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EMBRYOLOGY

### Question 1 (Cont): DISCUSS OVULATION

Ovulation is the release of a secondary oocyte from the ovarian follicle. Before ovulation, under the influence of Follicle stimulating hormone (FSH) and Luteinizing hormone (LH), the secondary follicle grows rapidly to a diameter of 28mm to become a Graafian follicle. Coincident with the final development of the follicle, there is an abrupt increase in Luteinizing hormone this causes:

- (1) The primary oocyte to complete meiosis I.
- (2) The follicle to enter the preovulatory mature vesicular stage.

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

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

For the oocyte to be released, two events must occur. These events are caused by a surge of Luteinizing hormone:

- 1) It increases collagenase activity resulting in the digestion of collagen fibers surrounding the follicle.
- 2) Prostaglandin levels also increase in response to the Luteinizing hormone surge and cause local muscular contractions in the ovarian wall.

These contractions extrude the oocyte, together with its surrounding follicular cells from the region of the ~~follicle~~ cumulus oophorus. This causes ovulation.



In which oocyte floats out of the ovary. Some of the cumulus oophorus cells then rearrange themselves around the zona pellucida to form the corona radiata.

### Clinical Correlates:

- 1) During ovulation, some women feel a variable amount of abdominal pain called **mittelschmerz**, also known as middle pain because it normally occurs near the middle of the menstrual cycle. It may be used as a symptom of ovulation. Other signs may be
  - a) change in cervical mucus
  - b) Drop in basal body temperature.

- 2) **Anovulation** - when women fail to ovulate because of a low concentration of gonadotropins

Question 2: Differentiate between Meiosis 1 and 2.

<del>Meiosis I</del>	Meiosis I	Meiosis II
1) Definition	It is the first cell division of meiosis	It is the second cell division of meiosis
<del>Subphase</del>		
2) Number of cells produced	Two	Four
3) Chromosome Number	Becomes half	Does not divide into two
4) Chromosome Separation	Homologous chromosomes separate from each other	Sister Chromatids separate from each other
5) Nature	Heterotypic division	Homotypic division
6) Crossing over and Genetic Recombination	Crossing over and genetic recombination occur	Crossing over and genetic recombination do not occur



	Meiosis I	Meiosis II
7 DURATION	Has a longer duration	A shorter duration
8 Splitting of centromeres of the chromosomes	Does not take place	Centromeres splits on sister chromatids separate.
9 Interphase	There is interphase before meiosis I occurs	There is no interphase between meiosis I & II

Question 4: Differentiate between monozygotic twins and dizygotic twins.

MONOZYGOTIC TWINS	DIZYGOTIC TWINS
1 Monozygotic twins are developed by the splitting of a fertilized embryo into two	Dizygotic twins are developed by two separate simultaneous fertilization events.
2 Cause is not known	Caused either by IVF, certain fertility drugs or hereditary predisposition.
3 Genetic codes are nearly identical	Genetic codes are same as any other siblings.
4 Gender is the same	Gender is different.
5 Blood types are the same	Blood types are different.
6 Appearance is extremely similar but may be affected by environmental factors.	Appearance is similar as any other siblings.
7 One-third of the twins in the world are monozygotic	Two-third of the twins in the world are dizygotic.
8 Bear a high risk of TTTS	Bear a low risk of for TTTS
9 <del>More</del> they are not hereditary	They can be hereditary
10 They can be either Di-Di, mono-Di or Mono-Mono twins	They are only Di-Di twins



Question:- Discuss the stages of fertilization.

Fertilization is the union of the sperm and oocyte. It occurs in the ampulla of the fallopian tube. The stages of fertilization include

### (1) Passage of a sperm through the Corona Radiata.

\* Only capacitated sperm can pass freely through the corona radiata. (ie removal of the glycoprotein coat and seminal plasma proteins from the plasma membrane that overlies the acrosomal region of the spermatozoa).

### (2) 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 on the zona pellucida. The release of acrosomal enzymes allows sperm to penetrate the zona pellucida, thereby coming in contact with the plasma membrane of the oocyte. When the sperm comes in contact with the oocyte surface, lysosomal enzymes are released from the lining membrane of the oocyte. The enzymes alter properties of the zona pellucida to

1) Prevent sperm penetration.

2) Inactivates binding sites for spermatozoa.

### (3) 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.

### 4) 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 is now called the female pronucleus.

### 5. 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.

\* All sperm mitochondria degenerate, so the mitochondria within the zygote are of maternal origin.

\* Morphologically, the male and female pronuclei are indistinguishable.

6. The two pronuclei fuse into a single diploid aggregate 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.

\* The oocyte containing two haploid pronuclei is called an ootid.