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MATRIC NO: 18/MHS02/135

DEPT: MEDICINE AND SURGERY

COURSE: EMBRYOLOGY

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QUESTIONS

1. DISCUSS OVULATION.

OVULATION

Ovulation is the release of eggs from the ovaries. This event occurs when the ovarian follicles rupture and release the secondary oocyte ovarian cells.

Ovulation occurs midway through the menstrual cycle, after the follicular phase (from approximately 10-18 days of a 28day cycle) constitute the most fertile phase.

The process of ovulation is controlled by the hypothalamus of the brain and through the release of hormones secreted in the anterior lobe of the pituitary gland- luteinizing hormone (LH) and Follicle-stimulating hormone (FSH).

In pre-ovulatory phase of the menstrual cycle, the ovarian follicle will undergo a series of transformations called cumulus expansions, which is stimulated by FSH.

Estrogen levels peak towards the end of the follicular phase. This, by positive feedback, causes a surge in levels of luteinizing hormone (LH) and follicle-stimulating hormone (FSH). This lasts from about 24-36 hours, and results in the rupture of the ovarian follicles, causing the oocyte to be released from the ovary.

Through a signal transduction cascade initiated by LH, proteolytic enzymes are secreted by the follicle of the blister, forming a hole called the stigma, where it is caught by the fimbriae at the end of the fallopian tube. After entering the fallopian tube, the oocyte is pushed along by the cilia, beginning its journey toward the uterus.

By this time, the oocyte has completed meiosis 1, yielding two cells, the larger secondary oocyte that contains all of the cytoplasmic material and a smaller, inactive first polar body. Meiosis II follows at once but will be arrested in the metaphase and will so remain until fertilization. The spindle apparatus of the second meiotic division appears at the time of ovulation. If no fertilization occurs, the oocyte degenerates between 12 and 24 hours after ovulation.

CLINICAL CORELLATES OF OVULATION

Females near ovulation experience changes in the cervical mucus, and in their basal body temperature. Many females experience secondary fertility signs including Mittelschmerz (pain associated with ovulation) and a heightened sense of smell, and can sense the precise moment of ovulation. Many females experience heightened sexual desire in the several days immediately before ovulation. Study shows that females subtly improve their facial attractiveness during ovulation

Symptoms related to the onset of ovulation, the moment of ovulation and the body's process of beginning and ending the menstrual cycle vary in intensity with each female but are fundamentally the same. The charting of such symptoms- primarily basal body temperature, mittelschmerz and cervical position- is referred to as the sympo-thermal method of fertility awareness, which allow auto- diagnosis by a female of her state of ovulation.

Disorders of ovulation are classified as menstrual disorders and include oligoovulation and anovulation

- Oligoovulation is infrequent or irregular ovulation (usually defined as cycles of greater than 36 days or fewer than 8 cycles a year)
- Anovulation- is absence of ovulation when it would be normally expected. Anovulation usually manifest itself as irregularity of menstrual periods, that is, unpredictable variability of intervals, duration, or bleeding. Anovulation can also cause cessation of periods(secondary amenorrhea) or excessive bleeding (dysfunctional unterine bleeding)

2. DIFFERENTIATE BETWEEN MEIOSIS I AND MEIOSIS II

DIFFERENCES BETWEEN MEIOSIS I AND MEIOSIS II.

	MEIOSIS I	MEIOSIS II
DEFINITION	Meiosis I is the first cell division of meiosis	Meiosis II is the second cell division of meiosis
SUBPHASES	Prophase I, Metaphase I, Anaphase I and Telophase I	Prophase II, Metaphase II, Anaphase II and Telophase II
NUMBER OF CELLS PRODUCED	Two	Four
CHROMOSOME NUMBER	Becomes half	Does not divide into half
CHROMOSOME SEPARATION	Homologous chromosomes separate from each other	Sister chromatids separate from each other
NATURE	Heterotypic division	Homotypic division
CROSSING OVER AND GENETIC RECOMBINATION	Crossing over and genetic recombination occur	Crossing over and genetic recombination do not occur
DURATION	Longer	Shorter
SPLITTING CENTROMERES OF CHROMOSOMES	Does not take place	Centromeres split and sister chromatids separate
INTERPHASE I	There is interphase before meiosis I	There is no interphase between meiosis I and meiosis II

3. DISCUSS THE STAGES INVOLVED IN FERTILIZATION.

- Stage 1-penetration of the corona radiata
- Stage 2- penetration of the zona pellucida
- Stage 3- fusion of the oocyte and sperm cell membranes

- Stage 4- Completion of the second meiotic division of the oocyte and formation of the female pronucleus
- Stage 5- formation of male pronucleus
- Stage 6- As the pronuclei fuse into a single diploid aggregation of chromosomes, the ootid becomes a zygote

Stage 1: <u>Penetration of the Corona Radiata</u>: Dispersal of the follicular cells of the corona radiata surrounding the oocyte and zona pellucida appears to result mainly from the action of the enzyme hyaluronidase released from the acrosome of the sperm, but the evidence of this is not unequivocal. Tubal mucosal enzymes also appear to assist the dispersal. Movements of the tail of the sperm are also important in its penetration of the corona radiata.

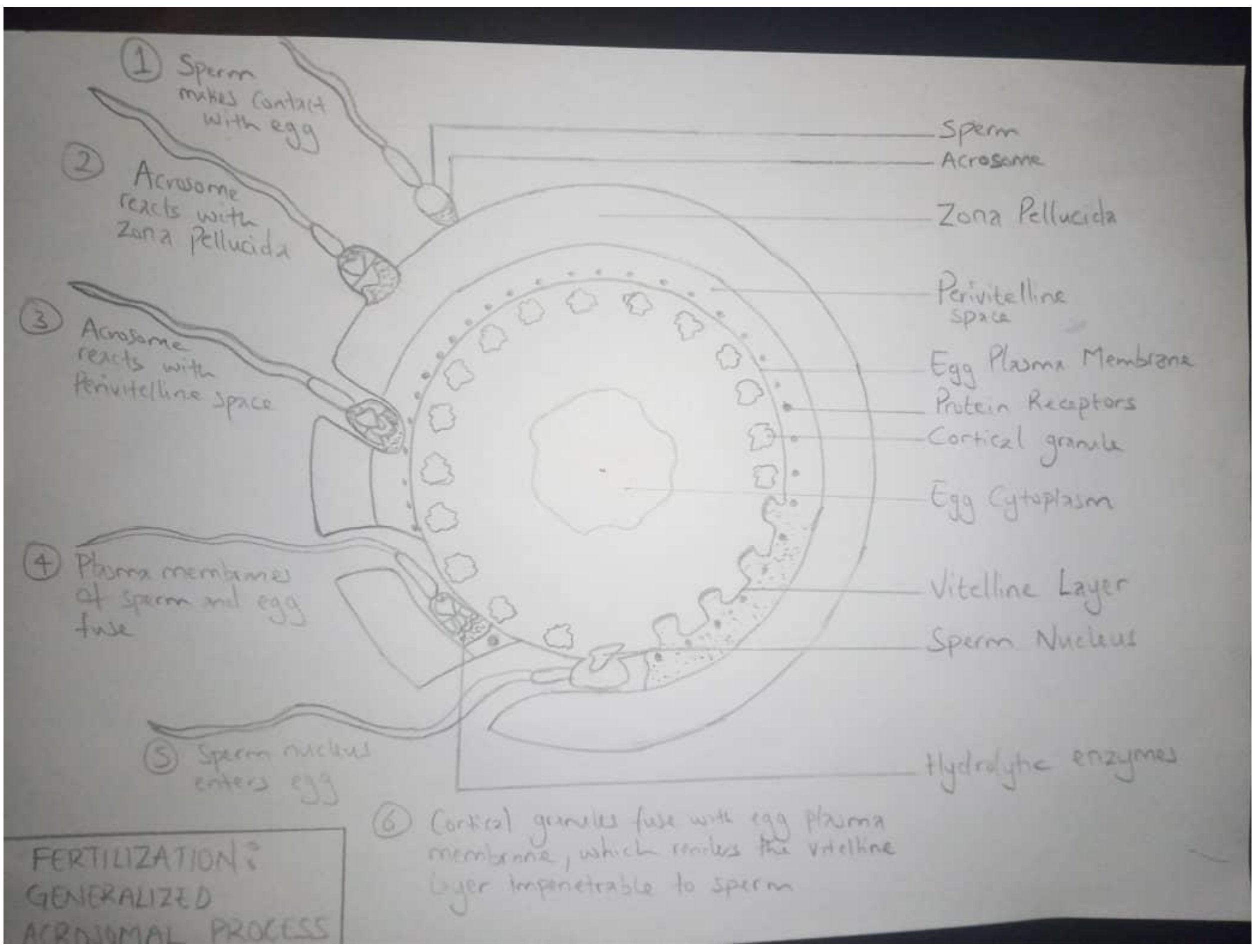
Stage 2: <u>Penetration of the Zona Pellucida</u>: Passage of a sperm through the zona pellucida is the important phase in the initiation of fertilization. Formation of a pathway also results from the action of enzymes released from the acrosome. The enzymes esterase, acrosin, and neuraminidase appear to cause lysis (dissolution or loosening) of the zona pellucida, thereby forming a path for the sperm to enter the oocyte. The most important of these enzymes is acrosin, a proteolytic enzyme. Once the sperm penetrates the zona pellucida, a zona reaction, a change in the properties of the zona pellucida, occurs that makes it impermeable to other sperms. The composition of this extracellular glycoprotein coat changes after fertilization. The zona reaction is believed to result from the action of lysosomal enzymes released by cortical granules near the plasma membrane of the oocyte. The contents of these granules, which are released into the perivitelline space also cause changes in the plasma membrane that make it impermeable to other sperms.

Stage 3: <u>Fusion of the Oocyte and Sperm Cell Membranes</u>: The plasma or cell membranes of the oocyte and sperm fuse and break down in the area of fusion. The head and tail of the sperm enter the cytoplasm of the oocyte, but the sperm’s cell membrane (plasma membrane) and mitochondria remain behind.

Stage 4: <u>Completion of the second meiotic division of the oocyte and formation of the female pronucleus:</u> 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. Following decondensation of the maternal chromosomes, the nucleus of the mature oocyte becomes the female pronucleus.

Stage 5: **<u>Formation of the male pronucleus:</u>** Within the cytoplasm of the oocyte, the nucleus of the sperm enlarges to form the male pronucleus, and the tail of the sperm degenerates. Morphologically, the male and female pronuclei are indistinguishable. During growth of the pronuclei, they replicate their DNA-1 n (haploid), 2 c (two chromatids). The oocyte containing the two haploid pronuclei is called an ootid, the nearly mature oocyte after the first meiotic divisions have been completed.

Stage 6: **<u>As the pronuclei fuse into a single diploid aggregation of chromosomes, the ootid becomes a zygote:</u>**The chromosomes in the zygote become arranged on a cleavage spindle in preparation for cleavage of the zygote.



FERTILIZATION

4. DIFFERENTIATE BETWEEN MONOZYGOTIC AND DIZYGOTIC TWINS.

DIFFERENCES BETWEEN MONOZYGOTIC AND DIZYGOTIC TWINS.

	MONOZYGOTIC	DIZYGOTIC
DEFINITION	Developed through a singular fertilized embryo, splitting into two.	Developed through two independent but simultaneous fertilization events
CAUSE	The cause of monozygotic twins is currently unknown	Either through in vitro fertilization (IVF), a hereditary predisposition, or the use of certain fertility drugs.
NAME USAGE	Monozygotic twins are known as identical twins	Dizygotic twins are known as fraternal twins.
GENETIC CODE	Monozygotic twins are genetically identical	Dizygotic twins are as genetically similar as would be the case with any other, non-identical sibling
GENDER	Monozygotic twins are always the same gender	Dizygotic twins can be different in genders
BLOOD TYPE	Monozygotic twins always have the same blood type	Dizygotic twins can have different blood types
PHYSICAL APPEARANCE	Extremely similar, if not identical appearance, but can be affected by some environmental factors.	Similar appearance, as would be expected with any other non-identical siblings
LIKELIHOOD OF CONCEPTION	Uniform chance of conceiving a monozygotic twin worldwide	The chance of conceiving a dizygotic twin varies from country to country and population around the world
WORLDWIDE PROPOTRION	One-third of all twins worldwide are monozygotic	Two-thirds of all twins worldwide are dizygotic
HEREDITARY	Not hereditary	Hereditary
TWIN TYPE(INISIDE THE UTERUS)	Either, Mono-Di, Di-Di, or Mono-Mono twins	Di-Di only twins
TWIN-TO-TWIN TRANSFUSION SYNDROM(TTS) RISK	There is a high TTS risk in monozygotic twins	There is a much lower TTS risk in dizygotic twins, when compared with the risk in monozygotic twins