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COURSE TITLE: EMBRYOLOGY I.

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## ASSIGNMENT QUESTIONS

1. Discuss Ovulation
2. Differentiate between meiosis I and meiosis II
3. Discuss stages involved in fertilization
4. Differentiate between monozygotic twins and dizygotic twins

## DISCUSS OVULATION

Ovulation is the release of an egg or oocyte from the ovarian follicle of a woman. The mature vesicular/ mature secondary or Graafian follicle is formed from the secondary follicle under the influence of **FSH (follicle stimulating hormone)** and **LH (luteinizing hormone).** There is an **abrupt increase in LH** that causes;

- the primary oocyte to complete meiosis I and
- 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. In the meantime, the surface of the ovary begins to bulge locally, and at the apex, an avascular spot, the STIGMA, which balloon out to a vesicle. The stigma soon ruptures, expelling the secondary oocyte with the follicular fluid. This secondary oocyte is surrounded by zona pellucida which is surrounded by corona radiata. The LH surge also seem to induce the resumption of meiosis I of primary oocyte. Hence the mature ovarian follicle contains secondary oocytes.

**SIGNS OF OVULATION**

- ✓ change in vaginal discharge
- ✓ increased sexual desires
- ✓ change in basal body temperature
- ✓ increase in luteinizing hormons
- ✓ breast tenderness

**CLINICAL CORRELATES**

- Anovulation is the clinical condition where by a woman is not able to ovulate due to decrease in gonadotropin production
- Oligovulation is irregular ovulation
- In the case of anovulation, administration of an agent to stimulate gonadotropin release and hence ovulation can be employed. Although such drugs are effective, they often produce multiple ovulations, so that the risk of multiple pregnancies is 10 times higher in these women than in the general population
- During ovulation, some women feel a variable amount of abdominal pain called **mittelschmer** also known as **middle pain** because it normally occurs near the middle of the menstrual cycle
- In these cases, ovulation results in slight bleeding into the peritoneal cavity, which results in sudden constant pain in the lower abdomen.

## DIFFERENTIATE BETWEEN MEIOSIS I AND MEIOSIS II

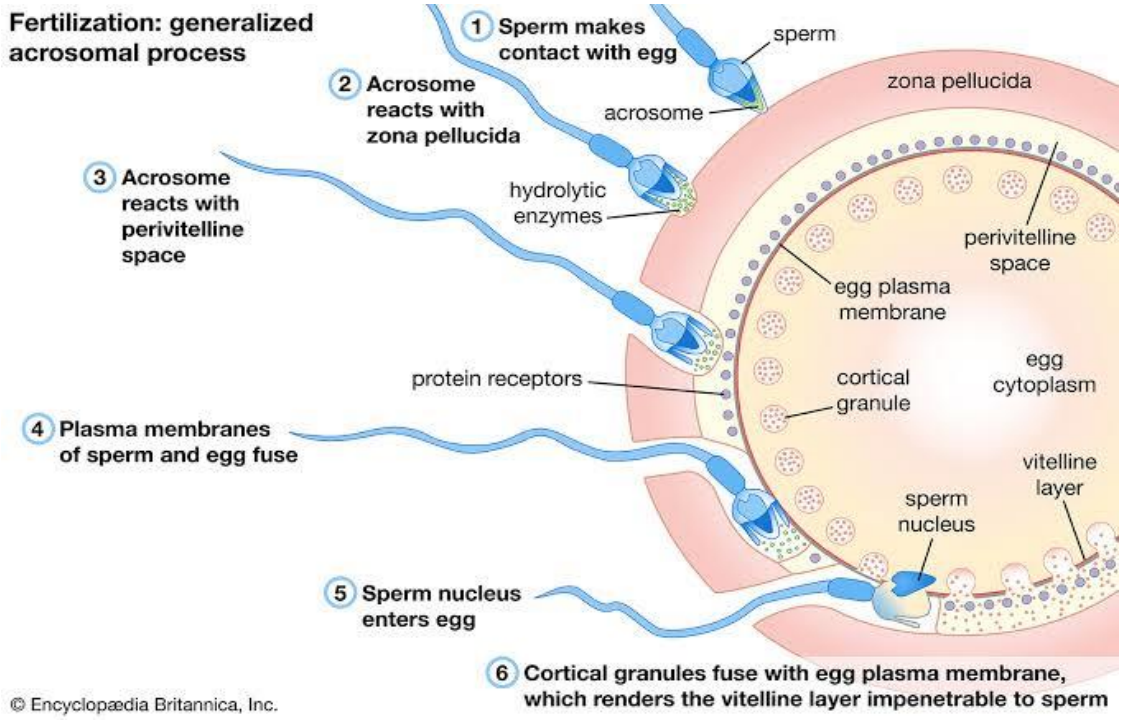
| S/N | MEIOSIS I | MEIOSIS II |
|---|---|---|
| 1. | In prophase I, there is synapsis. | In prophase II, there is no synapsis. |
| 2. | In prophase I, there is crossing over of the chromosome. | In prophase II, there is no crossing over. |
| 3. | In prophase I, there is chiasma formation. | In prophase II, there is no chiasma formation. |
| 4. | 46 Homologous duplicate chromosomes are involved | 23 homologous duplicated chromosomes are involved |
| 5. | In metaphase I, the 46 double stranded homologous duplicated | In metaphase II, the 23 double stranded homologous duplicated |

| | | |
|---|---|---|
| | chromosome align at the equatorial plate. | chromosomes align at the equatorial plate. |
| 6. | In anaphase I, the 46 double stranded homologous duplicated chromosomes that were aligned separate and move to opposite poles. | In anaphase II, the 23 double stranded homologous duplicated chromosomes that were aligned separate move to opposite poles. |
| 7. | The centromere do not split while disjoint happens. | They split at the centromere while disjoint happens. |
| 8. | In telophase, 2 daughter cells are formed. | In telophase, 4 daughter cells are formed |
| 9. | 23 double stranded homologous duplicated chromosomes are formed at telophase I | 23 single stranded homologous duplicated chromosomes are formed at telophase II |
| 10. | This is 4n=2n | This is 2n=n |

## DISCUSS THE STAGES INVOLVED IN FERTILIZATION

Fertilization is a sequence of coordinated events that occur during the union of sperm and oocyte. The site of fertilization is the ampulla of the uterine tube and the process takes approximately 24 hours. These events include:

- Passage of sperm through the corona radiata
- Penetration of the zona pellucida
- Fusion of the plasma membrane of the sperm and oocyte
- Completion of the second meiotic division and formation of female pronuclei
- Formation of male pronuclei
- Formation of zygote




**Passage of sperm through corona radiata**

Only sperms in capacitated state can pass through the corona radiata. Capacitation of sperm is the process by which the glycoprotein coat and sperm plasma proteins are removed from the plasma membrane that overlies the acrosome region of sperm.

**Penetration of zona pellucida**

The sperm successfully passes through the corona radiata and reaches the zona pellucida where the acrosome of the sperm binds to the zona pellucida on the binding site. Enzyme acrosin (a proteolytic enzyme) gets released to the site which creates a pathway by dissolution of the zona pellucida to help the sperm pass through it into the oocyte plasma membrane.

The plasma membrane secretes cortical granules which travels to zona pellucida to close the pathway created to block polyspermy.

**Fusion of the plasma membrane of the sperm and oocyte**

The region of the head and tail enters the cytoplasm leaving the plasma membrane and mitochondrion of the sperm behind.

**Completion of the second meiotic division and formation of female pro nucleus**

As soon as the sperm enters the oocyte, second meiotic division is completed. A mature oocyte and second polar body is formed. The nucleus of the mature oocyte becomes the female pro nucleus.

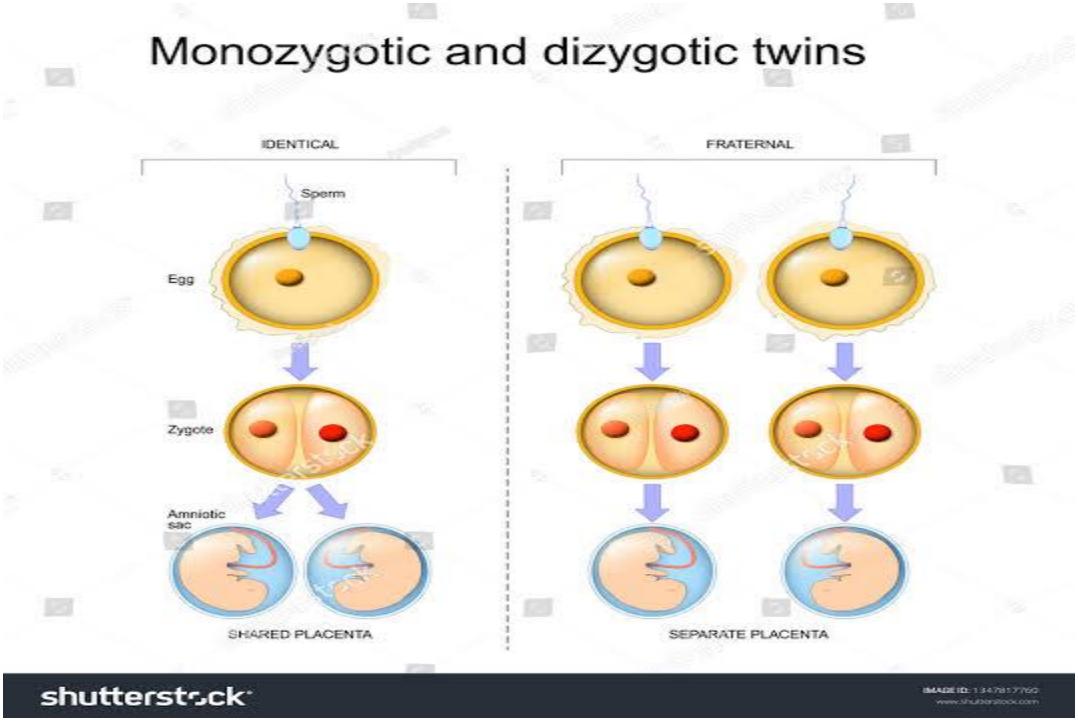
**Formation of male pro nucleus**

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

**Formation of zygote**

The male and female pro nuclei fuse together to form ootid which develops to form zygote. The zygote is genetically unique because half of its chromosomes came from the mother and half from the father. The mitochondrial DNA is of the mother because the mitochondrion of the sperm degenerated with the tail of the sperm.

## DIFFERNTIATE BETWEEEN MONOZYGOTIC TWINS AND DIZYGOTIC TWINS




| S/N | MONOZYGOTIC TWINS | DIZYGOTIC TWINS |
|---|---|---|
| 1. | One sperm fertilizes one egg | Two sperms fertilizes two eggs |
| 2. | The fertilization forms a zygote that divides into two during formation of blastocysts. | The fertilization forms two different zygotes |

| | | |
|---|---|---|
| 3. | They look alike and are genetically identical. They share the same DNA. | They don't look alike and are not genetically identical. They do not share the same DNA. |
| 4. | They are usually of the same sex | They can be of the same sex or different sexes |
| 5. | They share common embryonic features e.g. amniotic sac, chorion, placenta | The do not share common embryonic features |
| 6, | It is not hereditary | It is hereditary. |
| 7. | They have the same blood type | They have different blood types |