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MATRIC NUMBER: 18/MHS01/044

DEPARTMENT/COLLEGE: MBBS/MHS

EMBROLOGY ASSIGNMENT:

1. **DISCUSS OVULATION**
2. **DIFFERENTIATE BETWEEN MEOSIS 1 AND MEOSIS 2**
3. **DISCUSS THE STAGES INVOLVED IN FERTILIZATION**
4. **DIFFERENTIATE BETWEEN MONOZYGOTIC TWINS AND DIZYGOTIC TWINS**

1. DISCUSS OVULATION

This is the release of a secondary oocyte from the ovarian follicle.

Ovulation is the release of an egg from one of a woman's ovaries. After the egg is released, it travels down the fallopian tube, where fertilization may occur. **Ovulation** typically lasts one day(24hrs) and occurs in the middle of a woman's menstrual cycle, about two weeks before she expects to get her period.

In 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 25 mm to become mature vesicular/ mature secondary or Graafian follicle

Coincident with final development of the vesicular follicle, there is an abrupt increase in LH 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 LH surge:

1. It increases 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.

Those contractions extrude the oocyte, which together with its 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.

Note:

- Ovulation is triggered by a surge of LH production.
- Ovulation usually follows the LH peak by 12 to 24 hours.
- The LH surge, elicited by the high estrogen level in the blood, appears to cause the stigma to balloon out, forming a vesicle.

<u>Clinical correlates</u>

1. 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.
2. In these cases, ovulation results in slight bleeding into the peritoneal cavity, which results in sudden constant pain in the lower abdomen.
3. Mittelschmerz may be used as a symptom of ovulation.

Other signs of ovulation include

1. Changes in the cervical mucus:

- When you're 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 get 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 to detect the LH surge, which occurs 12 to 36 hours before ovulation, you can be sure to have sex at just the right time for conception.

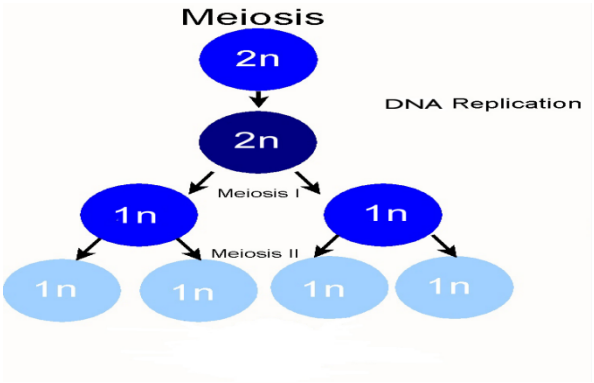
Some women fail to ovulate, this is called **anovulation**, because of a low concentration of gonadotropins.

2. DIFFERENTIATE BETWEEN MEIOSIS 1 AND MEIOSIS 2

Meiosis is a way sex cells (gametes) divide. Since sex cells determine the genetic code of offspring, meiosis attempts to create unique combinations of chromosomes in gametes.
Meiosis I is the first stage of this cell division, where pairs of chromosomes are split up.
There are a lot of differences between meiosis I and meiosis II, including:

1. In meiosis I, homologous chromosomes separate, while in meiosis II, sister chromatids separate.
2. Meiosis II produces 4 haploid daughter cells, whereas meiosis I produces 2 diploid daughter cells.
3. Genetic recombination (crossing over) only occurs in meiosis I.

Diploid Cells have **two** sets of chromosomes, while **Haploid Cells** have only **one** set of chromosomes. Here's how the chromatids and chromosomes split in meiosis, in terms of n.
The cell has 2 pairs of chromosomes after DNA replication, and 1 pair of chromatids is distributed to each cell during meiosis I. In meiosis II the daughter cells now have 1 chromatid each.



In meiosis II , there are 4 daughter cells produced, whereas in meiosis I , there are 2 daughter cells produced. However, notice in the above image the chromosomes in each daughter cell. For meiosis II, the daughter cells have only one set of chromosomes.
However, the cells in meiosis I have two sets of chromosomes. The first stage of meiosis II splits the pair of homologous chromosomes apart, so that 2 pairs of chromosomes are left, while the second stage splits each pair of sister chromatids to have half the number of chromosomes a normal cell would have, and is therefore haploid.
Also, genetic recombination only occurs in meiosis I. Genetic recombination occurs when two chromosomes exchange certain sections of their DNA to produce genetically unique genetic combinations.

However, since the gene combinations produced in meiosis I are already genetically unique, the chromosomes in meiosis II do not undergo genetic recombination a second time.
There are other differences, like differences in the equatorial plane and convergent arms, but these three are the most important ones.

3. DISCUSS STAGES INVOLVED IN FERTILIZATION

The following below 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).

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 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. DIFFERENTIATE BETWEEN MONOZYGOTIC TWINS AND DIZYGOTIC TWINS

Monozygotic twins are produced from the same zygote, that is, a single zygote divides to give rise to two embryos.This division takes place during the formation of blastocyst.

Dizygotic twins are formed when a female releases two eggs that are fertilized by two different sperms and results in the formation of two zygotes, and eventually two embryos.

S/N	MONOZYGOTIC TWINS	DIZYGOTIC TWINS
1.	Formed from a single zygote	Formed from two different zygotes
2.	They are genetically identical	They are not genetically identical
3.	They look alike	They do not look alike
4.	They are always the same sex	They can be of different sex
5.	They share the same placenta	They have separate placenta
6.	They share the same amniotic sac	They have separate amniotic sac
7.	They share the same umbilical cords	They have separate umbilical cords
8.	They share the same choronic sac	They have separate choronic sac
9.	They can also be referred to as **Identical twins.**	They can also be referred to as **Fraternal twins.**
10.	They can be cases of conjoined twins	They can not be seen as conjoined twins