

Name: Awe Onajevwe Anne

Matric number: 18/mhs01/095

Department: Medicine and Surgery

Assignment Title: Embryology

Course Title: Integrated Core Basic Sciences – Anatomy, Biochemistry, Physiology

Questions

1. Discuss ovulation

Ovulation is defined as the release of a secondary oocyte from the ovarian follicle. It is typically the second stage of the ovarian cycle. Under the influence of follicle stimulating hormone and luteinising hormone, a few days before ovulation, the secondary follicle grows to a diameter of about 25mm and becomes the mature vesicular/mature secondary/Graafian follicle. Coincident with the maturation of this follicle, there is a sudden increase in luteinising hormone which causes the primary oocyte to complete meiosis 1 and the follicle to enter the pre-ovulatory mature vesicular stage. Meiosis 2 also begins but is arrested in metaphase 2 approximately 3 hours before ovulation. The surface of the ovary begins to bulge locally and at the apex, an avascular spot, the stigma appears. Now for the oocyte to be released, 2 events caused by a surge in luteinising hormone occur. Firstly, the surge in luteinising hormone increases the collagenase activity resulting in digestion of collagen fibres surrounding the follicle. Secondly, the surge in luteinising hormone increases prostaglandin levels and cause local muscular contractions in the ovarian wall. These contractions push out the oocyte, which form the cumulus oophorus together with its surrounding follicular cells. This causes ovulation in which the oocyte flows out of the ovary.

During ovulation, some women feel abdominal pain called mittelschmerz / middle pain. In such cases, ovulation results in slight bleeding into the peritoneal cavity which is the cause of the pain. Other signs of ovulation include increased sex drive, tenderness of breast, swollen vagina, and drop in basal temperature, among others. The failure to ovulate is known as

anovulation and it is caused by a low concentration of gonadotropins. Administration of medication that stimulates gonadotropin release can be administered to stimulate ovulation.

2. Differentiate between meiosis 1 and meiosis 2

Meiosis 1	Meiosis 2
Starts as diploid	Starts as haploid
Ends as haploid	Ends as haploid
Reductive division	Equational division
Homologous chromosomes separate	Sister chromatids separate
Crossing over happens	Crossing over does not happen
Long duration	Short duration
Preceded by S-phase and G-phase	Preceded only by G-phase
Ends with 2 daughter cells	Ends with 4 daughter cells
Chiasma formation occurs	No chiasma formation
Synapsis occurs	Synapsis does not occur

3. Discuss the stages involved in fertilization

Fertilization is defined as the fusion of the sperm and oocyte to form a zygote. The site of fertilization is the ampulla of the uterine tube and it usually takes approximately 24 hours. Fertilization takes place in 6 stages:

- A. Passage of sperm through the corona radiata: for the sperm to pass through the corona radiata, it must have undergone capacitation which is the removal of the glycoprotein and seminal plasma proteins from the plasma membrane that overlies the acrosomal region of the spermatozoa. Once capacitated, sperm can pass freely through the corona radiata.
- B. Penetration of the zona pellucida: the zona is a glycoprotein shell surrounding the egg which facilitates and maintains sperm binding and induces the acrosome reaction. The acrosome binds with the zona pellucida and there is a release of acrosin, an acrosomal enzyme which enables the sperm to penetrate the zona pellucida and come in contact with the plasma membrane of the oocyte. Once the head of the sperm comes in contact with the plasma membrane of the oocyte, the permeability of the zona pellucida changes. Lysosomal enzymes are released from cortical granules lining the plasma membrane of the oocyte. These enzymes change the properties of the zona pellucida to

prevent sperm penetration and inactivate the binding sites for spermatozoa on the surface of the zona pellucida.

- C. Fusion of the plasma membranes of sperm and oocyte: the plasma membranes of the sperm and oocyte fuse and break down at the area of fusion. The head and tail of the sperm enter the cytoplasm of the oocyte, but the sperm plasma membrane remains behind.
- D. Completion of second meiotic division and formation of the female pronucleus: penetration of the oocyte by the sperm activates the oocyte to complete the second meiotic division to form a mature oocyte and second polar body. The nucleus of this mature oocyte is what is called the female pronucleus.
- E. Formation of male pronucleus: in the cytoplasm of the oocyte, the sperm nucleus enlarges to form the male pronucleus and the tail of the sperm degenerates.
- F. Formation of zygote: the male and female pronuclei fuse into a single diploid aggregation of chromosomes called ootid. This ootid then becomes a zygote. The chromosomes in the zygote become arranged on the cleavage spindle in preparation for cleavage of the zygote.

4. Differentiate between monozygotic twins and dizygotic twins

Monozygotic	Dizygotic
Developed from the splitting of the same fertilised egg into two	Developed from two different eggs fertilised by two different sperm cells
identical	Like any other sibling, not identical
Always the same gender	Usually different genders
May be contained in one sac in the uterus	Develop different sacs in the uterus
Lower rate of occurrence	Higher rate of occurrence
Share an amniotic sac	Have two different amniotic sacs