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Question 1;

OVULATION

Ovulation can be defined as the release of matured oocyte from the ovaries. The chief contributors to ovulation are **FOLLICLE STIMULATING HORMONE(FSH)** and **LUTEINIZING HORMONE(LH)**. When the ovarian follicle is matured, there is a bulge that appears in a small avascular spot on the surface of the graafian follicle. This bulge is as a result of the matured oocyte trying to expel itself from the follicle.

Ovulation is triggered by an abrupt **LH** surge. This LH surge causes a small cascade that causes the oocyte to burst out, accompanied by some follicular fluid and cumulus oophorus. The LH surge is caused as a result of high oestrogen levels in the blood. The matured oocyte is helped out by two reasons, which are **INCREASED COLLAGENASE ACTIVITY** and **INCREASED PROSTAGLANDIN** in blood.

Collagenase is an enzyme that digests collagen. When collagenase activity is increased, the collagen in the follicles begin to digest, therefore weakening the follicles and making it easier for the oocyte to come out. The increased prostaglandin activity causes increased muscular contractions that also helps to expel the matured oocyte. Plasmins and metalloproteins, play a role in the control of the rupture.

When the oocyte is expelled, it is expelled along with follicular fluids, the zona pellucida is still intact and a single layer of follicles still surrounds it forming the **CORONA RADIATA**. the follicles left behind then begin to form into the **CORPUS LUTEUM**.

Note that an enzyme called MITOGEN ACTIVATED PROTEIN KINASE, helps in controlling the signalling pathway that regulates ovulation.

Question 2:

MEIOSIS 1	MEIOSIS 2
First cell division of meiosis	Second cell division of meiosis

Two cells are produced	Four cells are produced
Homologous chromosomes separate at anaphase	Sister chromatids separate at anaphase
Crossing over occurs	Crossing over doesn't occur
Synapsis does occurs	Synapsis doesn't occur
Alignment of 46 homologous duplicated chromosomes at the equatorial plate	Alignment of 23 duplicated chromosomes at the equatorial plate
Disjunction of 46 homologous duplicated chromosome	Disjunction of 23 homologous duplicated chromosomes.
More complex and takes longer time	Less complex and takes lesser time
Heterotypic division	Homotypic division

Question 3:

FERTILIZATION

Fertilization is basically the fusion of an oocyte and a sperm to make a zygote. For fertilization to occur, the sperm has to go through five complex steps. These steps include

- Passage through the corona radiata
- Penetration of the zona pellucida
- Fusion of plasma membrane of sperm and egg
- Completion of meiosis 2 and formation of female pronucleus
- Formation of male pronucleus
- Formation of zygote

PASSAGE THROUGH THE CORONA RADIATA

The corona radiata is a bunch of follicular cells located on the outside of the eggs. For the sperm to be able to pass through the corona radiata, it has to undergo **CAPACITATION**. Capacitation is the process the sperm undergoes by which glycoprotein coat and seminal

plasma proteins are removed from the sperm. This occurs in order to expose the acrosome. As a result, the sperm is able to move freely through the corona radiata.

PENETRATION OF THE ZONA PELLUCIDA

After the sperm has passed through the corona radiata, it would need to penetrate the zona pellucida. Due to capacitation, the acrosome of the sperm is exposed. This causes the sperm to bind to a receptor on the surface of the zona pellucida called **Acrosome ZP3 receptor**. This causes the release of acrosine from the acrosome which helps in the breakdown of the zona pellucida.

On penetration of the zona pellucida, a conformational change in the zona pellucida occurs due to a zona reaction. This zona reaction activates cortical granules which secrete lysosomal enzymes. Due to the activation of the cortical granules, they enter the per vitelline space inside the egg and cause closure of the zona pellucida to prevent the entry of any more sperms.

FUSION OF PLASMA MEMBRANE OF EGG AND SPERM

After successful penetration of the zona pellucida, the plasma membrane of the egg and sperm fuse together. The head and tail of the sperm enter into the oocyte whereas the plasma membrane and mitochondria are discarded.

COMPLETION OF METAPHASE 2 AND FORMATION OF FEMALE PRONUCLEUS

As soon as the sperm gets into the cytoplasm, metaphase 2 of the oocyte is completed leading to the formation of a matured secondary oocyte and the first polar body. Then, the chromosomes of the oocyte begin to decondense forming the female pronucleus.

FORMATION OF MALE PRONUCLEUS

Within the cytoplasm of the cell, the nucleus of the sperm begins to enlarge, forming the male pronucleus. As this occurs, the sperm degenerates. Morphologically, the male and female pronucleus are indistinguishable.

FORMATION OF ZYGOTE

The male and female pronucleus fuses to form an ootid which later forms a zygote.

Question 4:

MONOZYGOTIC TWINS	DIZYGOTIC TWINS
Monozygotic twins are formed by the splitting of a fertilized embryo into two	Dizygotic twins are formed by two separate fertilization events
Cause is unknown	Caused by IVF, fertility drugs or hereditary predisposition
Blood types are the same	Blood types are different
They look alike in appearance	They don't look alike in appearance
They are less common	They are more common
Gender is the same	Gender may or may not be the same