ZOO517 – ANIMAL FORM & FUNCTION II

MID TERM MOST IMPORTANT QUESTIONS

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Q-1 What is Gestation?

- Pregnancy/Gestation is the time during which one or more offspring develops inside a woman.
- Pregnancy sets into motion a new series of physiological events.
- In pregnancy ovaries are directly affected.
- As the embryo develops, the placenta releases a hormone, human chorionic gonadotropin (hCG), which keeps the corpus luteum from disintegrating.
- The progesterone is necessary to maintain the uterine lining.
- After a time, the placenta takes over progesterone production, and the corpus luteum degenerates.
- By the end of two weeks following implantation, the concentration of hCG increases in the female's blood as well as in urine.
- hCG immunological test can check for pregnancy.
- As the embryo develops, other hormones such as prolactin and oxytocin are secreted.
- Prolactin induces the mammary glands to secrete and eject milk after childbirth.
- Oxytocin stimulates the uterine contractions during childbirth.
- It is also important for lactation, and certain aspects of human behavior.

Q-2 What is Placenta?

- The placenta is the organ that sustains the embryo and fetus throughout the pregnancy and through which gases are exchanged, nutrients are supplied and wastes are removed from the fetal systems to the maternal end.
- The tiny fingerlike projections are sent out from the blastocyst during implantation develop into numerous chorionic villi, which contain embryonic blood vessels.
- These blood vessels do not merge with those of the mother; the two bloodstreams remain separate throughout the pregnancy.
- Placenta is a feto-maternal organ
- It has two components

i. Fetal part develops from the chorionic sac.
ii. Maternal part, derived from endometrium.

- The placenta and the umbilical cord is the system for transporting substances between the mother and the fetus.
- Branches of the mother's arteries in the wall of her uterus open into pools near the chorionic villi.
- Oxygen and nutrients from the mother's blood diffuse into the fetal capillaries of the placenta.

Q-3 What is Digestion?

Digestion is the chemical and/or mechanical breakdown of complex food into diffusible molecules i.e. particles that individual cells of an animal can absorb.

- Starch into glucose.
- Proteins into amino acids.
- Fats into fatty acids & glycerol.

Q-4 Define External fertilization.

- It is a mode of reproduction in which a male organism's sperm fertilizes a female organism's egg outside of the female's body.
- The release of eggs and sperm into the water is known as spawning.
- Many invertebrates (e.g., sponges and corals) simply release their gametes into the water in which they live allowing external fertilization to occur.
- In these invertebrates, the transient structures, such as coelomic ducts, metanephridia, sperm ducts, or oviducts are used to release gametes from the body.
- Invertebrates utilizing external fertilization are mostly benthic, sessile, or both, including animals such as coral, sea anemones, and tube-dwelling polychaetes.
- Among vertebrates, external fertilization is most common in amphibians and fish.

Q-5 Explain structure of sperm.

- A mature human sperm consists of a head, midpiece, and tail.
- The head is flat, disc shaped 5.1 µm by 3.1 µm and contains the haploid nucleus, which is mostly DNA.
- The acrosome, a cap over most of the head, contains an enzyme called *acrosin* that assists the sperm in penetrating the outer layer surrounding a secondary oocyte.
- The spiral mitochondria in the midpiece supply the ATP necessary for these movements.
- The sperm tail is 50 µm long contains an array of microtubules that bend to produce whip like movements.

Q-6 Explain structure of Testis.

- Each testis is covered by a thick capsule called Tunica Albuginea.
- It is composed mainly of collagenous fibers and smooth muscle cells.
- Posteriorly the tunica albuginea is thickened and is called mediastinum testis.
- Thin fibrous septa, called Septula testis, radiate from the midiastinum to the capsule and divide the interior of the testis into 200 to 300 Pyramidal Lobules.
- The septula are not complete partitions; they show numerous gaps, through which the testicular lobules communicate quite freely.
- Beneath the tunica albuginea there is a layer of loose areolar connective tissue containing networks of blood vessels.
- This layer is known as tunica vasculosa, also lines the Septula Testis.
- Each testicular lobule contains 1-4 highly convoluted Seminiferous Tubules,
- Each seminiferous tubule is intricately coiled, averaging about 0.2 mm diameter and 50 cm in length.
- Individual tubules usually commence as free blind ends but neighboring tubules may form anastomosing loops.
- At the apex of the testicular lobule seminiferous tubules lose their convolutions and become straight.
- This makes the initial part of the male genital duct system.
- Seminiferous tubules are lined by a complex Germinal Epithelium.
- The germinal cells are present in several layers forming the wall of Seminiferous Tubules.
- Sertoli Cells are supportive in the seminiferous tubules and help in the process of spermatogenesis.
- Spermatogenesis takes place in the seminiferous tubules.
- This includes mitosis and meiosis to form haploid gametes.

Q-7 What is Ovary?

The ovaries are small, oval-shaped glands that are located on either side of the uterus. The ovaries produce eggs and hormones. Fallopian tubes: These are narrow tubes that are attached to the upper part of the uterus and serve as pathways for the ova (egg cells) to travel from the ovaries to the uterus.

Q-8 Explain Nephron with its parts.

- The nephron is the structural and functional unit of the kidney, having 1 M per kidney.
- A nephron has two main parts –corpuscle and tubule.
- The cup-shaped corpuscle containing the glomerulus is called the Bowman's capsule.
- The glomerulus and Bowman's capsule together form the renal corpuscle.
- The tubules are small tubes traveling through the inner part of the kidney that regulate the passage of various chemicals to and from the blood.
- The tubule has three parts:
    - The proximal convoluted tubule.
    - U-shaped curve, the loop of Henle and
    - The distal convoluted tubule.
- The cortex is the outer renal tissue composed of:
    - The renal corpuscles, as well as the proximal and distal convoluted tubules.
- The medulla is the inner renal tissue, splitting into triangular parts called renal pyramids.
- The renal pyramids contain the loops of Henle of each renal tubule, as well as the collecting ducts.

Q-9 What is Asexual reproduction?

Asexual reproduction is a type of reproduction that does not involve the fusion of gametes or change in the number of chromosomes. The offspring that arise by asexual reproduction from either unicellular or multicellular organisms inherit the full set of genes of their single parent.

Q-10 What is Oogenesis?

Oogenesis is the production of egg cells inside the ovaries. During foetal development, few germinal cells in human ovary differentiate and divide mitotically to produce egg mother cell/oogonia. Further, oogonia become larger and divide to produce diploid primary oocyte.

Q-11 Define Primitive streak.

- The major structural characteristic of avian, gastrulation is the primitive streak.
- This streak is first visible as a thickening of the epiblast at the posterior region of the embryo.
- As these cells migrate from the lateral region of the posterior epiblast toward the center the primitive streak, that elongates toward the future head region.
- The streak eventually extends 60 - 75% of the length of the area pellucida.
- The primitive streak defines the axes of the embryo. It extends from posterior to anterior end.
- As cells converge to form the primitive streak, a depression forms within the streak. This depression is called the primitive groove.

Q-13 Name two major anatomy structures of kidney.

Nephron, Medulla, Renal Cortex, Minor Calyx, Major Calyx

Q-14 Describe the structure of Ovary.

- The ovaries are held in place by ligaments (mesovarium) attached to the uterus through which vessels and nerves pass to the ovary.
- The ovaries have two functions:
  - ❖ Production of ova
  - ❖ Secretion of hormones.
- The surface of the ovary is covered by a single layer of cuboidal epithelium, called germinal epithelium.
- Fibrous connective tissue forms a thin capsule, the tunica albuginea, immediately beneath the epithelium.
- Ovary is divided into an outer cortex and an inner medulla.
- The cortex consists of a very cellular connective tissue stroma in which the ovarian follicles are embedded.
- The medulla is composed of loose connective tissue, which contains blood vessels and nerves.

Q-15 Define sexual reproduction in vertebrates.

- Sexual reproduction in animals involves the production and fusion of two types of gametes—sperm and eggs.
- Typically, two different individuals are required.
- A male parent contributes sperm, and a female parent contributes an egg, or ovum.
- The sperm provides genes coding for some of the male parent's traits, and the egg contributes genes coding for some of the female parent's traits.
- The egg is typically large and non-motile; with a store of nutrients that supports the development of the embryo.
- The sperm is usually small and motile and adapted to propel itself by beating its long, whip-like flagellum.
- When sperm and egg unite, a zygote, or fertilized egg, is produced.
- The zygote develops into a new animal, similar to both parents but not identical to either.
- Sexual reproduction typically involves remarkably complex structural, functional, and behavioral processes.
- The strong drive to mate or reproduce dominates the lives of many vertebrates.
- Females of most mammal species come into heat or estrus about the same time each year.
- Genetic, hormonal, and nervous system controls the estrus cycle so that the young are born when environmental conditions are favorable.

Q-16 What is Osmoregulation and its functions.

- It is defined as the maintenance of constant osmotic pressure in the fluids of an organism by the control of water and salt concentrations.
- It means osmoregulation governs water and salt balance, and excretion of metabolic wastes.
- In fishes, reptiles, birds, and mammals, the kidneys are the primary osmoregulatory structures.
- To understand osmoregulation, lets us first study the response of the cell in various external environmentsi.e. in different concentrations when the control system is not operating.
- In **hypertonic** solution cell shrinks due to the loss of water.
- In **hypotonic** solution the cell swells up and may even burst.
- To prevent these situations the cell's control system operates and osmoregulate itself to keep water and salts in balance in both plants and animals.

Q-17 What are Liver's function.

- The liver manufactures bile.
- Bile is a fluid containing bile salts and bile pigments.
- Bile salts play an important role in the digestion of fats, although they are not digestive enzymes.
- They emulsify dietary fat, breaking it into small globules (emulsification) on the surface of which the fatdigesting enzyme lipase can function.
- RBCs are phagocytized to form Bile Pigments in the spleen, liver and red bone marrow.
- Phagocytosis cleaves the hemoglobin molecule, releasing iron, and the remainder of the molecule is converted into pigments that enter the circulation.
- These pigments are subsequently extracted from the circulation in the liver and excreted in the bile as bilirubin (“red bile’’) and biliverdin (“green bile’’).
- Liver detoxifies various metabolites.
- Liver synthesizes proteins and produces bio chemicals necessary for digestion and growth.
- Destruction of RBCs and formation of bile pigments.
- Protein metabolism
- Synthesis of plasma proteins
- Enzyme synthesis.
- Conversion of ammonia to urea.
- Carbohydrate metabolism
- Fat metabolism
- Removal or excretion of drugs
- Gallbladder is a small hollow organ where bile is stored and concentrated before it is released into the small intestine.
- The structure and position of the gallbladder can vary significantly among animal species.
- Because of the importance of bile in fat digestion, the gallbladder is relatively large in carnivores and vertebrates.
- Gallbladder is much reduced or absent in bloodsuckers, such as the lamprey, and in animals that feed primarily on plant food (e.g., some teleosts, many birds, and rats).

Q-18 What structures form from first germ layer?

- The germ layers develop early in embryonic life, through the process of gastrulation.
- During gastrulation, the embryo develops/differentiate into three primary germ layers:
  - an inner layer, endoderm,
  - an outer layer, ectoderm and
  - a middle layer, mesoderm.

Q-19 What are Antennal glands?

- The excretory organs in some crustaceans (crayfish, crabs) are antennal glands or green glands because of their location near the antenna and their green color.
- The antennal gland, lies in front of and on both sides of the esophagus.
- The gland is divided into :
  - **An End Sac,** where fluid collects by filtration.
  - **A Labyrinth**, the walls of which are greatly folded and is glandular and an important site for reabsorption.
  - **Nephridial Canal** a canal that leads into bladder.
  - **Bladder** a short duct leads to an excretory pore.
- The fluid filters into the antennal gland from the hemocoel.
- The heart exerts pressure on Hemolymph which is the main driving force for filtration.
- Marine crustaceans have a short nephridial canal and produce urine that is isoosmotic to their hemolymph.

Q-20 Write steps of menstrual cycle.

Menstrual Cycle can be divided into three phases:

1. Menstrual phase
2. Proliferative and
3. Luteal/Secretory phase

The menstrual phase

- It is the first stage of the menstrual cycle that lasts for 4-5 days.
- This phase starts when an egg from the previous cycle is not fertilized, because pregnancy has not taken place.

The proliferative phase

- It is the second phase of the cycle when the lining of the uterus grows, or proliferate.
- It lasts for 8 to 9 days.

The luteal phase

- It begins after ovulation.
- It lasts about 14 days (unless fertilization occurs) and ends just before menstrual period.

Q-21 Which hormones maintain pregnancy ?

- FSH stimulates follicle development and stimulates the granulosa cells to produce estrogen.
- LH stimulates theca cells to multiply and produce androgens, which are converted to estrogen.
- Estrogen is responsible for primary and secondary female sex characteristics and stimulates development of the endometrium.
- After the first week, only one follicle continues to develop.
- Although at relatively low concentration, estrogen inhibits FSH secretion by negative feedback.
- Granulosa cells produce inhibin, which also inhibits FSH secretion
- During the late preovulatory phase, estrogen concentration peaks and through positive feedback signals the anterior pituitary to secrete LH.
- LH stimulates final maturation of the follicle and stimulates ovulation.
- During the postovulatory phase, LH promotes development of the corpus luteum.
- The corpus luteum secretes rogesterone and estrogen, which stimulate final preparation of the uterus for pregnancy.

Q-22 Define excretion in teleosts.

- Most teleost fishes have mesonephric kidneys.
- Since the body fluids of freshwater fishes are hyper-osmotic relative to freshwater, water tends to enter the fishes, causing excessive hydration or bloating.
- They absorb salts and ions by active transport across their gills.
- They also excrete a large volume of water as dilute urine.
- Freshwater fishes have enlarged glomeruli and short tubule systems.
- They filter large quantities of water from the blood and tubules reabsorb some ions from the filtrate.
- Freshwater fishes produce a hypo-osmotic urine.
- Marine fishes face a different problem of water balance—their body fluids are hypoosmotic with respect to seawater and water tends to leave their bodies, resulting in dehydration.
- Marine fishes conserve water by reducing the size of the glomerulus of the nephron, and thus reducing the quantity of water and ions filtered from the blood.
- Ions can be secreted from the blood into the kidney tubules.

- Marine fishes can produce urine that is iso-osmotic with the blood.
- To compensate, marine fishes drink large quantities of water, and they secrete Na, Cl, and K ions through secretory cells in their gills.
- Channels in plasma membranes of their kidneys actively transport the multivalent ions that are abundant in seawater (e.g., Ca2, Mg2, SO4 and PO4) out of the extracellular fluid and into the nephron tubes.
- The ions are then excreted in concentrated urine.

Q-23 How marine mammals regulate salt and water?

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Q-24 Explain excretory system of crustaceans.

Excretory System in Crutacean

- Crustaceans that have gills, nitrogenous wastes are removed by simple diffusion across the gills.
- Most crustaceans release ammonia, although they also produce some urea and uric acid as waste products.
- The excretory organs of freshwater species are more involved with the reabsorption of ions and elimination of water than with the discharge of nitrogenous wastes.
- The excretory organs in some crustaceans (crayfish, crabs) are antennal glands or green glands because of their location near the antenna and their green color.
- The antennal gland, lies in front of and on both sides of the esophagus.
- The gland is divided into :
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- The fluid filters into the antennal gland from the hemocoel.
- The heart exerts pressure on Hemolymph which is the main driving force for filtration.
- Marine crustaceans have a short nephridial canal and produce urine that is isoosmotic to their hemolymph.
- The nephridial canal is longer in freshwater crustaceans, which allows more surface area for ion transport.

Q-26 Development stages of human.

- This topic covers the main event in reproduction—the nine month pregnancy/gestation period, during which time the woman carries, nourishes, and protects the embryo that grows to a full-term baby.
- The development of a human being can be divided into: prenatal (before birth) and postnatal (after birth) development.
- During the prenatal period, the developing individual takes its start becomes a ball of cells called a morula, and eventually becomes a blastocyst that implants in the endometrium.
- From two weeks after fertilization until the end of the eighth week of its existence, the individual is called an embryo.
- From nine weeks until birth, it is a fetus.
- During or after birth, it is called a newborn baby, or neonate.
- Pregnancy is arbitrarily divided into three-month periods called trimesters.
- The first trimester begins at fertilization, and during this time most of the organs are formed.
- The next two trimesters are mainly periods of growth for the fetus.

Q-27 Explain fertilization in Human.

- Fertilization is the fusion of sperm and egg.
- Fertilization and the subsequent establishment of pregnancy together are referred to as conception.
- After ejaculation into the female reproductive tract, sperm remain alive and retain their ability to fertilize an ovum for an estimated 48 to 72 hours.
- The ovum remains fertile for 12 to 24 hours after ovulation.
- Therefore, in a very regular 28-day menstrual cycle, sexual intercourse at mid cycle is most likely to result in fertilization.
- When conditions in the vagina and cervix are favorable, sperm arrive at the site of fertilization, the upper oviduct, within 5 minutes after ejaculation.
- At the time of ovulation, when estrogen concentration is high, the cervical mucus has a thin consistency that permits passage of sperm from the vagina into the uterus.
- After ovulation, when progesterone concentration rises, the cervical mucus becomes thick and sticky.
- This blocks the entrance of sperm.
- Once sperm enter the uterus, contractions of the uterine wall help transport them.
- These contractions are induced, in part, by prostaglandins in the semen.
- The sperm's own motility is important, especially in approaching and fertilizing the ovum.
- When a sperm encounters an egg, openings develop in the sperm acrosome, exposing enzymes that digest a path through the zona pellucida surrounding the secondary oocyte.
- As soon as one sperm enters the secondary oocyte, changes occur that prevent the entrance of other sperm.
- As the fertilizing sperm enters, it usually loses its flagellum.
- Sperm entry stimulates the secondary oocyte to complete its second meiotic division.
- The head of the haploid sperm then swells to form the male pronucleus and fuses with the female pronucleus to form the diploid nucleus of the zygote.

Q-28 How blood supply to kidney.

- The kidneys receive blood from the renal arteries, left and right, which branch directly from the abdominal aorta.
- Despite their relatively small size, the kidneys receive approximately 20% of the cardiac output.
- Each renal artery branches into segmental arteries, dividing further into interlobar arteries, which penetrate the renal capsule and extend through the renal columns between the renal pyramids.
- The interlobar arteries then supply blood to the arcuate arteries that run through the boundary of the cortex and the medulla.
- Each arcuate artery supplies several interlobular arteries that feed into the afferent arterioles that supply the glomeruli.
- Blood drains from the kidneys, ultimately into the inferior vena cava.
- After filtration occurs, the blood moves through a small network of small veins (venules) that converge into interlobular veins.
- As with the arteriole distribution, the veins follow the same pattern: the interlobular provide blood to the arcuate veins then back to the interlobar veins, which come to form the renal veins which exiting the kidney.

Q-29 What is predation?

- Predation is one of the most sophisticated feeding strategies, since it requires the capture of live prey. Only a few generalizations about the many kinds of predation are presented here.
- Predators can be classified by how they capture their prey:
  - Motile stalkers,
  - Lurking predators,
  - Sessile opportunists and
  - Grazers.
- **Motile stalkers** actively pursue their prey.
- Examples include ciliates nemerteans, polychaetes gastropods, octopuses and squids, crabs, sea stars, and many vertebrates.
- **Lurking predators** sit and wait for their prey to come within seizing distance. Examples include certain species of praying mantises, shrimp, crabs, spiders, polychaetes, and many vertebrates.
- **Sessile opportunists** usually are not very mobile. They can only capture prey when the prey organism comes into contact with them.
- Examples include certain protozoa, barnacles, and cnidarians.
- **Grazing** carnivores move about the substrate picking up small organisms.
- Their diet usually consists largely of sessile and slow-moving animals, such as sponges, ectoprocts, tunicates, snails, worms, and small crustaceans.

Q-30 What are pronephros?

- Appears only briefly in many vertebrate embryos, and not at all in mammalian embryos.
- In some vertebrates, the pronephros is the first osmoregulatory and excretory organ of the embryo as in tadpoles and other amphibian larvae.
- In vertebrates such as in hagfishes, pronephros remains as the functioning kidney.
- The primitive pronephric kidney is found in adult hagfishes and in the embryos of fishes and amphibians.
- In the anterior half of the body the renal tubules occur in segments that lead from the body of the pronephros to the archinephric duct.
- Notice that the testes are separate from the kidneys.

Q-31 What are types of Parthenogenesis?

Types of Parthenogenesis:

• Diploid Parthenogenesis
• Haploid Parthenogenesis

Diploid Parthenogenesis:

- In this type, no meiosis occurs and the eggs are formed by mitosis.
- The eggs develop and the offspring are the copies or clones of the parents.
- In some cases egg are formed by modified form of meiosis involving total non-disjunction of the chromosomes thus retaining the diploid number.
- Such eggs develop into young females.
- Examples: some species of flat worm, rotifers and insects.

Haploid Parthenogenesis:

- In this type of Parthenogenesis haploid ova are formed by meiosis and they may or may not be fertilized by sperm.
- If fertilized, the zygotes develop into females (Queen or sterile female workers in bee).
- If unfertilized the eggs develop to become haploid males (drones). On maturity they produce sperms by mitosis.

Q-32 Explain excretory system in Turbellarians.

- A few groups of metazoan invertebrates possess structures, that serve for excretion, osmoregulation, or both, ther are the nephridia.
- Among nephridia the simplest are the protonephridia or flame-cell systems.
- These are found in flatworms, rotifers, some annelids, and larval molluscs.
- The protonephridial excretory system is composed of a network of excretory canals that open to the outside of the body through excretory pores.
- Bulblike flame cells are located along the excretory canals.
- A flame cell is a specialized excretory cell found in the simplest freshwater invertebrates, including flatworms, rotifers and nemerteans (ribbon worms); these are the simplest animals to have such an excretory system.
- Chiefly Nitrogenous waste simply diffuses across the body surface into the surrounding water.

Q-33 What are accessary glands?

Accessory Glands and their Secretions

After the ductus deferens passes around the urinary bladder, several accessory glands add their secretions to the sperm as they are propelled through the ducts.
These accessory glands are:
1. Seminal vesicles
2. Prostate gland, and
3. Bulbourethral glands

Seminal Vesicles:

- These vesicles are paired secrete water, fructose, prostaglandins, and vitamin C.
- This secretion provides an energy source for the motility of sperms.
- Also helps to neutralize the natural protective acidity of the vagina. (The pH of the vagina is about 3 to 4).
- When vaginal pH increases to about 6 the sperm motility and fertility enhances

The Prostate Gland

- It is walnut sized gland, located between the bladder and penis.
- It secretes water, enzymes, cholesterol, buffering salts, and phospholipids.

The Bulbourethral Glands:

- The bulbourethral glands (also known as Cowper's glands) are a pair of pea shaped exocrine glands urethra.
- These glands secrete a clear, alkaline fluid that lubricates the urethra to facilitate the ejaculation of semen and lubricates the penis prior to sexual intercourse.