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ASSIGNMENT

1. Discuss Ovulation

Ovulation is the release of an oocyte from the ovarian follicle.

Around the middle of the ovarian cycle, a few days before ovulation, under the influence of FSH (Follicle Stimulating Hormone) and LH (Luteinizing Hormone) the secondary/vesicular ovarian follicle undergoes rapid growth spurt and becomes a mature secondary/Graafian follicle.

Along with the final development of the vesicular follicle there is an abrupt increase in LH that cause:

- The primary oocyte to complete meiosis I and
- The follicle enters the preovulatory mature vesicular stage

Meiosis II is initiated but is arrested at metaphase stage approximately 3 hours before ovulation while the surface of the ovary begins to bulge locally at the apex and an avascular spot (stigma) appears.

Two events triggered by a surge in LH production takes place for ovulation to occur, they are;

- The increase of a collagenase activity resulting in digestion of collagen fibers (connective tissue) surrounding the follicle.
- Prostaglandin levels also increases in response to the LH surge and causes local muscular contractions in the ovarian wall.
  These contractions extrude the oocyte along with its surrounding follicular cells from the region of the cumulus oophorus. It causes ovulation in which the oocyte floats out of the ovary. Some of the cumulus oophorus arranges around the zona pellucid to form the corona radiata.

Ovulation takes place 12-24 hours after the LH surge which in turn is induced by high estrogen level in the blood.

2. Differentiate between Meiosis 1 and Meiosis 2

S/N	Meiosis 1	Meiosis 2
1	It reduces the ploidy number from 4n to 2n	It divides the ploidy number from 2n to n
2	There is synapsis	There is no synapsis
3	There is crossing over or chiasma formation	There is no crossing over or chiasma formation
4	It is a heterotypic division	It is a homotypic division
5	Homologous chromosomes are present in the beginning	Individual, bivalent chromosomes are present in the beginning
6	Individual chromosomes are present in the daughter nuclei	Sister chromatids are present in the daughter nuclei
7	A complex division that takes more time	Comparatively more simple and takes less time
8	Preceded by interphase	No interphase takes place
9	Reduces the chromosome number in the daughter cells	Equalizes the chromosome number of both parent and daughter cells
10	Cohesion protein complexes at the arm of the homologous chromosomes are cleaved	Cohesion at the centromeres are cleaved in order to separate the two sister chromatids

3. Discuss the stages involved in fertilization

I. Passage of a sperm through the corona radiata:

For sperms to pass through the corona radiata, they must have been capacitated. This is the removal of the glycoprotein coat and seminal plasma proteins from the plasma membrane that overlies the acrosomal region of the spermatozoa. Only capacitated sperms can pass freely through the corona radiata.

II. Penetration of the zona pellucida:

The zona is a glycoprotein shell surrounding the egg that facilitates and maintains sperm binding and induces the acrosome reaction. The intact acrosome of the sperm **binds** with a zona glycoprotein (ZP3/ zona protein 3) on the zona pellucida.

The acrosomal enzymes (acrosin) are released and it allows sperm to penetrate the zona pellucida, thereby coming in contact with the plasma membrane of the oocyte. As soon as the head of a sperm comes in contact with the oocyte surface, the permeability of the zona pellucida changes.

When a sperm comes in contact with the oocyte surface, lysosomal enzymes are released from cortical granules lining the plasma membrane of the oocyte. In turn, these enzymes alter properties of the zona pellucida to:

1. prevent sperm penetration and
2. inactivate binding sites for spermatozoa on the zona pellicida surface

Only one sperm seems to be able to penetrate the oocyte**.**

III. Fusion of plasma membranes of the oocyte and sperm

The plasma or cell membranes of the oocyte and sperm fuse and break down at the area of fusion. The head and tail of the sperm enter the cytoplasm of the oocyte, but the sperm's plasma membrane remains behind.

IV. Completion of the second meiotic division of oocyte and formation of female pronucleus

Penetration of the oocyte by a sperm activates the oocyte into completing the second meiotic division and forming a mature oocyte and a second polar body.

The nucleus of the mature ovum/oocyte is now called the female pronucleus.

V. Formation of the male pronucleus

Within the cytoplasm of the oocyte, the nucleus of the sperm enlarges to form the male pronucleus and the tail of the sperm degenerates.

Since all sperm mitochondria degenerate, all mitochondria within the zygote are of maternal origin (i.e., all mitochondrial DNA is of maternal origin)

Morphologically, the male and female pronuclei are indistinguishable. The oocyte now contains 2 pronuclei, each having haploid number of chromosomes (23). The oocyte containing two haploid pronuclei is called an ootid

VI. The 2 pronuclei fuse into a single diploid aggregation of chromosomes, the ootid becomes a zygote:

The chromosomes in the zygote become arranged on a cleavage spindle in preparation for cleavage of the zygote.

4. Differentiate between monozygotic and dizygotic twins

S/N	MONOZYGOTIC TWINS	DIZYGOTIC TWINS
1	They are developed by the splitting of a fertilized embryo into two	They are developed by two separate simultaneous fertilization events
2	Known as Identical twins	Known as fraternal twin
3	Cause unknown	Caused by IVF, certain fertility drugs or hereditary predisposition
4	Genetics codes are nearly identical	Genetic codes are the same as normal siblings
5	Gender is the same	Gender is different
6	Blood types are the same	Blood types are different
7	Physical appearance is similar if not identical	Physical appearance is similar as normal siblings
8	It is not hereditary	It is hereditary
9	High risk of *TTS	Low risk of *TTS
10	Make up one-third of the twins in the world	Make up two-third of the twins in the world

***TTS is Twin-to-Twin Transfusion Syndrome risk**