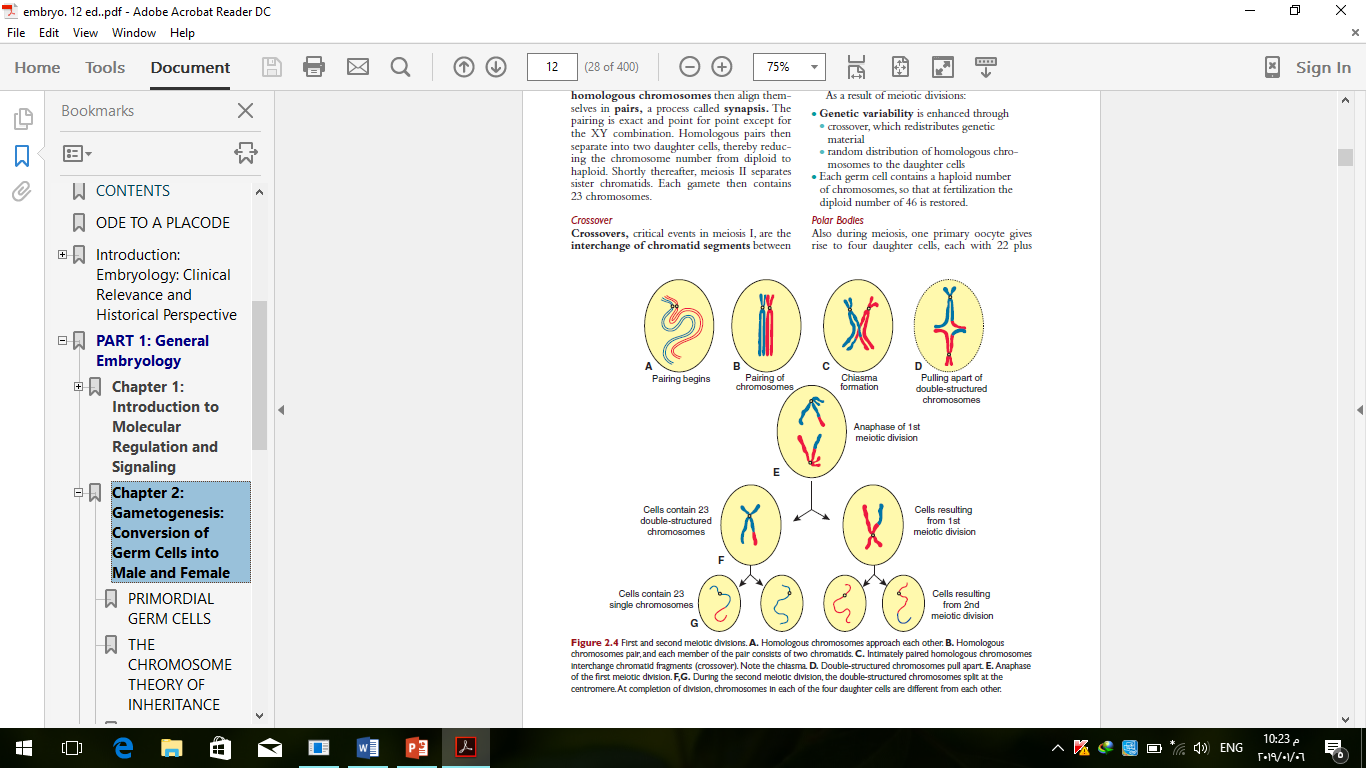
It is a process by which gametes (sex cells) are generated in organisms that can reproduce sexually.

Gametes are produced in male and female gonads; it contains one half the number of chromosome of parent cells

The division of cells occur twice in meiosis, it results in 4 daughter cells (haploid cells, genetically diverse)

Meiosis requires two cell divisions, meiosis I and meiosis II, to reduce the number of chromosomes to the haploid number of 23.

Each germ cell contains a haploid number of chromosomes, so that at fertilization the diploid number of 46 is restored.

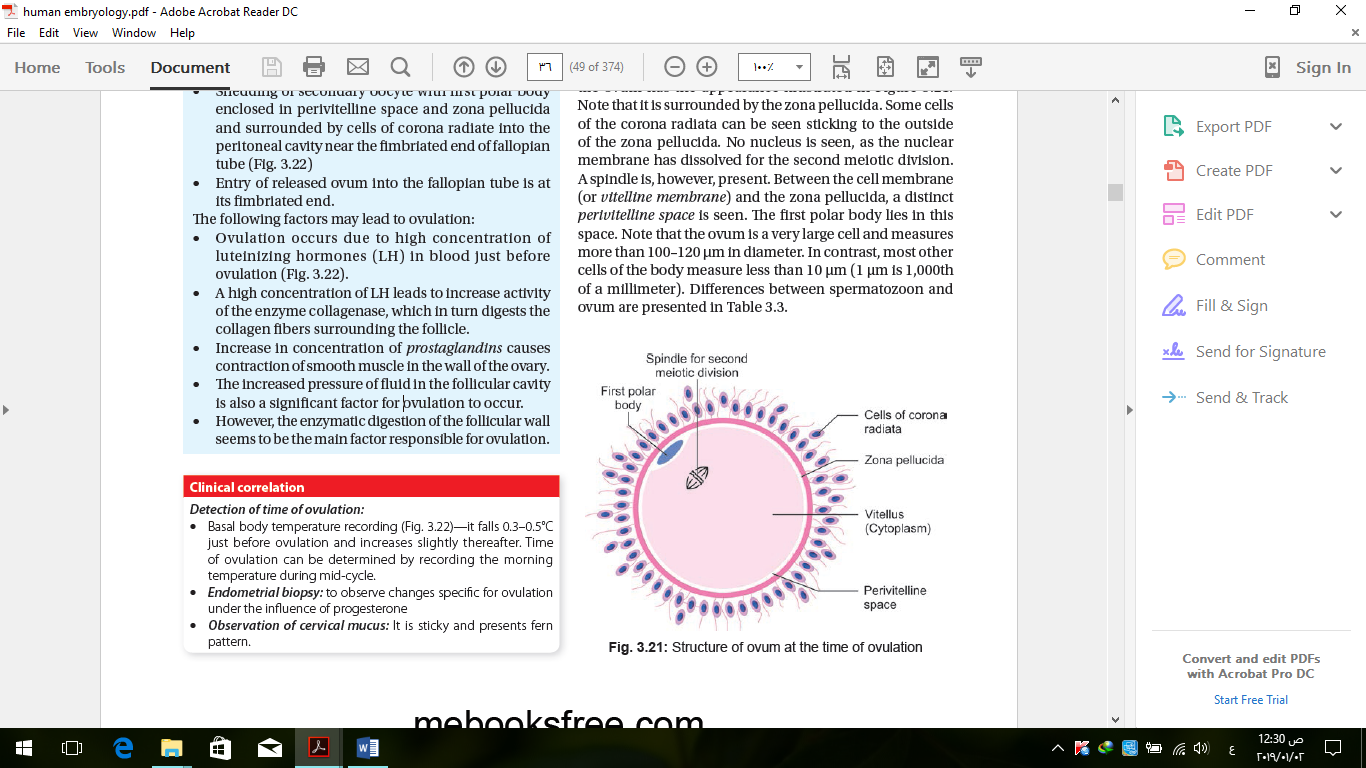


**Ovulation**

An ovarian follicle is a rounded structure that contains a developing ovum surrounded by follicular cells. Ovarian follicles have a cellular covering called the theca interna. The cells of the theca interna produce estrogens.

The follicle gradually increases in size and finally bursts and expels the ovum. This process of shedding of the ovum is called ovulation.

At this stage, it is surrounded by the zona pellucida. Some cells of the corona radiata can be seen sticking to the outside of the zona pellucida.



The term **menstrual cycle** is applied to cyclical changes that occur in the endometrium every month. The most obvious feature is a monthly flow of blood (menstruation).

• The menstrual cycle is also divided into the follicular phase (in which changes are produced mainly by estrogens) and the luteal phase (in which effects of progesterone predominate). Both phases are of roughly equal duration.

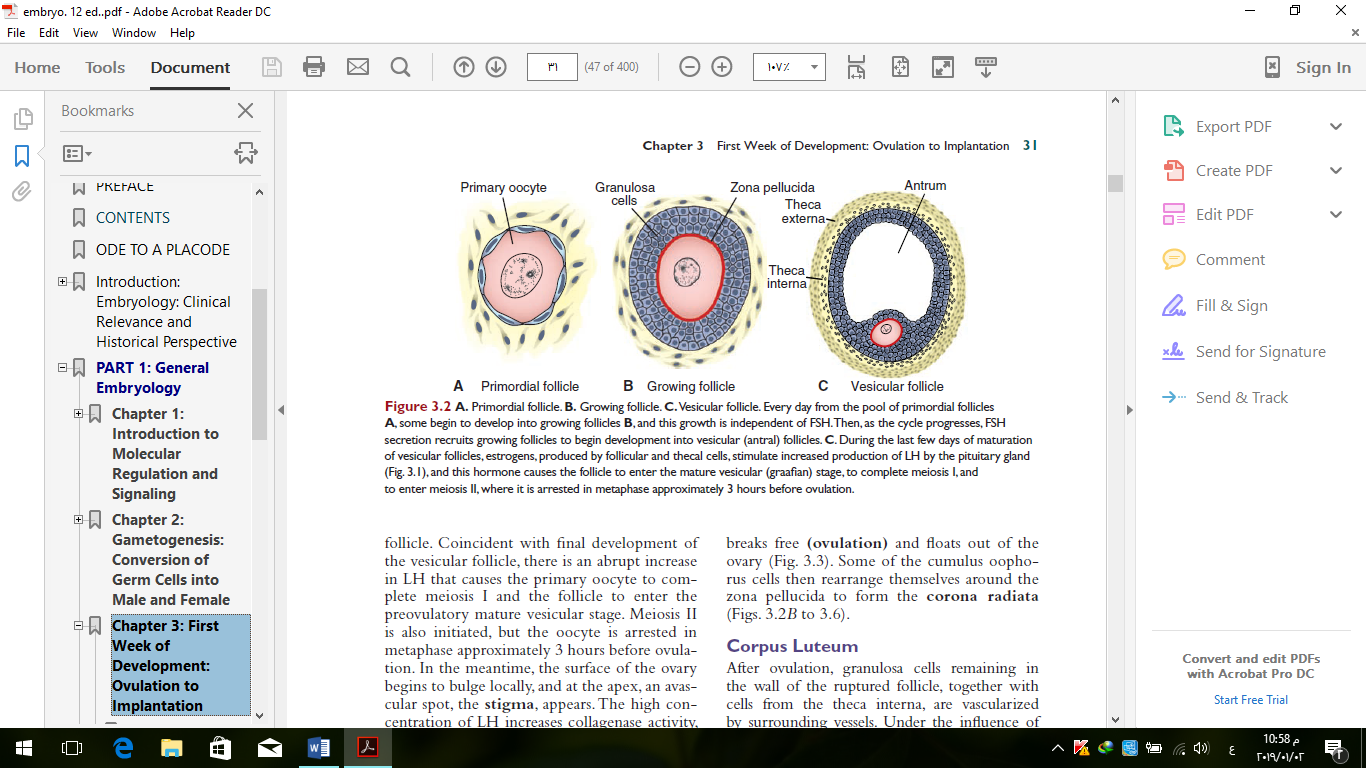
**Ovarian Cycle**

Cyclical change in ovaries during 28-day reproductive cycle, terminating in the release of single mature ovum (ovulation).

At puberty, the female begins to undergo regular monthly cycles. These **sexual cycles** are controlled by the hypothalamus. **Gonadotropin-releasing hormone** **(GnRH)** produced by the hypothalamus acts on cells of the anterior pituitary gland, which in turn secrete **gonadotropins.** These hormones, **follicle-stimulating** **hormone (FSH)** and **luteinizing hormone (LH),** stimulate and control cyclic changes in the ovary.

At the beginning of each ovarian cycle, 15 to 20 primary follicles are stimulated to grow under the influence of FSH. Under normal conditions, only one of these follicles reaches full maturity, and only one oocyte is discharged; the others degenerate and become atretic.

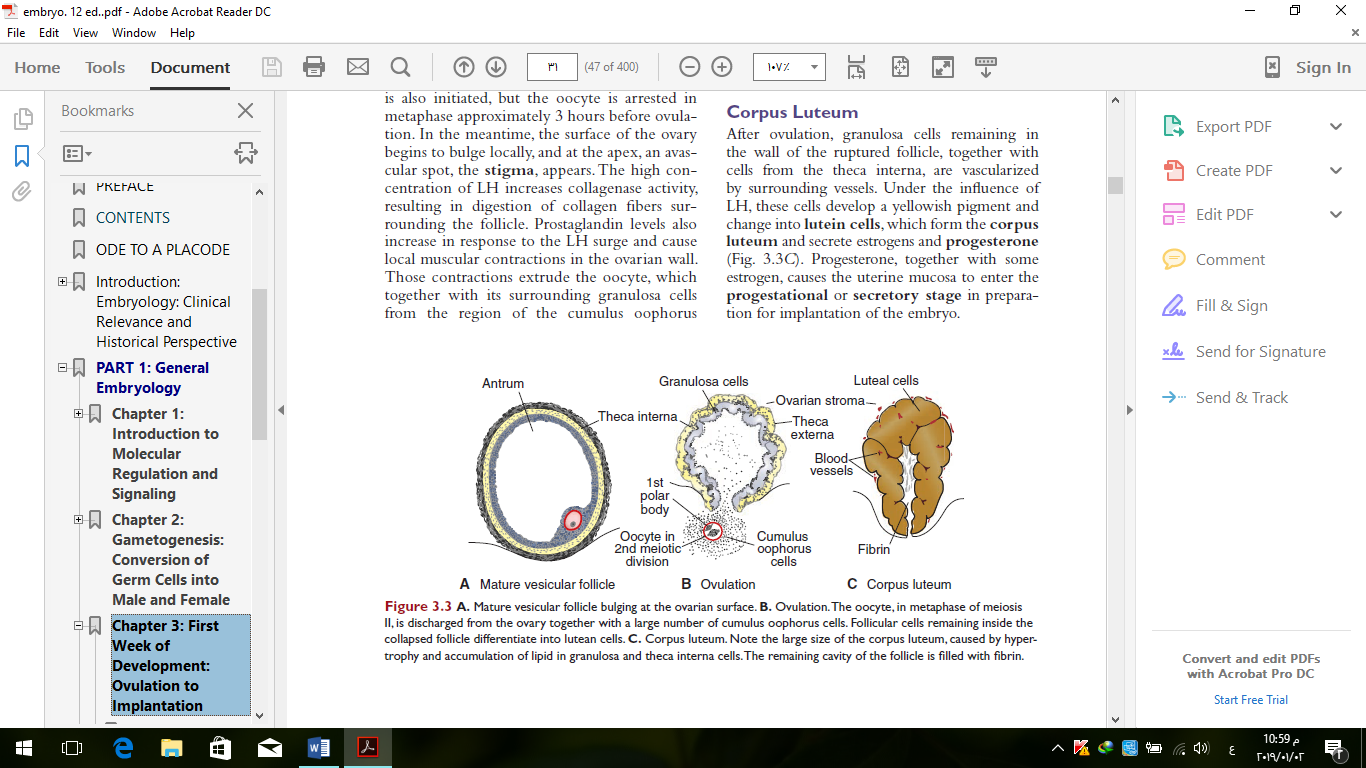
In the days immediately preceding ovulation, under the influence of FSH and LH, the secondary follicle grows rapidly to a diameter of 25 mm.if the ovum is not fertilized it dies in 12–24 hours. It passes through the uterus into the vagina and is discharged.



**Corpus Luteum**

After ovulation, granulosa cells remaining in the wall of the ruptured follicle, together with cells from the theca interna , Under the influence of LH, they develop to a yellowish pigment and change into **lutein cells**, which form the **corpus** **luteum**.

Progesterone, together with someestrogen, causes the uterine mucosa to enter the **progestational** or **secretory stage** in preparation for implantation of the embryo.



**Oocyte Transport**

Once the oocyte is in the uterine tube, it is propelled by peristaltic muscular contractions of the tube and by cilia in the tubal mucosa. In humans, the fertilized oocyte reaches the uterine lumen in approximately 3 to 4 days.

