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EMBRYOLOGY ASSIGNMENT

1. Discuss ovulation?

Ovulation is the release of a secondary oocyte from the ovarian follicle. In a few days before ovulation, under the influence of **FSH** (Follicle stimulating hormone) and **LH** (Luteinizing hormone), the secondary follicle grows rapidly to a diameter of about 25 mm to become mature vesicular/ mature secondary or Graafian follicle. The abrupt increase in LH causes the primary oocyte to complete meiosis I and the follicle to enter the preovulatory mature vesicular stage. Here the Meiosis II is also initiated but the secondary oocyte is arrested at metaphase approximately 3 hours before ovulation. During this period, the ovary begins to bulge locally and at the apex, an avascular spot, the stigma, appears.

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

- I. it increases collagenase activity, resulting in digestion of collagen fibers (connective tissue) surrounding the follicle
- II. Prostaglandin levels also increase in response to the LH surge and cause local muscular contractions in the ovarian wall

Those contractions extrude the oocyte, which cause **OVULATION** in which oocyte floats out of the ovary.

2. Differentiate between meiosis I and meiosis II

Meiosis I

| Meiosis II

Meiosis I reduce the ploidy level from $2n$ to n (reduction)	Meiosis II divides the remaining set of chromosomes
In prophase I, the chromatin condenses into chromosomes, the nucleolus dissolves, nuclear membrane is disassembled, the spindle apparatus forms, synapsis and crossing over are present	In prophase II, the nuclear envelope dissolves, spindle fibers reform, synapsis and crossing over are absent
In Metaphase I, alignment of 46 homologous duplicated chromosomes at the metaphase plate (equatorial plate)	In Metaphase II, alignment of 23 duplicated chromosomes at the metaphase plate
In Anaphase I, separation of 46 homologous duplicated chromosomes from each other (centromeres do not split)	In Anaphase II, separation of 23 duplicated chromosomes to form 23 single chromosomes (centromeres split)
In Telophase I, formation of two secondary gametocytes	In Telophase II, formation of four gametes

3. Discuss the stages involved in fertilization

Fertilization

- This is the union of the sperm and oocyte
- The usual site of fertilization is the ampulla of the uterine tube
- The fertilization process takes approximately 24 hours
- It is a sequence of coordinated events which include the following stages

I. Passage of a sperm through the corona radiata:

- For sperms to pass through the corona radiata, they must have been capacitated (removal of the glycoprotein coat and seminal plasma

proteins from the plasma membrane that overlies the acrosomal region of the spermatozoa)

II. 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 (ZP3/ zona protein 3) 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 properties of the zona pellucida to:
 - ✓ prevent sperm penetration and
 - ✓ inactivate binding sites for spermatozoa on the zona pellucida surface
- only one sperm seems to be able to penetrate the oocyte

III. 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

IV. 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/oocyte 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
- The 2 pronuclei fuse into a single diploid aggregation 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

4. Differentiate between monozygotic twins and dizygotic twins

Monozygotic twins	Dizygotic twins
They are formed from one single zygote	They are formed from two zygotes
They are genetically identical	They are not genetically identical
The resemblance is similar	The resemblance is just like any other two siblings
They are of same sex	They are of same sex or of different sex
The incidence is more common	The incidence is less common
They are often seen as conjoined twins	They are not seen as conjoined twins

