

NAME: BOROKINNI OLUWATOFUNMI DIVINE

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COLLEGE: MEDICINE AND HEALTH SCIENCES (MHS)

DEPARTMENT: MEDICINE AND SURGERY (MBBS)

1. Discuss Ovulation

Answer: Ovulation can be defined as the release of an oocyte from the ovarian follicle. Few days before ovulation, under the influence of Follicle-stimulating hormone (FSH) and Luteinizing hormone (LH), the secondary follicle grows rapidly to a diameter of approximately 25 mm to become mature vesicular or Graafian follicle. Coincident with final development of the vesicular follicle, there is an abrupt increase in Luteinizing hormone (LH) that causes:

- I. the primary oocyte to complete meiosis I
- II. the follicle enters the preovulatory mature vesicular stage

Meiosis II is also initiated, but the secondary oocyte is arrested in metaphase approximately 3 hours before ovulation. Also, the surface of the ovary begins to bulge locally, and at the apex, an avascular spot known as the stigma appears. For the oocyte to be released, two events occur which are caused by Luteinizing hormone (LH) surge:

- I. It increases collagenase activity which leads to the digestion of collagen fibers (connective tissue) surrounding the follicle
- II. Prostaglandin levels also increase in response to the Luteinizing hormone (LH) surge and causes local muscular contractions in the ovarian wall. These contractions extrude the oocyte, which together with its surrounding follicular cells form 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. Ovulation is triggered by a surge of Luteinizing hormone (LH) production and usually follows the Luteinizing hormone (LH) peak by 12 to 24 hours. The Luteinizing hormone (LH) surge, elicited by the high estrogen level in the blood, appears to cause the stigma to balloon out, forming a vesicle.



The diagram above is the process of ovulation

CLINICAL CORRELATE:

- I. During ovulation, some women feel a variable amount of abdominal pain called mittelschmerz also called middle pain because it normally occurs near the middle of the menstrual cycle. In these cases, ovulation results in slight bleeding into the peritoneal cavity, which results in sudden constant pain in the lower abdomen.
- II. Slight drop in basal body temperature
- III. Some women fail to ovulate, this is called anovulation, because of a low concentration of gonadotropins. Administration of an agent to stimulate gonadotropin release is given and hence ovulation can be employed. Although, such drugs are effective, they often produce multiple ovulations so that the risk of multiple pregnancies is ten times higher in these women than in the general population.

2. Differentiate between meiosis 1 and meiosis 2.

S/N	MEIOSIS 1	MEIOSIS 2
1.	This is the first cell division of meiosis	This is the second cell division of meiosis
2.	Two daughter cells are produced	Four daughter cells are produced
3.	Chromosome number becomes half	Chromosome number remains the same
4.	The centromere doesn't split at anaphase I	The centromere splits at anaphase II
5.	Homologous chromosomes separate from each other	Sister chromatids separate from each other
6.	There is an interphase stage before meiosis I	There is no interphase stage before meiosis II
7.	Synapsis, crossing over and chiasma formation takes place	Synapsis, crossing over and chiasma formation do not take place
8.	The sub phases are: prophase I, metaphase I, anaphase I and telophase I	The sub phases are: prophase II, metaphase II, anaphase II and telophase II.
9.	The duration is longer	The duration is shorter
10.	It is an heterotypic division	It is an homotypic division

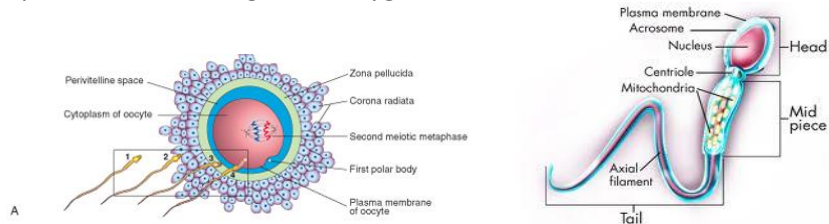
3. Discuss the stages involved in fertilization

Answer: Fertilization can be defined as the union of the sperm and oocyte in the ampulla of the uterine tube. Fertilization process takes approximately 24 hours. The following are the stages involved in fertilization:

- 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 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. Then, 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 is able to penetrate the oocyte.
- iii. **Fusion of plasma membranes of the oocyte and sperm:** The plasma 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. 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.

S/N	MONOZYGOTIC TWINS	DIZYGOTIC TWINS
1.	These are twins that develop from one zygote	They develop from two separate zygotes
2.	Twins are always of the same sex	They can be of the same sex or of different sex
3.	They are fertilized by the same sperm	They are fertilized by two sperm
4.	They share the same DNA	They do not share the same DNA
5.	Resemblance is similar	Resemblance is not similar
6.	Incidence is more common	Incidence is less common
7.	Mostly two amnions and one chorion	Mostly have two amnions and two chorions
8.	They have a single placenta	They have two placentas
9.	Often called conjoined twins	Not seen as conjoined twins
10.	Not hereditary	hereditary