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COURSE CODE: 1CBS

ASSIGNMENT TITLE: EMBRYOLOGY

QUESTIONS

1. Discuss ovulation

Ovulation is the release of a mature secondary oocyte from the ovarian follicle. It is the phase in a female's menstrual cycle in which a mature ovarian follicle ruptures and discharges an oocyte. It occurs in the middle of a woman's menstrual cycle about two weeks before she is expected to see her next period. It takes place in approximately 24 hours.

In the pre-ovulatory phase, the vesicular follicle grows rapidly to a diameter of 25mm to become a mature vesicular /graafian follicle. In its final developments, there is an abrupt increase in the Luteinizing hormone production which causes the completion of meiosis I of the primary oocyte to form the secondary oocyte and the first polar body and also causes the follicle to enter the pre-ovulatory mature vesicular stage. Meiosis II is also initiated but arrested at metaphase II due to an activity called the cytostatic factor approximately 3 hours before ovulation. Meanwhile, the surface of the ovary begins to bulge and there is an appearance of an avascular spot, the stigma at the apex.

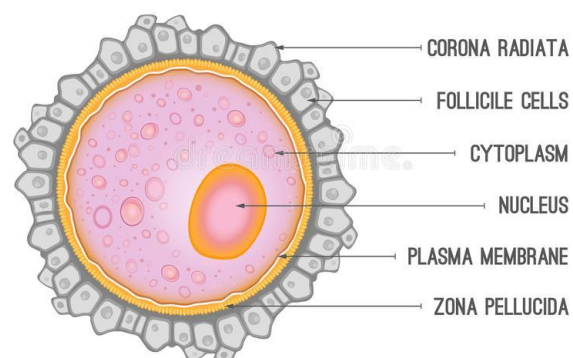
For the oocytes to be released, the high concentration of luteinizing hormone increases the enzyme, collagenase activity which breaks down collagen, the connective tissue surrounding the follicle. Prostaglandin levels also increases as a result of the luteinizing

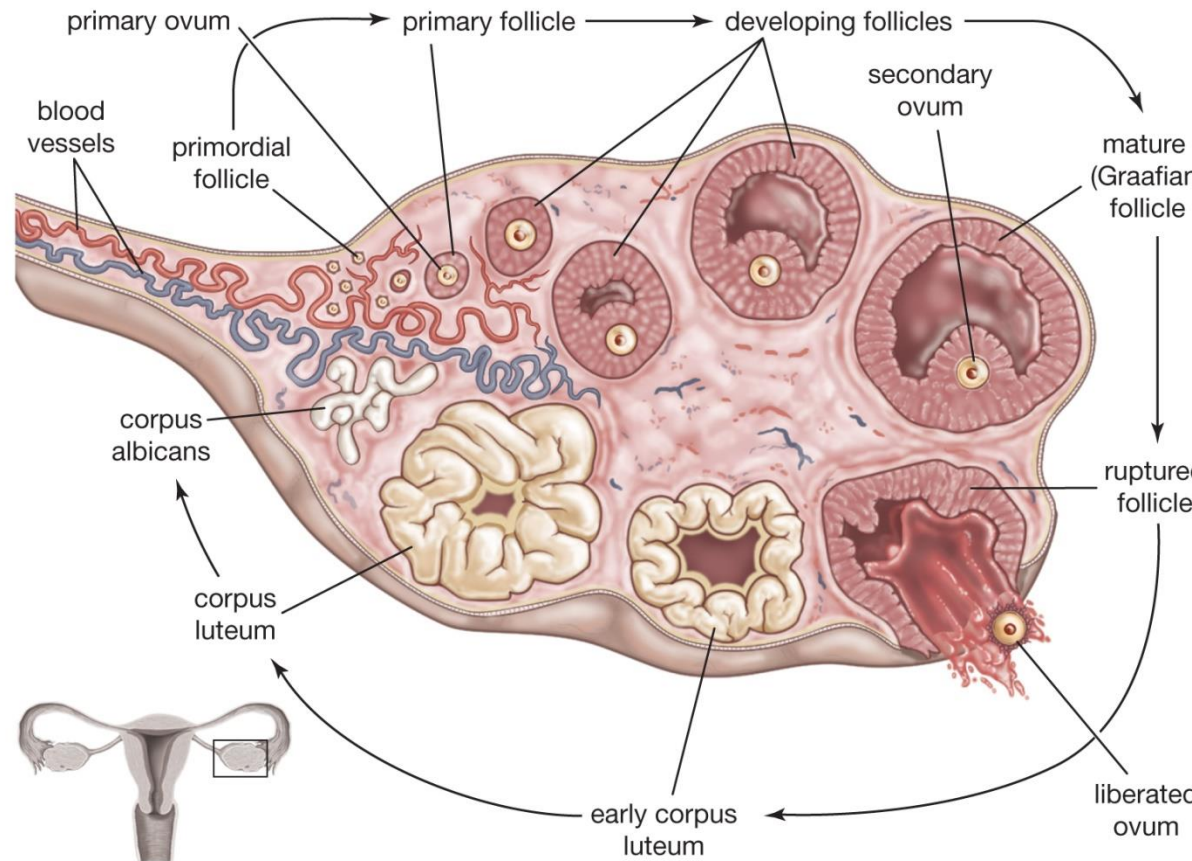
hormone and causes local muscular contractions in the ovarian wall which in turn causes the oocyte together with the cumulus oophorus to float out of the ovary. Some of the cells of the cumulus oophorus rearrange themselves around the zona pellucida of the secondary oocyte to form the corona radiata while the cells remaining in the wall of the ruptured follicle, together with the theca interna develop and form the corpus luteum.

Clinical correlates-

- During ovulation, some women feel a slight abdominal pain called mittelschmerz {middle pain in German because it occurs near the middle of the menstrual cycle.
- Ovulation is also accompanied by different signs and changes: swollen vagina/vulva; increased sexual urge; tenderness of the breast, changes in the cervical mucus which becomes a watery raw white egg look which is slippery and stretchy to the touch but becomes thicker and cloudy after ovulation; slight drop in the basal body temperature followed by an increase after ovulation
- Some women fail to ovulate due to a low concentration of gonadotropins, a case known as Anovulation. In these cases, there is an administration of an agent to stimulate gonadotropin release but such drugs often produce multiple ovulations which will increase the likelihood of multiple pregnancies.

FEMALE EGG STRUCTURE





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2. Differentiate between meiosis I and meiosis II

Meiosis I	Meiosis II
<u>Prophase I</u> <ul style="list-style-type: none"> - There is occurrence of synapsis, crossing over and chiasma formation. - Sister chromatids have convergent arms. 	<u>Prophase II</u> <ul style="list-style-type: none"> - No synapsis, no crossing over and no chiasma formation. - Sister chromatids have divergent arms.
<u>Metaphase I</u> Alignment of 46 homologous duplicated chromosomes at the metaphase plate.	<u>Metaphase II</u> Alignment of 23 duplicated chromosomes at the metaphase plate.
<u>Anaphase I</u> Separation of 46 homologous duplicated chromosomes from	<u>Anaphase II</u> Separation of 23 duplicated chromosomes to form 23 single

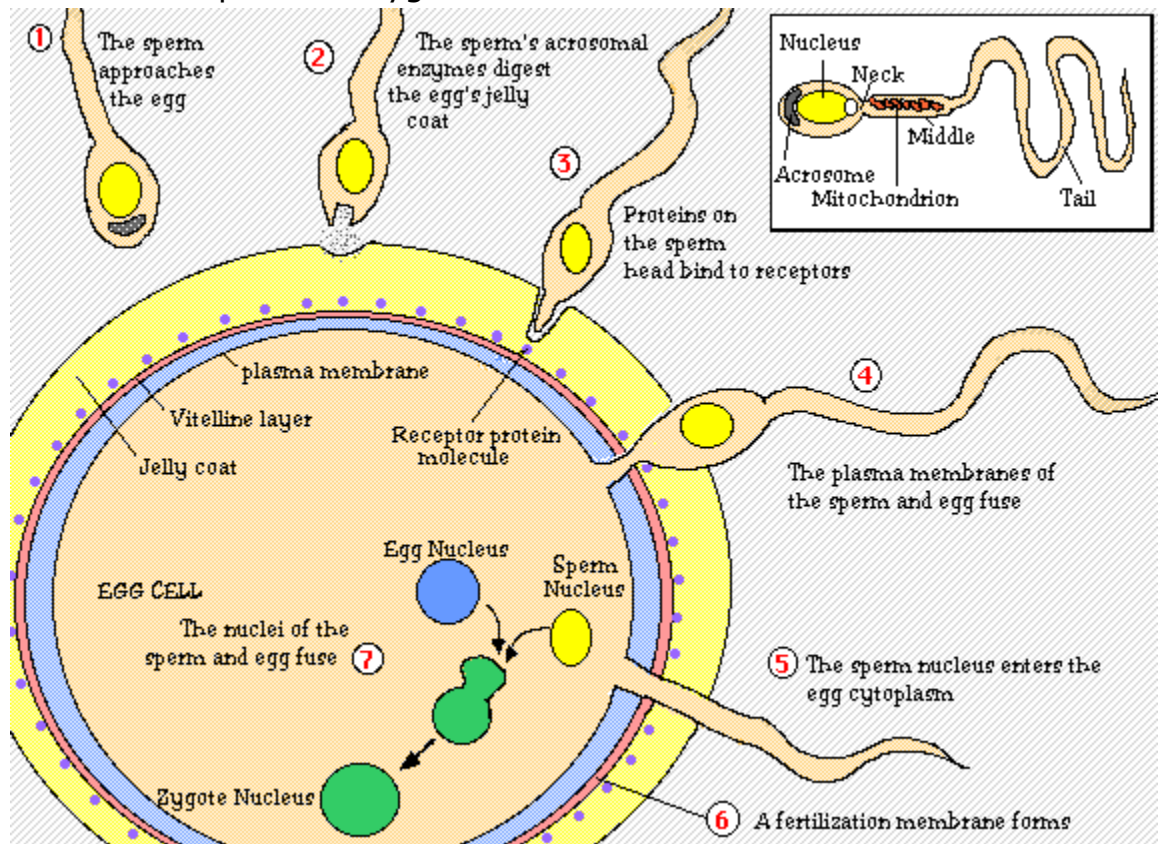
each other; centromeres do not split.	chromosomes; centromeres split.
<u>Telophase I</u> Formation of two daughter cells [23 duplicated chromosomes, 2N]	<u>Telophase II</u> Formation of 4 daughter cells [23 single chromosomes, 1N]
Reductive division	Equatorial division
Proceeded by S-phase and G-phase.	Proceeded only by G-phase.

3. Discuss the stages involved in fertilization.

Fertilization is the fusion/union of the male and female gametes [sperm and oocyte]. It takes place in approximately 24 hours in the ampulla of the uterine tube, the widest part close to the ovary. It involves 6 stages

- **Penetration of the corona radiata-** For sperms to pass through the corona radiate, Capacitation will occur that is, the glycoprotein coat and seminal plasma proteins from the plasma membrane that overlies the acrosomal region of the spermatozoa can pass freely through the corona radiate.
- **Penetration of the zona pellucida-** The zona is a glycoprotein shell surrounding the egg facilitating and maintaining sperm binding also inducing acrosome reaction; the acrosome binds with receptor sites on zona pellucida and releases acrosin an acrosomal enzyme which enables sperm to penetrate the zona, thereby coming in contact with the plasma membrane of the oocyte. This contact causes the release of lysosomal enzymes from cortical granules lining the plasma membrane of the oocyte; this enzyme alters the properties of the zona pellucida and inactivates binding sites for spermatozoa on the zona pellucida surface to block polyspermy. Hence, only one sperm penetrates the oocyte.
- **Fusion of the plasma membranes of oocyte and sperms-** The plasma membranes of sperm and oocyte fuse and break down. Hence, the region of the head and tail of the sperm enter the cytoplasm of the oocyte but the plasma membrane is left behind on the oocyte surface.

- **Completion of the second meiotic division and formation of the female pronucleus-** Immediately the sperm enters the cytoplasm of the oocyte; the second meiotic division of the oocyte is completed forming a mature oocyte and second polar body. The nucleus of the mature oocyte becomes the female pronucleus.
- **Formation of the male pronucleus-** The sperm moves until it lies close to the female pronucleus . Then, the tail of the sperm detaches and degenerates while the nucleus of the sperm enlarges and swells to form the male pronucleus.
- **Formation of zygote-** Both the male and female pronuclei fuse into a single diploid aggregation of chromosomes[half from sperm and the other half from oocyte] to form an ootid which develops into a zygote.



4. Differentiate between monozygotic twins and dizygotic twins

Monozygotic twins	Dizygotic twins
They are formed from one sperm fertilizing one oocyte which splits	They are formed from two different sperms fertilizing two

during blastocyst formation	different oocytes.
They are genetically identical	They are genetically unidentical
They look alike	They do not look alike
They are of the same gender	They are of different gender
They share placenta, chorionic sacs and amniotic sacs	They do not share placenta, chorionic sacs and amniotic sacs
They have the same blood type	Their blood type may be different
They are also called identical twins	They are also called fraternal twins
They are not hereditary	They are hereditary
They can be either Dichorionic\diamniotic, monochorionic\monoamniotic or monochorionic\diamniotic twins	They are only dichorionic/dizygotic twins