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MATRIC NO: 18/MHS01/026

ASSIGNMENT TITLE: EMBRYOLOGY

COURSE TITLE: INTEGRATED CORE BASIC SCIENCES - ANATOMY, BIOCHEMISTRY & PHYSIOLOGY

COURSE CODE: ICBS

DEPARTMENT: MEDICINE AND SURGERY

ANSWERS TO THE ASSIGNMENT

1. **OVULATION:**

This is the process that involves the release of secondary oocytes from the ovarian follicles. Under the influence of the Follicle stimulating hormone and Lieutinizing hormone the secondary follicle grows rapidly with its diameter at about 25mm and transforms into a mature vesicular/ mature secondary/ Graafian follicle after a few days. Coincident with the transformation process into a mature vesicular follicle, there is an abrupt increase in the lieutinizing hormone that causes;

- the primary oocyte to complete meiosis 1
- the follicle enters the preovulatory mature vesicular stage

Meiosis II is initiated but the secondary oocyte is arrested at metaphase stage three hours before ovulation by a cytostatic factor. The surface of the ovary then begins to bulge out locally, and at its apex (an avascular spot), the stigma appears.

In order for the oocyte to be released, two important events must take place caused by the lieutinizing hormone surge;

- Collagenase activity is increased, resulting in the digestion of collagen fibers surrounding the follicle, rendering the oocyte weak.
- Next is an abrupt increase in the level of prostaglandin in response to LH surge which aids the local muscular contractions of the ovarian wall to release the mature oocyte.

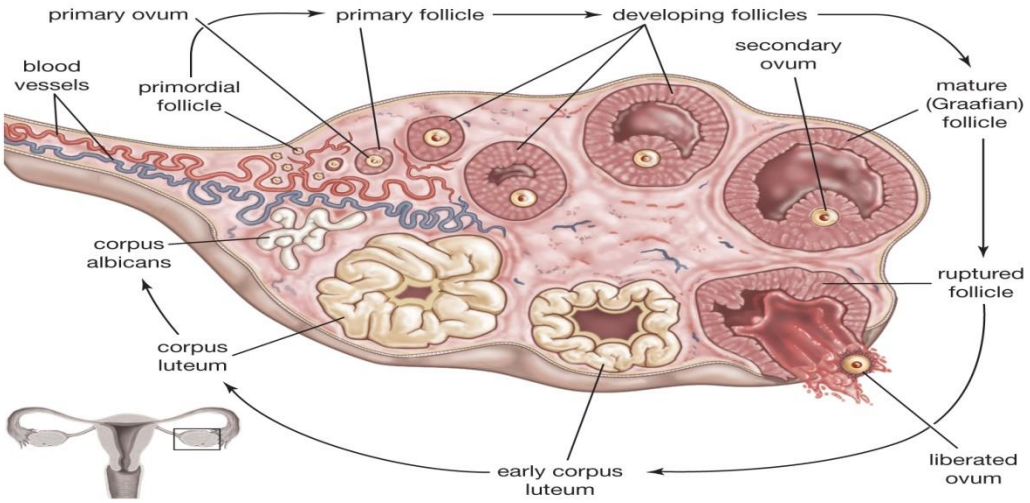
The contractions cause the expulsion of the oocyte along with follicular cells that form the region on the cumulus oophorus. Some of the cells of the cumulus oophorus then rearrange themselves along the region of the zona pellucida to form the corona radiata. **NOTE:** the process of ovulation is triggered only by a surge in LH production and this process follows LH peak by 12-24 hours.

CLINICAL CORRELATTES:

During the process of ovulation, some women tend to feel a variable amount of abdominal pain called **mittelschemerz** or **middle pain** as it normally occurs towards the middle of the endometrial cycle. Ovulation results in slight bleeding into the peritoneal cavity which causes a sudden constant pain in the lower abdomen in this case. Other signs of ovulation include;

a. Increased urge for sex
b. Tenderness of the breast
c. Swollen vagina

d. Slight drop in basal temperature (36.5-37.5^{0}C): most women prior to ovulation have a rather consistent basal temperature. But on getting closer to ovulation, there might be a slight decline which is then followed up by a sharp increase after ovulation.
The use of ovulation predictor kits helps to detect LH surge so as to be sure of when to have sexual intercourse for conception.
Anovulation is the process whereby a woman fails to ovulate due to a decreased level of the hormone, gonadotropin. To this effect, they are given stimulants that will then facilitate an increased production of the hormone. Though they are effective, they produce more ovulations so the risk of multiple pregnancies is higher in them than when compared to the general population.



2. **DIFFERENCE BETWEEN MEIOSIS I AND MEIOSIS II:**

MEIOSIS I	MEIOSIS II
1. Starts as diploid and ends as haploid	Starts as haploid and ends as haploid
2. Ends with two daughter cells	Ends with four daughter cells
3. Crossing over occurs	There is no crossing over
4. Homologous chromosome pairs separate	Sister chromatids separate
5. Long duration	Short duration
6. Reductive division	Equational division
7. Complicated division process	Simple division process
8. It is preceded by the S-phase and G-phases	It is preceded by only the G-phase
9. Sister chromatids in prophase stage have convergent arms	Sister chromatids in prophase stage have divergent arms
10. Equatorial plane is centred	Equatorial plane is rotated at 90^0
11. Prophase stage splits into five sub-stages	Prophase stage does not have sub-stages

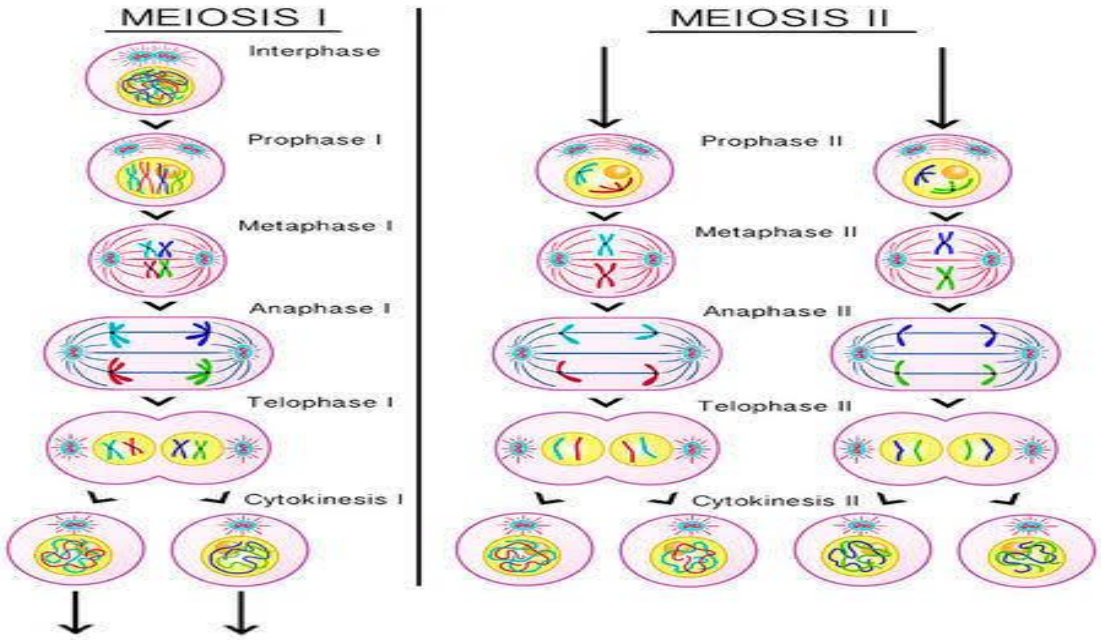


DIAGRAM OF MEIOSIS I AND MEIOSIS II

3. **THE STAGES INVOLVED IN FERTILIZATION:**

Fertilization is the process that involves the union of the sex gametes, sperm (from the male) and egg (from the female) to form a zygote, usually at the ampulla of the uterine tube (the point of fertilization). This process takes about 24 hours and consists of a series of coordinated events including;

- Passage of the sperm through the corona radiata: the corona radiata of the oocyte is the first barrier penetrated by an already capacitated sperm. This means that the sperm underwent capacitation involving the removal of its glycoprotein coat and seminal plasma protein at its acrosomal region of the sperm.
- Penetration of the zona pellucida: the zona pellucida is a glycoprotein shell surrounding the oocyte that facilitates and maintains sperm binding and acrosomal reactions. The zona pellucida contains binding receptors to which the acrosome of the sperm binds to. The acrosome contains the enzyme acrosine (a lysing enzyme), that allows for its penetration when bound to the receptors. Its passage allows the sperm penetrate the membrane of the oocyte which possesses cortical granules on it. The cortical granules are stimulated when the sperm comes in contact with the membrane of the oocyte and its function is to send signals back to the zona pellucida instructing it to deactivate its binding receptors allowing no further passage of spermatozoa after one has already passed through. This acts as a blockage of polyspermy.

- Fusion of the membranes of the sperm and oocyte: both plasma membranes of the egg and sperm fuse together and breakdown at the point of fusion. The head and tail of the sperm enters into the cytoplasm of the oocyte, leaving behind its plasma membrane.
- Completion of the second meiotic division and the formation of a female pronucleus: the second meiotic stage is completed if and only if there is fertilization between both sex gametes. After the fusion of the gametes, a mature oocyte is formed along with a second polar body whose faith is to eventually degenerate. The nucleus of the mature ovum is now called the female pronucleus.
- Formation of a male pronucleus: inside the cytoplasm of the oocytes, the sperms nucleus enlargens to form a male pronucleus. It then degenerates by its tail and loses all of its mitochondria. Hence the zygotes mitochondria DNA is of maternal origin. The oocyte is observed to have two haploid pronuclei and therefore becomes an ootid.
- Formation of the zygote: the two pronuclei of each gamete then fuse together to form an aggregate of chromosomes, the ootid becomes a zygote.

In the passage of the sperm until fertilization, the following barriers are penetrated;

- ❖ The corona radiata
- ❖ The zona pellucida
- ❖ Plasma membrane of the oocyte
- ❖ The cytoplasm
- ❖ The nucleus ⟶ **FERTILIZATION**

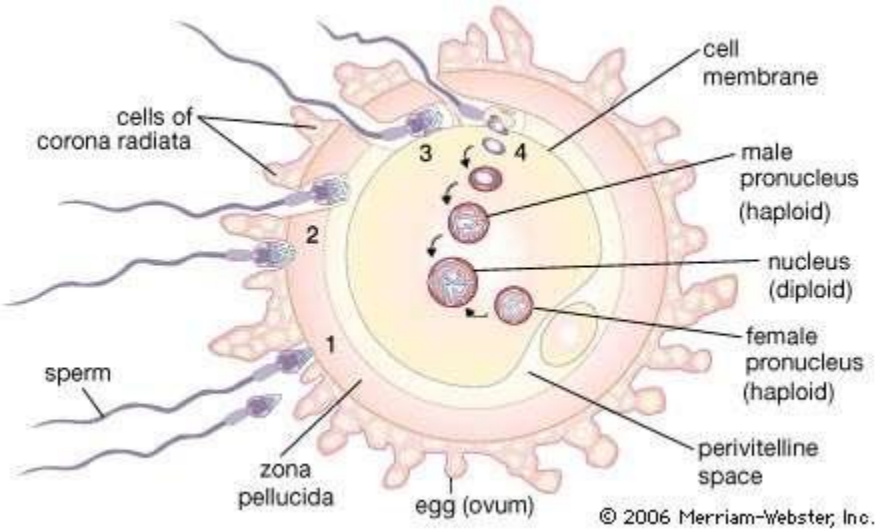


DIAGRAM OF FERTILIZATION

4. **THE DIFFERENCE BETWEEN MONOZYGOTIC AND DIZYGOTIC TWINS:**

MEIOSIS I	MEIOSIS II
a. Develop from one egg fertilized by a sperm which then splits into two	Develop from two separate eggs fertilized by two different sperm cells
b. Are often called conjoined twins	Not seen as conjoined twins
c. Share the same placenta, amniotic sac and	Do not share the same placenta, amniotic sac

	chorionic sacs	and chorionic sac
d.	Monozygotic twins are known as identical twins	Dizygotic twins are known as fraternal twins
e.	Monozygotic twins are always the same gender	Dizygotic twins are not always the same gender
f.	Monozygotic twins always have the same blood type	Dizygotic twins can have different blood types
g.	Are less common in occurrence	Are very common in occurrence
h.	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 sibling

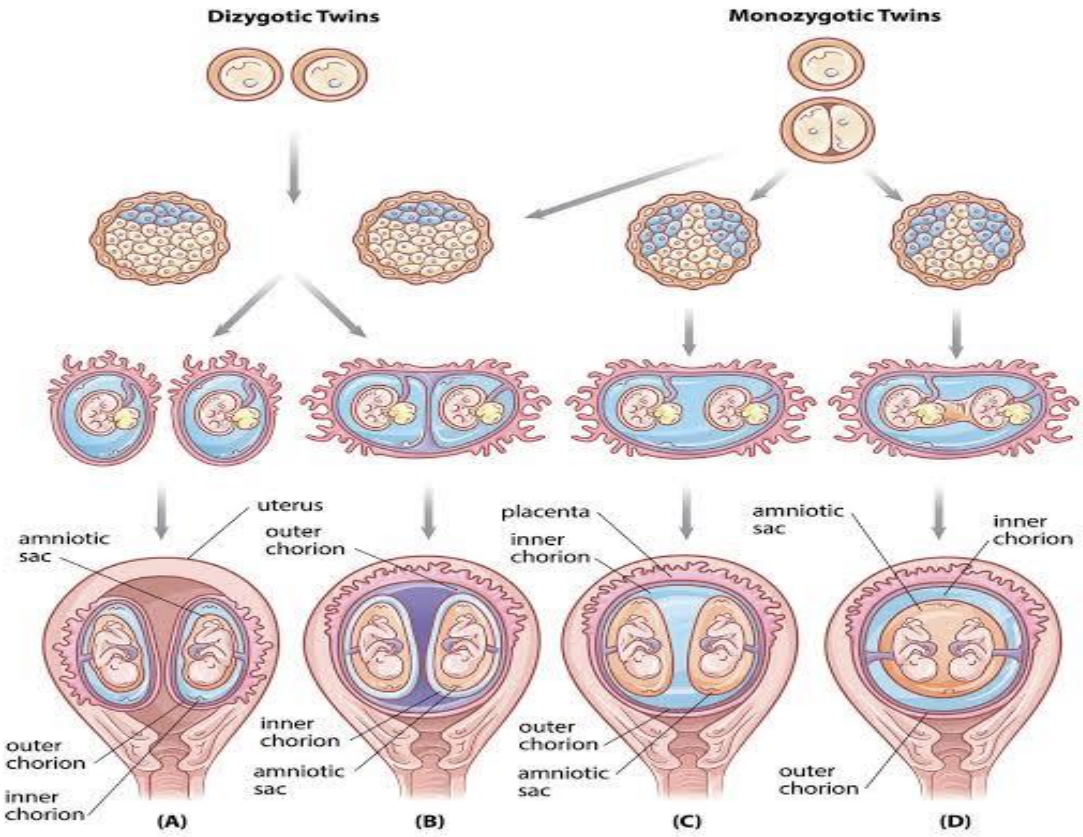


DIAGRAM OF MONOZYGOTIC AND DIYGOTIC TWINS