What Is Gametogenesis?

Gametogenesis is a process by
which diploid or haploid
cells undergo cell
division and differentiation
to form mature
haploid gametes.

gametogenesis

- occurs
  by meiotic division
  of
  diploid gametocytes
  into various
  gametes, or
  by mitotic division
  of haploid
  gametogenous cells.
- The existence of a multicellular, haploid phase in the life cycle between meiosis and *gametogenesis* is also referred to
  as alternation of generations.

Gametogenesis is simply...

- the process of gametes formation
- It occurs in the gonads (ovary or testis)

Gametogenesis is divided into four phases

- 1. Extra-gonadal origin of primordial germ cells
- 2. Proliferation of germ cells by mitosis
- 3. Meiosis
- 4. Structural and functional maturation of the ova and spermatozoa

Gonial cells are the designation given to germ cells before they enter meiosis.

- replicate mitotically.
- genetically identical to the original zygote.

- When they begin meiosis, they are called **spermatocytes** and **oöcytes.**

gametogenesis

spermatogenesis

(male)

oogenesis

(female)

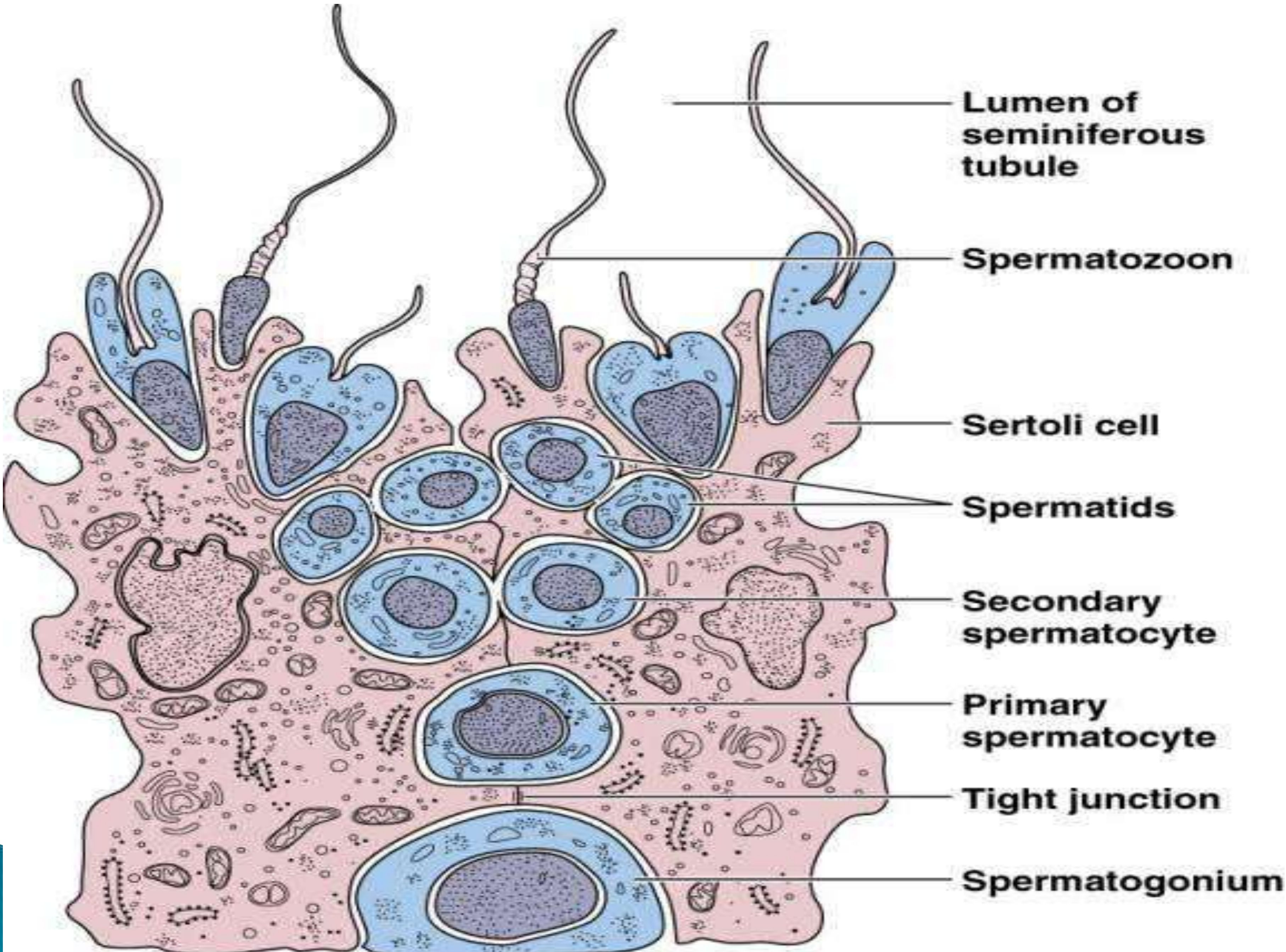
SPERMATOGENESIS

Spermatogenesis

- is the process of formation of the male germ cells (sperm formation).

- It occurs in the seminiferous tubules of the testis.

- It is thread-like in shape.


Lumen of seminiferous tubule
Spermatozoon
Sertoli cell
Spermatids
Secondary spermatocyte
Primary spermatocyte
Tight junction
Spermatogonium

- **Spermatogenesis** *occurs from puberty to old age, producing immense numbers of spermatozoa at an average rate of 1.5 million spermatozoa per minute.*

- *The sperm will mature in the* **epidiymis**, *nourished by* **sertoli** *cells for up to 10 weeks.*

- *Humans aged 13-90 can make 1 billion sperm a day.*

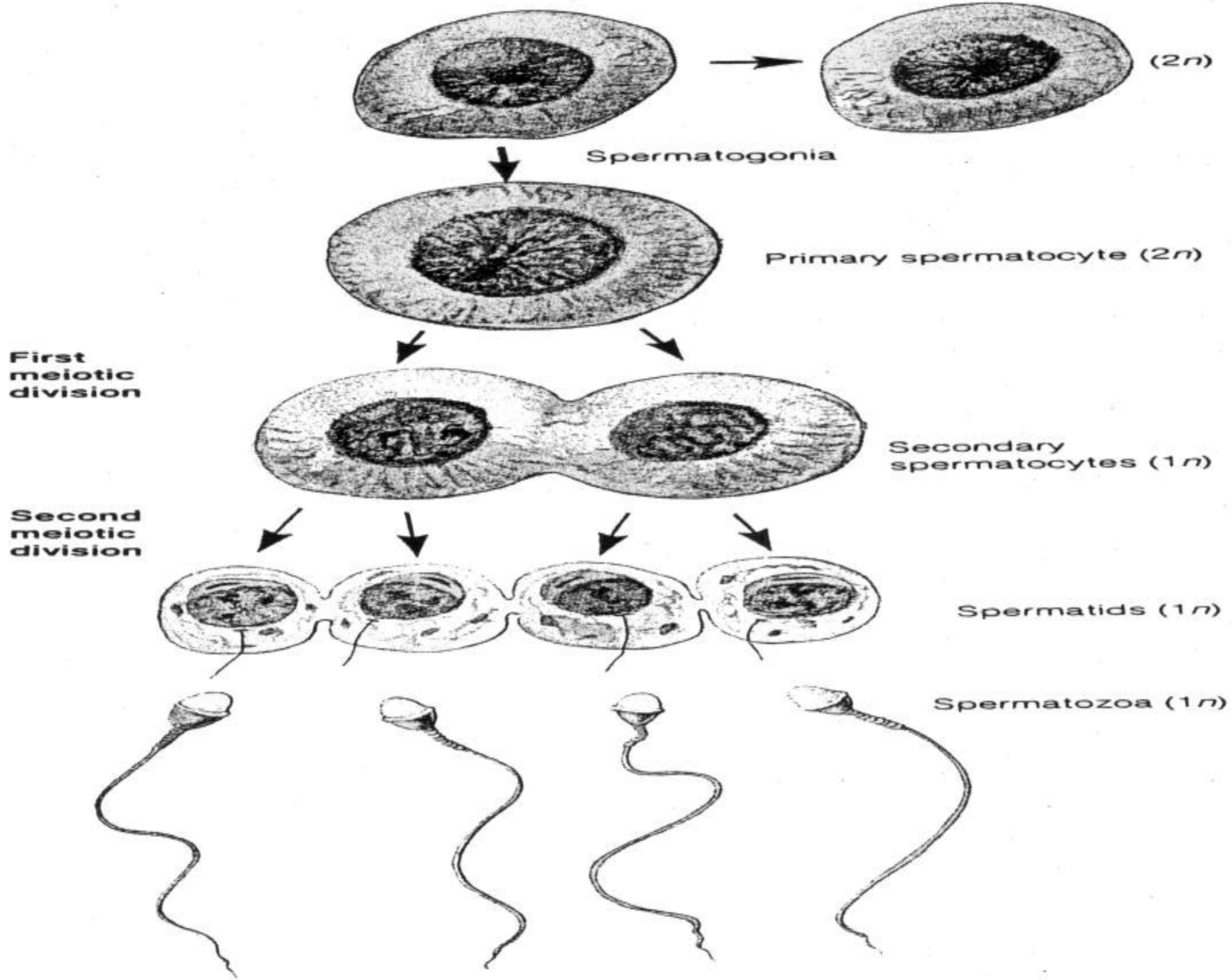
- The sertoli cells are supporting cells that have several functions.

- They form the blood-testes barrier: nutrients, and circulating substances do not directly reach the germ cells

- The sertoli cells determine which substances reach the germ cells

- The spermatogonia are outside the blood-testis barrier.

- They also produce antigen-binding proteins, which are necessary for spermiogenesis (*morphological development of spermatids to spermatozoa*).


(2n)
Spermatogonia
Primary spermatocyte (2n)
First meiotic division
Secondary spermatocytes (1n)
Second meiotic division
Spermatids (1n)
Spermatozoa (1n)

- Spermatogenesis is the process by which male primary *sperm cells* undergo *meiosis*, and produce a number of cells termed *spermatogonia*, from which the primary *spermatocytes* are derived.

- Each primary spermatocyte divides into two secondary spermatocytes, and each secondary spermatocyte into two *spermatids* or young *spermatozoa*.

- These develop into mature spermatozoa, also known as *sperm cells.*

- The primary spermatocyte gives rise to two cells, the secondary spermatocytes, and the two secondary spermatocytes by their subdivision produce four spermatozoa.

Spermatogonium

- It is an intermediary male *gametogonium* (*a kind of germ cell*).

- Diploid in number: *44 autosomes* and *2 sex cells*

- It is very small and under the process of development.

- Undergoing G1-S.

Primary Spermatocytes

- diploid in number:
<u>*44 autosomes*</u> and <u>*2 sex cells*</u>

- Increases in size

- Undergoing G2.

Secondary Spermatocytes

- Haploid in number: 22 autosomes *(double stranded)* and 1 sex cell each.
- Can see the cleavage furrow
- Undergoing Meiosis I *(Reduction Division)*
- Chromosomes are reduced into half number.

Spermatid

- Haploid in number:
22 (single stranded) autosomes and
1 sex cell.

- Undergoing Meiosis II
(Equational Division)

Spermatozoa

- It is a motile sperm cell, or moving form of the haploid cell that is the male gamete.

- It joins an ovum to form a zygote.

- Matured Sperm Cell are ready to fertilized the egg.

Oogenesis

- ***Oogenesis*** is the process of formation of the female germ cells (*egg formation*).

- It happens in the Ovary.

- It is Spherical in shape.

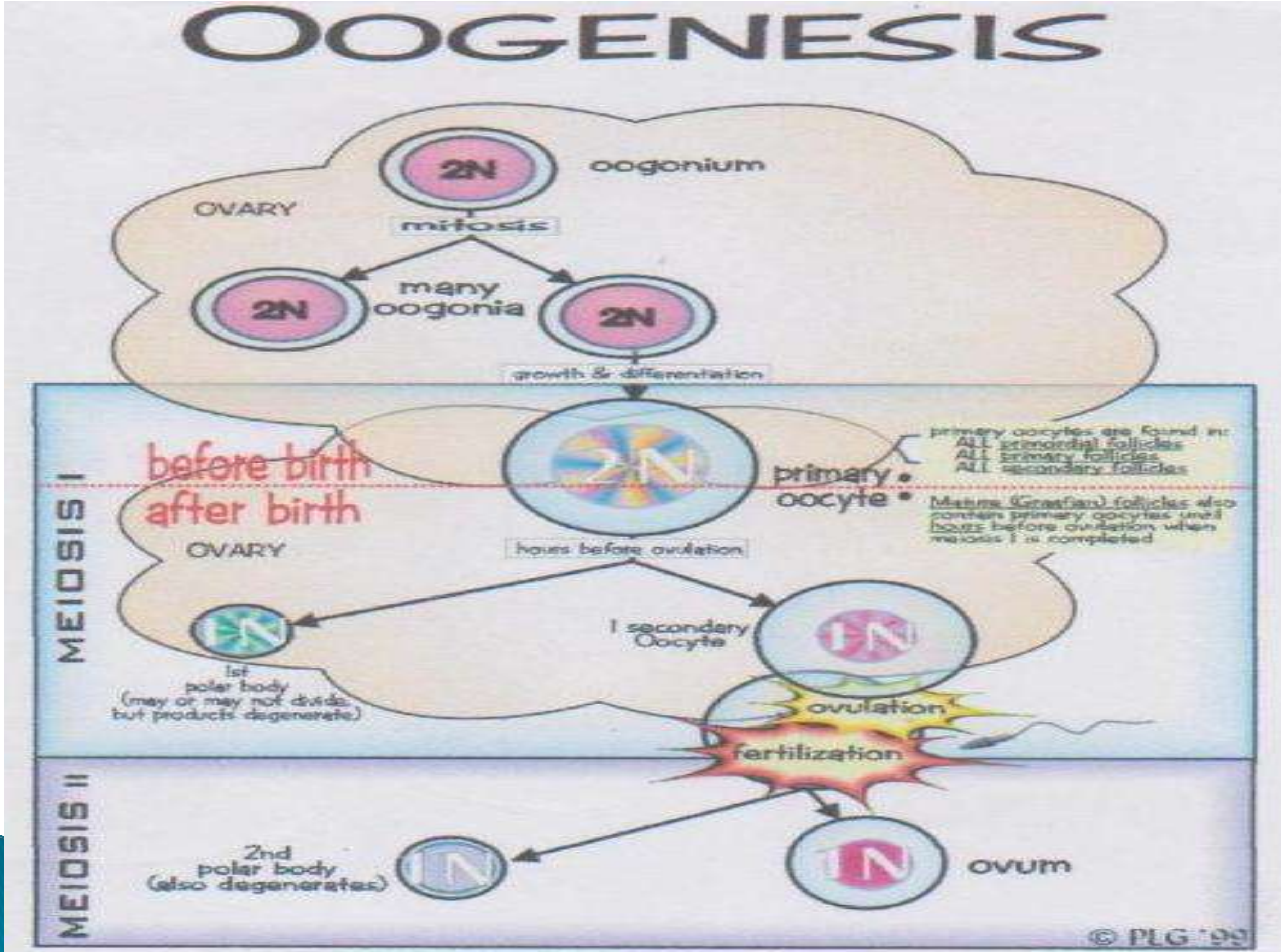
- *Oogenesis* begins in early foetal life.

- All oocytes formed in females are produced during foetal life. Many of them degenerate with time and at birth the ovaries contain about 2 million oocytes.

- All the oocytes go into meiotic arrest when they reach the first meiotic division during foetal life.

- The primary oocytes remain in the prophase of the first meiotic division until the time of puberty, when they are gradually released to complete meiosis at regular intervals known as the ovarian cycle.

- On the average only one oocyte matures during each cycle, which occurs at approximately monthly intervals, so that the total amount of oocytes to be ovulated is about 500 oocytes in a lifetime.


OOGENESIS
2N
oogonium
OVARY
mitosis
many oogonia
2N
2N
growth & differentiation
2N
before birth
after birth
primary oocyte
primary oocytes are found in:
ALL primordial follicles
ALL primary follicles
ALL secondary follicles
Mature (Graafian) follicles also contain primary oocytes until hours before ovulation when meiosis I is completed
MEIOSIS I
OVARY
hours before ovulation
1N
1st polar body (may or may not divide but products degenerate)
1 secondary Oocyte
1N
ovulation
fertilization
MEIOSIS II
2nd polar body (also degenerates)
1N
1N
ovum
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Oogonium/Oogonia

- Diploid in number: *44 autosomes* and 2 *sex cells*
- It is very small and under the process of development.
- Undergoing G1-S.

Primary Oocytes

- It is a cell whose primary function is to divide by the process of meiosis.
- It is also diploid in number: *44 autosomes* and *2 sex cells*
- Increases in size
- Undergoing G2.

Secondary Oocytes

- Undergoing Meiosis I (Reduction Division).

- Chromosomes are reduced into its half number.

- Begins during embryonic development, but halts in
the <u>*diplotene stage*</u> of prophase I until puberty.

- *Primary oocytes* that continue to develop in each menstrual
cycle, however, *synapsis* occurs
and tetrads form, enabling chromosomal crossover to occur.

- Result of meiosis I, the *primary oocyte* has now developed into
the *secondary oocyte* and the first polar body.

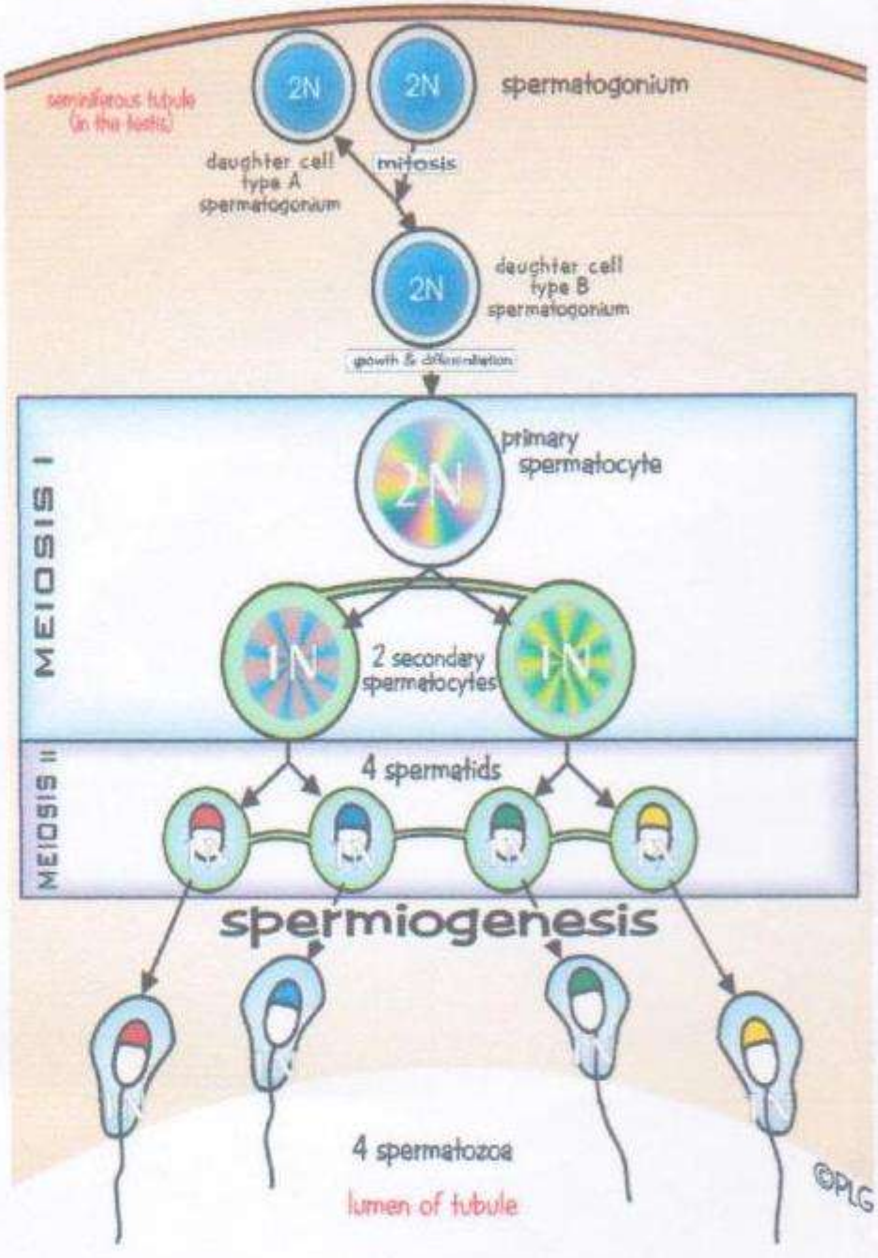
Ootid/Ovum

- Immediately after meiosis I, the haploid secondary oocyte initiates meiosis II (Equational Division).
- This process is also halted at the metaphase II stage until fertilization, if such should ever occur.
- When meiosis II has completed, an ootid and another polar body have now been created.

Polar Bodies

- Both polar bodies disintegrate at the end of Meiosis II, leaving only the ootid, which then eventually undergoes maturation into a mature ovum.
- The function of forming polar bodies is to discard the extra haploid sets of chromosomes that have resulted as a consequence of meiosis.

SPERMATOGENESIS



OOGENESIS