



embryology



LEC. 1-2

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The development of a new individual begins by the union of 2 cells.

- A) One from the male known as sperm.
- B) One from the female known as an ovum.

The union of the 2 cells is called fertilized ovum or zygote. The sperm or ovum each has haploid number of chromosomes.

The results of fertilization :

1. Restoration of the complete number of chromosomes called diploid.
2. Determination of the sex of the new organism.
3. Initiation of cleavage (repeated cellular division to form the blastocyst-)

About 280 days (i.e. about 10 lunar months) after fertilization a new individual is born. These 280 days are divided into three stages:

- 1- The zygote (fertilized ovum) stage lasts for 2 weeks after fertilization.
- 2- Embryonic stage extends from the beginning of the 3rd week after fertilization to the end of 8th week.
- 3- fetal stage extends from the beginning of the 9th week (third month) till the time of birth at the end of the 10th lunar month.

General features of each stage:

- A) The zygote stage, all the cells look like each other.
- B) Embryonic stage, the tissues, organs system are formed.
- D) Fetal stage,
 1. Body grows in length & weight.
 2. Tissues and organs develop further.

Tissues :- As the cells during the embryonic stage continue to divide, certain cells start to have specific characteristic and forms tissues.

Organs :- Several tissues join each other in a special arrangement to form organs.

System :- Different organs which have the same functions form systems.

Why do we study embryology?

1- To understand the basis of the congenital abnormalities (malformations).

2- Is important to understand histology, as it explains how the different tissues and organs develop from a single cell (the fertilized ovum).

3. Necessary for the proper understanding of anatomy as for examples.

A- Phrenic nerve arises in the neck supply the diaphragm.

B- Innervation of tongue from 3 cranial nerve system (hypoglossal, glossopharyngeal and lingual).

C- The right & left recurrent laryngeal Ns have different origin.

* Gametogenesis *

Means the formation of sperms (in the tests of male i.e. spermatogenesis) and mature ovum (in the ♀ ovary i.e. oogenesis). The sperm (from spermatid) and mature ovum contain 23 single chromosomes (i.e. haploid number of chromosomes).

♦ Spermatogenesis

It include 2 steps:

A) Spermato-cytogenesis to get spermatids.

B) Spermiogenesis: modification of the spermatids to get sperms.

Spermato-cytogenesis:

The primitive male sex cells (spermatogonium) with 46 chromosomes divides by mitosis into 2 daughter cells called type A & type B spermatogonia. Type A will remain in contact with the basement membrane of the seminiferous tubules of the testes while type B continues maturation and is transformed into primary spermatocyte with 46 chromosomes ($44+xy$).

Then primary spermatocyte undergoes the first meiotic division giving rise to 2 secondary spermatocytes each of which has 23 chromosomes.

Each of the secondary spermatocyte undergoes the second meiotic division thus giving rise to 2 spermatids each has 23 chromosomes.

The spermatids are not capable to move and not capable to penetrate and fertilizes an ovum thus it needs some morphological changes (spermiogenesis) to become capable for fertilizing amature ovum.

Spermiogenesis include the following changes :

- 1. The nucleus of the cell form the head of the sperm & the genetic materials.*
- 2. The golgi apparatus forms the head cap of acrosome of the sperm.*
- 3. The mitochondria will form a sheath around the middle piece of the sperm to supply energy for the sperm.*
- 4. The centriole:*
 - The proximal one come to lie in the neck, and gives the axial filament which forms the central core of the middle piece and tail of the sperm*
 - The distal one becomes ring-shaped and forms the terminal ring.*

The head of sperm attaches to the sertolic cells to get nourishment. Then discharged during ejaculation in the seminal fluid (from sex gland as prostate; seminal vesicle & bulbo-urethral gland).

The volume of seminal fluid at each ejaculation measures 3-5 cc and contains 100 million sperms in each cc the sperms are genetically of tow types one carries x-chromosome , while the other carries y-chromosome while all ova are of one type of and carry x-chromosome .

Oogenesis:

It is cyclic process which takes place every lunar (28 days) under the influence of follicle stimulating hormone (FSH) from pituitary gland. In oogenesis the following events occur:

- 1- Formation of graafian follicle.
- 2- Ovulation.
- 3- Formation of corpus luteum.

It starts from puberty (11-14) years and end at menopause (45-50) years.

Formation of graafian follicle (follicular stage):

The graafian follicle is formed by maturation of the primordial follicle which consists of:

- a- A primary oocyte ($44+xx$).
- b- A layer of follicular cell surrounding the primary oocyte.

The primary oocyte undergoes the first meiotic division giving rise to secondary oocyte (23 or $22 + x$ -chromosome), and the first polar body (23 chromosome).

The follicular cell increase in number and acquire granules in there cytoplasm and thus called granulosa cell (zona granulosa).

A cavity appears between the granulosa cells known as the follicular antrum and is filled with fluid (follicular antrum). This antrum fluid separates the granulosa cells in to two parts:

- 1- stratum granulosum (outer layer)
- 2- cumulus oophorus, an inner part of cells surrounding the secondary oocyte and the oocyte is separated from them by the zone pellucida.

All the follicle then becomes surrounded by theca while consist of tow layers :

- a- Theca externa of fibrous layer.
- b- Theca interna (secretes estrogen).

The follicular stage is under the influence of the follicular stimulating hormone (FSH) from the pituitary gland.

ovulation

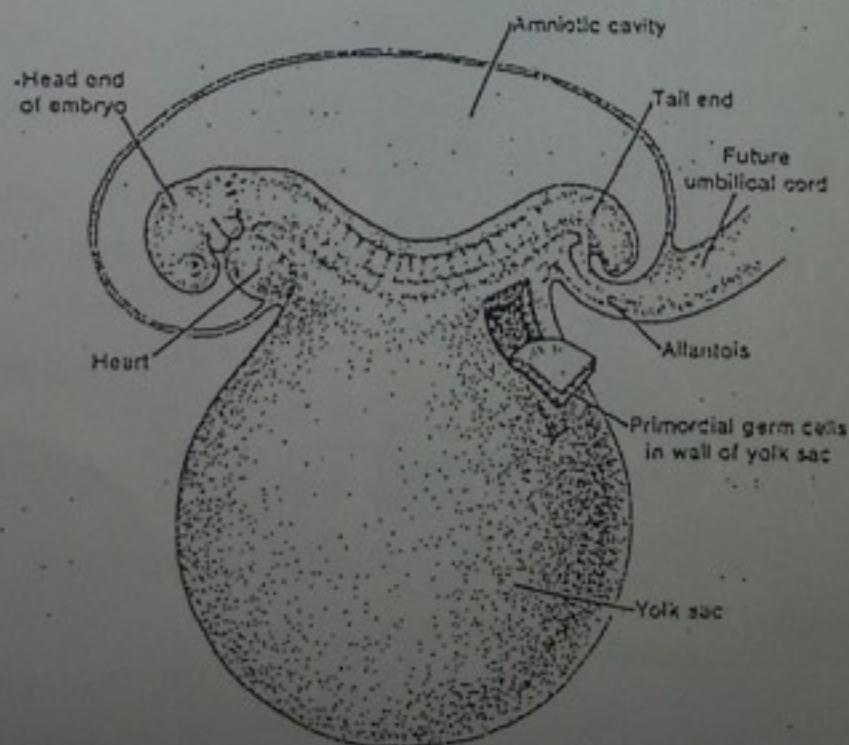
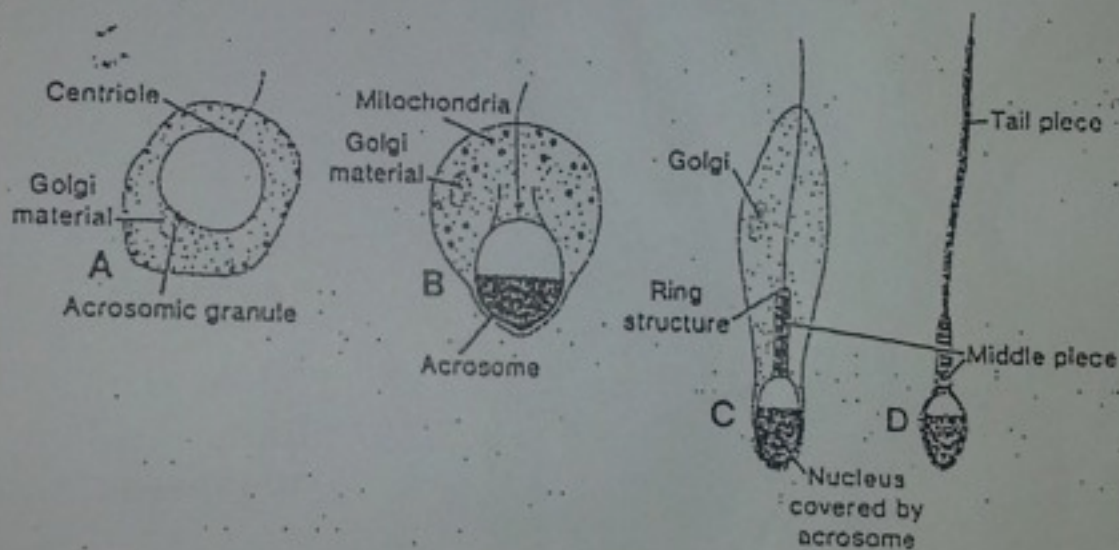
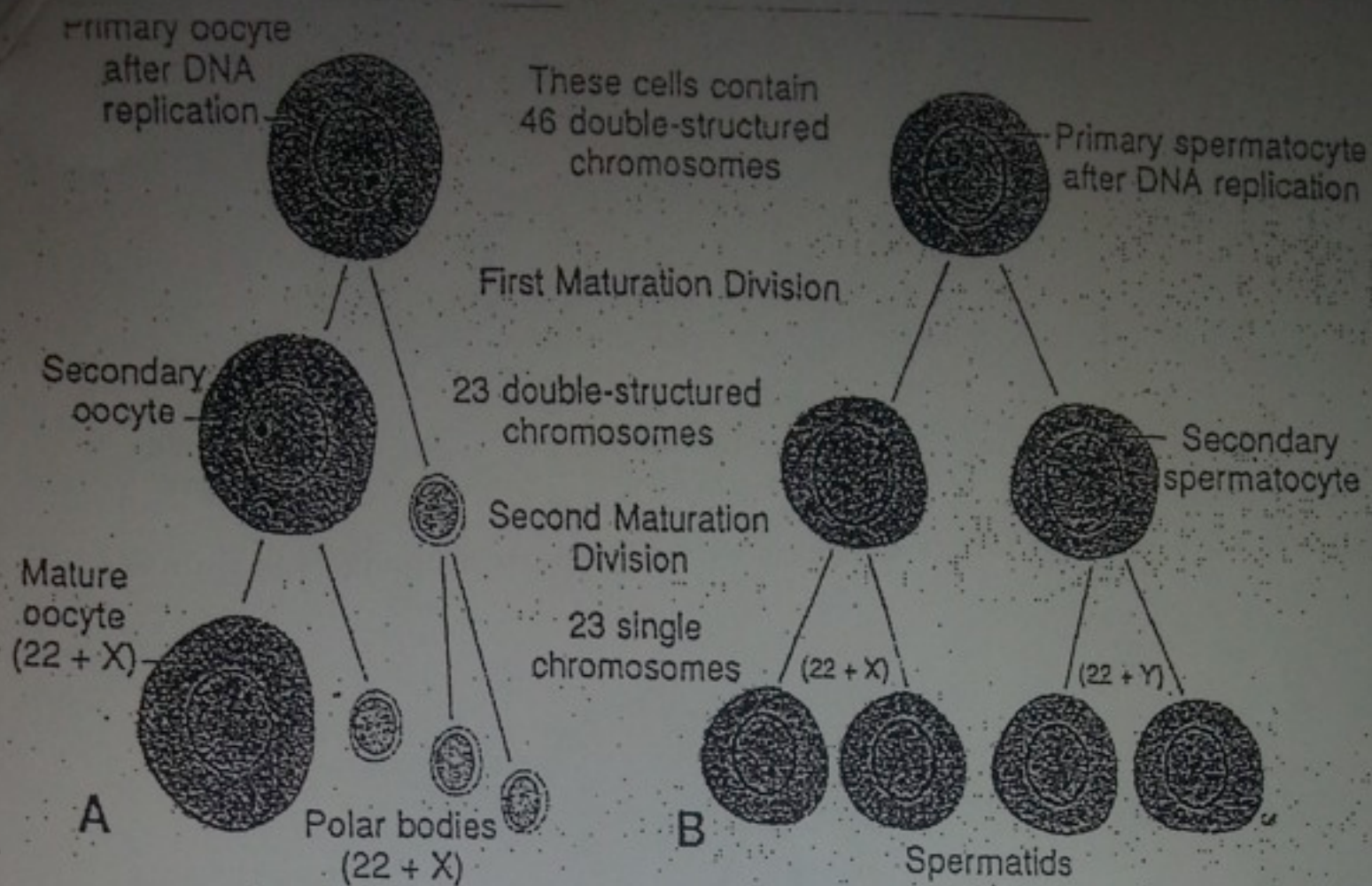
means rupture of the mature graaffian follicle of the discharge of the mature . ovum , ovulation takes place due to following factors:

- 1- Increases in the intra-follicular pressure
- 2- The influence of lutenizing hormone (LH) secreted from the pituitary gland.

On ovulation the oocyte start the second meiotic division while is not completed until fertilization.

- 3- The wall of the G.F become very thin .
- 4- The cells of the cumulus oophoricus become loosened .

Thus the G.F. ruptures and the ovum is released .once the ovum is released the first meiotic division is completed and the second spermatocyte will enter the second meiotic division , while is not completed until fertilization of the ovum take place . once fertilization is completed the second meiotic division is complete . the result of the 2 meiotic division is to get a single mature ovum and 3 polar bodies .



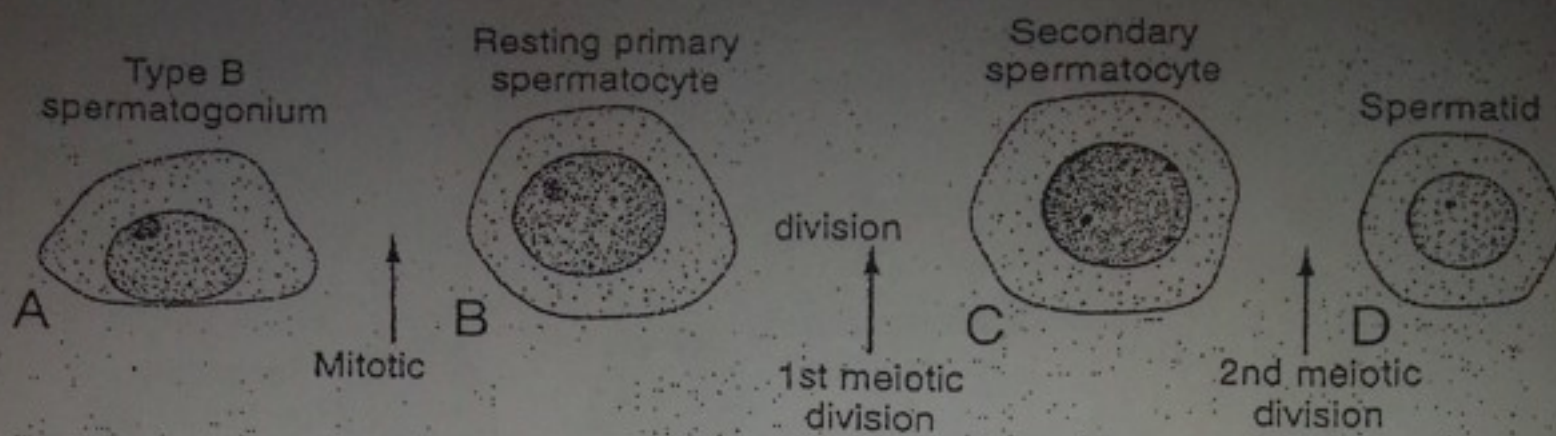


Figure 1.23. The products of meiosis during spermatogenesis in humans.

