**NAME: OKUEGHA .O. BEAUTY**

**MATRIC NO: 18/MHS01/275**

**DEPARTMENT: MEDICINE AND SURGERY**

**LEVEL: 200**

**COURSE: EMBRYOLOGY**

## ASSIGNMENT

1. Discuss ovulation.
2. Differentiate between meiosis 1 and meiosis 2.
3. Discuss the stages involved in fertilization.
4. Differentiate between monozygotic and dizygotic twins.

## ANSWERS

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

Mature vesicular or Graafian follicle.

Coincident with the final development of the vesicular follicle there is an abrupt increase in LH that causes the primary oocyte to complete meiosis 1 and the follicle to enter the preovulatory mature vesicular stage. Meiosis 2 is also initiated but the secondary oocyte is arrested at metaphase 2 approximately three 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, two events occur which are caused by LH surge:

I. It increases the 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 together with it's 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.

2.

| | MEIOSIS I | MEIOSIS II |
|---|---|---|
| TYPE OF DIVISION | Heterotypic or reduction division (diploid cell to haploid cells). | Homotypic or equational division ( haploid cells to haploid cells). |
| DURATION | It is a more complex division thus, it takes more time. | Less time is taken for the division. |
| REPLICATION | DNA replication. | No replication. |
| CROSSING OVER | Crossing over occurs in prophase I. | Crossing over does not occur. |
| INTERPHASE | It is preceded by interphase. | No interphase takes place. |
| CHROMOSOMES | Homologous chromosomes are present at the beginning of meiosis I. | Individual, bivalent chromosomes are present at the beginning of meiosis II. |
| NUMBER OF DAUGHTER CELLS AT THE END. | Two daughter cells are produced. | Four gametes are produced. |
| SYNAPSIS | Synapsis is Present. | Synapsis is Absent. |

| | | | |
|---|---|---|---|
| CHIASMA FORMATION | Present. | Absent. | |
| CENTROMERE | Centromeres do not split during anaphase I. | Centromeres split during anaphase II. | |

3. There are six (6) stages involved in fertilization:

I. Passage of sperm through the corona radiata.

II. Penetration of Zona pellucida

III. Fusion of plasma membranes of the oocyte and sperm

IV. Completion of the 2nd meiosis division of oocyte and formation of female pronucleus.

V. Formation of male pronucleus.

VI. Formation of zygote.

**I. PASSAGE OF SPERM THROUGH THE CORONA RADIATA:**

For sperms to pass through the Corona Radiata, they must have being capacitances ( removal of the glycoproteins 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 bonds with a Zona glycoprotein (ZP3/Zona protein 3) on the Zona Pellucida. Release of acrosomal enzymes (acrosin) allows sperm the penetrates the Zona pellucida, thereby coming in contact with the plasma membrane of the oocyte.

As soon as the head of the 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;

I. Prevent sperm penetration.

II. Inactivate binding sites for spermatozoa on the Zona pellucida surface.

Only one sperm can 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 breakdown 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 2ND MEIOTIC DIVISION OF OOCYTE AND FORMATION OF FEMALE PRONUCLEUS:

Penetration of the oocyte by a sperm activates the oocyte into completing the 2nd meiotic division and forming a mature oocyte and second polar body. The nucleus of the mature ovum/ oocyte is now called female pronucleus.

## V. FORMATION OF MALE PRONUCLEUS:

Within the cytoplasm of the oocyte, the nucleus of the sperm enlarged to form the male pronucleus and the tail of the sperm degenerates.

## VI. FORMATION OF THE ZYGOTE:

The two 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.

| MONOZYGOTIC TWINS. | DIZYGOTIC TWINS. |
|---|---|
| It results from fertilization of one secondary oocyte by one sperm. | It results from the fertilization of two different secondary oocyte by two different sperms. |
| These twins are of the same sex and they look alike. | These twins do not look alike and can be of different sex. |
| They are genetically identical. | They are not genetically identical. |
| Incidence is more common. | Incidence is less common. |
| They have common chrionic and amniotic sacs. | They chrionic and amniotic sacs are desperate and independent. |