NAME :AMADIKE CHIOMA PAMELA

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COURSE: EMBRYOLOGY ASSIGNMENT

1. **Discuss Ovulation**

Ovulation is the release of a secondary oocyte from the ovarian follicle of a woman. In a few days before ovulation, under the influence of Follicle Stimulating Hormone (FSH) and Luteinising Hormone (LH), the secondary follicle grows rapidly to a diameter of about 25mm to become mature secondary follicle.

Coincident with the final development of the secondary follicles, there is an abrupt increase in LH that causes;

* 1. The primary oocyte to complete meiosis I
* 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,

2appears

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 flows out of the ovary.**
* Some of the cumulus oophorus cells then rearrange themselves around the zona pellucida to form the corona radiata.

**Note;**

* Ovulation is triggered by a surge of LH production.
* Ovulation usually follows the LH peak by 12 to 24 hours
* The **LH surge,** elicited by the high estrogen level in the blood appears to cause the stigma to balloon out, forming a vesicle.

1. **Differentiate between Meiosis I and Meiosis II**

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| **Meiosis I** | **Meiosis II** |
| 1.Starts as diploid; ends as haploid | **1.** Starts as haploid ; ends as haploid |
| 2.Reductive division | 2.Equational division |
| 3.Homologous chromosomes pairs seperate | 3.Sisters chromatids separate |
| 4.Complicated division process | 4.Simple division process |
| 5.Crossing over happens | 5.Crossing over does not happen |
| 6.Long duration | 6.Short duration |
| 7.Ends with 2 daughter cells | 7.Ends with 4 daughter cells |

1. **Discuss the stages in fertilization**

* The usual site of fertilization is the ampulla of the uterine tube.
* The fertilization takes place approximately 24 hours .
* It is a sequence of coordinated events which are in the following stages

1. **Passage of a sperm to pass 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).**NOTE ;Only capacitated sperms can pass through the corona radiata**
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 (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 the cortical granules lining the plasma membrane of the oocyte.
* In turn, these enzymes alter properties of the zona pellucida to;

1. Prevent sperm penetration and
2. Inactivate binding sites for spermatozoa on the zona pellucida surface.

**Note: only one sperm seems to be able to penetrate the oocyte.**

1. **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.

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 degenerates.

Note; since all sperm degenerate**, all mitochondria within the zygote are of maternal origin**

**Morphologically; the male and female pronuclei are indistinguishable**

**The oocyte now contains 2 pronuclei, each having haploid number of chromosomes(23)**

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

1. **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.

1. **Differentiate between monozygotic and dizygotic twins.**

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| **Monozygotic Twins** | **Dizygotic Twins** |
| 1.Developed by the splitting of one fertilized embryo into two. One egg ;One sperm. | **1.** Developed by two separate simultaneous fertilization event. Two eggs; Two sperms |
| 2.Gender of the twins are the same eg. Boy and Boy or Girl and Girl | 2. Gender of the twins may be the same or different eg. Boy and Boy, Girl and Girl or Boy and Girl |
| 3.Appearance is extremely identical. | 3. Appearance is similar as any other siblings. |
| 4.Blood types are the same | 4. Blood types may be the same or different |
| **5.**Genetic codes are nearly identical | **5**. Genetic codes are the same as siblings. |