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SCIENCES**

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**COURSE CODE:ANATOMY**

**COURSE TITLE: EMBRYOLOGY**

**ASSIGNMENT:**

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

## 1. Discuss Ovulation?

Ovulation is the release of secondary oocyte from the ovaries for the purpose of fertilization. Few days before ovulation Follicle stimulating hormone(FSH) and Luteinizing Hormone (LH) causes the maturation of the ovarian follicle (25mm) which is called the graffian follicle. The process of ovulation coincides with the final development of the follicles leading to LH surge that causes:

- The completion of meiosis 1
- The ovarian follicle enters preovulatory mature vesicular stage: whereby meiosis 2 is paused at the metaphase 3 hours to ovulation.

During that time, a bulge appears on the ovary with an avascular spot called stigma then the fimbriae of the uterine tube moves closer to the ovary.

Before ovulation occurs Luteinizing Hormone causes the production of two substances:

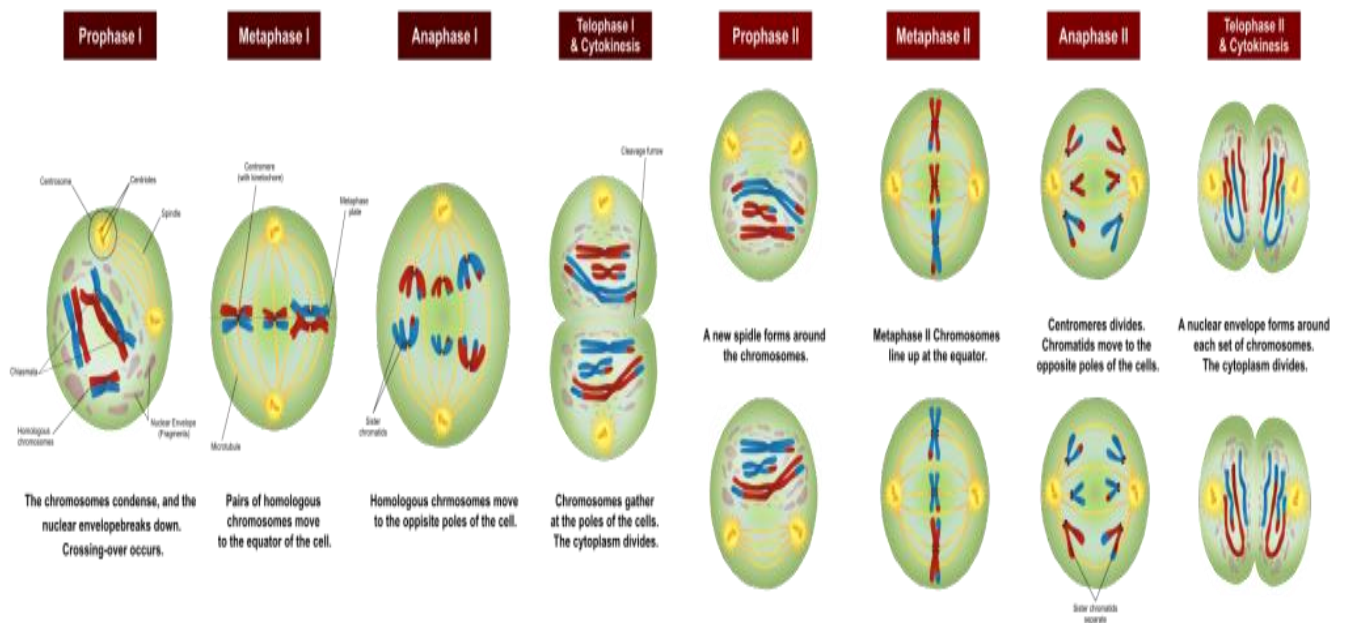
- i. It causes the production of collagenase in order to breakdown the surrounding connective tissue(theca folliculi)
- ii. It produces prostaglandins that cause contractions of the ovarian wall to enable the release of the secondary oocyte.

The secondary oocyte and the cumulus oophorus is released into the infundibulum of the uterine tube. The cumulus oophorus then becomes the corona radiate of the oocyte. Ovulation follows LH peak by 12-24 hours.

## 2. Differentiate between meiosis 1 and meiosis 2?

MEIOSIS 1	MEIOSIS 2
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<p>Prophase 1:</p> <ul style="list-style-type: none"> <li>➤ Synapsis occurs</li> <li>➤ Formation of chiasma</li> <li>➤ Crossing over occurs</li> </ul>	<p>Prophase 2:</p> <ul style="list-style-type: none"> <li>➤ Synapsis is absent</li> <li>➤ Chiasma formation is absent</li> <li>➤ Crossing over is absent</li> </ul>
<p>Metaphase 1:</p> <p>Alignment of 46 homologous duplicated chromosomes at the metaphase plate(equatorial plate)</p>	<p>Metaphase 2:</p> <p>Alignment of 23 duplicated chromosomes at the metaphase plate</p>
<p>Anaphase 1:</p> <p>Separation of 46 homologous duplicated chromosomes to form 23 duplicated chromosomes. Centromeres do not split</p>	<p>Anaphase 2:</p> <p>Separation of 23 duplicated chromosomes to form 23 single chromosomes. Centromeres split.</p>
<p>Telophase 1:</p> <p>Formation of two secondary gametocytes (23 duplicated chromosomes, 2N)</p>	<p>Telophase 2:</p> <p>Formation of 4 gametes (23 single chromosomes, 1N)</p>
<p>The duration is longer</p>	<p>The duration is shorter</p>
<p>Heterotypic division occurs</p>	<p>Homotypic division occurs</p>
<p>There is interphase before meiosis 1</p>	<p>No interphase before meiosis 2</p>



### 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). Only capacitated sperms can pass freely through the corona radiata

#### 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 pellucid. 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 pellicida 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

### **Note**

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

### **VI. 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?

<b>MONOZYGOTIC TWINS</b>	<b>DIZYGOTIC TWINS</b>
Form from single zygote	Form from two zygotes
Incidence is more common	Incidence is less common
Genetically identical	Genetically not identical
Twins are of the same sex	Twins are of the same sex or different sex
Resemblance is similar	Resemblance is just like any other two siblings
Mostly diamniotic, mono-chorionic, with single placenta	Mostly have two amnions, two chorions, and two placentas