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**EMBRYOLOGY**

**QUESTION 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 and LH, the secondary follicle grows rapidly to a diameter of about 25 mm to become mature vesicular/ mature secondary or Graafian follicle. Coincident with final development of the vesicular follicle, there is an abrupt increase in LH that 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

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, 2 events occur which are caused by LH surge:

1. it increases collagenase activity, resulting in digestion of collagen fibers (connective tissue) surrounding the follicle
2. 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 together with its surrounding follicular (granulosa) cells from the region of the 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 CORRELATE**

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 use as a symptom of ovulation. Other signs my be
2. Change in cervical mucus
3. Drop in basal temperature
4. Increased libido
5. Tenderness of breast
6. Swollen vagina.
7. **Anovulation**: Some women fail to ovulate, this is called anovulation, because of a low concentration of gonadotropins

**QUESTION 2: DIFFERENTIATE BETWEEN MEIOSIS 1&2**

|  |  |
| --- | --- |
| Meiosis 1 | Meiosis 2 |
| Starts as diploid; ends as haploid  | Starts as haploid; ends as haploid |
| Reductive division | Equational division |
| Homologous chromosome pairs separate | Sister chromatids separate |
| Crossing over happens | Crossing over does not happen |
| Complicated division process | Simple division process |
| Long duration | Short duration |
| Preceded by S-phase and G-phase | Preceded only by G-phase |
| Sister chromatids in prophase have convergent arms | Sister chromatids in prophase have divergent arms |
| Equatorial plane is centered | Equatorial plane is rotated 90° |
| Prophase split into 5 sub-phases  | Prophase does not have sub-phases |
| Ends with 2 daughter cells | Ends with 4 daughter cells |
|  |  |

**QUESTION 3: DISCUSS THE STAGES OF FERTILIZATION**

Fertilization the union of the sperm and the oocyte. It occurs in the ampulla of the Fallopian tube or uterine tube. The stages that include in fertilization are:

1. **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)

1. **Penetration of the zona pellucida:**

The zona is a glycoprotein shell surrounding the egg that facilitates and maintains sperm binding and induces the acrosome reactionThe intact acrosome of the sperm binds with a zona glycoprotein (ZP3/ zona protein 3) on the zona pellucidaRelease of acrosomal enzymes (acrosin) allows sperm to penetrate the zona pellucida, thereby coming in contact with the plasma membrane of the oocyteAs soon as the head of a sperm comes in contact with the oocyte surface, the permeability of the zona pellucida changesWhen a sperm comes in contact with the oocyte surface, lysosomal enzymes are released from cortical granules lining the plasma membrane of the oocyte. The enzyme alters properties of the zona pellucida to

1. Prevent sperm penetration
2. Inactivate binding sites for the 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 ofThe head and tail of the sperm enter the cytoplasm of the oocyte, but the sperm's plasma membrane remains behind.

1. **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.

1. **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 degenerate.

Since all sperm mitochondria degenerate, all mitochondria within the zygote are of maternal origin (i.e., all mitochondrial DNA is of maternal origin)

1. Morphologically, the male and female pronuclei are indistinguishable
2. The oocyte now contains 2 pronuclei, each having haploid number of chromosomes(23)
3. The oocyte containing two haploid pronuclei is called an ootid
4. The 2 pronuclei fuse into a single diploid aggregation of chromosomes, the ootid becomes a zygoteThe 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.**

Monozygotic Twins are developed by the splitting of a fertilized embryos into two while Dizygotic Twins are developed by two separate simultaneous fertilization events

The cause of Monozygotic Twins is not known while the cause of Dizygotic twins is either by IVF ,certain fertility drugs or hereditary predisposition.

The Genetic codes of Monozygotic Twins are nearly identical while in Dizygotic twins genetic codes are same as any other sibling Monozygotic Twins gender is the same while Dizygotic twins gender is different

Monozygotic Twins blood types are the same while Dizygotic twins blood types are different

The appearance of Monozygotic Twins is extremely similar but may be affected by environmental factors while in Dizygotic twins the appearance is similar as any other sibling

1/3 of the Monozygotic twins in the world are monozygotic while 2/3 of the Dizygotic twins in the world are dizygotic

Monozygotic Twins beer high-risk of TTTS while Dizygotic twins beer a low -risk of TTTS

Monozygotic Twins are not hereditary while Dizygotic twins are hereditary

Monozygotic Twins can be either Di-Di, mono Di or mono mono twins while Dizygotic twins are only Di-Di twins