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COURSE EMBRYOLOGY

1. Discuss Ovulation
2. Differentiate between Meiosis 1 and 2.
3. Discuss the stages involved in fertilization.
4. Differentiate between monozygotic twins and dizygotic twins.

### Ovulation

- This is the release of an oocyte from the ovarian follicle.
- In a few days before ovulation, under the influence of FSH and LH, the secondary follicle grows rapidly to a diameter of about 25mm, to become the mature vesicular / mature secondary / Graafian follicle.
- Coincident with the final development of the vesicular follicle, there is an abrupt increase in LH that causes:

- ① The primary oocyte to complete meiosis I & II
- ② And the follicle to enter the preovulatory mature vesicular stage.

- Meiosis 2 is also initiated, but the secondary oocyte is arrested in metaphase approximately 3 hours before ovulation.

- In the meantime, the surface of the ovary begins to bulge locally, and at the apex of an avascular spot, the stigma appears.

- For the oocyte to be released, 2 events occur which are caused by LH surge:

1. It increases collagenase activity, resulting in the digestion of the collagen fibres surrounding the follicle.
2. Prostaglandin levels also increase in response to the LH surge to cause local muscular contractions in the ovarian wall.

- These contractions extrude the oocyte, which together with its surrounding follicular [granulosa] cells, from the region of the cumulus oophorus.

- This causes ovulation in which oocyte floats out of the ovary.

## 2. Differences between Meiosis 1 and 2

Meiosis 1	Meiosis 2
1. It is heterotypic / reduction division.	It is homotypic / equatorial division.
2. Chromosomes remain in the replicated state.	The two chromatids of the replicated chromosomes separate.
3. The number of chromosomes is reduced to half i.e. from diploid to haploid.	The number of chromosomes remain the same i.e. from haploid to haploid state.
4. Crossing over occurs which makes the two chromatids of a chromosome different.	The generally different chromatids of a chromosome are separated.
5. It is a complicated and long division.	It is a short and simple equatorial division.
6. An interphase having both growth and synthetic phase precedes meiosis 1.	The interphase <del>is</del> <sup>has only</sup> growth phase. S phase is absent.
7. In prophase I, sister chromatids have convergent arms.	In prophase II, the sister chromatids have divergent arms.

## 3. Stages Involved in Fertilization.

Fertilization is the union of the sperm and ovocyte. It occurs at the ampulla of the uterine tube. Takes about 24 hours. There are six stages involved in the process of fertilization.

- I. Passage of a sperm through the zona radiata.
- II. Penetration of the zona pellucida.
- III. Fusion of the plasma membranes of the ovocyte and sperm. ~~Release of acrosomal enzymes (acrosin).~~
- IV. Completion of meiosis 2 and formation of female pronucleus.
- V. Formation of male pronucleus.
- VI. Formation of Zygote.

### I. Passage of a sperm through the Corona Radiata.

For sperms to pass through the zona radiata, they must have been capacitated i.e. removal of glycoprotein coat and seminal plasma membranes that overlies the acrosomal region of the spermatozoa.

## II Penetration of the Zona pellucida.

- The intact acrosome of the sperm binds with a zona glycoprotein on the zona pellucida.
- Release of acrosomal enzymes [acrosin] 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 the properties of the zona pellucida to:
  - (a) Prevent sperm production.
  - (b) Inactivate binding site for spermatozoa on the zona pellucida surface.

## III Fusion of plasma membrane of the oocyte and sperm.

- The plasma or cell membranes of the oocyte and sperm fuse and breakdown 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 the sperm activates the oocyte into completing the <sup>second</sup> meiotic division and forming a mature oocyte and a second polar body.
- The nucleus of the mature ovum/oocyte becomes/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.

## VI Formation of Zygote

The 2 pronuclei fuse into a single diploid aggregation of chromosomes, the ovid becomes a oocyte.

4 Differentiate between Monozygotic and Dizygotic Twins

- 1. Genetically identical
- 2. Also called identical twins
- 3. They usually have the same sex
- 4. They share the same chorionic sac
- 5. They share the same amniotic sac
- 6. They share the same umbilical cord

Also called fraternal twins  
They can be of different sexes  
They have separate chorionic sacs  
They share separate amniotic sacs  
They have separate umbilical cords

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