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COURSE CODE: ANA201 (EMBRYOLOGY)

QUESTIONS

a. **Discuss ovulation**
b. **Differentiate between meiosis I and II**
c. **Discuss the stages involved in fertilization**
d. **Differentiate between monozygotic and dizygotic twins**

ANSWERS

1. Ovulation is the release of secondary oocytes from the ovarian follicle

The secondary follicle grows rapidly to a diameter of about 25mm to become Graafian follicle under the influence of luteinizing hormone and follicle stimulating hormone few days before ovulation. Coincident with the final development of vesicular follicle, there is an abrupt increase in luteinizing hormone that causes

- Primary oocyte to complete meiosis 1
- The follicle to enter the pre-ovulatory mature vesicular stage

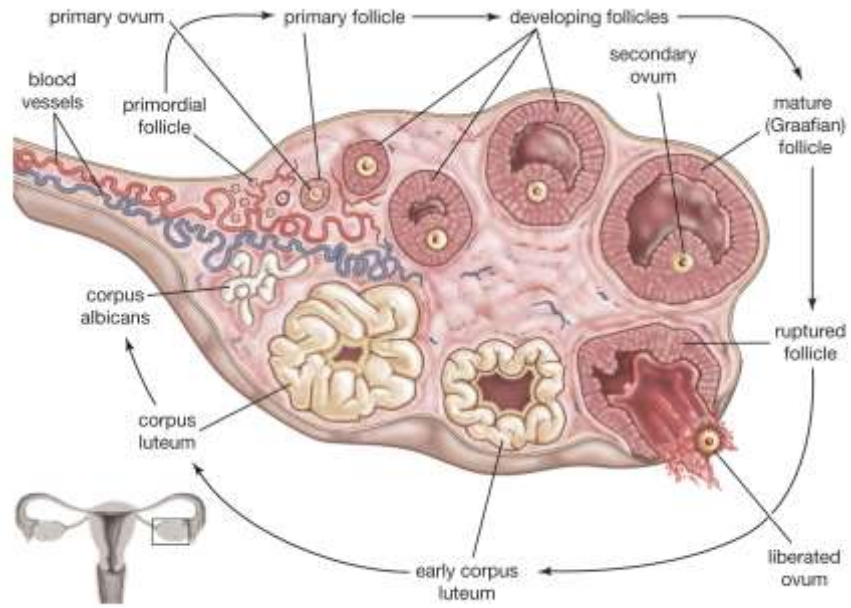
Meiosis II is initiated but the secondary oocyte is arrested in metaphase approximately 3 hours before ovulation.

In the meantime, the surface of the ovary begins to bulge locally and at the apex, an avascular spot, the stigma appears. For the oocyte to be released, two events occur caused by luteinizing hormone surge

- Increase in collagenase activity, resulting in digestion of collagen fibres surrounding the follicle
- Prostaglandin levels also increase and cause local muscular contractions in the ovarian wall.

These contractions extrude the oocyte together with follicular cells from the region of the cumulus oophorus. Some of the cumulus oophorus cells rearrange themselves around the zona pellucida to form the corona radiata.

Ovulation is triggered by luteinizing hormone production surge. It usually follows the luteinizing hormone peak by 12 to 24 hours. The luteinizing hormone surge, brought about by high estrogen level in blood, appears to cause the stigma to balloon out, forming a vesicle



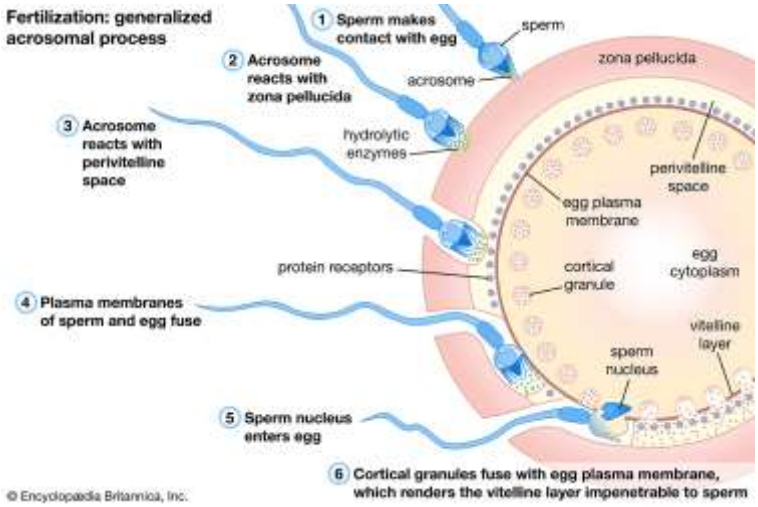
2.

MEIOSIS I	MEIOSIS II
a. Reduces the ploidy level from 2n to n	Divides the remaining set of chromosomes
b. Synapsis occurs	No synapsis
c. Crossing over occurs	No crossing over occurs
d. Chiasma formation occurs	No chiasma formation occurs

3. Fertilization is the union of the sperm and oocyte. The usual site of fertilization is the ampulla of the uterine tube. This process takes approximately 24hours and involves the following stages:
   - **Passage of sperm through corona radiata**: For sperms to pass through the corona radiata, they must have been capacitated (removal of glycoprotein coat and seminal plasma proteins from the plasma membrane that overlies the acrosomal region of the spermatozoa)
   - **Penetration of zona pellucida**: The zona is a glycoprotein shell surrounding the egg that facilitates and maintains sperm binding and induces the acrosome reaction. The acrosome of the sperm binds with a zona glycoprotein (ZP3/Zona protein 3) on the zona pellucida. Release of acrosin allows the sperm penetrate the zona pellucida, thereby coming in contact with the plasma membrane of the oocyte.
     As soon as the sperm comes in contact with the oocyte surface, lysosomal enzymes are released from cortical granules lining the plasma membrane of the oocyte which alter the properties of the zona pellucida to prevent sperm penetration and inactivate binding sites for spermatozoa on the zona pellucida surface.
   - **Fusion of plasma membranes of 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 oocyte cytoplasm but the sperm's plasma membrane remains behind.
   - **Completion of 2nd meiotic division of oocyte and formation of female pronucleus:** Penetration of the oocyte by a sperm activates the oocyte into completing meiosis II and

forming a mature oocyte and a second polar body. The nucleus of the mature oocyte is now called the female pronucleus

- **Formation of 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. The oocyte now contains two pronuclei, each with haploid number of chromosomes (23). The oocyte containing two haploid pronuclei is called an ootid.
- Male and female pronucleus fuse into a single diploid aggregation of chromosomes, the ootid becomes a zygote



4.

MONOZYGOTIC TWINS	DIZYGOTIC TWINS
a. Formed from single zygote	Formed from two zygotes
b. Incidence is more common	Incidence is less common
c. Genetically identical	Genetically unidentical
d. Same sex	Different sexes
e. Similar resemblance	Resemblance is like any other two siblings
f. Diamniotic, monochorionic with single placenta	Two amnions, two chorions and two placentas
g. Often called conjoined twins	Not seen as conjoined twins