ZOO202 – ANIMAL DIVERSITY (INVERTEBRATES)

MID TERM IMPORTANT QUESTIONS

Q-1 What are Protochordates?

Protochordate is an informal category of organisms to describe the invertebrates that are closely related to vertebrates. This group is composed of the Phylum Hemichordata and the Subphyla Urochordata and Cephalochordata.

Q-2 Discuss reproduction in cephalochordates.

Cephalochordates are dioecious. Gametes are shed into the atrium and leave the body through the atriopore. External fertilization leads to a bilaterally symmetrical larva.

Q-3 Define osmoregulation in marine fishes.

Osmoregulation is the process of maintaining an internal balance of salt and water in a fish's body. A fish is, after all, a collection of fluids floating in a fluid environment, with only a thin skin to separate the two. They absorb a controlled amount of water through the mouth and the gill membranes. Due to this intake of water, they produce large quantities of urine through which a lot of salt is lost. The salt is replaced with the help of mitochondria-rich cells in the gills.

Q-4 What is lateral line system?

The lateral line is a sensory system that allows fishes to detect weak water motions and pressure gradients. Lateral line information is used for prey detection, spatial orientation, predator avoidance, schooling behavior, intraspecific communication and station holding. The lateral line of most fishes consists of superficial neuromasts (SNs) and canal neuromasts (CNs).

Q-5 Explain class Myxini.

The Myxini are unique among living chordates in that they have a partial cranium (skull), but no vertebrae, and so they are not truly vertebrates. The skeleton is composed of cartilage, and lacks bone. They are the only known living animals that have a skull but no vertebral column, although hagfish do have rudimentary vertebrae.

Q-6 Define osmoregulation in freshwater fishes.

In freshwater fishes, water will diffuse into the body of the fish, so it excretes very hypotonic or dilute urine to expel all the excess water. Gills absorb salt to compensate for salt lost in urine. This is how they maintain water balance.

Q-7 Write mode of feeding in Enteropneusta.

An important method of feeding in all enteropneusts is by a sheet of mucus, which is secreted by the proboscis epithelium, to which particles will adhere.

Q-8 Write four characters of chordates.

A large phylum of animals that includes the vertebrates together with the sea squirts and lancelets. They are distinguished by the possession of a notochord at some stage during their development.
Bilaterally symmetrical and deuterostomate animals

- Four unique characteristics present at some stage in development: notochord, pharyngeal slits or pouches, dorsal tubular nerve cord, and post anal tail Presence of an endostyle or thyroid gland
- Complete digestive tract.
- Ventral, contractile blood vessel (heart)

Q-9 Write mode of respiration in Eteropneusta.

Because acorn worms are small, respiratory gases and metabolic waste products (principally ammonia) probably are exchanged by diffusion across the body wall. In addition, respiratory gases are exchanged at the pharyngeal slits.

Compiled by: Sir Mughal
BS ZOOLOGY

Characteristics of Protochordata (Tunicates & Amphioxus)
They are generally found in marine water. Their body is bilaterally symmetrical, triploblastic, and coelomated. At a certain stage of their lives, their body develops a long, rod-like structure for support called the notochord. They exhibit organ system level of organization. E.g., Herdmania, Amphioxus.

What are Protochordates?
Protochordate is an informal category of organisms to describe the invertebrates that are closely related to vertebrates.

Classification of Protochordates:
This group is composed of the Phylum Hemichordata and the Subphyla Urochordata and Cephalochordata.

What are the Hemichordata (Tunicates & Amphioxus) or characteristics of Hemichordata:
Hemichordates are the sister group to echinoderms, not chordates. Phylogenomics suggest that the tunicates are the sister group to vertebrates, while lancelets are more distantly related to vertebrates.
The main characteristics of Hemichordata are the presence of a stomochord. They are bilaterally symmetrical, triploblastic and have a true coelom. They have gills for respiration and proboscis glands for excretion.

Clasification of Hemichordata:
The Hemichordata consist of four classes: Enteropneusta, Pterobranchia, Planctosphaeroidea and Graptolita. Enteropneusts, or acorn worms (about 70 species), are solitary, wormlike, bilaterally symmetrical animals, often brilliantly coloured. They are known as acorn worms because of the appearance of the proboscis and collar.

What is the mode of feeding in Enteropneusta:
An important method of feeding in all enteropneusts is by a sheet of mucus, which is secreted by the proboscis epithelium, to which particles will adhere.

What is the mode of digestion in Enteropneusta:
The digestive tract of enteropneusts is a simple tube. Food is digested as diverticula of the gut, called hepatic sacs, release enzymes.

The Nervous system of Enteropneusta:
The nervous system of enteropneustsis ectodermal in origin Lies at the base of the ciliated epidermis. Consists of dorsal and ventral nerve tracts and a network of epidermal nerve cells, called a nerve plexus.

What is the mode of Respiration in Enteropneusta?
Because acorn worms are small, respiratory gases and metabolic waste products (principally ammonia) probably are exchanged by diffusion across the body wall. In addition, respiratory gases are exchanged at the pharyngeal slits.

What is the mode of Circulation in Enteropneusta:
The circulatory system of acorn worms consists of one dorsal and one ventral contractile vessel. Blood moves anteriorly in the dorsal vessel and posteriorly in the ventral vessel.

What is the mode of Excretion in Enteropneusta:
Excretory wastes may be filtered through the glomerulus, into the coelom of the proboscis, Later on release to the outside through one or two pores in the wall of the proboscis.

Reproduction and Development in Enteropneusta:

Enteropneusts are dioecious, they are normally reproduce sexually via external fertilization, and develop either directly or via tornaria larvae.

What are the phylum Chordata or Chordates and their characteristics?
A large phylum of animals that includes the vertebrates together with the sea squirts and lancelets. They are distinguished by the possession of a notochord at some stage during their development.
Bilaterally symmetrical • deuterostomate animals • Four unique characteristics present at some stage in development: notochord, pharyngeal slits or pouches, dorsal tubular nerve cord, and post anal tail Presence of an endostyle or thyroid gland • Complete digestive tract. • Ventral, contractileblood vessel (heart)

What are the subphylum Urochordata and their characteristics?
The subphylum Urochordata constitutes a unique group of animals under the, Phylum Chordata. The members of this subphylum exhibit a high degree of diversity in form, habit and habitat.
• Tail chordate • Most primitive of the chordates • They are found in the marine environment.
•They are sessile and filter-feeders. • They are also known as tunicates because their body is surrounded by a leathery sheath composed of tunicin (cellulose).

Classification of Urochordata:
The members of Urochordata are classified under three classes: Ascidiacea, Thaliacea and Larvacea or Appendicularia.

What are the Ascidians (tunicates)?
Ascidiacea, commonly known as the ascidians, tunicates (in part), and sea squirts (in part), is a polyphyletic class in the subphylum Tunicata of sac-like marine invertebrate filter feeders. Ascidians are characterized by a tough outer "tunic" made of a polysaccharide.

Body organization of Ascidians (tunicates):
Tunicates derive their name from a thick extracellular body covering, called a tunic that is made up of cellulose-like, complex sugars. The adult tunicate body is shaped like a small barrel with two large openings called siphons.

Mode of digestion in Ascidians (tunicates):
The digestive tract of adult tunicates continues from the pharynx and ends at the anus near the atrial siphon. Tunicates mainly eat phytoplankton, zooplankton, detritus and other small organisms in the water, these organisms are filtered through the tunicate. They have cilia in the pharynx and they also produce mucus.

Mode of Respiration in Ascidians
The pharynx also functions in gas exchange. Gases are exchanged as water circulates through the tunicate.

Blood circulatory system of tunicates:
Tunicates have a well-developed heart and circulatory system. The heart is a double U-shaped tube situated just below the gut. One vessel from the heart runs anteriorly under the endostyle, and another runs posteriorly to the digestive organs and gonads. Blood flow through the heart is not unidirectional.

Excretory system of tunicates:
Ammonia diffuses into water that passes through the pharynx and is excreted.

Reproduction in tunicates:
Urochordates are monoecious. Gametes may be shed through the atrial siphon for external fertilization or eggs may be retained in the atrium for fertilization and early development. Although self-fertilization occurs in some species, crossfertilization is the rule. Development results in the formation of a tadpole like larva with all four chordate characteristics.

What are the Cephalochordata and their characteristics:
Members of the subphylum Cephalochordata are called lancelets. • The cephalochordates consist of two genera, Branchiostoma(amphioxus) and Asymmetron, and about 45 species. • They are distributed throughout the world's oceans in shallow waters that have clean sand substrates. • Cephalochordates are small (up to 5 cm long), tadpole like animals.

Feeding in Cephalochordates:
Cephalochordates are filter feeders. During feeding, they are partially or mostly buried in sandy substrates with their mouths pointed upward.

Digestion in Cephalochordates:
Digestion is both extracellular and intracellular. The cephalochordate commonly is buried in the substrate and positions its mouth above the surface of the sand. During feeding, the cirri form a kind of grid that keeps out large particles. Water is drawn into the mouth by the beating action of cilia on the gills.

Blood circulatory system in Cephalochordates:
Cephalochordates do not possess a true heart.

Excretory system in Cephalochordates:
Excretory tubules are modified coelomic cells closely associated with blood vessels. This arrangement suggests active transport of materials between the blood and excretory tubules.

Reproduction and Development in Cephalochordates:
Cephalochordates are dioecious. Gametes are shed into the atrium and leave the body through the atriopore. External fertilization leads to a bilaterally symmetrical larva.

Phylogenetic Relationships between hemichordates and chordates:
Animals in the phyla Hemichordata and Chordata share deuterostome characteristics with echinoderms. The evolutionary relationships between the hemichordates and chordates are difficult to document with certainty. The dorsal tubular nerve cord and pharyngeal slits of hemichordates are evidence of evolutionary ties between these phyla. Synapomorphiesthat distinguish chordates from hemichordates include tadpole larvae, a notochord, a postanal tail, and an endostyle.

Phylogenetic Relationships of Fishes:
Fishes are members of the chordate subphylum Vertebrata; thus, they have vertebrae that surround their spinal cord and provide the primary axial support. They also have a skull that protects the brain. Muscle blocks along the body wall suggest an active swimming existence. This evidence means that these 530 million-year-old animals located prey by sight and then pursued it through prehistoric seas. They have two large eyes and a mouth filled with tooth like structures made of dentine a component found in the vertebrate skeleton. Other hypotheses on the origin of bone suggest that it may have arisen as denticles in the skin (similar to those of sharks), in association with certain sensory receptors.

What are the classification of the fishes:?
Fishes are typically divided into three groups: superclass Agnatha (jawless fishes), class Chondrichthyes (cartilaginous fishes), and superclass Osteichthyes (bony fishes). The latter two groups are included within the infraphylum Gnathostomata, a category containing all jawed vertebrates.

What are the Agnathans?
Agnatha is an infraphylum of jawless fish in the phylum Chordata, subphylum Vertebrata, consisting of both present (cyclostomes) and extinct (conodonts and ostracoderms) species. Among recent animals, cyclostomes are sister to all vertebrates with jaws, known as gnathostomes.

What are the Agnathans (Cephalaspidomorphi):
Cephalaspidomorphs are a group of jawless fishes named for Cephalaspis of the osteostracans. Most biologists regard this taxon as extinct, but the name is sometimes used in the classification of lampreys, because lampreys were once thought to be related to cephalaspids.

What are the Gnathostomes?
The term derives from Greek: (gnathos) "jaw" + (stoma) "mouth". Gnathostome diversity comprises roughly 60,000 species, which accounts for 99% of all living vertebrates. In addition to opposing jaws, living gnathostomes have true teeth (lost in some), paired appendages (pectoral and pelvic fins).

What are the Osteichthyes?
Osteichthyes, popularly referred to as the bony fish, Members of the class Osteichthyes are characterized by having at least some bone in their skeleton and/or scales, bony operculum covering the gill openings, and lungs or a swim bladder.

What are the Chondrosteans?
Chondrostean, (subclass Chondrostei), any of approximately 30 species of primitive ray-finned bony fishes that inhabit marine and freshwater environments of North America and Eurasia. Chondrosteans make up one of the three major subdivisions of the superclass Actinopterygii, the other two being the holosteans and the teleosts.

Locomotion, Nutrition, Digestive system, Circulation and the respiration of the fishes:

- Fins and body wall to push against the incompressible surrounding water. Most fishes are arranged in a zigzag pattern. The forked shape of the caudal fin reduces surface area that could cause turbulence and interfere with forward movement.
- The earliest fishes were probably filter feeders and scavengers. Fish nutrition dramatically changed with the evolution of jaws. Most modern fishes are predators. Some fishes feed on invertebrate animals.
- The fish digestive tract is similar to that of other vertebrates. Stomach stores large, often infrequent, meals. Primary site for enzyme secretion. Sharks and other elasmobranchshave a spiral valve.
- Closed circulatory system. Heart pumps blood. Red blood cells containing hemoglobin. Blood flows from the venous system through the sinus venosus, the atrium, the ventricle, the conus arteriosus, and into the ventral aorta. Five afferent vessels carry blood to the gills.
- Less than 2.5% of the oxygen present in air. Fishes pass water across gill surfaces and extract the small amount of oxygen present in the water.

Swim Bladders and Lungs Buoyancy Regulation in the fishes:
Swim bladders: a gas-filled sac present in the body of many bony fishes, used to maintain and control buoyancy. While modern fishes can regulate buoyancy by secreting gases from the blood into the swimbladder, primitive fishes, such as sturgeons, lack this secretion mechanism and rely entirely on air gulped at the surface to inflate the swimbladder.

Nervous and sensory function of fishes:
The sensory organs send the information they receive to the central nervous system and the brain. Fishes use their sensory organs to detect changes in their bodies and in their environment. Sensory organs include the eyes, the ears, the lateral lines, the nostrils, and the taste organs.

Excretion in fishes:
The primary excretory organ in fishes, as in other vertebrates, is the kidney. In fishes some excretion also takes place in the digestive tract, skin, and especially the gills (where ammonia is given off).

Osmoregulation in fishes:
Osmoregulation is the process of maintaining an internal balance of salt and water in a fish's body. A fish is, after all, a collection of fluids floating in a fluid environment, with only a thin skin to separate the two.

Compiled by: Sir Mughal
BS ZOOLOGY

Reproduction in fishes:
In most cases, the female drops eggs in the water which are immediately fertilized by sperm from the male. Another way is for fertilization to occur within the female's body before she drops them into the water. With the third and final method, the female retains the eggs within her body and the young are born alive.

Mode development in fishes:
Fish eggs hatch into larvae that are different from the adult form of the species. A larva swims attached to a large yolk sac, which provides the larva with food. The larva eventually goes through metamorphosis and changes into the adult form.

What are the amphibians?
Amphibians are small vertebrates that need water, or a moist environment, to survive. The species in this group include frogs, toads, salamanders, and newts. All can breathe and absorb water through their very thin skin. Amphibians also have special skin glands that produce useful proteins.

What are the characteristics of amphibians?
Amphibians are vertebrates, Their skin is smooth and slimy, Amphibians breath through their skin, as well as their lungs in some cases, Amphibians are cold-blooded, They have a complex life cycle (larval and adult stages), Many species of amphibians vocalize. One example is the chorus frog, Some species fertilize eggs externally, some internally.

Phylogenetic relationship of amphibians:
Amphibians evolved about 365 million years ago from a lobe-finned fish ancestor. As the earliest land vertebrates, amphibians were highly successful for more than 100 million years until reptiles took over as the dominant land vertebrates.

Classification of amphibians:
They are classified into three orders: frogs and toads, salamanders and newts, and caecilians. Order Anura (Salientia)
Tail absent in adult • Eyelids and tympanum present • Skin scaleless and loose • Further divided into five suborders • Amphicoela, Opisthocoela, Procoela, Diplasiocela • E.g. Frog and Toad
Order caudate:
Members of the order Caudata are the salamanders. • Tail throughout life • Pairs of legs relatively unspecialized • Approximately 115 of the 350 described species of salamanders live in North America. • Most live in moist forest-floor litter

External structure and locomotion of amphibians
Amphibians are the first true tetrapods, or vertebrates with four limbs. Amphibians breathe with gills as larvae and with lungs as adults. They have a three-chambered heart and relatively complex nervous system. Locomotion on land is by walking and the tail often swings from side to side or is used as a prop, particularly when climbing.

Nutrition and the digestive system of amphibians:
Most adult terrestrial and aquatic amphibians feed on invertebrates (animals that do not have backbones), including earthworms, bloodworms, black worms, white worms, tubifex worms, springtails, fruit flies, fly larvae, mealworms, and crickets. The amphibian GIT is simple (short and without a cecum), digestion is enzymatic (e.g., pepsinogen) and, peristalsis (muscular action) and ciliary action moves food through the system. The stomach of amphibians is low in pH (acidic) and the enzyme pepsinogen is converted to pepsin to breakdown proteins into amino acids.

Circulation, gas exchange, and temperature regulation of amphibains:
Amphibians have two circulatory routes: one for oxygenation of the blood through the lungs and skin, and the other to take oxygen to the rest of the body. The blood is pumped from a three chambered heart with two atria and a single ventricle. Respiratory gas exchange is conducted through the thin, gas-permeable skin and the gills. Amphibians and reptiles are ectotherms that control their body temperature through external sources such as basking in the sun to warm up.

Nervous and sensory functions of amphibians:
The nervous system is basically the same as in other vertebrates, with a central brain, a spinal cord, and nerves throughout the body. The amphibian brain is relatively simple but broadly the same structurally as in reptiles, birds and mammals.

Excretion and osmoregulation in amphibians:
Although amphibians are formally given the status of terrestrial animals, they are poorly adapted to life on land. They excrete nitrogen in the form of urea and cannot produce urine more concentrated than the blood. Their skins are permeable to water. Fluid and electrolyte homeostasis in amphibians is maintained by fine balance of the activity of the kidneys, urinary bladder and skin. In these animals, the kidneys produce copious volumes of dilute urine, and the bladder serves mostly as a reservoir of water during terrestrial activity.

Reproduction, development, and metamorphosis in amphibains:
Amphibians reproduce sexually with either external or internal fertilization.

Development in amphibians:
It includes three stages: Egg, larva, and adult: Frogs are not the only animals to undergo metamorphosis; most other amphibians also undergo remarkable changes throughout their life cycles, as do many species of invertebrates.
Metamorphosis: in amphibians is the transformation of the larva to a miniature adult replicate, and usually from an aquatic to a terrestrial or semi-terrestrial lifestyle. Metamorphosis marks the beginning of the end of larval life.

Parental care in amphibians:
Among amphibians, parental care includes attendance of the eggs, transportation of eggs or larva, and feeding of larvae. Parental care is associated with only those species that place their eggs in single clusters, never with those that scatter their eggs in aquatic situations.

SHORT TERMS MCQs LIKE QUESTIONS:

1. IN Protochordata, At a certain stage of their lives, their body develops a long, rod-like structure for support called notochord.
2. In Hemichordata, Primitive notochord restricted to proboscis only, thus called stomochord.
3. In Acorn worms, Pharyngeal slits are openings between the anterior region of the digestive tract, called the pharynx.
4. In Enteropneusta: Food is digested as diverticula of the gut, called hepatic sacs.
5. At low tide, coils of fecal material, called castings, lie on the substrate at burrow openings.
6. In Enteropneusta, nervous system Lies at the base of the ciliated epidermis. Consists of dorsal and ventral nerve tracts and a network of epidermal nerve cells, called a nerve plexus.

7. All blood flowing anteriorly passes into a series of blood sinuses, called the glomerulus, at the base of the proboscis.

8. The body wall of most tunicates (L. tunicatus, to wear a tunic or gown) is a connective-tissue-like covering, called the tunic, that appears gel-like but is often quite tough.

9. Rootlike extensions of the tunic, called stolons, help anchor a tunicate to the substrate and may connect individuals of a colony.

10. Tunicates derive their name from a thick extracellular body covering, called a tunic, that is made up of cellulose-like, complex sugars.

11. The heart pumps blood through a number of small pockets called sinuses.

12. The adult tunicate body is shaped like a small barrel with two large openings called siphons.

13. The majority of the organs lie within a body cavity below the atrial cavity called the epicardium.

14. The most obvious internal structures of the urochordates are a very large pharynx and a cavity, called the atrium, that surrounds the pharynx laterally and dorsally.

15. Numerous pharyngeal slits called stigmas perforate the pharynx.

16. During feeding, cells of a ventral, ciliated groove, called the endostyle, form a mucous sheath.

17. Members of the subphylum Cephalochordata are called lancelets.

18. Ciliated, fingerlike projections, called cirri, hang from the ventral aspect of the oral hood and are used in feeding.

19. The opening from the atrium to the outside is called the atriopore

20. A diverticulum off the gut, called the midgut cecum, extends anteriorly.

21. Recent cladistic analysis of vertebrate evolution indicates that a group of fishes called hagfishes are the most primitive vertebrates known (living or extinct).

22. It was present in the bony armor of a group of fishes called ostracoderms.

23. Members of the genus Lampetra are called brook lampreys.

24. A narrow, tapering tail has resulted in the common name “ratfish.”

25. Since that time, specializations not found in other elasmobranchs have evolved, including a gill cover, called an operculum.

26. A third group of sarcopterygians, called osteolepiforms, became extinct before the close of the Paleozoic period.

27. The subclass Actinopterygii contains fishes that are sometimes called the ray finned fishes because their fins lack muscular lobes.

28. A vessel to the lungs has developed as a branch off aortic arch VI. This vessel is called the pulmonary artery.

29. The atrium and ventricle are partially divided.

30. Maintain water flow by holding their mouths open. This method is called ram ventilation.

31. Gill filaments extend from each gill arch called pharyngeal lamellae.

32. Teleosts have swim bladders.

33. The blood secretes gases into the swim bladder in a vascular network called the rete mirabile (“miraculous net’’).

34. Excretory structures in the kidneys are called nephrons.

35. Male elasmobranchs have modified pelvic fins called claspers.

36. A second lineage flourished into the Jurassic period. This lineage is called the non-amniote lineage.

37. Members of the family Salamandridae are commonly called newts.

38. Supportive processes called zygapophyses on each vertebra prevent twisting.

39. The first vertebra is a cervical vertebra

40. The last trunk vertebra is a sacral vertebra

41. Sternum is present in the anterior ventral trunk region. Unlike other vertebrates, amphibians have contractile vessels, called lymphatic hearts.

42. Gas exchange across the skin is called cutaneous respiration.

43. The forebrain contains olfactory centers and regions that regulate color change and visceral functions.

44. The midbrain contains a region called the optic tectum.

45. The midbrain also processes visual sensory information.

46. The lower eyelid is movable, and cleans and protects the eye. Much of it is transparent and is called the nictitating membrane.

47. A fold of epithelium called the iris surrounds it.

48. Abutting the tympanic membrane is a middle-ear ossicle (bone) called the stapes (columella)

49. Pectoral girdle to the inner ear through a second ossicle, called the operculum.

50. Amphibian development includes larval stages called tadpoles. Tadpoles often differ from the adults.

51. The male grasps the female in a position called amplexus.

52. The skin of amphisbaenians has ringlike folds called annuli.

53. A plate of bone, called the secondary palate, evolved in the archosaurs and separates the nasal and mouth passage ways.

54. All reptiles periodically shed the outer, epidermal layers of the skin in a process called ecdysis.

55. The organisms belonging to the Protochordata are generally known as the lower chordates.

56. Protochordata are also known as Acraniata because they lack a true skull.

57. A Precambrian fossil known as Yarnemia has been referred to the Urochordata, but this assignment is doubtful.

58. Urochordates are also known as tunicates because their body is surrounded by a leathery sheath composed of tunicin (cellulose).

59. A group of ancient eel-like animals, the conodonts, are known from fossils that date back about 510 million years.

60. Muscle blocks along the body wall suggest an active swimming existence. This evidence means that these 530 million-year-old animals located prey by sight and then pursued it through prehistoric seas.

61. Oldest vertebrate fossils: Jawless fish were only vertebrates for more than 50 m.y.a

62. They are found mainly in lakes and large rivers of the Mississippi River basin and are also known from western North America and China

63. Order Labyrinthodontia Also known as “Stem Amphibia”.