Oogenesis

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Oogenesis is the process of formation of female gametes.
It occurs in the ovary of female animals. It is comparable to spermatogenesis so far as nuclear changes are concerned. But the cytoplasmic specialization in oogenesis is different from spermatogenesis .Oogenesis.process begins inside the fetus before birth. The steps in oogenesis up to the production of primary oocytes occur before birth. Primary oocytes do not divide further. They either become secondary oocytes or degenerate.Oogenesis occurs in the outermost layers of the ovaries. Oogenesis starts with a germ cell called oogonium and undergoes mitosis to increase in number. The process of oogenesis takes place in the following three stages that is, first before birth primary oocyte formation .then development from birth to puberty and at last development of secondary oocyte from puberty to menopause.

The primary oocyte grows while being arrested in meiosis-I. The follicular cells proliferate and form a stratified cuboidal epithelium. Such cells are known as granulosa cells. These cells secrete glycoproteins to form zona pellucida around the primary oocyte.

The fluid-filled area, present between granulosa cells, combines to form a central fluid-filled space called the antrum. These are known as secondary follicles. In every month cycle, these secondary follicles develop under the influence of follicle-stimulating hormone and luteinizing hormone.

This stage is induced by LH surge, and meiosis-I completes here. Two haploid cells of unequal sizes are formed within the follicle. One of the daughter cells that receive less cytoplasm forms a polar body. This cell does not participate in ovum formation. The other daughter cell is known as the secondary oocyte. The two daughter cells undergo meiosis-II. The polar body replicates to form two polar bodies, while the secondary oocyte arrests in the metaphase stage of meiosis-II.

Oogenesis is divisible into following three phases:

1. Multiplication Phase:

The primary germinal cells of the ovary with diploid number of chromosomes (2n) divide several times mitotically so as to form a large number of daughter cells known as oogonia .

2. Growth Phase:

The oogonium does not divide but increases in size enormously to form a primary oocyte. The growth is associated with both nuclear and cytoplasmic growth. The nuclear growth is due to accumulation of large amount of nuclear sap and is termed as germinal vesicle. The cytoplasmic growth is associated with increase in number of mitochondria, endoplasmic reticulum and Golgi complex and accumulation of reserve food material called yolk or vitellin.

3. Maturation phase:

The primary oocyte undergoes two successive divisions by meiosis. The first division is meiosis-I and two unequal daughter cells are produced. The large cell is called secondary oocyte containing haploid (n) set of chromosomes . The smaller cell is called first polar body or polocyte containing 'n' number of chromosomes and practically no cytoplasm.

The secondary oocyte and first polar body then undergo second maturation division by meiosis-II which is an equational division. As a result of this division one large ovum is formed containing entire amount of cytoplasm and 'n' number of chromosomes and a second polar body like the first polar body.

Simultaneously, the first polar body may divide into two polar bodies or may not divide at all. Thus only one functional ovum is formed and the two or three polar bodies soon degenerate. In vertebrates the first polar body is formed after the primary oocyte is released from ovary and has entered into the oviduct. The second polar body is formed only when the sperm enters into ovum during fertilization.

Stages in oogenesis

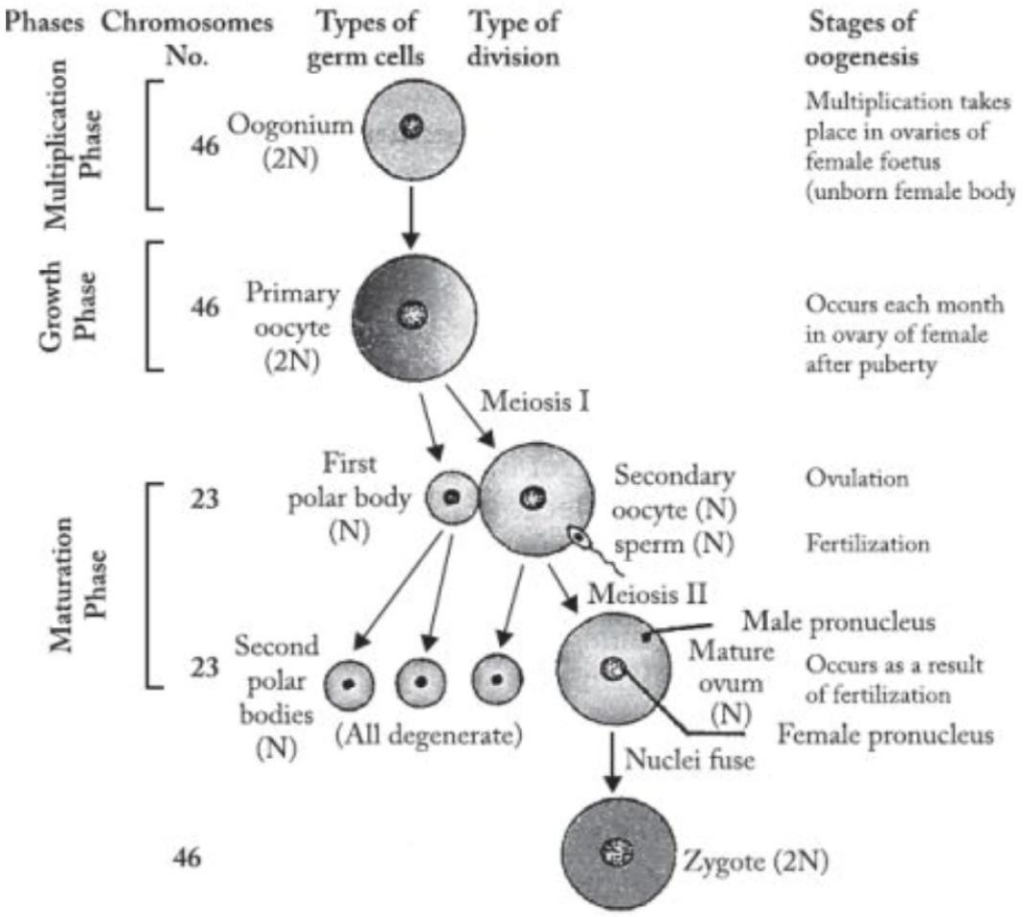

Fig.: Stages in oogenesis.