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DEPARTMENT: MEDICINE AND SURGERY

COURSE: ICBS EMBRYOLOGY

QUESTION 1: DISCUSS OVULATION

Ovulation is the release of mature secondary oocyte/mature oocyte from an ovary. It is the second stage of the ovarian cycle.

As a result of a sudden increase in the luteinizing hormone, the primary oocyte completes meiosis I which results in the formation of the secondary oocyte and first polar body. The follicle surrounding the oocyte enters the pre-ovulatory mature vesicular stage.

The secondary oocyte begins meiosis II where it is arrested at metaphase II 3hours before ovulation. At the pre-ovulatory mature vesicular stage an avascular stigma (boil like structure) is formed on the surface of the ovary. The surface of the ovary begins to bulge locally and at the apex the avascular spot (stigma) appears.

As a result of another sudden increase in luteinizing hormone:

- **Collagenase enzyme** is produced for the breaking down or digestion of collagen fibres surrounding the secondary oocyte.
- **Prostaglandin** is also produced resulting in the contraction of the walls of the ovary thereby pushing the secondary oocyte out.

The mature secondary oocyte surrounded by the cumulus oophorus float out and the cumulus oophorus cells rearrange themselves around the zona pellucida of the mature secondary oocyte to give rise to the **Corona radiata**. The mature oocyte is released and caught by the fimbriae of the infundibulum. Ovulation is completed.

QUESTION 2: DIFFERENTIATE BETWEEN MEIOSIS 1 AND MEIOSIS 2

MEIOSIS 1	MEIOSIS 2
In Meiosis 1, homologus chromosomes separate	Meiosis 2 results in the separation of sister chromatids.
Genetic recombination (crossing over) occurs in meiosis 1	Genetic recombination (crossing over) does not occur.

Results in the formation of 2 daughter cells	Results in the formation of 4 daughter cells
Daughter cells are 23 homologus duplicated chromosome	Daughter cells formed are 23 homologus single stranded chromosome
During separation centromeres do not split	During separation centromeres split
Reduces the ploidy number from 4n to 2n	Divides the remaining set of chromosomes from 2n to n
Involves the the occurance of synapsis, formation of chiasma in prophase 1	Synapsis and formation of chiasma are all absent in prophase 2

QUESTION 3: DISCUSS THE STAGES INVOLVED IN FERTILIZATION

Fertilisation is the union of the sperm (male sex gamete) and oocyte (female sex gamete). The fertilisation process takes approximately 24hours. The site of fertilisation is the ampulla of the fallopian tube. Fertilisation is the first event that will take place in the first week of human development.

The stages of fertilization include:

- **Passage of sperm through the corona radiata**: For this stage to occur, the sperm must have undergone capacitation which is the removal of glycoprotein and seminal plasma protein from the plasma membrane surrounding the acrosome. This will allow in pass through the corona radiata to get to the zona pellucida. Only capacitated sperms can pass freely through the corona radiata.
- **Penetration through the zona pellucida**: In this stage, the acrosome of the sperm will bind to the receptor binding sites on the zona pellucida of the oocyte. Acrosine will be released ny the acrosome to break through the zona pellucida to get to the plasma membrane. When the sperm enters into the plasma membrane of the oocyte, an acrosomal reaction occurs in which the plasma membrane sends cortical granules to block the binding site on the zona pellucida. This is done to prevent binding of other sperm cells to the oocyte thereby preventing polyspermy.
- **Fusion of plasma membrane of sperm and oocyte**: At this stage, only the head and tail of the sperm enter into the cytoplasm of the oocyte leaving behind its own plasma membrane.
- **Completion of second meiotic division and formation of the female pronucleus**: the second meiotic division of is completed as soon as the head and tail of the sperm enters into the cytoplasm of the oocyte.
  The nucleus of the female then becomes a pronucleus.
- **Formation of male pronucleus**: The male pronucleus is formed after the tail of the sperm degenerates and the head of the sperm enlarges. The enlarged head of the

sperm becomes the male pronucleus. N/B: all mitochondria within the zygote are from maternal origin since that of the sperm is degenerated. The oocyte now contains two pronucleus each having haploid number of chromosomes (23).

- **Formation of zygote**: this is the final stage of fertilisation. The female and male pronucleus fuse together to form an OOTID. The OOTID then develops and becomes a zygote. The chromosomes in the zygote become arranged on a cleavage spindle in preparation for cleavage of the zygote.

QUESTION 4: DIFFERENTIATE BETWEEN MONOZYGOTIC TWINS AND DIZYGOTIC TWINS

Twins are formed as a result of two conceptus developing or being formed at the same time or in a period of one pregnancy. There are two types of twinning:

- Monozygotic twins: Meaning that they develop from one zygote, which splits and forms two embryos
- Dizygotic twins: Meaning that each twin develops from a separate egg and each egg is fertilized by its own sperm cell.

MONOZYGOTIC TWINS	DIZYGOTIC TWINS
Originate from a single zygote/ fertilised egg which later divides into two	Originates from the fertilisation of two different oocyte by two different sperms
They are genetically identical	They are not genetically identical
They look alike (physical appearance)/ Identical twins	They do not look alike/ fraternal twins
They have the same sex	They can be of different or the same sex
They share a common amniotic sac	They have separate amniotic sacs
They share a common placenta	They have separate placentas
They share a common Chorionic sac	They have separate Chorionic sacs