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18/MHS01/232

MBBS/MHS

EMBRYOLOGY

**ASSIGNMENT**

1. Discuss Ovulation.

**Answer**

Ovulation is the release of the secondary oocyte from the ovarian follicle in the ovary into the uterine tube. Ovulation is a phase of the ovarian cycle which is triggered by a surge in lutenizing hormone production. It usually follows the lutenizing hormone peak by 12 to 24 hours. The lutenizing hormone surge elicited by the estrogen level in the blood appears to cause the stigma to balloon out, forming a vesicle. The stigma soon ruptures, expelling the secondary oocyte with follicular fluid. Expulsion of the oocyte is as a result of the intrafollicular pressure and possibly by contraction of the smooth muscle in the theca externa owing to stimulation by prostaglandins. The expelled secondary oocyte is surrounded by the zona pellucida and one or more layers of follicular cells (cumulus oophorus) which are arranged radially as the corona radiata forming the oocyte-cumulus complex.

After the egg is released, it travels down the fallopian tube where it may be fertilised by a sperm at the ampulla of the uterine tube. The zona pellucida is composed of three glycoproteins (ZPA, ZPB and ZPC) which usually forms a network of filaments with multiple pores to which the sperm binds to during fertilization. Shortly after ovulation the walls of the ovarian follicle and theca folliculi collapse and are thrown into folds to develop a glandular structure under the influence of the lutenizing hormone called **corpus luteum.** If the released oocyte is not fertilized the corpus luteum enlarges to form corpus luteum of pregnancy and increases its hormone production. The Human Chorionic Gonadotropin prevents the corpus luteum from degenerating and helps it to remain functionally active throughout the first 20 weeks of pregnancy. It secretes progesterone. Whereas, if the oocyte is not fertilized the corpus luteum involutes and degenerate 10-12 days after ovulation. It then becomes the corpus luteum of menstruation and subsequently it transforms into a white scar in the ovary called corpus albicans.

Furthermore, during ovulation corpus luteum secretes mainly progesterone and some estrogen which causes the endometrial gland to secrete and prepare for the implantation of the blastocyst. This in turn causes the walls of the uterus to thicken. If the oocyte is not fertilized, the uterine lining is shed about two weeks later causing menstrual flow to begin. But simply having her period does not mean the woman is ovulating.

**CLINICAL CORRELATES**

**Signs of Ovulation**

1. Mittelschmerz: Mittelschmerz is one-sided, lower abdominal pain associated with ovulation. German for "middle pain" mittelschmerz occurs midway through a menstrual cycle about 14 days before your next menstrual period. In most cases, mittelschmerz doesn't require medical attention. For minor mittelschmerz discomfort, over-the-counter pain relievers and home remedies are often effective. If your mittelschmerz pain is troublesome, your doctor may prescribe an oral contraceptive to stop ovulation and prevent midcycle pain.
2. Changes in Cervical Mucus
3. Increase in libido
4. Tenderness of the breast
5. Swollen vagina or vulva

There are other better symptoms such as a slight change in basal body temperature. The use of Operation Predictor Kits (OPKs) can be used to detect a surge in lutenizing hormone.

Anovulation

Anovulation is when the ovaries do not release an oocyte during a menstrual cycle. Therefore, ovulation does not take place. However, a woman who does not ovulate at each menstrual cycle is not necessarily going through menopause.

1. Differentiate between Meiosis I and Meiosis II

**Answer**

Meiosis I Meiosis II

1. Homologous chromosomes separate Sister chromatids separate
2. Chromosomal crossing over during No chromosomal crossing over

Prophase II during prophase II

1. Presence of synapsis Absence of synapsis
2. Presence of crossing over Absence of crossing over
3. Presence of chiasma formation Absence of chiasma formation
4. Reduces the chromosome number Equalizes the chromosome number

in daughter cell of both daughter and parent cell

1. Complex division and takes more time Comparatively less simple and

takes less time

1. Preceded by interphase No interphase present
2. Individual chromosomes are present Sister chromosomes are present in the daughter nuclei in the daughter nuclei
3. It is a heterotypic division It is a homotypic division
4. Discuss the stages involved in fertilization

**Answer**

Fertilization occurs when the sperm and oocyte unite, mainly in the ampulla of the uterine tube. It takes approximately 24 hours for the process of fertilization to occur. There are 7 stages involved in fertilization they include;

1. Passage of a Sperm through the corona radiate
2. Penetration of the zona pellucida
3. Fusion of the plasma membrane of the sperm and oocyte
4. Completion of the second meiotic division
5. Formation of the male pronucleus
6. Formation of zygote
7. Passage of Sperm through the corona radiate:

In order for the sperm to pass through the corona radiate capacitation must occur. What is capacitation? Capacitation is the process whereby the glycoprotein coat and seminal plasma protein are removed at the region of the head. The plasma membrane of the sperm is made up of carbohydrate, protein and lipids. Only sperms that have been capacitated can pass easily through the corona radiate

1. Penetration of the Zona Pellucida

A glycoprotein shell surrounds the egg called zona pellucida which facilitates the sperm binding and induces the acrosome reaction after the cell membrane has been removed. The acrosome binds with some receptor sites which are zona glycoproteins found on the surface of the zona pellucida. The acrosome binds specifically with zona glycoprotein 3. After the acrosome binds with the zona glycoprotein, the permeability of the zona pellucida changes and the sperm comes in contact with the plasma membrane of the oocyte. After the sperm has come in contact with the oocyte surface the cortical granules release some lysosome enzymes which prevent other sperms from penetrating and inactivates the binding site of the zona pellucida so that only one sperm can penetrate the oocyte, in order to avoid polyspermy.

1. Fusion of the Plasma Membrane of the Oocyte and Sperm:

Durin fusion, the region of the head and and tail of the sperm enter the oocyte leaving behind the plasma membrane. The plasma membrane of the oocyte and sperm then fuse.

1. Completion of the Second Meiotic Division and Formation of the Female Pronucleus:

Fertilization involves two main structures, the nucleus of the sperm and the nucleus of the oocyte. As the sperm enters the region of the oocyte second meiotic division is completed and the secondary oocyte become mature. The nucleus of the mature oocyte becomes the female pronucleus after fusion.

1. Formation of Male Pronucleus:

For the male pronucleus to be formed, the nucleus of the sperm in the oocyte will enlarge and the tail will degenerate. This enlarged nucleus forms the male pronucleus. Since all of the mitochondria in the male sperm cell has been degenerates the zygote will inherit that of the mother. The male and female pronucleus are indistinguishable morphologically.

Now the oocyte contains two pronuclei each having a haploid number of chromosomes. The oocyte is therefore referred to as an **OOTID**.

1. Formation of Zygote:

The ootid now becomes a zygote as the female and male pronucleus fuse into a single diploid aggregation of chromosome which becomes arranged on a cleavage spindle in preparation for cleavage of the zygote.

1. Differentiate between monozygotic and dizygotic twins

**Answer**

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| --- | --- | --- |
| s/n | Monozygotic | Dizygotic |
| 1 | Monozygotic twins are developed by the splitting of a fertilized embryo into two | Dizygotic twins are developed by two separate simultaneous fertilization event |
| 2 | Genetic code is nearly similar | Genetic code is the same as any sibling |
| 3 | Cause is unknown | Caused by either IVF, certain fertility drugs or hereditary predisposition |
| 4 | Gender is the same | Gender is not the same |
| 5 | Blood types are the same | Blood types are different |
| 6 | Appearance is extremely similar but may be affected by environmental factors | Appearance is similar as any other sibling |
| 7 | High risk for TTTS | Low risk for TTTS |
| 8 | One-third of all twins worldwide are monozygotic | Two-third of all twins worldwide are dizygotic |
| 9 | They are known as identical twins | They are known as fraternal twins |
| 10 | Uniform chance of conceiving monozygotic twins worldwide | The chance of conceiving dizygotic twins vary from country to country and population round the world |

TTTS- Twin to twin transfusion syndrome