

NAME: IGE TEMITOPE RACHEAL

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COLLEGE: MEDICINE AND HEALTH SCIENCES

COURSE: EMBRYOLOGY (ANATOMY)

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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

1. OVULATION

Ovulation is the release of secondary oocyte from the ovarian cycle.

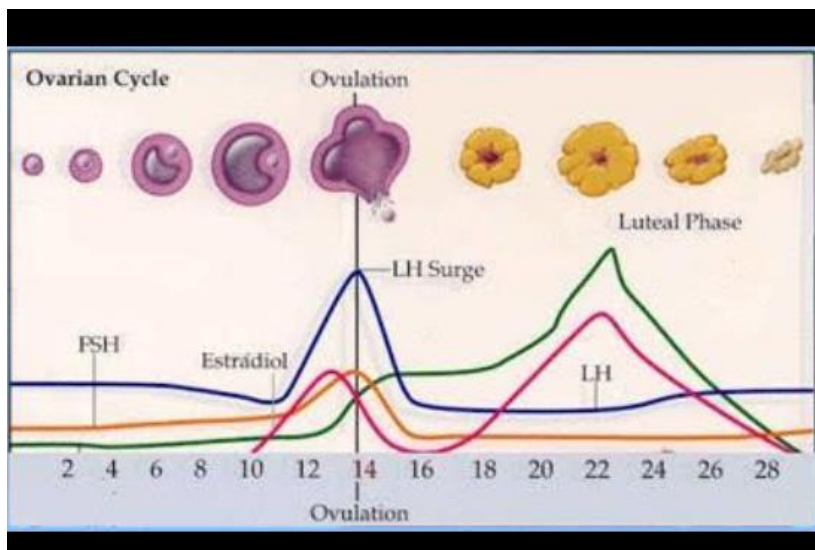
In a few days before ovulation, under the influence of Follicle Stimulating Hormone and Lieutinizng hormone, the secondary follicle grows rapidly to a diameter of about 25mm to become mature vesicular/mature secondary or Grafian follicle .

Coincident with final development of the vesicular follicle, there is an **abrupt increase in Lieutinizng hormone** 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 Lieutinizing hormone surge.

I. It increases collagenase activity, resulting in digestion of collagen fibers (coonective tissue) surrounding the follicle

II. Prostaglandin levels also increase in response to the Lieutinizing hormone 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 oophorous,

*this cause **ovulation in which oocyte floats out of the ovary.**

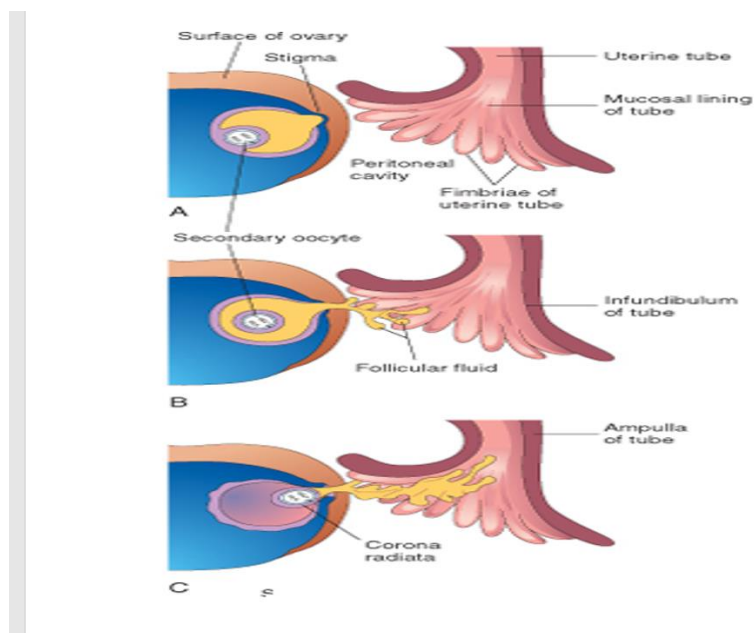
*Some of the cumulus oophorous cells then rearrange themselves around the zona pellucida to form the corona radiata

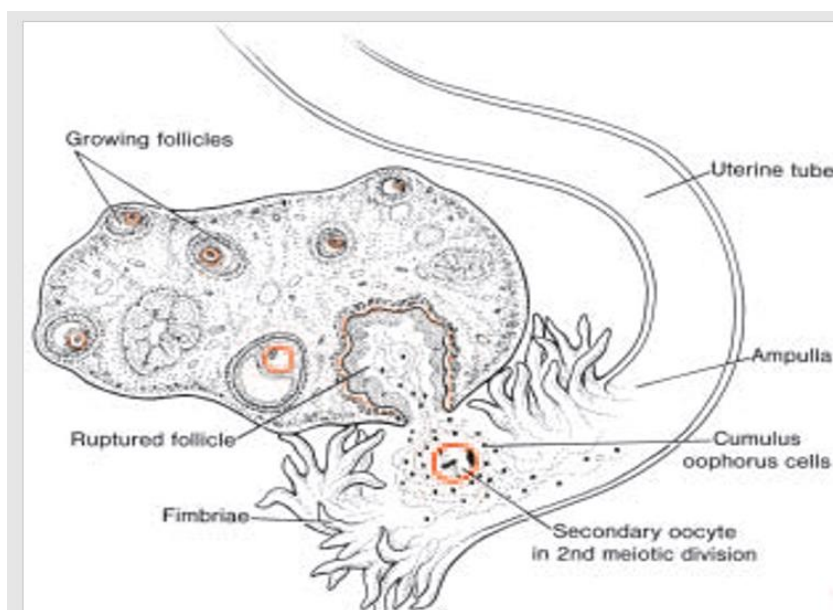
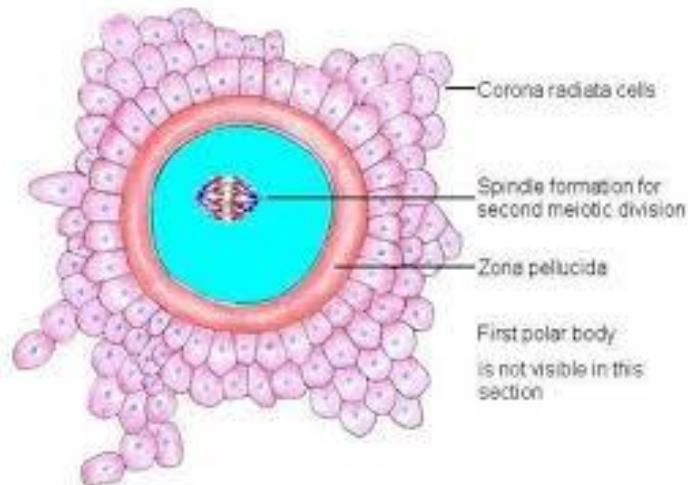
*** NOTE:**

-Ovulation is triggered by a surge of Lieutinizing Hormone production

-Ovulation usually follows the Lieutinizing hormone peak by 12 to 24 hours

- The **lieutinizing hormone surge**, elicited by the high estrogen level in the blood, appears to cause the stigma to balloon out, forming a vesicle





Clinical correlates

-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.

-In these cases, ovulation results in slight bleeding into the peritoneal cavity, which results in constant pain in the lower abdomen.

-Mittelschmerz may be used as a symptom of ovulation

-Other signs of ovulation include

1. Changes in cervical mucus:

* When you are not ovulating, cervical mucus may appear sticky, creamy, or may be entirely absent

*As ovulation approaches, cervical mucus becomes more abundant, takes on a watery to raw-egg-white-like consistency (slippery egg white looking discharge), and stretches up to an inch or more between your fingers

2. Increase libido/ increase urge for sex

3. Tenderness of the breast

4. Swollen vagina or vulva

* but there are better symptoms, such as the slight drop in basal body temperature

-For most women, prior to ovulation, the basal body temperature is rather consistent

-As one closer to ovulation, one may have a slight decline, but it will be followed by a sharp increase after ovulation.

-The increase in temperature is the sign that ovulation has just occurred.

→Also the use of ovulation predictor kits (OPKs) help detect the Lieutinizing Hormone surge, which occurs 12 to 36 hours before ovulation, you can be sure to have sex just at the right time for conception

→Some women fail to ovulate and this condition is called **anovulation**, because of low concentration of gonadotropins

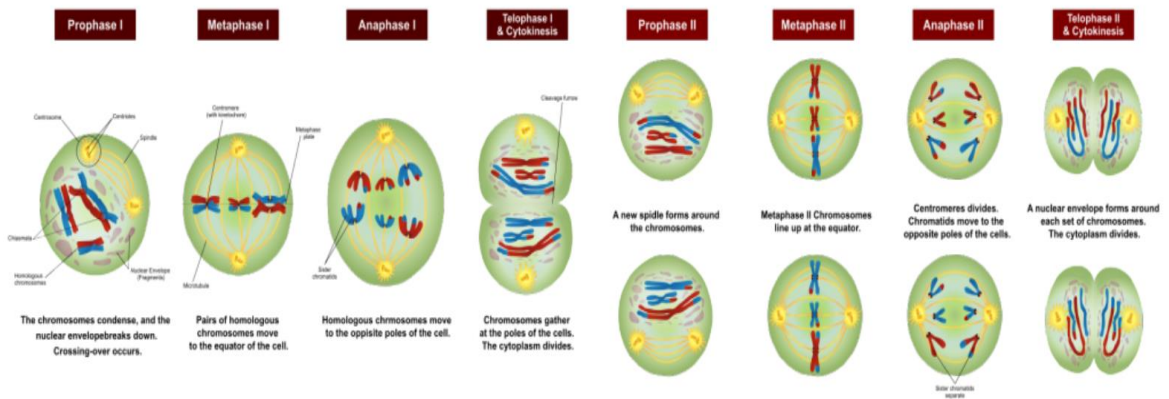
*In these cases, administration of an agent to stimulate gonadotropin release and ovulation can be employed.

* Although such drugs are effective, they often produce multiple ovulations, so that the risk of multiple pregnancies is ten (10) times higher in these women than in the general population.

2. Differentiate between meiosis 1 and 2

Meiosis is a special type of cell division in sexually-reproducing organisms used to produce the gametes, such as sperm or egg cells. It involves two rounds of division that

ultimately result in four cells with only one copy of each chromosome



MEIOSIS 1	MEIOSIS 2
Meiosis 1 is a heterotypic division	Meiosis 2 is a homotypic
Reduces the chromosome number in the daughter cell	Equalizes the chromosome number of both parent and daughter cells
Homologous chromosomes are present at the beginning	Individual, bivalent chromosomes are present at the beginning
Prophase 1, Metaphase 1, Anaphase 1 and Telophase and Telophase 1 are the four phases	Prophase 2, Metaphase 2, Anaphase 2 and telophase 2 are the four phases.
Individual chromosomes are present in the daughter nuclei	Sister chromosomes are present in the daughter nuclei
Chromosomes cross-over occurs during prophase 1	No chromosomal cross-over occurs during prophase 2
A complete division and takes more time	Comparatively less simple and takes less time
Preceded by interphase	No interphase takes place
Cohesin protein complexes at the arms of the homologous chromosomes are cleaved	Cohesins at the centromeres are cleaved in order to separate the two sister chromatids.

3. Discuss the stages involved in fertilization

➤ Fertilization

- *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
 - ┆ 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)

Note:

- ❖ *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 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
- In turn, these enzymes alter properties of the zona pellucida to :
 - ✓ prevent sperm penetration and
 - ✓ inactivate binding sites for spermatozoa on the zona pellucida 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

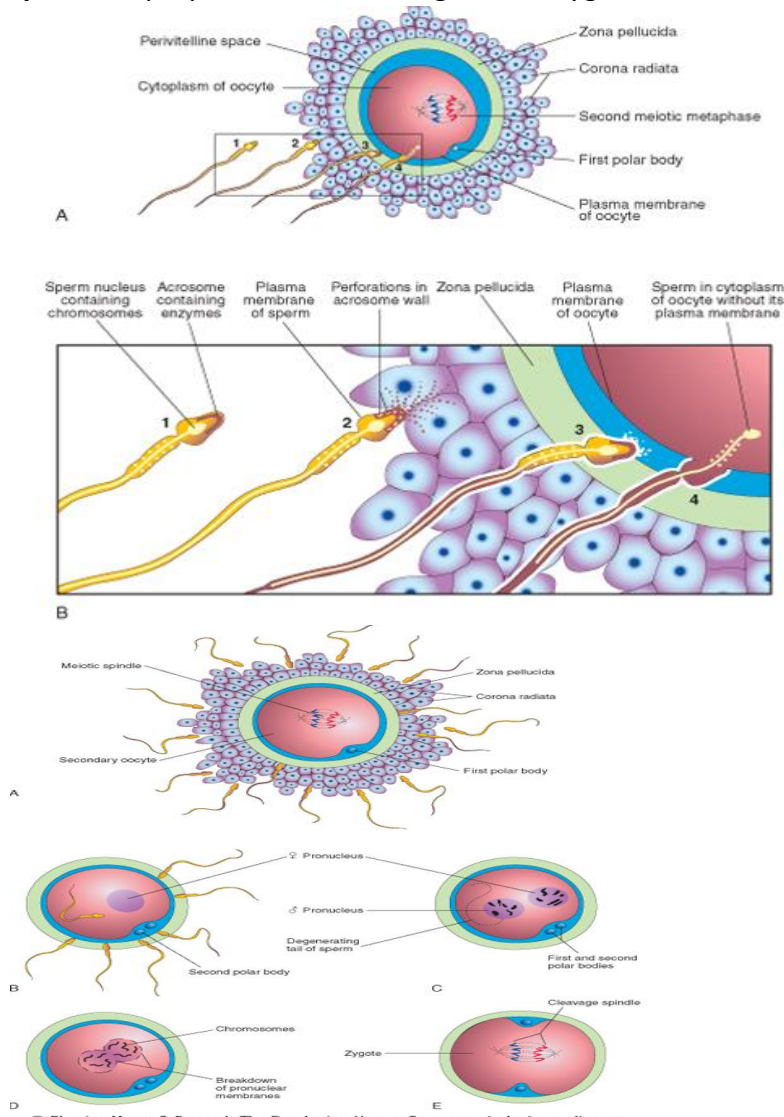
- Within the cytoplasm of the oocyte, the nucleus of the sperm enlarges to form the male pronucleus and the tail of the sperm degenerates

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



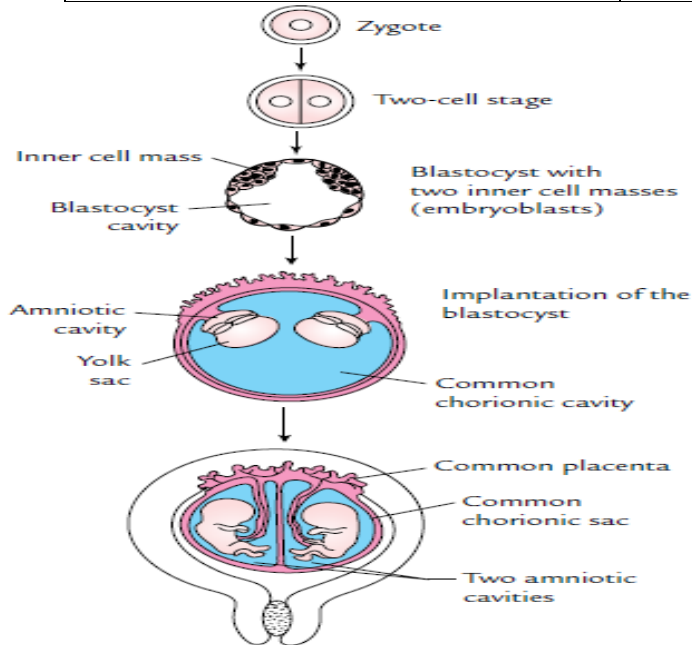
4. Differentiate between monozygotic and dizygotic twins

Twinning

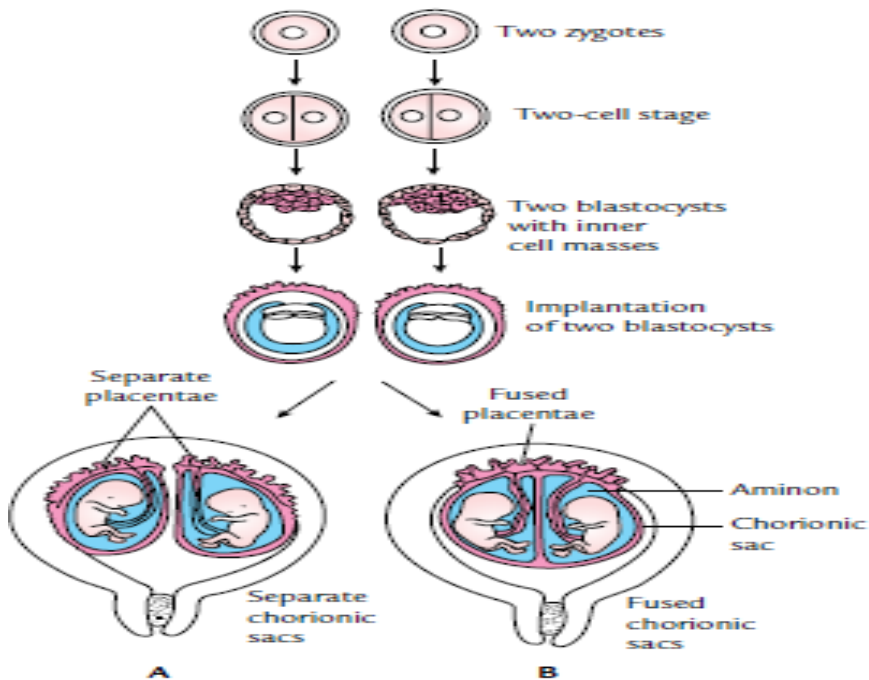
- The nurturing of 2 conceptuses at the same time is termed twinning
- 2 infants born at the same time are called twins
- Similarly, there can be birth of 3 (triplets), 4 (quadruplets), or more at the same time
- There are 2 types of twins:
 - (a) monozygotic /identical twins
 - (b) dizygotic/fraternal twins

Monozygotic twins	Dizygotic Twins
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 could be either of the same sex or different sex

Resemblance is similar	Resemblance is just like any other wo siblings
Mostly diamniotic, monochorionic, with single placenta	Mostly have two amnions, two chorions and two placentas
Are often called conjoined twins	Not seen as conjoined twins



Monozygotic twins.



Dizygotic twins.