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LEVEL: 200

DEPARTMENT: MBBS

COLLEGE: MHS

ASSIGNMENT QUESTION:

1. Discuss ovulation
2. Differentiate between meiosis1 and meiosis2
3. Discuss the stages involved in fertilization
4. Differentiate between monozygotic twins and dizygotic twins

### 1. DISCUSS OVULATION

Ovulation is one of the events that take place during the ovarian cycle . Ovulation can be defined as the release of a secondary oocyte from the ovarian follicle. A few days before ovulation, under the influence of FSH (follicle stimulating hormone) and LH (luteinizing hormone), the secondary follicle grows rapidly to a diameter of about 25mm to become MATURE VESICULAR FOLLICLE/GRAAFIAN FOLLICLE/MATURE SECONDARY FOLLICLE. The final development of this follicle will also meet up with a coincident and abrupt increase of the LH hormone that causes;

1. The primary oocyte to complete meiosis1
2. The follicle to enter the PREOVULATORY MATURE VESICULAR STAGE

Meiosis2 is also initiated but the secondary oocyte is arrested in metaphase by a CYTOSTATIC FACTOR approximately 3hours 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 from the ovary, 2 events must occur which are caused by the LH surge;

1. Increase in 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 to release the secondary oocyte surrounded by the CORONA RADIATA and ZONA PELLUCIDA.

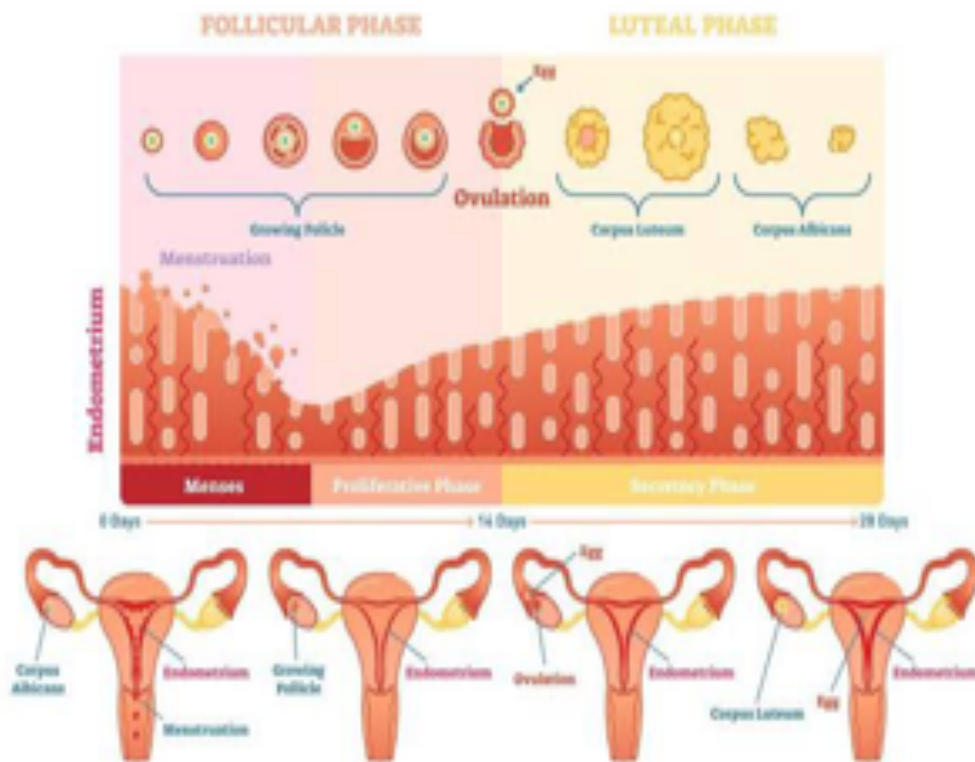
These contractions extrude the oocyte, which together with its surrounding follicular (granulosa) cells from the region of the CUMULUS OOPHORUS, this causes OVULATION in which the oocyte floats out of the ovary. The floating out of the cells of the CUMULUS OOPHORUS along with the secondary oocyte, results in their arrangements to form the CORONA RADIATA.

It should however be noted that:

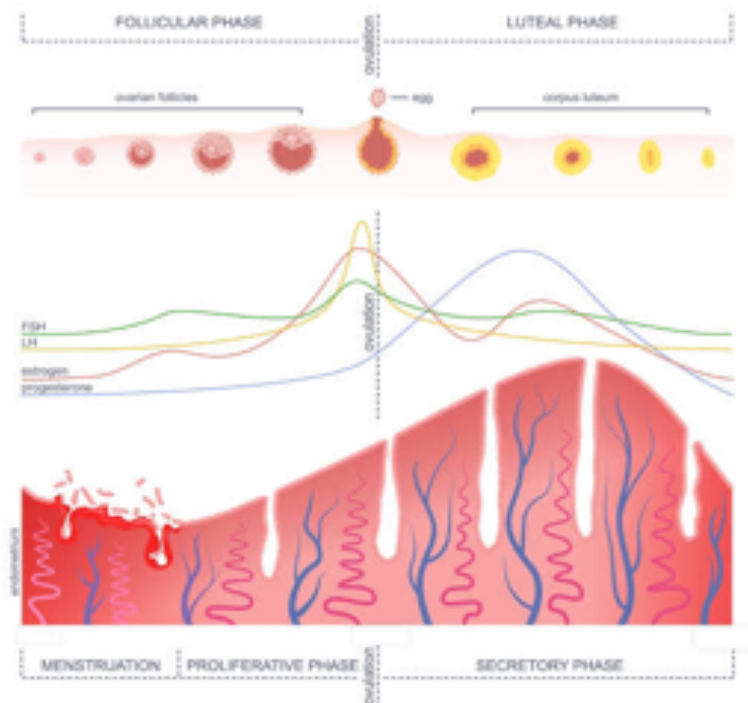
Ovulation is triggered by a surge of LH production

Ovulation usually follows the LH peak by 12-24 hours

# FEMALE SEXUAL CYCLE



## MENSTRUAL CYCLE



## **SOME 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.

This may be used as a symptom of ovulation. Other signs include;

1. increased libido or urge for sex
2. Tenderness of the breast
3. Swollen vagina

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

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

ANOVULATION: some women do not ovulate (cessation of ovulation, or anovulation) because of an inadequate release of gonadotropins. In some of these women, ovulation can be induced by the administration of gonadotropins or an ovulatory agent such as clomiphene citrate. This drug stimulates the release of pituitary gonadotropins (FSH and LH), resulting in maturation of several ovarian follicles and multiple ovulation. The incidence of a multiple pregnancy increases significantly when ovulation is induced. Rarely do more than seven embryos survive.

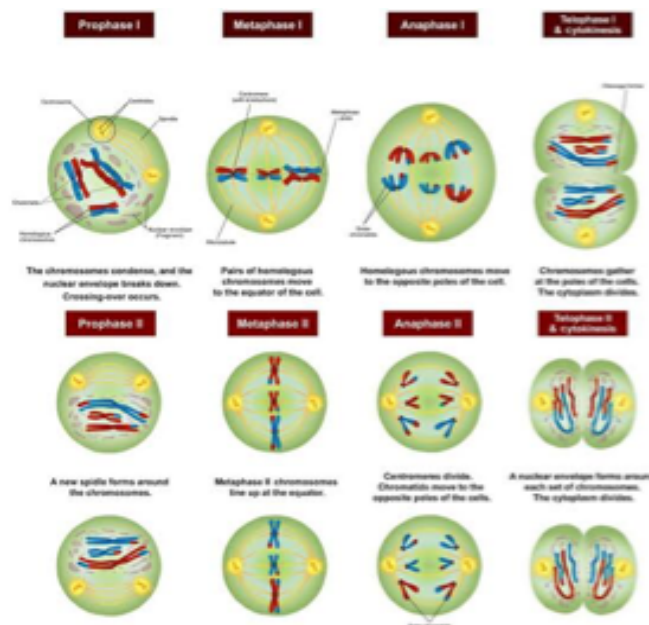
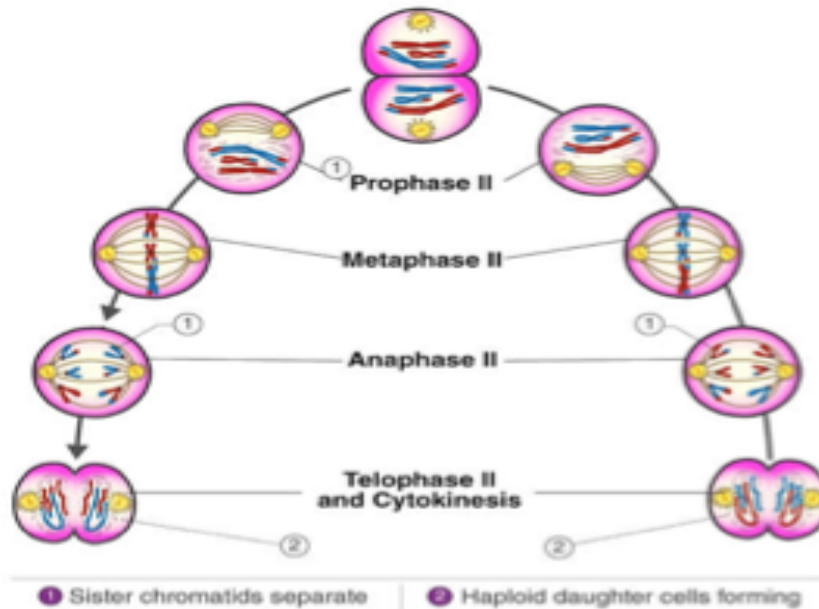
## **2. Differentiate between meiosis1 and meiosis2**

MEIOSIS1	MEIOSIS2
Homologous chromosome pairs separate	Sister chromatids separate
Is a heterotypic division	is a homotypic division
Reduces the chromosome number (n) in the daughter cell	Equalizes the chromosome number of both parent and daughter cells
Preceded by S-phase and G-phase	preceded by only G-phase
Two daughter cells are produced	Four daughter cells are produced
Crossing over takes place	Crossing over doesn't take place
A complex division and takes more time	Comparatively less simple and takes less time
Centromeres of the chromosomes do not split and homologous chromosomes separate	Centromeres split and sister chromatids separate
The chromosome number is halved	the chromosome number is not halved

## MEIOSIS I

## MEIOSIS II

### MEIOSIS II : REDUCTION CELL DIVISION



### 3. DISCUSS THE STAGES INVOLVED IN FERTILIZATION

Fertilization is defined as the union of the sperm and oocyte. It takes place in the ampulla of the uterine tube. The fertilization process takes approximately 24 hours

The stages involved are;

1. Passage of sperm through the CORONA RADIATA : for spermatozoa to pass through the corona

RADIATA, they must've been CAPACITATED (removal of the glycoprotein coat and seminal plasma proteins from the plasma membranes that overlies the acrosomal region of the spermatozoa

2. PENETRATION IF THE ZONA PELLUCIDA: The ZONA is a glycoprotein she'll 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 the acrosomal enzymes (acrosine) allows sperm to penetrate the ZONA PELLUCIDA

Thereby coming in contact with the plasma membrane 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 spermatozoa 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 ;

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

3. 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 and sperm's plasma membrane remains behind

4. 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 the mature oocyte and a second polar body

The nucleus of the mature ovum/oocyte is now called the female pronucleus

5. 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.

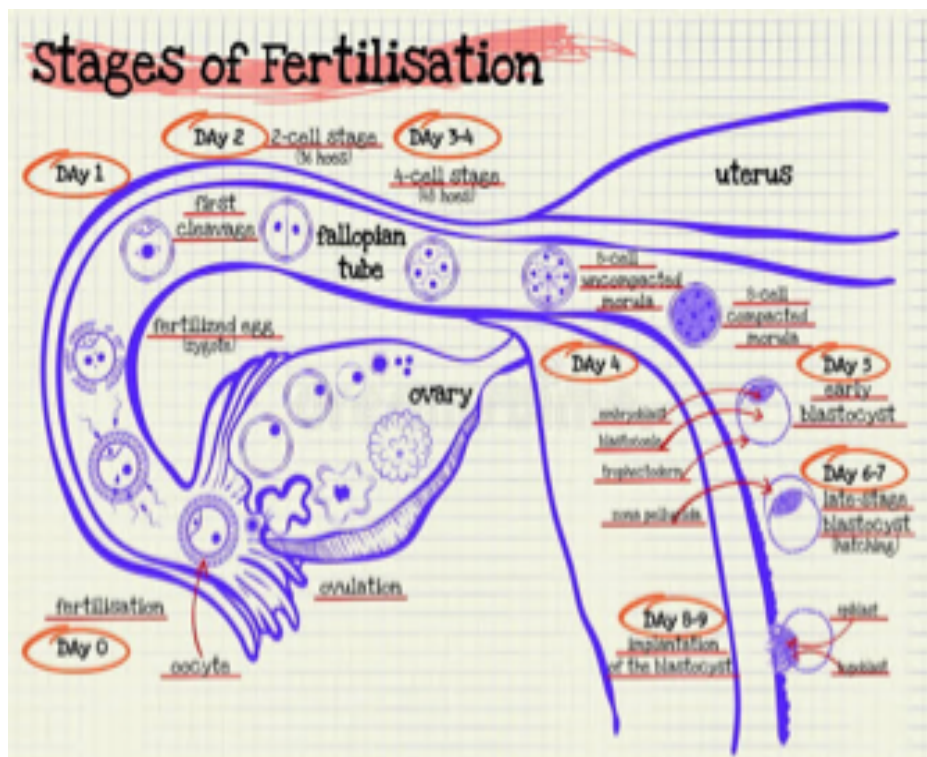
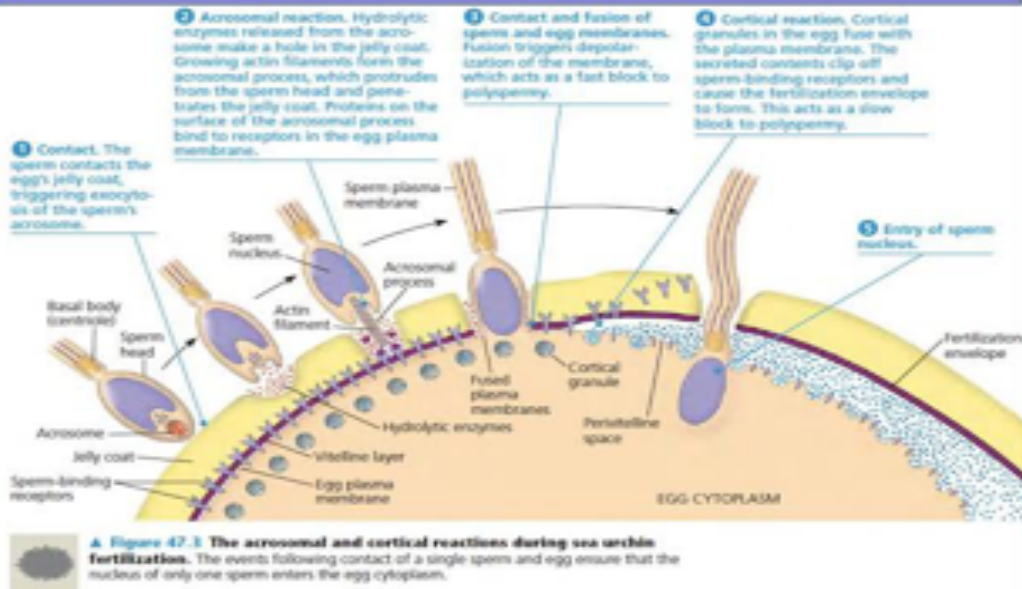
The mitochondrial DNA of the zygote is of maternal origin since the mitochondria of the sperm has been destroyed . Morphologically, the male and female pronucleus are indistinguishable and as such the oocyte now contains two pronucleus, each having haploid number of chromosomes . The oocyte containing two haploid pronucleu is called an OOTID

6. The two pronucleus then fuse into a single diploid aggregation of chromosomes, the OOTid then becomes a zygote;

The chromosomes in the zygote become arranged on a CLEAVAGE SPINDLE in preparation for cleavage of the zygote.

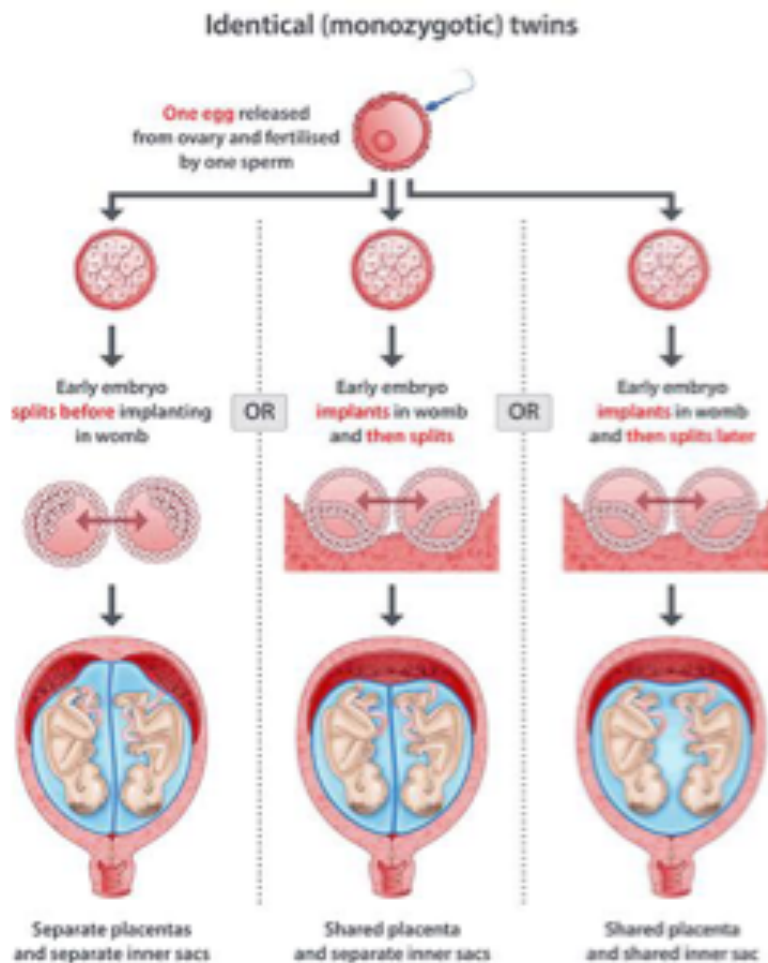


## 11.4 Process of Fertilization



#### 4. DIFFERENTIATE BETWEEN MONOZYGOTIC AND DIZYGOTIC TWINS:

MONOZYGOTIC TWINS	DIZYGOTIC TWINS
Originate from a single zygote or fertilized egg	originate from two zygotes or fertilized eggs
Also known as identical twins	Also known as fraternal twins
Less common form of twinning	Most common form of twinning
Have identical DNA	Do not have identical DNA
Occurs when one fertilized zygote, splits into two separate embryos	Two eggs are released by the mother and fertilized by two sperm

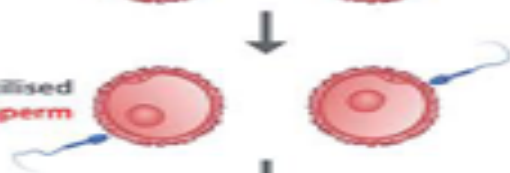


## Fraternal (dizygotic) twins

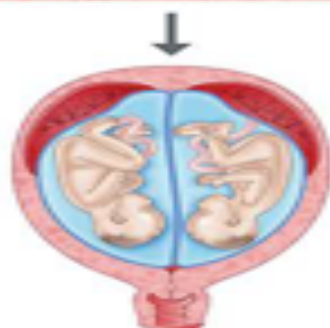
Two eggs released from ovaries



Each egg fertilised by separate sperm



Each embryo implants in womb separately



Separate placentas and separate inner sacs