NAME: ADEOBA JESUTOYAN SAMUEL

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COURSE: EMBRYOLOGY

1. **Discuss Ovulation**

Ovulation can be defined as the release of a mature secondary oocyte from the ovarian follicle after it has completed meiosis I and metaphase II of meiosis II (If such should ever happen). It is the stage in the ovarian cycle where the eggs (oocyte) are egested from the ovarian follicle.

Ovulation is triggered by surge of LH production. It usually follows the LH peak by 12 to 24 hours.

Some events happen before ovulation, those events are:

a) With coincident with the final development of the vesicular follicle, there is an abrupt increase in LH that causes;
- The primary oocyte to complete meiosis 1
- The follicle to enter the preovulatory mature vesicular stage

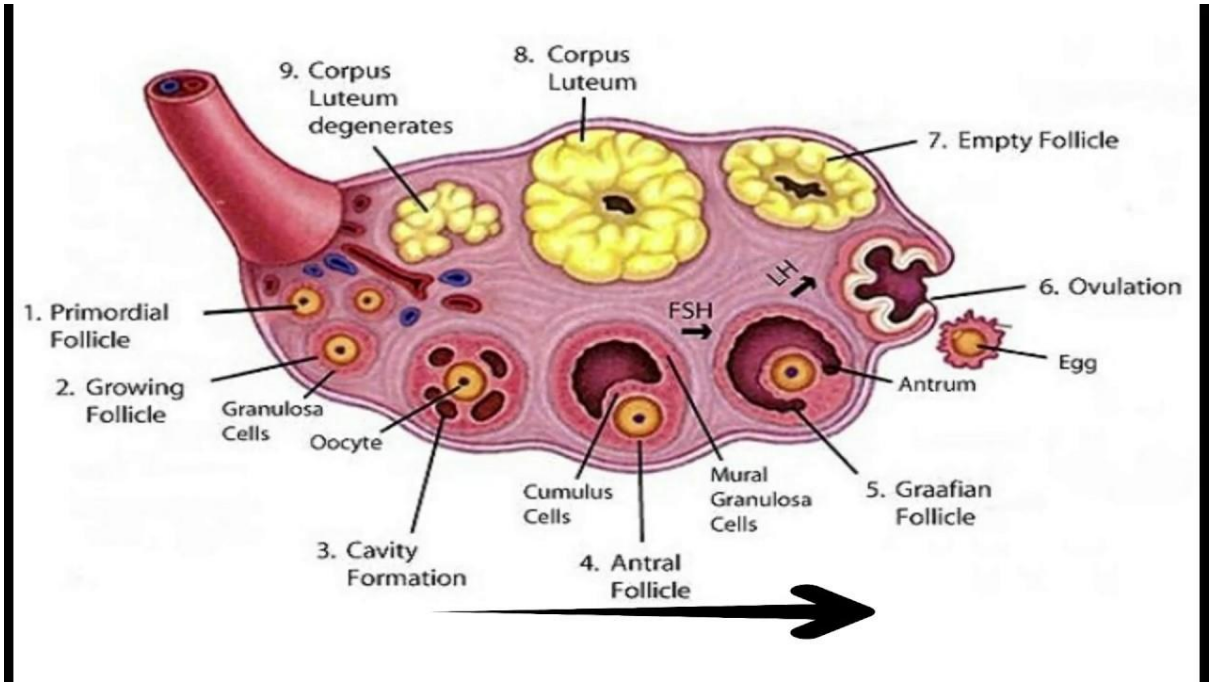
b) Meiosis II is also initiated, but the secondary oocyte is arrested in metaphase approximately 3 hours before ovulation by cytostatic factor

c) In the meantime, there is a bulge on the surface of the ovary locally, and an avascular spot at the apex, the stigma, appears

For the eggs to be released, two events take place caused by LH surge:

I. It increases collagenase activity, resulting in the digestion of collagen fibres (connecting tissues surrounding the follicle.

II. Prostaglandin level increases due to the increase in LH surge and cause local muscular contractions in the ovarian wall.



Ovulation happens about 14 days for ladies whose average menstrual cycle are 28 days, and their most fertile days are 12,13, and 14. Ovulation happens around day 21 for women whose average menstrual cycle are 35 days, and their fertile days are 19, 20, and 21.

<u>Signs and symptoms of ovulation include:</u>

Tenderness of the breast

Increase in libido/ increase urge for sex

Swollen vagina or vulva

Slight drop in basal body temperature

Changes in the cervical mucus, it appears sticky, creamy or may be entirely absent.

There is also an ovulation prediction kits (OPKs) which helps to detect LH surge, which occurs 12 to 36 hours before ovulation.

<u>Problems of ovulation</u>

There are many reasons why a woman may have ovulation problems. Some women for example have blocked fallopian tubes due to pelvic inflammatory diseases. Endometriosis or surgery for an ectopic pregnancy.

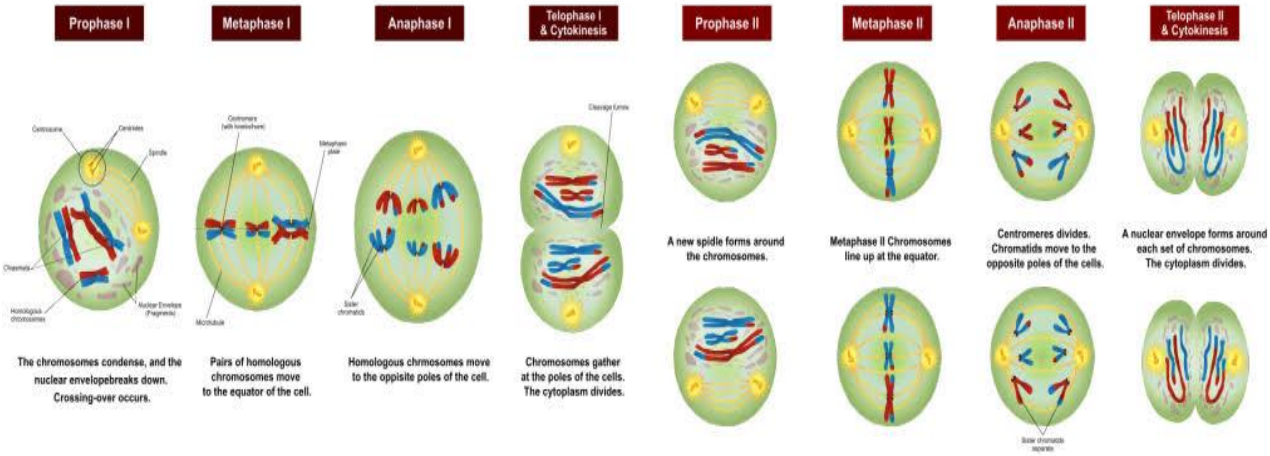
Thyroid problems, and other conditions can make the ovaries less likely to produce an egg. Problem with ovulation are just one possible cause for infertility.

The condition where women fail to ovulate is called **Anovulation.**

2. Differences between Meiosis I and Meiosis II

Meiosis I	Meiosis II
It is a reduction division	It is a normal somatic division
Synapsis takes place	Absence of synapsis
Crossing over takes place	Absence of crossing over
Presence of Chiasma formation	Absence of Chiasma formation
Two diploid daughter cells are formed	Four haploid daughter cells are formed
The centromere does not split at Anaphase 1	The centromere splits at Anaphase 1
Homologous chromosome separates	Sister chromatid separate
There is interphase before Meiosis 1	There is no interphase before Meiosis II
It takes a longer duration	It takes a shorter duration
Chromosomes number becomes half	Does not divides into half
Its stages include: Prophase I, Metaphase I, Anaphase I, Telophase I	Its stages include: Prophase II, Metaphase II, Anaphase II, Telophase II
It is a heterotypic division	It is a homotypic division

Below is a diagrammatical difference between Meiosis I and Meiosis II



3. Discuss the stages involved in fertilization.

The `stages involved in fertilization are:

- Passage of sperm through the corona radiata
- Penetration of the zona pellucida
- Fusion of plasma membrane of sperm and oocyte
- Completion of the second meiotic division of oocyte and formation of female pronucleus
- Formation of male pronucleus
- The 2 pronuclei fuse into a single diploid aggregation of chromosomes, the ootid becomes a zygote

❖ Passage of sperm through the corona radiata

For sperm to pass through corona radiata, they must have been capacitated, capacitation involves: the removal of glycoprotein coat and seminal plasma protein from the plasma membrane that overlies the acrosomal region of spermatozoa.

- ❖ Penetration of the zona pellucida.

The release of acrosin (acrosomal enzyme) allows sperm to penetrate the zona pellucida, thereby coming in contact with the plasma membrane of the oocyte.

When a sperm comes in contact with the oocyte surface, lysosomal enzymes are released from cortical granules lining the plasma membrane of the oocyte to prevent di-spermy, polyspermy

- ❖ Fusion of plasma membranes of the sperm and oocyte.

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, but the sperms plasma membranes remain behind.

- ❖ 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 matured ovum/ oocyte is now called female pronucleus

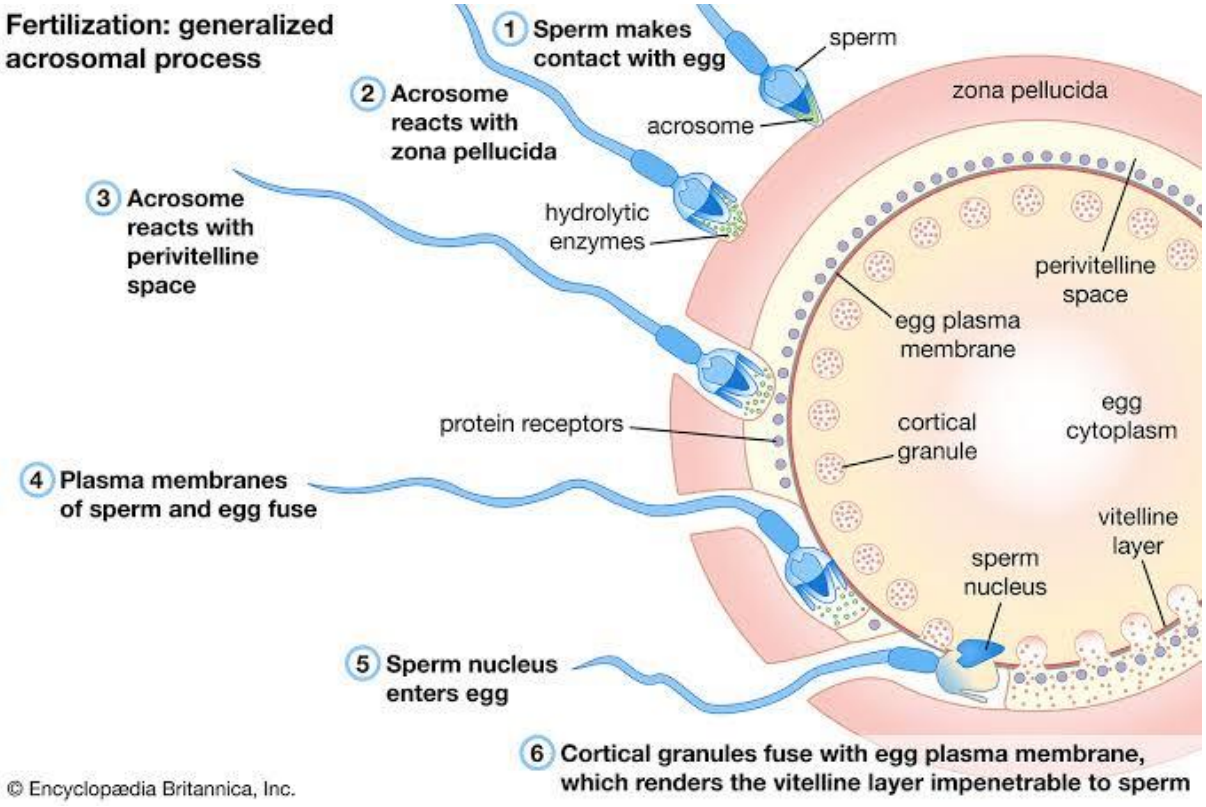
- ❖ Formation of male pronucleus

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 2 pronuclei fuse into a single diploid aggregation of chromosomes, the ootid becomes a zygote.

The chromosome in the zygote become arranged on a cleavage spindle in preparation for the breakage of the zygote.

Below is a diagram illustrating all the stages involved in Fertilization.



Differences between monozygotic twin and dizygotic twin

MONOZYGOTIC TWINS	DIZYGOTIC TWINS
They are genetically identical	They are genetically unidentical
They look alike	They don’t look alike
They have the same sex	They have different sex
These twins share amniotic sac, umbilical cord, and chorionic sac	These twins have different amniotic sac, umbilical cord, and chorionic sac.
It is less common	It is more common
They are also called identical twins	They are also called fraternal twins
It is not hereditary	It is hereditary
There is a high TTS (Twin-Twin Transfusion Syndrome) in monozygotic twins	There is a much lower TTS risk in dizygotic twins, when compared with the risks in monozygotic twins
Monozygotic twins always have the same blood type	Dizygotic twins have different blood types
They can be affected by environmental factors	They cannot be affected by environmental factors

Below is a diagram showing difference between Monozygotic and Dizygotic twins