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1. OVULATION

Ovulation can be defined as the release of a mature secondary oocyte from the ovarian follicle. After development of vesicular follicles, there is an abrupt increase in Luteinizing Hormone (LH). As a result, meiosis 1 is completed. Also, the abrupt increase causes the follicle to move into the pre-ovulatory mature vesicular stage. Meiosis 2 is also initiated and is arrested in metaphase 2, 3 hours before ovulation by cytostatic factor. The surface of the ovary begins to bulge out locally at the apex and an avascular spot, stigma appears.

In order for the oocyte to be released, 2 events occur which are also caused by the abrupt increase in LH;

- Collagenase activity is increased and an enzyme called collagenase is produced which breaks down or digest collagen fibers (connective tissue) around the secondary oocyte (follicle).
- Prostaglandin levels are increased and this causes local muscular contraction in the ovarian wall. These contractions cause the release of the oocyte together with its surrounding follicular cells from the region of the cumulus oophorus.

This causes ovulation in which the oocyte floats out of the ovary. Some of the cells of the cumulus oophorus which float out with the secondary follicle form the corona radiata. This corona radiata surrounds the zona pellucida.

Ovulation can be triggered by a surge in LH. Also, ovulation usually follows the LH surge by 12-24 hours.

Clinical correlates

Mittelschmerz or middle pain is a variable amount of abdominal pain that women experience during ovulation. It is also called middle pain because it occurs near the middle of the menstrual cycle. In these cases, ovulation causes slight bleeding into the peritoneal cavity, which results in sudden constant pain in the lower abdomen.

Symptoms of ovulation include a slight drop in basal body temperature, changes in cervical mucus, increased urge for sex and sometimes, mittelschmerz.

Also, some women fail to ovulate i.e. anovulation because of low concentration of gonadotropin. Drugs can be used to stimulate gonadotropin release but they often produce multiple ovulations and this increases the risk of multiple pregnancies.

2. DIFFERENCES BETTWEEN MEIOSIS 1 AND MEIOSIS 2

	MEIOSIS 1	MEIOSIS 2
a.	Meiosis 1 reduces the chromosome number in the daughter cell i.e. reduction division	Meiosis 2 equalizes the chromosome number of both parent and daughter cells.
b.	The 4 phases are prophase 1, metaphase 1,, anaphase 1 and telophase 1	The 4 phases are prophase 2, metaphase 2, anaphase 2 and telophase 2
c.	Individual chromosomes are present in the daughter nuclei	Sister chromatids are present in the daughter nuclei
d.	Chromosomal cross-over occurs during prophase 1	No chromosomal cross-over occurs during prophase 2
e.	Preceded by interphase	No interphase takes place
f.	There is chiasma formation in prophase 1	There is no chiasma formation in prophase 2
g.	Synapsis occurs in prophase 1	No synapsis in prophase 2
h.	The centromere does not split in anaphase 1	The centromere splits in anaphase 2
i.	At telophase 1, 23 duplicated chromosomes are formed	At telophase 2, 23 single stranded chromosomes are formed
j.	At the end of meiosis 1, 2 daughter cells are formed	At the end of meiosis 2, 4 daughter cells are formed.

3. STAGES INVOLOVED IN FERTILIZATION

There are 6 stages involved in fertilization. They include:

i. Passage of sperm through the corona radiata: For the sperm to pass through the corona radiata, it must undergo capacitation. Only capacitated sperms can pass through the corona radiata. Capacitation is the removal of the glycoprotein coat and seminal plasma proteins from the plasma membrane that overlies the acrosomal region of the sperm.

ii. Penetration of the zona pellucida: The zona pellucida is an amorphous acellular glycoprotein material that surrounds the oocyte and induces acrosome reaction. In order for the sperm to penetrate the zona pellucida, it must undergo acrosome reaction. The acrosome binds to the receptor site which is zona glycoprotein (ZP3/zona protein 3) on the surface of the zona pellucida. Release of acrosomal enzymes (acrosin) causes the binding of the head of the sperm to the zona pellucida. As soon as the head of a sperm binds to the surface of the oocyte, the permeability changes. Lysosomal enzymes are released from the cortical granules lining the plasma membrane of the oocyte. This alters the properties of the zona pellucida and prevents sperm penetration and also inactivates binding sites on the surface of the zona pellucida.

iii. Fusion of the plasma membrane of the sperm and oocyte: the plasma membrane of the oocyte and sperm fuse and break down at the area of fusion. The head and tail of the sperm will move through the cytoplasm of the oocyte leaving behind its plasma membrane.

iv. Completion of the second meiotic division and formation of female pronucleus: as soon as the sperm passes enters the region of the oocyte, second meiotic division is completed. This leads to the formation of a mature oocyte and a second polar body.

The nucleus of the mature oocyte is now called the female pronucleus.

v. Formation of male pronucleus: the tail of the sperm will degenerate and the nucleus of the sperm enlarges to form the male pronucleus.

Note:

All mitochondria within the zygote are of maternal origin because the mitochondrion of the sperm has degenerated.

The male and female pronuclei are morphologically indistinguishable

The oocyte now contains 2 pronuclei, each having haploid number of chromosomes (23)

vi. Formation of zygote: An ootid (oocyte containing 2 haploid nuclei) is formed. The male and female pronuclei are fused together and the ootid develops into a zygote.

4. DIFFERENCES BETWEEN MONOZYGOTIC TWINS AND DIZYGOTIC TWINS

	Monozygotic twins	Dizygotic twins
a.	Monozygotic twins are genetically identical	Dizygotic twins are genetically unidentical

b.	They are usually of the same sex.	They can be of different sexes
c.	They share the same amniotic sac, chorion and placenta	The amniotic sac, chorion and placenta are separate
d.	Formed from single zygote which divides into 2 at the region of the embryoblast	Formed from two zygotes
e.	One third of all twins worldwide are monozygotic i.e. incidence is less common	Two third of all twins worldwide are dizygotic i.e. incidence is more common
f.	They are not hereditary	They are hereditary.
g.	They are also known as identical twins	They are also called fraternal twins
h.	They always have the same blood type	They do not always have the same blood type