NAME; AKPOFURE OGHENEVWEDE ANTHONY
MAT NO; 18/MHS01/058
COURSE; EMBRYOLOGY
DEPARTMENT; MBBS

1.Discuss Ovulation

Ovulation is the release of eggs from the ovaries. In women, it occurs when the ovarian follicles rupture and release the secondary oocyte ovarian cells. After

ovulation, during the luteal phase, the egg will be available to be fertilized by sperm. In addition, the uterine lining, the endometrium is thickened to be able to receive a fertilized egg. If no conception occurs, the uterine lining as well as blood will be shed during menstruation.

In humans, ovulation occurs about midway through the menstrual cycle, after the follicular phase. The few days surrounding ovulation (from approximately days 10 to 18 of a 28-day cycle), constitute the most fertile phase. The time from the beginning of the last menstrual period (LMP) until ovulation is, on average, 14. days, but with substantial variation among females and between cycles in any single female, with an overall 95% prediction interval of 8.2 to 20.5 days.

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

is done, a hole called the stigma will form in the follicle, and the secondary oocyte will leave the follicle through this hole. Ovulation is triggered by a spike in the amount of FSH and LH released from the pituitary gland. During the luteal (post-ovulatory) phase, the secondary oocyte will travel through the fallopian tubes toward the uterus. If fertilized by a sperm, the fertilized secondary oocyte or ovum may implant there 6–12 days later.

2. Differentiate between meiosis 1 and meiosis 2

	MEIOSIS 1	**MEIOSIS 2**
Prophase		
1	Synapsis is present	Synapsis is absent
2	Crossing over occurs	Crossing over doesn't occur
3	Chiasma forms	Chiasma doesn't form
4	Sister chromatids have convergent arm	Sister chromatids have divergent arms
Metaphase		
5	Alignment of 46 homologous duplicated chromosomes	Alignment of 23 homologous duplicated chromosomes
Anaphase		
6	Seperation of 46 homologous duplicated	Homologous duplicated chromatids will
7	Movement towards the pole	No movement to pole
8	Centromere will not split	Centromere will split
Telophase		
8	Two diploid daughter cells form	Four haploid daughter cells form
OTHERS		
10	Chromosomes remain in the replicated state	Two chromatids of a replicated chromosomes separate
11	Number of chromosomes reduced to half	Number of chromosomes remain the same

3. Discuss the stages involved in fertilization

Sperm capacitation:
Freshly ejaculated sperm are unable or poorly able to fertilize. Rather, they must first undergo a series of changes known collectively as capacitation. Capacitation is associated with removal of adherent seminal plasma proteins, reorganization of plasma membrane lipids and proteins. It also seems to involve an influx of extracellular calcium, increase in cyclic AMP, and decrease in intracellular pH. The molecular details of capacitation appear to vary somewhat among species.

Capacitation occurs while sperm reside in the female reproductive tract for a period of time, as they normally do during gamete transport. The length of time required varies with species, but usually requires several hours. The sperm of many mammals, including humans, can also be capacitated by incubation in certain fertilization media.

Sperm that have undergone capacitation are said to become hyperactiviated, and among other things, display hyper-activated motility. Most importantly however, capacitation appears to destabilize the sperm's membrane to prepare it for the acrosome reaction

Sperm - zona pellucida binding:
Binding of sperm to the zona pellucida is a receptor-ligand interaction with a high degree of species specificity. The carbohydrate groups on the zona pellucida glycoproteins function as sperm receptors. The sperm molecule that binds this receptor is not known with certainty, and indeed, there may be several proteins that can serve this function.

The acrosome reaction:
Binding of sperm to the zona pellucida is the easy part of fertilization. The sperm then faces the daunting task of penetrating the zona pellucida to get to the oocyte. Evolution's response to this challenge is the acrosome - a huge modified lysosome that is packed with zona-digesting enzymes and located around the anterior part of the sperm's head.

The acrosome reaction provides the sperm with an enzymatic drill to get through the zona pellucida. The same zona pellucida protein that serves as a sperm receptor also stimulates a series of events that lead to many areas of fusion between the plasma membrane and outer acrosomal membrane. Membrane fusion (actually an exocytosis) and vesiculation expose the acrosomal contents, leading to leakage of acrosomal enzymes from the sperm's head.

As the acrosome reaction progresses and the sperm passes through the zona pellucida, more and more of the plasma membrane and acrosomal contents are lost. By the time the sperm traverses the zona pellucida, the entire anterior surface of its head, down to the inner acrosomal membrane, is denuded. The animation to the right depicts the acrosome reaction, with acrosomal enzymes colored red.

Sperm that lose their acrosomes before encountering the oocyte are unable to bind to the zona pellucida and thereby unable to fertilize. Assessment of acrosomal integrity of ejaculated sperm is commonly used in semen analysis.

Penetration of the zona pellucida:
The constant propulsive force from the sperm's flagellating tail, in combination with acrosomal enzymes, allow the sperm to create a tract through the zona pellucida. These two factors - motility and zona-digesting enzymes- allow the sperm to traverse the zona pellucida. Some investigators believe that sperm motility is of overriding importance to zona penetration, allowing the knife-shaped mammalian sperm to basically cut its way through the zona pellucida.

Sperm – oocyte bonding:
Once a sperm penetrates the zona pellucida, it binds to and fuses with the plasma membrane of the oocyte. Binding occurs at the posterior (post-acrosomal) region of the sperm head.

The molecular nature of sperm-oocyte binding is not completely resolved. A leading candidate in some species is a dimeric sperm glycoprotein called fertilin, which binds to a protein in the oocyte plasma membrane and may also induce fusion..

Egg activation and the cortical reaction:
Prior to fertilization, the egg is in a quiescent state, arrested in metaphase of the second meiotic division. Upon binding of a sperm, the egg rapidly undergoes a number of metabolic and physical changes that collectively are called egg activation. Prominent effects include a rise in the intracellular concentration of calcium, completion of the second meiotic division and the so-called cortical reaction.

The cortical reaction refers to a massive exocytosis of cortical granules seen shortly after sperm-oocyte fusion. Cortical granules contain a mixture of enzymes, including several proteases, which diffuse into the zona pellucida following exocytosis from the egg. These proteases alter the structure of the zona pellucida, inducing what is known as the zona reaction. Components of cortical granules may also interact with the oocyte plasma membrane.

The zona reaction:
The zona reaction refers to an alteration in the structure of the zona pellucida catalyzed by proteases from cortical granules. The critical importance of the zona reaction is that it represents the major block to polyspermy in most mammals. This effect is the result of two measurable changes induced in the zona pellucida:

• The zona pellucida hardens. Crudely put, this is analogous to the setting of concrete. Runner-up sperm that have not finished traversing the zona pellucida by the time the hardening occurs are stopped in their tracks.
• Sperm receptors in the zona pellucida are destroyed. Therefore, any sperm that have not yet bound to the zona pellucida will no longer be able to bind, let alone fertilize the egg.

The loss of sperm receptors can be demonstrated by mixing sperm with both unfertilized oocytes (which have not yet undergone the zona reaction) and two-cell embryos (which have previously undergone cortical and zona reactions). In this experiment, sperm attach avidly to the zona pellucida of oocytes, but fail to bind to the two-cell embryos.

Post fertilization events:
Following fusion of the fertilizing sperm with the oocyte, the sperm head is incorporated into the egg cytoplasm. The nuclear envelope of the sperm

disperses, and the chromatin rapidly loosens from its tightly packed state in a process called decondensation. In vertebrates, other sperm components, including mitochondria, are degraded rather than incorporated into the embryo.

Chromatin from both the sperm and egg are soon encapsulated in a nuclear membrane, forming pronuclei. The image to the right shows a one-cell rabbit embryo shortly after fertilization - this embryo was fertilized by two sperm, leading to formation of three pronuclei, and would likely die within a few days. Pass your mouse cursor over the image to identify pronuclei.

Each pronucleus contains a haploid genome. They migrate together, their membranes break down, and the two genomes condense into chromosomes, thereby reconstituting a diploid organism.

5. Differentiate between monozygotic twins and dizygotic twins

	Monozygotic twins	**Dizygotic twins**
1	They are developed from a single zygote	Developed from two different zygotes
2	Incidence is more common	Incidence is less common
3	Genetically identical	Not genetically identical
4	Resembance is similar	Resemblance is like that of any other sibling
5	Twins are of the same sex	Twins are of the same or different sex
6	Mostly diamniotic, monochorionic with single placenta	Mostly have two amnions, two chorions and two placentas
7	They are often called conjoined twins	They are not seen as conjoined twins
8	Blood groups are the same	Blood groups are different