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COLLEGE: MEDICINE AND HEALTH SCIENCES

DEPT: MEDICINE AND HEALTH SCIENCES

ASSIGNMENT TITLE: EMBRYOLOGY

QUESTION

1. Discuss Ovulation
2. Differentiate between Meiosis Ⅰ and Meiosis Ⅱ
3. Discuss the stages involved in fertilization
4. Differentiate between Monozygotic twins and Dizygotic twins.
5. OVULATION

Ovulation may be defined as the release of a secondary oocyte from the ovarian follicle. Around mid-cycle (14 days in an average 28-day menstrual cycle) the ovarian follicle undergoes a sudden growth sprut under the influence the Follicle Stimulating Hormone (FSH) and the Luteinizing hormone (LH) to become mature vesicular/mature secondary/Graafian follicle.

This growth sprut produces a cystic swelling or bulge on the surface of the ovary. A small avascular spot, called stigma, soon appears in the swelling.

Ovulation is triggered by a sudden increase in Luteinizing hormone production which reaches its peak at about 12-24hours prior to ovulation. The surge in LH in the blood causes the primary oocyte to complete meiosis Ⅰ and the stigma to balloon out forming a vesicle. The stigma then ruptures expelling the secondary oocytes with the follicular fluids.

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

For the oocyte to be released, two (2) events occur which are caused by Luteinizing Hormone (LH) surge

* It increases collagenase activity resulting in digestion of collagen fibers surrounding the follicle
* 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 cells from the region of the cumulus oophorous. This causes ovulation in which oocyte floats out of the ovary. Some of the cumulus oophorous cells then rearrange themselves around the zona pellucida to form the corona radiata. At this point, ovulation is complete.

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| MEIOSIS Ⅰ | MEIOSIS Ⅱ |
| * Synapsis is present | Synapsis is absent |
| * Crossing over is present | Crossing over is absent |
| * Chiasma formation is present | Chiasma formation is absent |
| * Homologous chromosomes separate | Sister chromatids separate |
| * Produces 2 diploid daughter cells | Produces 4 haploid daughter cells |

1. FERTILIZATION

It is defined as the union of sperm and oocyte. There are six (6) stages involved

1. Passage of a sperm through the corona radiata

For sperm to pass through the corona radiata, they must have been capacitated i.e. removal of glycoproteins and seminal plasma proteins on the region of the acrosomal head.

1. Penetration of the zona pellucida

* The sperm forms a pathway through the zona pellucida which is believed to be as a result of the actions of the enzymes***,*** acrosin which causes lysis of the zona, thereby forming a path for the sperm to follow to the oocyte.Once the sperm penetrates the zona pellucida a zona reaction occurs that prevents the other sperms from entering. This is to prevent polyspermy.

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

1. Fusion of plasma membrane of sperm and oocyte

Plasma membranes of the oocyte and sperm fuse and break down. The head and tail of the sperm enter the cytoplasm of the oocyte but the sperm’s plasma membrane remains behind.

1. Completion of the second (2nd) meiotic division and formation of the female pronucleus

As soon as the head and tail of the sperm enter the region of the cytoplasm, 2nd meiotic division is completed. This completion forms a mature oocyte and a second polar body. The nucleus in the cytoplasm of the mature oocyte becomes the female pronucleus.

1. Formation of the male pronucleus

Within the cytoplasm of the oocyte, the tail of the sperm degenerates and the nucleus of the sperm that is left enlarges to form the male pronucleus. Since the tail (which has mitochondria) degenerates, all mitochondria within the zygote is of maternal origin.

1. Formation of zygote.

The male and female pronuclei fuse together, the ootid becomes a zygote. The result of the fertilization is the formation of a zygote.

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| MONOZYGOTIC TWINS | DIZYGOTIC TWINS |
| * Form from single (1) zygote | Form from two (2) zygotes |
| * Incidence is more common | Incidence is less common |
| * Genetically identical | Genetically not identical |
| * Twins are of the same sex | Twins are of the same sex or of different sex |
| * Resemblance is similar | Resemblance is just like any other two (2) siblings |
| * Mostly have common amnion, chorion and placenta | Mostly have two (2) amnions, chorions and placentas |
| * Are often called conjoined twins | Not seen as conjoined twins |