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COLLEGE: MHS

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LEVEL: 200

ASSIGNMENT TITLE: EMBRYOLOGY

COURSE TITLE: Integrated Core Basic Sciences- Physiology, Anatomy, Biochemistry

COURSE CODE: ICBS

QUESTION

1) Discuss Ovulation.

2) Differentiate between meiosis 1 and meiosis 2.

3) Discuss the stages involved in fertilization.

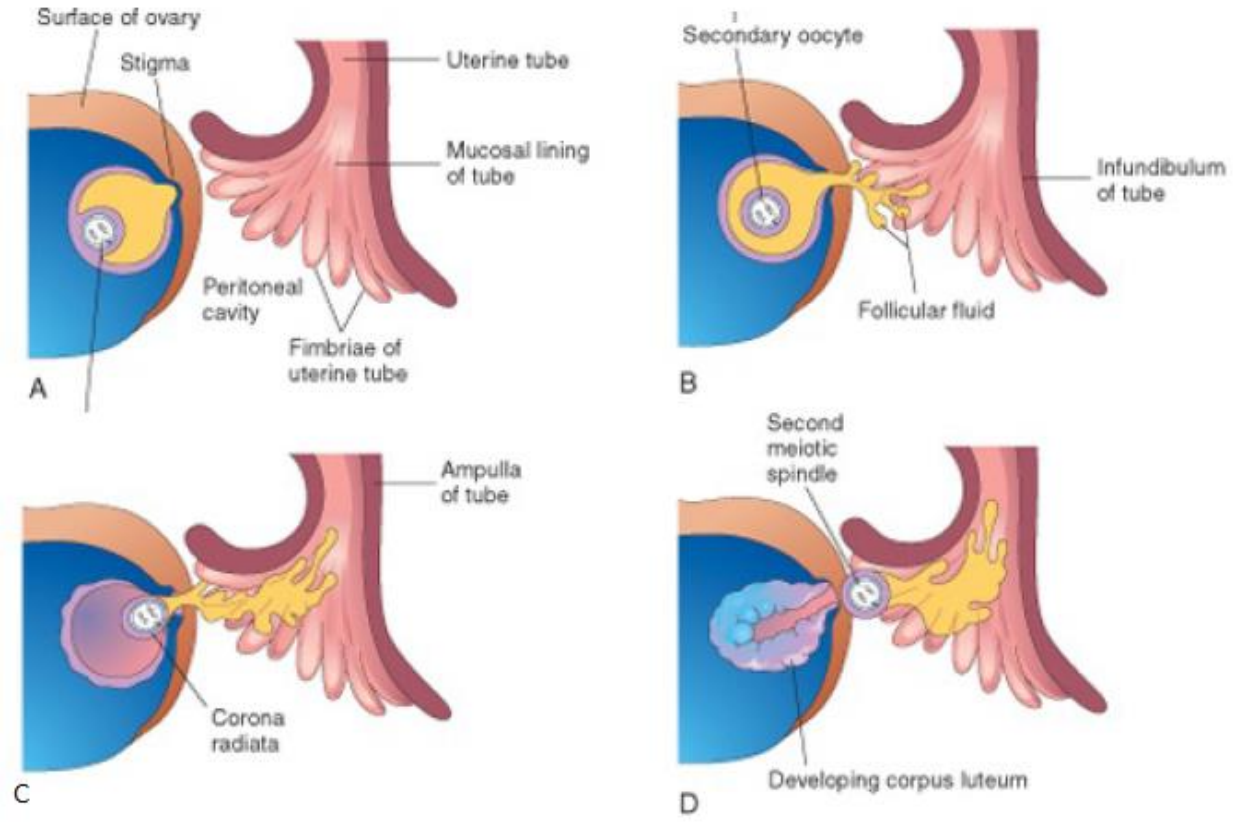
4) Differentiate between monozygotic twins and dizygotic twins.

ANSWERS

(1) Ovulation is the process whereby the oocyte in the female is released from the ovarian follicle. Under the influence of follicle stimulating hormone and luteinizing hormone the secondary follicle grows in diameter to about 25mm and becomes the graafian/ matured secondary or matured vesicular follicle. During this period there is an abrupt increase in luteinizing hormone which in turn causes the primary oocyte to complete meiosis 1 and the follicle to enter pre-ovulatory mature vesicular stage. Meiosis 2 is initiated but the secondary oocyte is prohibited approximately 3 hours before ovulation during its metaphase stage, at this time the ovary begins to bulge and the stigma (an avascular spot) appears.

Two events caused by the luteinizing hormone promote the release of oocytes: 1) Increase in collagenase activity resulting in the digestion of collagen fibers surrounding the follicle. 2) Prostaglandin levels increase and cause local muscular contractions in the ovarian wall. The contractions eject the oocyte, causing ovulation as the oocytes float out of the body. Cumulus oophorus rearrange themselves around the zona pellucida to form the corona radiata.

Ovulation usually follows the luteinizing hormone peak by12-24 hours.



Source: Keith Moore et al (2016). The Developing Human Clinically Oriented Embryology 8th Edition

Clinical Correlates

I) Middle pain/ Mittelschmer- Abdominal pain usually felt in the middle of the menstrual cycle, it is usually used as a symptom of ovulation.

II) Anovulation- Failure of women to ovulate usually due to low concentration of gonadotropins.

III) Some drugs produce multiple ovulations hereby increasing the risk of multiple pregnancies.

(2) The differences between meiosis 1 and meiosis 2 include:

MEIOSIS 1	MEIOSIS 2
1) In prophase 1 synapsis, crossing over and chiasma formation occurs. 2) There is alignment of 46 homologous duplicated chromosomes at metaphase 1. 3) There is disjunction of 46 homologous duplicate chromosomes at anaphase 1.	1) There is no occurrence of synapsis, crossing over and chiasma formation at prophase 2. 2) There is alignment of 23 duplicated chromosomes at metaphase 2. 3) There is disjunction of 23 duplicated chromosomes to form 23 single chromosomes at anaphase 2.

4) There is formation of two secondary gametocytes (23 duplicated chromosomes) at telophase 1. 5) The stages involved in meiosis 1 include; prophase 1, metaphase 1, anaphase 1, telophase 1.	4) There is formation of four gametes (23 single chromosomes) at telophase 2. 5) The stages involved in meiosis 2 include; prophase 2, metaphase 2, anaphase 2, telophase 2.

(3) Fertilization is a process in which the gametes from the male and gametes of the female fuse together to form a zygote. Fertilization occurs in the ampulla of the uterine tube.

The sperm has to undergo certain stages in order for fertilization to take place. They include

I) Passage of sperm through the corona radiate: For this to occur the sperm has to undergo capacitation. Capacitation is the process in which the glycoprotein coat and the seminal plasma proteins from the plasma membrane overlying the acrosomal region of the spermatozoa is removed.

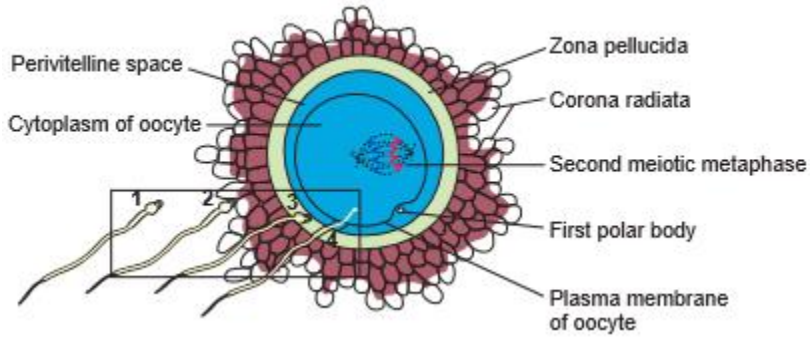
II) Penetration of the zona pellucida: The zona pellucida is a protective shell for the egg, the capacitated sperm binds with the zona protein 3 to release acrosin in order to penetrate the egg. Due to the action of lysosomal enzyme only one sperm normally penetrates the oocyte.

III) Fusion of plasma membranes of the sperm and oocyte: During this stage the head and tail of the sperm penetrates the oocyte leaving behind the plasma membrane of the sperm.

IV) Completion of second meiotic division of oocyte and formation of female pronucleus: Penetration of sperm into the oocyte triggers the completion of secondary meiotic division of the oocyte and formation of the mature oocyte and a second polar body, the nucleus of the mature oocyte is called female pronucleus.

V) Formation of male pronuclues: The nucleus of the sperm enlarges to form the male pronucleus while its tail degenerates. In this stage all sperm mitochondria degenerate and therefore all mitochondria in the zygote are of maternal origin.

VI) Both pronuclei fuse into a single diploid aggregation of chromosomes, the ootid becomes the zygote: The chromosomes in the zygote become arranged on a cleavage spindle in preparation for the cleavage of the zygote.



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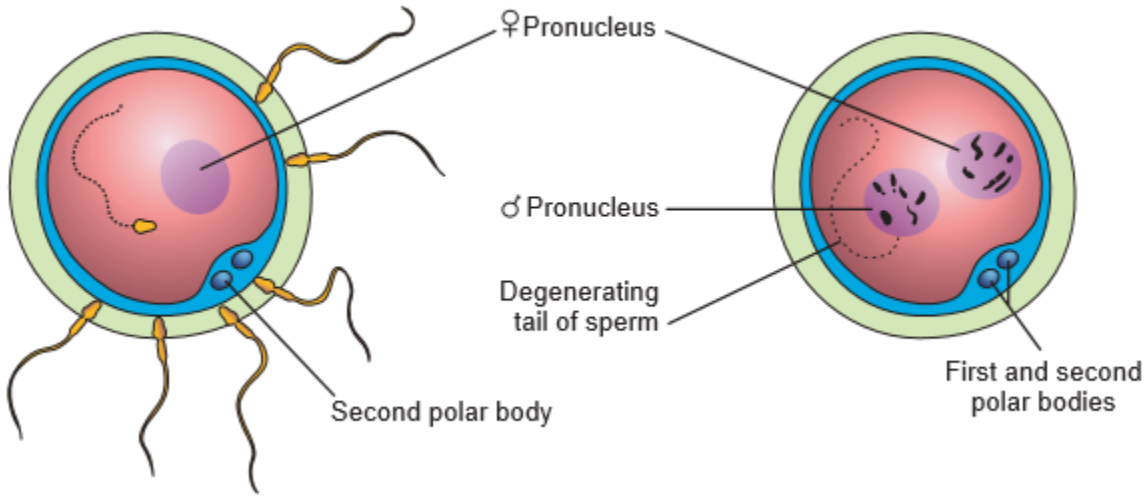

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Clinical Correlates

I) In Vitro Fertilization (IVF)-A process where an egg is fertilized by a sperm outside a body usually in a test tube. The fertilized zygote which is cultured for 2-6 days is the implanted in the same or a different woman.

II) Intracytoplasmic Injection- A situation whereby a sperm is directly injected into the cytoplasm of a mature oocyte. It is usually carried out when the sperm has difficulty penetrating the egg.

III) Cryopreservation of embryos- It is a case where the embryo from an in vitro fertilization can be preserved for long periods of time by freezing them with a cryoprotectant.

(4) The differences between dizygotic twins and monozygotic twins include:

DIZYGOTIC TWINS	MONOZYGOTIC TWINS
1) They develop from two different oocytes fertilized by two different sperm.	1) They develop from a single fertilized oocyte by one sperm.
2) They are not genetically identical.	2) They are genetically identical.
3) The resultant two zygotes form two blastocysts.	3) The resultant zygote forms a blastocysts where the embryoblast splits into two.
4) Their chorionic and amniotic sacs are separate.	4) They have common amniotic and chorionic sac.
5) They possess two different placentas.	5) They share one placenta.